UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
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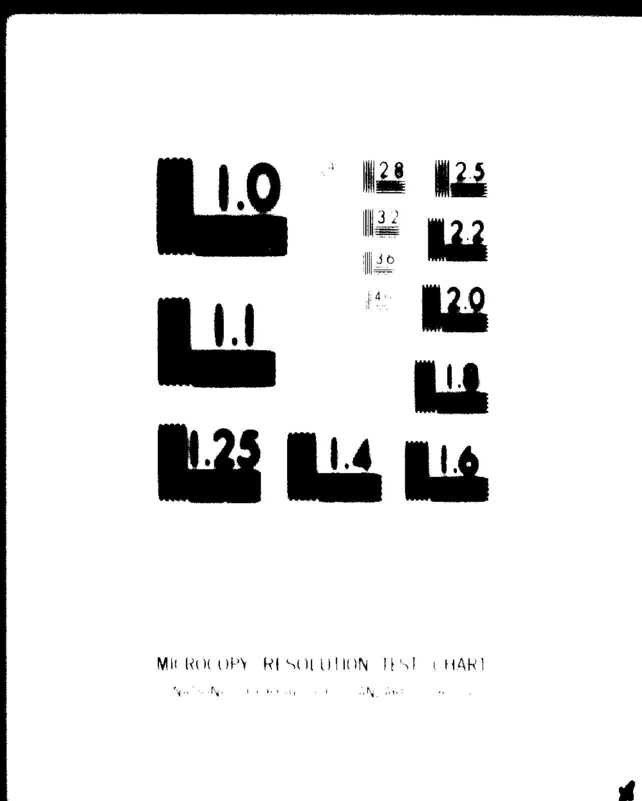
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02342

(1 of 6)

SYSTEM DEVELOPMENT REPORT FOR THE DANUBE IRON AND STEEL WORKS

September 197[illegible]

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02342

(1 of 6)

SYSTEM DEVELOPMENT REPORT FOR THE DANUBE IRON AND STEEL WORKS

September 1975

IKO-KONSULENT A/S
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Norconsult A.S.
Consulting Engineers, Architects & Economists
P.O.Box 9, 1322 Hövik
Norway

SYSTEM DEVELOPMENT REPORT

FOR

DANUBE IRON & STEEL WORKS

SEPTEMBER 1975

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1. INTRODUCTION

The system development for the managed maintenance system of Danube Iron and Steel Work has been completed in close co-operation between the counterpart and the consultants.

It remains now for the consultants to complete implementation plan and the implementation counselling.

The method used for system development included the following steps:

a. In a 20-hours intensive course the consultants trained an analytical staff of 18 persons from the counterpart in systems analysis and job description writing.

b. The project leader from Danube Iron and Steel Work made a study trip to Scandinavian steelworks, together with the consultants' project leader, in order to study implemented managed maintenance systems.

c. 25 sub-projects were defined and scheduled in a network (attachment 1.1 presents a section of this network).

d. Each sub-project was described by objective, activities to be carried out, time requirements, and responsible manager (attachment 1.2 presents an example of a sub-project description).

e. A working group of one to five persons for each sub-project, in close cooperation with the consultants, made an inventory of the present situation and the system development.

f. The final description of the systems was elaborated in some detail by the consultants and completed by the counterpart's staff. During the total development careful attention was given to achieving step-by-step acceptance from the future users of the systems.

In order to test the systems developed, simulations are made of their use in the different types of organizational units in the maintenance function in the Hot Steel Mill, the Mechanical Shop, the Erection Shop and the Central Maintenance Office.

It should be pointed out that in the very short time of the system development phase (approximately 6 months), it has not been possible to complete all the necessary discussions which would result in acceptance of the proposed concept. However, all systems are based on this proposal and if it is not accepted, they shall be adjusted to an alternative organizational concept.

The work carried out up to now in the project has demanded a much larger effort from the consultants than calculated. It is estimated that an input of 50% more consultant hours than offered will be necessary before the conditions of the terms of reference are fullfilled. The reasons for this are several, the most important being:

g. The participation from the counterpart has not been according to the plans.

h. The condition of the counterparts present management system is much weaker than when the terms of references were written.

i. The consultants underestimated the work of inventorying the present situation, on which the system development will be based.

In addition, the consultants decided that to assure success of the projects it was necessary to go beyond the requests of the terms of reference and do the following:

j. Give 18 persons an intensive course in systems analysis and job description writing.

k. Take 2 persons on a one-week study trip to Scandinavia.

l. Demonstrate how to improve efficiency and general knowledge by organising and EDP-processing some ratio delay studies.

However, the cooperation with the counterpart's management has been excellent. It is our opinion that problems not solved have been problems outside management control.

The degree to which the systems are detailed today demands a rather large amount of further detailing before the systems can be brought into operation. The counterpart's staff is able to do this work; however, the implementation period will be considerably shorter if they could be given consultant's aid in this work, and if minor failures can be avoided.

We recommend a staff of approximately 8 persons from the counterpart be appointed to undertake this work for a number of years. Furthermore, we recommend that this group be given consultant's aid in the first year. The objectives of the consultants should be to secure progress in the implementation by following up and by giving direct guidance to each sub-project for instance by transferring formulas, routines and methods used in other steelworks.

Attachment 1.1

OPTIMA
NORWEGIAN
COMPUTING PROJECT NO. 1
CENTER MANAGED MAINTENANCE SYSTEM
30 JUL 75 THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

*** T I M E L I S T I N G ***

PAGE 1
ALPHACODE: 01

PROJECT START: 1MAY75
PLANNED FINISH:
COMPUTED FINISH: 24NOV75

TIME UNIT: DAY

ACTIVITY IDENTIFICATION				ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
2611	01	2	ORGANIZATION	-INFORMATION	2	1MAY75	2MAY75			0	0	0	
2612	01	2	ORGANIZATION	-REGISTRATION OF PRESENT SITUATION	13	5MAY75	21MAY75			0	0	0	
2613	01	2	ORGANIZATION	-ANALYSIS	24	10MAY75	25JUN75			0	0	0	
2614	01	2	ORGANIZATION	-PROPOSALS	13	17JUN75	3JUL75			0	0	0	
2615	01	2	ORGANIZATION	-IMPLEMENTATION	6	4JUL75	11JUL75	17NOV75	24NOV75	90	0	90	

NORWEGIAN
COMPUTING PROJECT NO. 1
CENTER MANAGED MAINTENANCE SYSTEM
04 JUN 75 THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1MAY75
PLANNED FINISH:
COMPUTED FINISH: 24NOV75

ALPHACODE: 02
TIME UNIT: DAY

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ACTIVITY IDENTIFICATION				ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
2421	02	5	M.I.S.	-INFORMATION	2	1MAY75	2MAY75	10SEP75	10SEP75	100	0	0	
2431	02	3	CENTRAL PLAN.	-INFORMATION	6	1MAY75	8MAY75	27MAY75	3JUN75	18	0	0	
2422	02	5	M.I.S.	-REGISTRATION OF PRESENT SITUATION	6	5MAY75	14MAY75	22SEP75	1OCT75	100	0	0	
2432	02	3	CENTRAL PLAN.	-REGISTRATION OF PRESENT SITUATION	7	9MAY75	19MAY75	4JUN75	12JUN75	18	0	0	
2423	02	5	M.I.S.	-ANALYSIS	20	15MAY75	9JUN75	30SEP75	27OCT75	100	0	79	
2433	02	3	CENTRAL PLAN.	-ANALYSIS	32	16MAY75	30JUN75	11JUN75	24JUL75	18	0	11	
2434	02	3	CENTRAL PLAN.	-PROPOSALS	25	4JUL75	7AUG75	15JUL75	18AUG75	7	0	0	
2435	02	3	CENTRAL PLAN.	-IMPLEMENTATION	11	8AUG75	22AUG75	10NOV75	24NOV75	66	0	65	
2424	02	5	M.I.S.	-PROPOSALS	19	22SEP75	16OCT75	21OCT75	14NOV75	21	0	0	
2425	02	5	M.I.S.	-IMPLEMENTATION	6	17OCT75	24OCT75	17NOV75	24NOV75	21	0	21	

OPTIMA
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*** TIME LISTING ***

PROJECT NO. 1
MANAGED MAINTENANCE SYSTEM
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1MAY75
PLANNED FINISH:
COMPUTED FINISH: 24NOV75

ALPHACODE: 03
TIME UNIT: DAY

ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
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2231	03	4	PLANN. SYSTEM -INFORMATION	3	1MAY75	3MAY75	7AUG75	11AUG75	70	0	0	
2241	03	4	PROJ.PLANNING -INFORMATION	1	1MAY75	1MAY75	3OCT75	3OCT75	111	0	0	
2242	03	4	PROJ.PLANNING -REGISTRATION OF PRESENT SITUATION	8	2MAY75	13MAY75	6OCT75	15OCT75	111	0	0	
2222	03	2	PREVENT.MAINT.-REGISTRATION OF PRESENT SITUATION	8	5MAY75	14MAY75	11SEP75	22SEP75	93	0	0	
2232	03	4	PLANN. SYSTEM -REGISTRATION OF PRESENT SITUATION	5	6MAY75	12MAY75	12AUG75	18AUG75	70	0	0	
2233	03	4	PLANN. SYSTEM -ANALYSIS	14	12MAY75	29MAY75	18AUG75	4SEP75	70	0	53	
2243	03	4	PROJ.PLANNING -ANALYSIS	16	12MAY75	2JUN75	14OCT75	4NOV75	111	0	52	
2223	03	2	PREVENT.MAINT.-ANALYSIS	23	13MAY75	12JUN75	19SEP75	21OCT75	93	0	55	
2234	03	4	PLANN. SYSTEM -PROPOSALS	10	8AUG75	21AUG75	2SEP75	15SEP75	17	0	0	
2244	03	4	PROJ.PLANNING -PROPOSALS	10	8AUG75	21AUG75	30OCT75	12NOV75	56	0	0	
2224	03	2	PREVENT.MAINT.-PROPOSALS	20	22AUG75	18SEP75	14OCT75	10NOV75	37	0	0	
2235	03	4	PLANN. SYSTEM -IMPLEMENTATION	6	22AUG75	29AUG75	17NOV75	24NOV75	61	0	61	
2245	03	4	PROJ.PLANNING -IMPLEMENTATION	8	22AUG75	2SEP75	13NOV75	24NOV75	59	0	59	
2225	03	2	PREVENT.MAINT.-IMPLEMENTATION	10	19SEP75	2OCT75	11NOV75	24NOV75	37	0	37	

OPTIMA
NORWEGIAN
COMPUTING PROJECT NO. 1
CENTER MANAGED MAINTENANCE SYSTEM
04 JUN 75 THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

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ALPHACODE: 04

PROJECT START: 1MAY75
PLANNED FINISH:
COMPUTED FINISH: 24NOV75

TIME UNIT: DAY

ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
2261	04	6	MAT.ADM.SYST. -INFORMATION	2	1MAY75	2MAY75	13AUG75	14AUG75	76	0	0	
2271	04	5	COST CONTR.S. -INFORMATION	2	1MAY75	2MAY75	12JUN75	13JUN75	30	0	0	
2262	04	6	MAT.ADM.SYST. -REGISTRATION OF PRESENT SITUATION	15	5MAY75	23MAY75	15AUG75	4SEP75	76	0	0	
2272	04	5	COST CONTR.S. -REGISTRATION OF PRESENT SITUATION	8	5MAY75	14MAY75	16JUN75	25JUN75	30	0	0	
2273	04	5	COST CONTR.S. -ANALYSIS	20	15MAY75	10JUN75	26JUN75	31JUL75	30	0	30	
2263	04	6	MAT.ADM.SYST. -ANALYSIS	35	26MAY75	7JUL75	1SEP75	17OCT75	76	0	67	
2274	04	5	COST CONTR.S. -PROPOSALS	43	23JUL75	19SEP75			0	0	0	
2264	04	6	MAT.ADM.SYST. -PROPOSALS	25	28AUG75	2OCT75	7OCT75	10NOV75	27	0	0	
2275	04	5	COST CONTR.S. -IMPLEMENTATION	16	22SEP75	15OCT75	30OCT75	24NOV75	28	0	28	
2265	04	6	MAT.ADM.SYST. -IMPLEMENTATION	10	3OCT75	16OCT75	11NOV75	24NOV75	27	0	27	

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COMPUTER PROJECT NO. 1
CENTER [illegible]
26 JUN 75 THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

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PLANNED FINISH: [illegible]
COMPUTED FINISH: [illegible]
TIME UNIT: DAY

ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PROG.	FLOAT SEC.	FLOAT FREE	UP DATE
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2302	05	3	PLANNING GUIDE -PRESENTATION OF PRESENT SITUATION	6	[illegible]	[illegible]	17JUL75	24JUL75	32	0	[illegible]	
2303	05	3	PLANNING GUIDE -ANALYSIS	24	[illegible]	[illegible]	24JUL75	[illegible]	32	0	45	
2304	05	3	PLANNING GUIDE -PROPOSALS	24	[illegible]	[illegible]	[illegible]	[illegible]	7	0	[illegible]	
2305	05	3	PLANNING GUIDE -IMPLEMENTATION	6	[illegible]	[illegible]	[illegible]	[illegible]	67	0	67	

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PROJECT NO. 1

THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: [illegible]
PLANNED FINISH:
COMPUTED FINISH: [illegible]

TIME UNIT: DAY

ACTIVITY IDENTIFICATION		ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
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[illegible]	[illegible]	4 MGT.ADM.SYST. -INFORMATION	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	5 COST CENTRE S. -INFORMATION	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	3 PLAN.DETAIL & -[illegible] OF PRESENT SITUATION	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	4 MGT.ADM.SYST. -[illegible] OF PRESENT SITUATION	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	5 COST CENTRE S. -[illegible] OF PRESENT SITUATION	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	5 COST CENTRE S. -[illegible]	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	3 PLAN.DETAIL & -[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	4 MGT.ADM.SYST. -[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	5 COST CENTRE S. -PROPOSALS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	5 COST CENTRE S. -IMPLEMENTATION	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
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[illegible]	[illegible]	4 MGT.ADM.SYST. -IMPLEMENTATION	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	3 PLAN.DETAIL & -IMPLEMENTATION	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	15	[illegible]	[illegible]	[illegible]	[illegible]	15	[illegible]	15	

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COMPUTING CENTER
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*** TIME LISTING ***

PROJECT NO. 1
[illegible] SYSTEM
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: [illegible]75
PLANNED FINISH:
COMPUTED FINISH: 24NOV75

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[illegible]: 07
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ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
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2302	07	6 PERSONNEL	-[illegible]ATION OF PRESENT SITUATION	3	[illegible]75	[illegible]75	19AUG75	21AUG75	70	0	0	
2303	07	6 PERSONNEL	-ANALYSIS	13	[illegible]75	[illegible]75	22AUG75	9SEP75	70	0	0	
2304	07	6 PERSONNEL	-PROPOSALS	20	[illegible]75	27JUN75	9SEP75	15OCT75	70	0	27	
2306	07	6 PERSONNEL	-IMPLEMENTATION	25	[illegible]75	[illegible]75	[illegible]OCT75	1[illegible]NOV75	51	0	0	
				10	[illegible]75	[illegible]75	[illegible]NOV75	24NOV75	51	0	51	

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ALPHACODE: DP

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[illegible] SYSTEM
04 JUN 75 THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1MAY75
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COMPUTED FINISH: 24NOV75

TIME UNIT: DAY

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ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
2401	DP	4 SYSTEM ANAL.	-INFORMATION	2	1MAY75	2MAY75	16JUL75	17JUL75	54	0	0	
2402	DP	4 SYSTEM ANAL.	-REGISTRATION OF PRESENT SITUATIO-	25	5MAY75	6JUN75	18JUL75	19AUG75	54	0	0	
2403	DP	4 SYSTEM ANAL.	-ANALYSIS	40	20MAY75	28JUL75	12AUG75	6OCT75	54	0	0	
2404	DP	4 SYSTEM ANAL.	-PROPOSALS	30	9JUL75	[illegible]	[illegible]	3NOV75	54	0	0	
2405	DP	4 SYSTEM ANAL.	-IMPLEMENTATION	15	20AUG75	9SEP75	4NOV75	24NOV75	54	0	54	

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PROJECT NO. 1
[illegible] [illegible] SYSTEM
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PROJECT START: 1MAY75
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ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
2201	10	5	CODING SYST. -INFORMATION	2	1MAY75	2MAY75	6AUG75	7AUG75	69	0	0	
2202	10	5	CODING SYST. -REGISTRATION OF PRESENT SITUATION	13	3MAY75	20MAY75	6AUG75	26AUG75	69	0	0	
2203	10	5	CODING SYST. -ANALYSIS	28	19MAY75	25JUN75	22AUG75	30SEP75	66	0	69	
2204	10	5	CODING SYST. -PROPOSALS	33	22SEP75	3NOV75			0	0	0	
2205	10	5	CODING SYST. -IMPLEMENTATION	13	6NOV75	24NOV75			0	0	0	

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PROJECT NO. 1
[illegible]

04 JUN 75 THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

*** T I M E   L I S T I N G ***

PAGE 10
[illegible]: 13
PROJECT START: 1MAY75
[illegible] FINISH:
COMPUTED FINISH: 24NOV75
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ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
2211	13	2	ORGANIZATION -INFORMATION	1	1MAY75	9MAY75	19SEP75	19SEP75	101	0	0	
2212	13	2	ORGANIZATION -REGISTRATION OF PRESENT SITUATION	8	2MAY75	13MAY75	22SEP75	1OCT75	101	0	0	
2213	13	2	ORGANIZATION -ANALYSIS	23	12MAY75	13JUN75	30SEP75	30OCT75	101	0	22	
2214	13	2	[illegible] -[illegible]LS	15	4JUL75	[illegible]JUL75	[illegible]OCT75	12NOV75	79	0	0	
2215	13	2	ORGANIZATION -IMPLEMENTATION	8	25JUL75	5AUG75	13NOV75	24NOV75	79	0	79	

OPTIMA
NORWEGIAN
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CENTER MANAGED MAINTENANCE SYSTEM
04 JUN 75 THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

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PROJECT START: 1MAY75
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ACTIVITY IDENTIFICATION	ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
2251 14 4	WORK ORDER S. -INFORMATION	2	1MAY75	2MAY75	1AUG75	4AUG75	66	0	0	
2252 14 4	WORK ORDER S. -REGISTRATION OF PRESENT SITUATION	12	5MAY75	20MAY75	5AUG75	20AUG75	66	0	0	
2253 14 4	WORK ORDER S. -ANALYSIS	28	16MAY75	24JUN75	18AUG75	24SEP75	66	0	49	
2254 14 4	WORK ORDER S. -PROPOSALS	30	22AUG75	2OCT75	16SEP75	27OCT75	17	0	0	
2255 14 4	WORK ORDER S. -IMPLEMENTATION	20	3OCT75	30OCT75	28OCT75	24NOV75	17	0	17	

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*** T I M E   L I S T I N G ***

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ALPHACODE: 15

PROJECT NO. 1
MANAGED [redacted] SYSTEM
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1MAY75
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ACTIVITY IDENTIFICATION				ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
2311	15	2	ORGANIZATION	-INFORMATION	3	1MAY75	5MAY75	28AUG75	1SEP75	85	0	[illegible]	
2312	15	2	ORGANIZATION	-REGISTRATION OF PRESENT SITUATION	6	6MAY75	13MAY75	2SEP75	9SEP75	85	0	[illegible]	
2313	15	2	ORGANIZATION	-ANALYSIS	23	13MAY75	12JUN75	9SEP75	9OCT75	85	0	21	
2314	15	2	ORGANIZATION	-PROPOSALS	29	4JUL75	12AUG75	2OCT75	10NOV75	64	0	0	
2315	15	2	ORGANIZATION	-IMPLEMENTATION	10	13AUG75	26AUG75	11NOV75	24NOV75	64	0	54	

OPTIMA
NORWEGIAN
COMPUTING
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04 JUN 75

*** T I M E   L I S T I N G ***

PROJECT NO. 1
MANAGED MAINTENANCE SYSTEM
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1MAY75
PLANNED FINISH:
COMPUTED FINISH: 24NOV75

TIME UNIT: DAY

ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
331	16	3	PLAN.DETAIL M -INFORMATION	2	1MAY75	2MAY75	27AUG75	28AUG75	86	0	0	
361	16	6	PLANT LAYOUT M-INFORMATION	1	1MAY75	1MAY75	1SEP75	1SEP75	87	0	0	
351	16	6	TECHN.DATA M-M-INFORMATION	4	1MAY75	6MAY75	26AUG75	29AUG75	83	0	0	
342	16	6	PLANT LAYOUT M-REGISTRATION OF PRESENT SITUATION	6	2MAY75	9MAY75	2SEP75	9SEP75	87	0	0	
332	16	3	PLAN DETAIL M -REGISTRATION OF PRESENT SITUATION	8	5MAY75	14MAY75	29AUG75	9SEP75	86	0	0	
352	16	6	TECHN.DATA M-M-REGISTRATION OF PRESENT SITUATION	13	7MAY75	23MAY75	1SEP75	17SEP75	83	0	0	
343	16	6	PLANT LAYOUT M-ANALYSIS	18	9MAY75	4JUN75	9SEP75	3OCT75	87	0	0	
333	16	3	PLAN.DETAIL M -ANALYSIS	20	13MAY75	9JUN75	8SEP75	3OCT75	84	0	72	
353	16	6	TECHN.DATA M-M-ANALYSIS	25	21MAY75	24JUN75	15SEP75	17OCT75	83	0	0	
344	16	6	PLANT LAYOUT M-PROPOSALS	28	29MAY75	7JUL75	29SEP75	5NOV75	87	0	0	
354	16	6	TECHN.DATA M-M-PROPOSALS	22	17JUN75	16JUL75	10OCT75	10NOV75	83	0	0	
345	16	6	PLANT LAYOUT M-IMPLEMENTATION	13	8JUL75	24JUL75	6NOV75	24NOV75	87	0	87	
355	16	6	TECHN.DATA M-M-IMPLEMENTATION	10	17JUL75	30JUL75	11NOV75	24NOV75	83	0	83	
334	16	3	PLAN.DETAIL M -PROPOSALS	33	11SEP75	27OCT75	29SEP75	12NOV75	12	0	0	
335	16	3	PLAN DETAIL M -IMPLEMENTATION	5	28OCT75	6NOV75	13NOV75	24NOV75	12	0	12	

OPTIMA
NORWEGIAN
COMPUTING CENTER
26 JUN 75

*** T I M E L I S T I N G ***

PAGE 16
ALPHACODE: 17

PROJECT NO. 1
MANAGED MAINTENANCE SYSTEM
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1MAY75
PLANNED FINISH:
COMPUTED FINISH: 26NOV75

TIME UNIT: DAY

ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
2441	17	6	MAT.ADM.SYST. -INFORMATION	1	1MAY75	1MAY75	25AUG75	25AUG75	82	0	0	
2451	17	5	COST CONTR.S. -INFORMATION	1	1MAY75	1MAY75	16JUN75	16JUN75	32	0	0	
2442	17	6	MAT.ADM.SYST. -REGISTRATION OF PRESENT SITUATION	5	2MAY75	8MAY75	26AUG75	1SEP75	82	0	0	
2452	17	5	COST CONTR.S. -REGISTRATION OF PRESENT SITUATION	6	2MAY75	9MAY75	17JUN75	24JUN75	32	0	0	
2443	17	6	MAT.ADM.SYST. -ANALYSIS	9	8MAY75	19MAY75	1SEP75	10SEP75	82	0	63	
2453	17	5	COST CONTR.S. -ANALYSIS	10	9MAY75	22MAY75	24JUN75	7JUL75	32	0	32	
2454	17	5	COST CONTR.S. -PROPOSALS	13	4JUL75	22JUL75			0	0	0	
2455	17	5	COST CONTR.S. -IMPLEMENTATION	10	23JUL75	5AUG75	11NOV75	26NOV75	79	0	79	
2444	17	6	MAT.ADM.SYST. -PROPOSALS	15	8AUG75	28AUG75	9SEP75	29SEP75	22	0	0	
2445	17	6	MAT.ADM.SYST. -IMPLEMENTATION	13	29AUG75	16SEP75	6NOV75	26NOV75	49	0	49	

OPTIMA
NORWEGIAN
COMPUTING   PROJECT NO. 1
CENTER   MANAGED MAINTENANCE SYSTEM
26 JUN 75   THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

*** TIME LISTING ***

ALPHACODE: 15

PROJECT START: 1MAY75
PLANNED FINISH:
COMPUTED FINISH: 24NOV75

TIME UNIT: DAY

ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
2361	13	5	PLANT LAYOUT E-INFORMATION	1	1MAY75	1MAY75	11JUL75	11JUL75	51	0	0	
2351	18	6	TECHN.DATA F-J-INFORMATION	3	1MAY75	5MAY75	25SEP75	29SEP75	105	0	0	
2362	18	5	PLANT LAYOUT F-REGISTRATION OF PRESENT SITUATION	6	2MAY75	9MAY75	16JUL75	21JUL75	51	0	0	
2352	19	6	TECHN.DATA F-J-REGISTRATION OF PRESENT SITUATION	8	6MAY75	15MAY75	30SEP75	9OCT75	105	0	0	
2363	19	5	PLANT LAYOUT E-ANALYSIS	25	9MAY75	12JUN75	21JUL75	22AUG75	51	0	0	
2353	14	6	TECHN.DATA F-J-ANALYSIS	19	16MAY75	6JUN75	8OCT75	31OCT75	105	0	0	
2354	18	6	TECHN.DATA F-J-PROPOSALS	15	3JUN75	23JUN75	20OCT75	17NOV75	105	0	0	
2344	18	5	PLANT LAYOUT E-PROPOSALS	37	5JUN75	25JUL75	15AUG75	6OCT75	51	0	0	
2355	16	6	TECHN.DATA F-J-IMPLEMENTATION	5	26JUN75	30JUN75	10NOV75	24NOV75	105	[illegible]	105	
2345	19	6	PLANT LAYOUT E-IMPLEMENTATION	14	29JUL75	18AUG75	3NOV75	24NOV75	70	[illegible]	70	

OPTIMA
NORWEGIAN
COMPUTING
CENTER
04 JUN 75

*** T I M E   L I S T I N G ***

PROJECT NO. 1
MANAGED MAINTENANCE SYSTEM
THE ACTIVITIES ARE SORTED ACCORDING TO TOTAL (PRIMARY) FLOAT

PROJECT START: 1MAY75
PLANNED FINISH:
COMPUTED FINISH: 24NOV75

TIME UNIT: DAY

ACTIVITY IDENTIFICATION		ACTIVITY DESCRIPTION			ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
2411	01	2	ORGANIZATION	-INFORMATION	2	1MAY75	2MAY75			0	0	0	
2412	01	2	ORGANIZATION	-REGISTRATION OF PRESENT SITUATION	13	5MAY75	21MAY75			0	0	0	
2413	01	2	ORGANIZATION	-ANALYSIS	28	19MAY75	25JUN75			0	0	0	
2414	01	2	ORGANIZATION	-PROPOSALS	13	17JUN75	3JUL75			0	0	0	
2454	17	5	COST CONTR.S.	-PROPOSALS	13	4JUL75	22JUL75			0	0	0	
2274	04	5	COST CONTR.S.	-PROPOSALS	43	23JUL75	10SEP75			0	0	0	
2284	10	5	CODING SYST.	-PROPOSALS	33	22SEP75	5NOV75			0	0	0	
2285	10	5	CODING SYST.	-IMPLEMENTATION	13	6NOV75	24NOV75			0	0	0	
2434	02	3	CENTRAL PLAN.	-PROPOSALS	25	4JUL75	7AUG75	15JUL75	18AUG75	7	0	0	
2324	05	3	PLANNING MAIN	-PROPOSALS	24	8AUG75	10SEP75	19AUG75	19SEP75	7	0	0	

AN EXAMPLE OF A SUB-PROJECT DESCRIPTION.

2.3.4/2 PLAN LAYOUT (MACHINE SHOP)

I. OBJECTIVE

The aim of this project is to analyse the present layout - including material flow, local stores, transportation system and equipment - in order to develop optimal conditions for production.

II. ACTIVITIES

1. Information

It is to be ensured that all the necessary information on the project will be provided to all those who are concerned with the project.

2. Inventory of present situation

The following are to be recorded:

2.1 Present layout.

2.2 P-Q diagrams.

2.3 Material flow diagrams for typical products.

2.4 Material input and output, quantity of local stores' stock.

2.5 Transportation equipment, transport routes.

2.6 The weak and strong points, their causes, controllable and uncontrollable factors.

2.7 Opinions and proposals from workers and leaders.

3. Analyses

3.1 Analysis of present layout.

3.2 Analysis of P-Q diagrams.

3.3 Analysis of material flow diagrams for typical products.

3.4 Analysis of material input and output, quantity of local store's stock.

3.5 Analysis of transportation equipment, transport routes.

3.6 Analysis of the weak and strong points, their causes, the controllable and uncontrollable factors.

3.7 Analysis of the opinions and proposals from workers and leaders.

4. Proposals

On the basis of the above analyses, a series of several preliminary proposals will be elaborated. These have to be simulated and analysed. Factors needing special attention are the following:

4.1 Logical layout of machinery.

4.2 Short transport routes.

4.3 Standard transport units.

4.4 Means of transportation which does not disturb work on machines.

4.5 Easy and reliable way of transport ordering.

4.6 Local stores kept in good order.

4.7 Good physical conditions for workers.

4.8 Easy communication between workers and leaders.

The workshop manager should be consulted frequently during elaboration of proposals. If poor machinery will reduce the possibility of developing an efficient workshop, this information should be given to the responsible individual of project 2.3.5. The proposals elaborated have to meet the requirements stated in "IV. Results".

5. Implementation

The total plan for implementation of the proposals is to be elaborated in two steps:

a. A preliminary plan depending on which proposals are accepted.

b. Elaboration of final plans. They should include the following:

   - economic calculations,
   - time scheduling,
   - resource requirements,
   - results expected,
   - conditions of implementation,
   - distribution of responsibilities.

III. INFORMATION SOURCES

- INO consultants
- Project 2.3, 2.3.1, 2.3.2, 2.3.5, 2.3.7.
- Workshop plan elaborated in hand.
- Records (cards) in the workshop.
- Discussions.
- Project-leader.

IV. RESULTS

- Layout in scale of 1:50 for the workshop.
- Elaboration of a permanent transport system, involving:

  Kind of goods,
  Kind of transport facilities,
  Items (units),
  Frequency.

- Administration of transport orders,
- Detailed description of new machines proposed,
- Economic calculation of modifications.

V. TIME CONSUMPTION

INO: 10 hours.
DV: 504 hours.

VI. RESPONSIBLE:

Markivics József

2. SUMMARY

2. SUMMARY OF THE PROPOSALS

The managed maintenance system of Danube Iron and Steel Works is completed according to the contract between UNIDO and Norconsult/IKO. The terms of references for the project are accordingly respected.

Close cooperation between the counterpart and the consultants resulted in a complete system for managed maintenance consisting of:

a. A proposal for future organisation of the maintenance function and its relation to the other parts of the company. The proposed concept includes a centralisation of the maintenance function, a clear separation of responsibilities between production and maintenance, and a division of the maintenance function into logical units according to functions.

b. A system for central planning of all maintenance activities. The proposed system consists of a yearly plan coordinating all maintenance activities by means of a network planning technique.

c. A system for planning of maintenance work to be carried out within each production unit. The proposal consists of a system for planning of projects and repair jobs based on a work order approach.

d. A system for planning of work, production of spare parts, etc. in the central work shops. The proposed system consists of a general production planning system well-suited to the actual production of spare parts.

e. A system for preventive maintenance. The proposed system includes a registration and information system, as well as necessary routines and instructions.

f. A system for administration of spare parts and material. The proposed system consists of a centralised and coordinated material administration based on central files, uniform routines and a simplified decision-making procedure.

g. A cost control system covering all maintenance activities. The proposed system is based on the proposed organisational concept and distributes responsibilities, reporting and control accordingly. Its main objective is to improve cost consciousness throughout the organisation.

h. Coding system for:

   Machine numbers
   Account numbers
   Drawing numbers
   Spare parts numbers
   Materials numbers

The proposed systems are elaborated as modular systems covering the whole enterprise.

i. Proposals for contents of all necessary data bases and files.

k. Description of EDP-files, input and output request necessary for a later conversion to EDP.

l. Re ommendation of a method for determining sise of stocks a spare parts (see article 10).

m. R mmendation of a method for project planning by use of EDP-network (see article 10).

n. Recommendation of a method for revaluation of plant-layout(see article 10).

o. Recommendation of a method for modern information files, copying equipment, etc. (see article 10).

r. A complete education program in maintenance management for both production and maintenance managers. This system is described in a report delivered for UNIDO in July 1975 under the contract 75/2 - 13 (HUN/72/804).

The managed maintenance system is worked out as a manual system, which can be brought rapidly into action, but a later conversion to EDP has been taken into consideration.

3. GENERAL REMARKS

3. GENERAL REMARKS

In order to give a better understanding of the proposals in this report, we shall in this chapter describe our impressions of the present situation at the Danube Iron and Steel Works. We shall comment on such matters which during our work have been studied in connection with the system development studies. We do not intend to give a status analysis, as this is not our task and as a part of the information we have received has not been double-checked. However, we do have sufficient documentation to state the following:

There are many positive factors in the company's present situation. The technological achievements and past expansion of production show the high quality of workers and management. The continous improvement of the plant demonstrates the high technical quality of the technical staff.

The programs for further technological development and expansion of production will ensure even greater improvements in the future. The opportunities for obtaining them at reasonable cost depend mostly on how well the company solves its management problems and in which way Hungarian industry is developed.

Compared with similar plants in Western Europe, we must state that plant conditions are considerably lower and maintenance costs considerably higher than normal. The reasons for this are in our opinion:

- Production has expanded to a level much higher (+ 25% to + 75%) than foreseen when the plant was originally projected. This results in an overload on several points throughout the production line.

  As an example, the hot rolling mill during the first eight months of this year has had 28 breakdowns caused by broken rolls. This is a very high figure and indicates extremely poor quality of the rolls, and/or considerable overload, and/or poor instruction of the operators.

- The description of the present organization is old and outdated. Job descriptions and descriptions of functions are not coordinated and do not correspond to reality. The quality of the system descriptions varies greatly, and as they are made up individually, they are not well integrated as a whole.

  For example, it has been necessary to make new descriptions of all existing systems which we wanted to study. We have never seen an "in-use" description of a system.

- The function of the organization for the total company is very unclear. There is a lot of overlapping between production and maintenance. Responsibilities are often impossible to place in one organizational unit. The same situation exists within the maintenance function.

  For example decisions about a major repair involve some 20 different persons and nobody has the final responsibility.

- The organization is established in such a way as to give priority to production; maintenance possibilities to influence decisions about repairtime and conditions in the plant. This is also significant in planning maintenance work and in keeping the maintenance staff efficient.

  For example, in January of this year a large repair demanding approximately 860 maintenance workers in the hot steel mill was decided and planned, in cooperation between production and maintenance staff. The workers were taken away from the normal shift and made ready to start at a certain time. The work to be performed was prepared. Then production called off the repair because the production plan had not been fulfilled.

- The amount of instruction, education, and motivation of the production workers is not sufficient. User's manuals exist for the equipment, but are not sufficiently developed. The maintenance people are instructing the production workers in proper operation even though this is the responsibility of the production foremen.

  For example blocks coming down the roll table in the hot steel mill are often not properly planned and have large burrs on them. The operator should refuse such blocks, as they harm the equipment and cause down-time and unnecessary maintenance costs.

- The demand for service from the central maintenance shops is unrealistic. The total yearly demand for spare parts amounts to approximately 250 mill. Forints; approximately 40% of this is imported, approximately 30% is bought in Hungary, and approximately 30% is produced by the counterpart.

  Any item used at the plant in principle can be ordered from the central workshops, as:

  - The delivery time for imported spare parts ranges between one and two years

  - The capacity of the Hungarian machine industry often is limited so that delivery is impossible.

- The Hungarian machine industry is not sufficiently equipped for manufacturing many of the spare parts needed by the counterpart.

- The spare parts administration is weak. This causes major difficulties, in some cases insufficient quality, and often very high costs.

As an example, rolls for the sheet straightener are to be hardened before use. This, usually is done by heating the rolls in an induction furnace, but this size furnace does not exist in Hungary. The counterpart demands such rolls. The Central Maintenance Workshop performs the hardening by heating the rolls one by one in a pit furnace. The temperature range cannot be properly controlled and the results are not good. The rolls will have a shorter life and be more expensive.

- The central maintenance shops are not efficient. They get their orders from a number of sources (about thirty) and each ordering unit can demand delivery time by giving priority. The orders often are not suitable for the existing equipment and require expensive modifications. The documentation, in general, is poor.

Drawings are not divided for each operation, and a lot of corrections are made with different coloured pencils on the blueprints. The workshops in general are not suited for efficient production, the machinery and equipment are not sufficient for production of spare parts in the wide range of technology that is needed by the counterpart, heating systems are insufficient in some factories, transport means are poor. The tools are not organized properly and their quality varies considerably.

- The administration of spare parts and materials is today decentralized, labors under very difficult conditions, and is not efficient.

Often it is impossible to get a realistic delivery time when ordering a spare part. In our samples we found deviations in delivery time from one month to one year for spare parts purchased from outside. Also, we found that some orders given to the central workshops are years old and not filled.

At present the total value of spare parts in the company amounts to approximately 400 mill. Forints. Approximately 70% of this is produced outside the company and requires delivery times from a few months to two years. Taking this into consideration, the rate of turnover for spare parts is not bad, and the total amount of spare parts in stock probably too small. This view is underscored by the fact that approximately 15% of the present spare parts have had no turnover since 1972.

- The technical staff for maintenance is too small. All technicians we talked to mentioned an overload of work. The missing documentation and the inefficient planning activities prove this.

  For example, when this UNIDO project was started, 18 technicians from the counterpart were allocated for the different sub-projects and were told by the top management to concentrate on this job. However, their normal functions were not taken over by others, because there is no spare capacity. Therefore, none of these people has been fulltime on the project and the systems developed are not as integrated as intended.

- The use of modern management tools has been started by the company, but the progress is insufficient. Three years ago the network-planning technique was introduced. Still today it is used only as a description of the logical structure in a job and not for planning control.

  The use of EDP is very low. There is sufficient computer capacity with some 40 persons working in this function.

  However, for the maintenance and materials administration no input or output proposals have been presented, and the coding systems used today are unsuitable for EDP. No plans exist for the introduction of EDP in the maintenance function, and no calculations have been made concerning the efforts required.

The present situation, partially described above, forms part of the background for our proposals concerning a new organisation and a new management system for the maintenance function of the Danube Iron and Steel Works.

We are convinced that the introduction of this system will give the company major advantages. Improvements can be made in capabilities of the plant, in the quality of production, and in the volume of production, specific maintenance costs can be decreased.

However, we must stress that this is a major task for the organisation of the company and must be realized as such if remarkable results shall be obtained. The system development phase of this project has been injuriously affected by lack of capacity from the counterparts organization. In order to get a successful implementation of the proposed systems it will be necessary to allocate qualified fulltime personnel to the project for a number of years.

Besides and above this are three important conditions:

- the top-management of the Danube Iron and Steel Works must consider the implementation of these systems as a responsibility demanding priority.

- the need for maintenance and the potential of the maintenance organization to meet this must be realisticly analysed, and changes in capacity must be carried out accordingly.

- the advanced training of managers in modern management techniques must be accelerated at all levels.

The duration of a complete implementation is preliminary estimated to approximately 4 years. This estimation is based on the above mentioned conditions and some consultants participation.

4. ORGANIZATION

ATTACHMENT 4.1	Organisation scheme Danube Iron & Steel Works
ATTACHMENT 4.2	Organization scheme Maintenance Head Department
ATTACHMENT 4.3	Organization scheme Rolling Mills - Maintenance Unit

4. ORGANIZATION

The present organization of the maintenance function at the Danube Iron and Steel Works is unclear and complicated.

The maintenance can be seen as consisting of 4 different units:

a. The central maintenance office which is partly without line responsibility for maintenance. However, the most efficient chief engineer advises on important maintenance decisions and holds a great deal of informal authority.

b. One part of the workshops produces spare parts and machinery. These shops, alternatively, could be located outside and independently of the company. They are a foundry, a steel casting factory, a mechanical workshop, a forging shop, etc.

c. One part of the workshops carries out maintenance work in close connection with production units (Steel Mill, etc.). Such shops are an erection shop, a wagon repair shop, etc.

Both above mentioned groups of workshops, b and c, report to the same manager and form one of eight economically indepandent units of the Danube Iron and Steel Works.

This unit reports to the chief engineer of maintenance. Other units (7) report to the technical director.

d. Within each production department (hot steel mill, etc.), there is a maintenance unit, responding directly to the department manager, responsible for carrying out the maintenance operation within the department, as well as pre-planning such preventive maintenance as is carried out.

This typa of organizational structure is unusual in the steel industry, and while it was efficient during the very rapid establishment and expansion of the plant, it is so no longer.

The main weaknesses of the present organizational structure are:

e. The decentralized organization has caused a non-integrated development of the maintenance management systems.

f. The present administrative routines are complicated and cause both slow decision procedures and high administrative costs.

g. Since the administrative systems are complicated, demand for quick action often causes the systems to fail.

h. Central information files are difficult to maintain and do not function.

i. General conditions in the plant are totally controlled by the production managers who by nature are more qualified for production than for maintenance. Consequently, conditions are unsatisfactory.

k. The materials administration follows the decentralized organization, and therefore the possibilities for standardization and analyses of buy/make nature are difficult and do not work well. The overall control of amounts of spare parts and materials in stock is poor.

Therefore we recommend reorganizing the maintenance function of Danube Iron and Steel Works.

In appendix 4.1, 4.2 and 4.3, examples of the logical structure which is recommended are shown. The main objective of this proposal is to establish an integrated maintenance management organization. All maintenance decisions are to be controlled by a director of maintenance who answers to the technical director.

The director of maintenance is responsible for all maintenance costs and for the efficiency of the maintenance. He will divide the organization below him according to this responsibility. His first-line subordinates will be:

l. Chief of production units maintenance workshops.

m. Chief of central maintenance workshops.

n. Chief of maintenance production workshops.

o. Chief of materials administration.

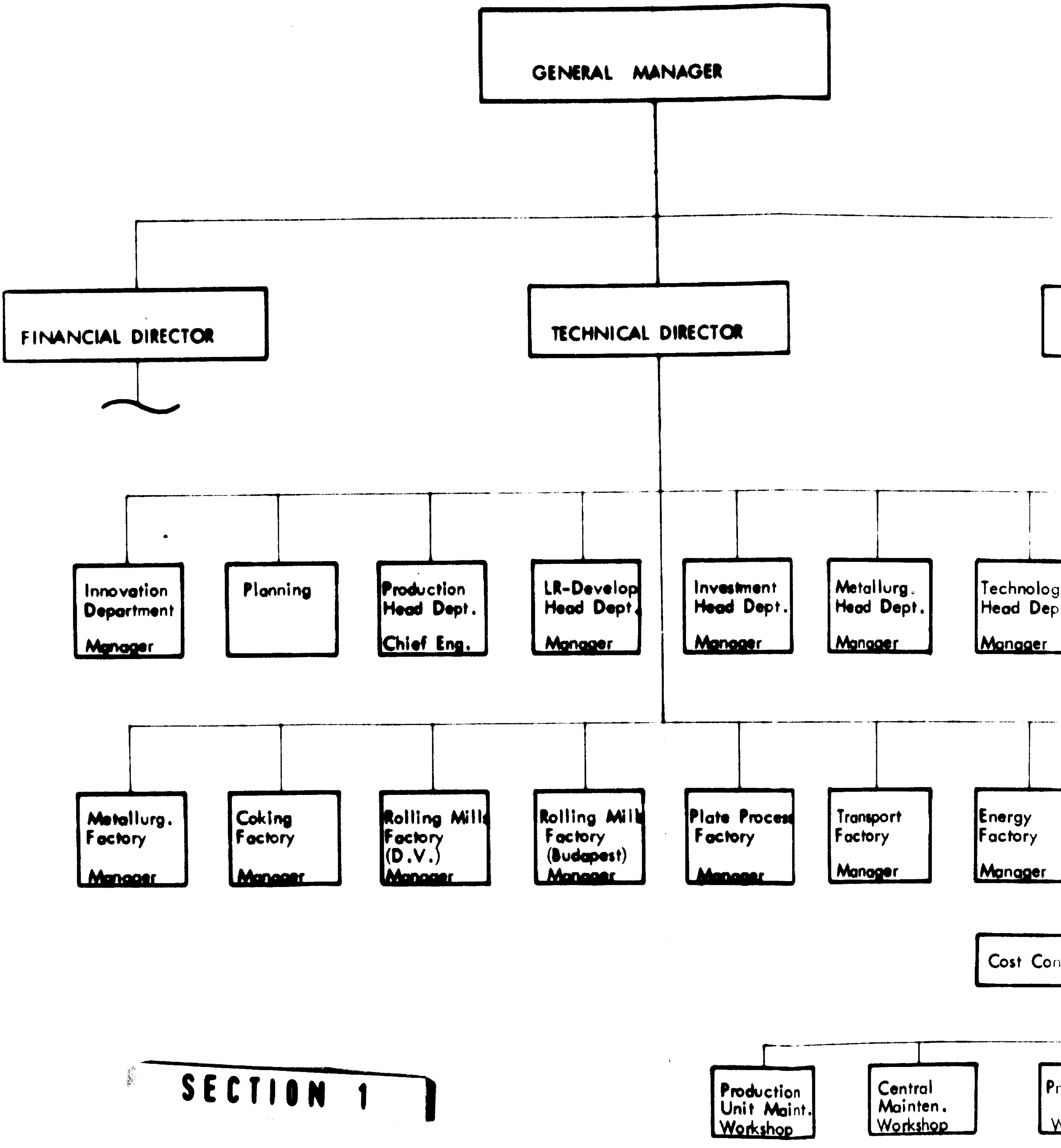
p. Chief of maintenance engineering department.

To assist the director of maintenance in making plans, comments on reports, analyses, and such continuous development of systems which might be necessary, he will have two central staffs with the following functions:

q. Central planning function.

r. Cost control function.

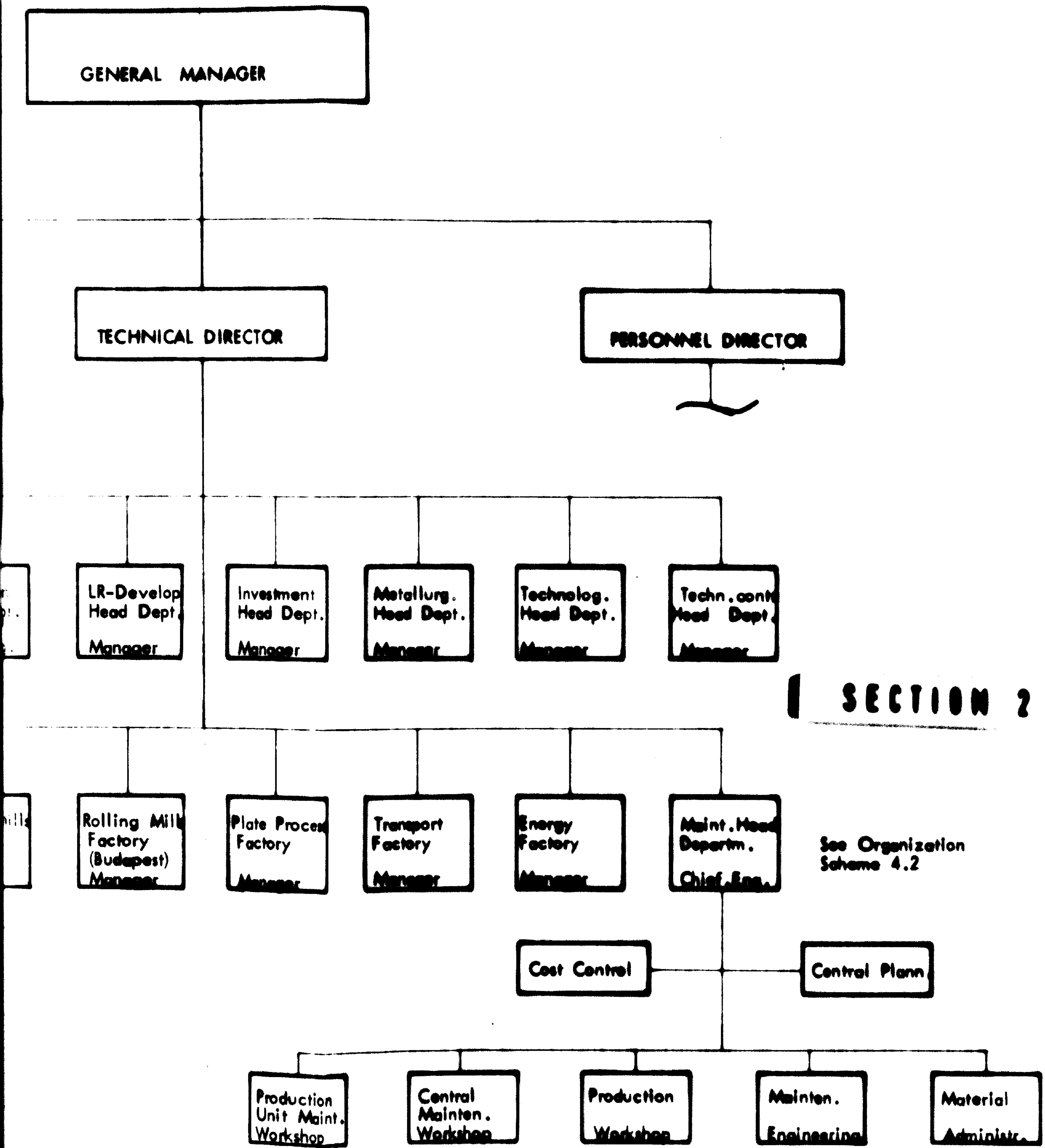
The function of this organisation will be more clearly understood by studying the function of the different management systems presented later in this report.


GENERAL MANAGER
FINANCIAL DIRECTOR
TECHNICAL DIRECTOR
Innovation Department Manager
Planning
Production Head Dept. Chief Eng.
LR-Develop Head Dept. Manager
Investment Head Dept. Manager
Metallurg. Head Dept. Manager
Technolog Head Dep Manager
Metallurg. Factory Manager
Coking Factory Manager
Rolling Mill Factory (D.V.) Manager
Rolling Mill Factory (Budapest) Manager
Plate Process Factory Manager
Transport Factory Manager
Energy Factory Manager
Cost Con
Production Unit Maint. Workshop
Central Mainten. Workshop
Pr W

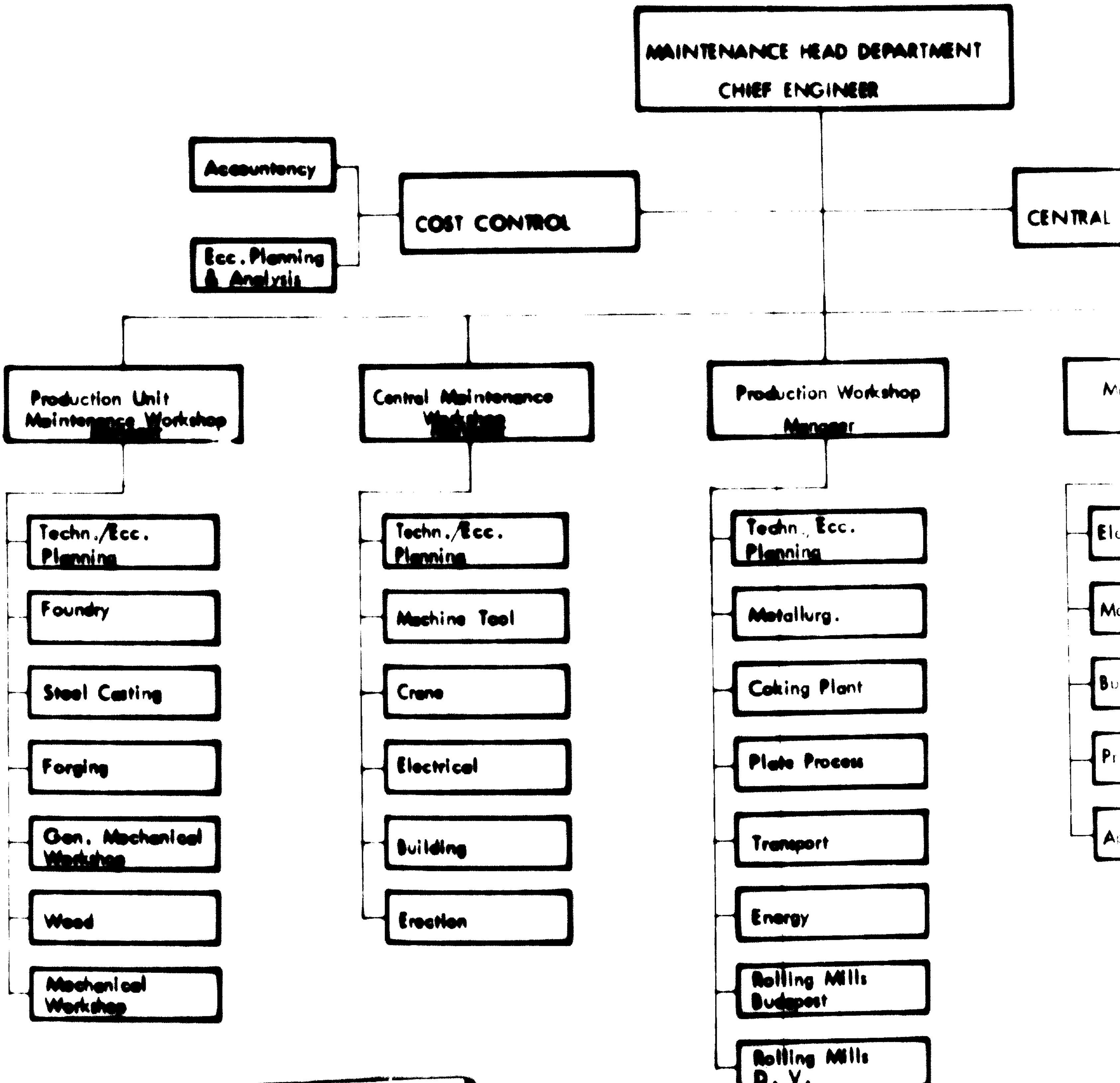
SECTION 1

ORGANIZATION SCHEME 4.1

DUNAI VASMÜ



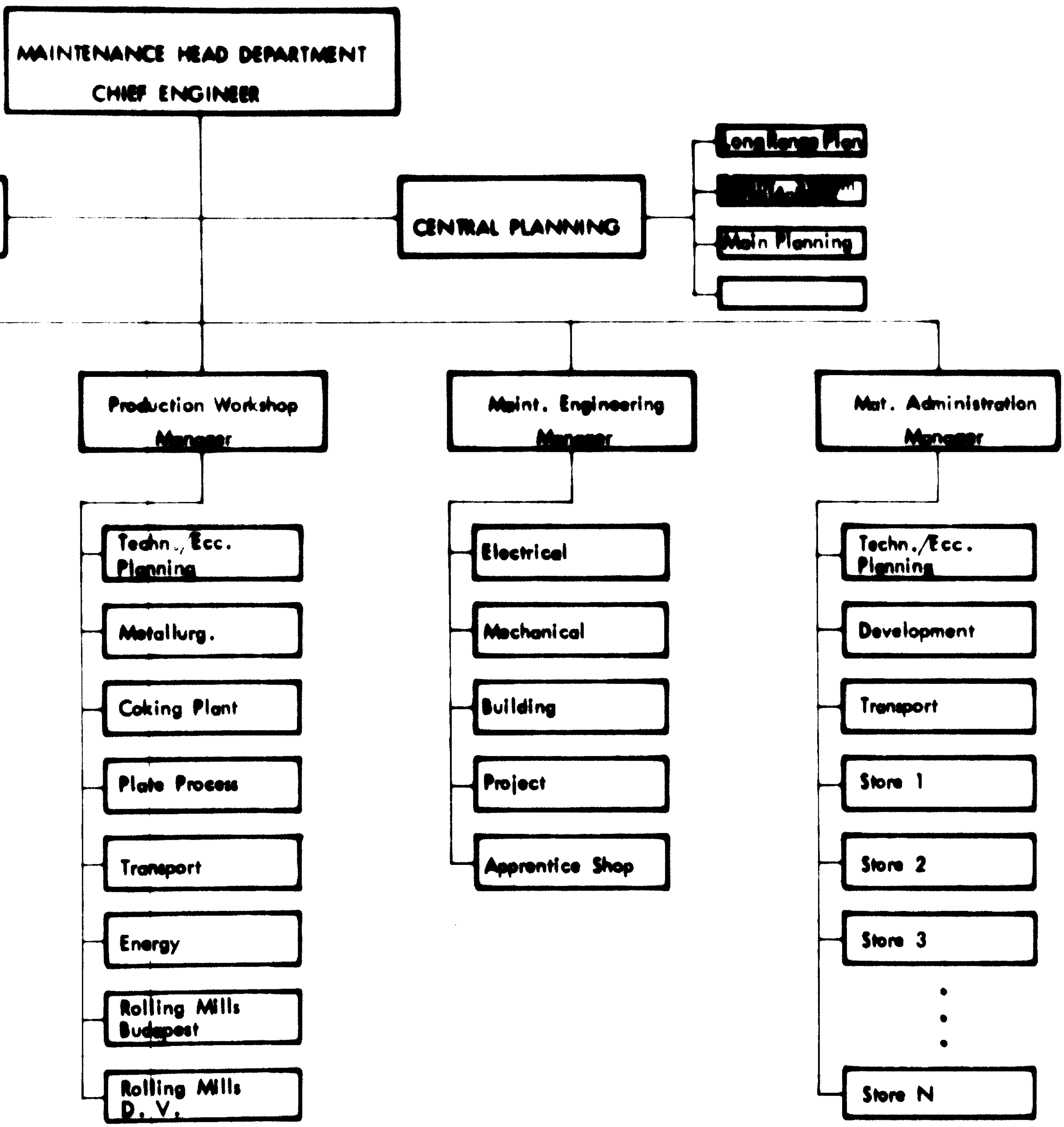
SECTION 2


MAINTENANCE HEAD DEPARTMENT
CHIEF ENGINEER
Accountency
Ecc. Planning & Analysis
COST CONTROL
CENTRAL
Production Unit Maintenance Workshop
Central Maintenance Workshop
Production Workshop Manager
Techn./Ecc. Planning
Foundry
Steel Casting
Forging
Gen. Mechanical Workshop
Wood
Mechanical Workshop
Techn./Ecc. Planning
Machine Tool
Crane
Electrical
Building
Erection
Techn., Ecc. Planning
Metallurg.
Coking Plant
Plate Process
Transport
Energy
Rolling Mills Budapest
Rolling Mills D. V.

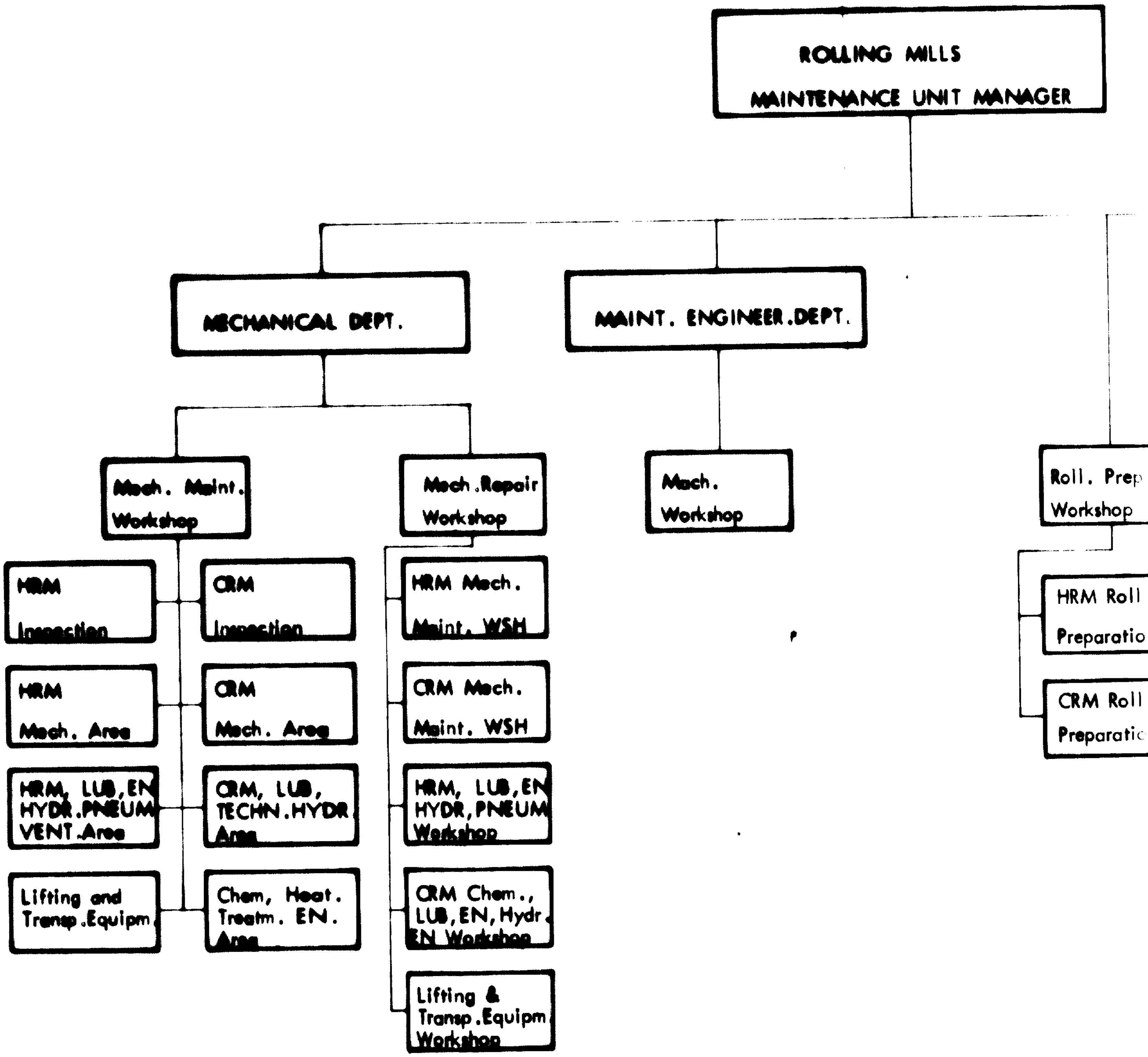
SECTION 1

ORGANIZATION SCHEME 4.2

MAINTENANCE HEAD DEPARTMENT



SECTION 2

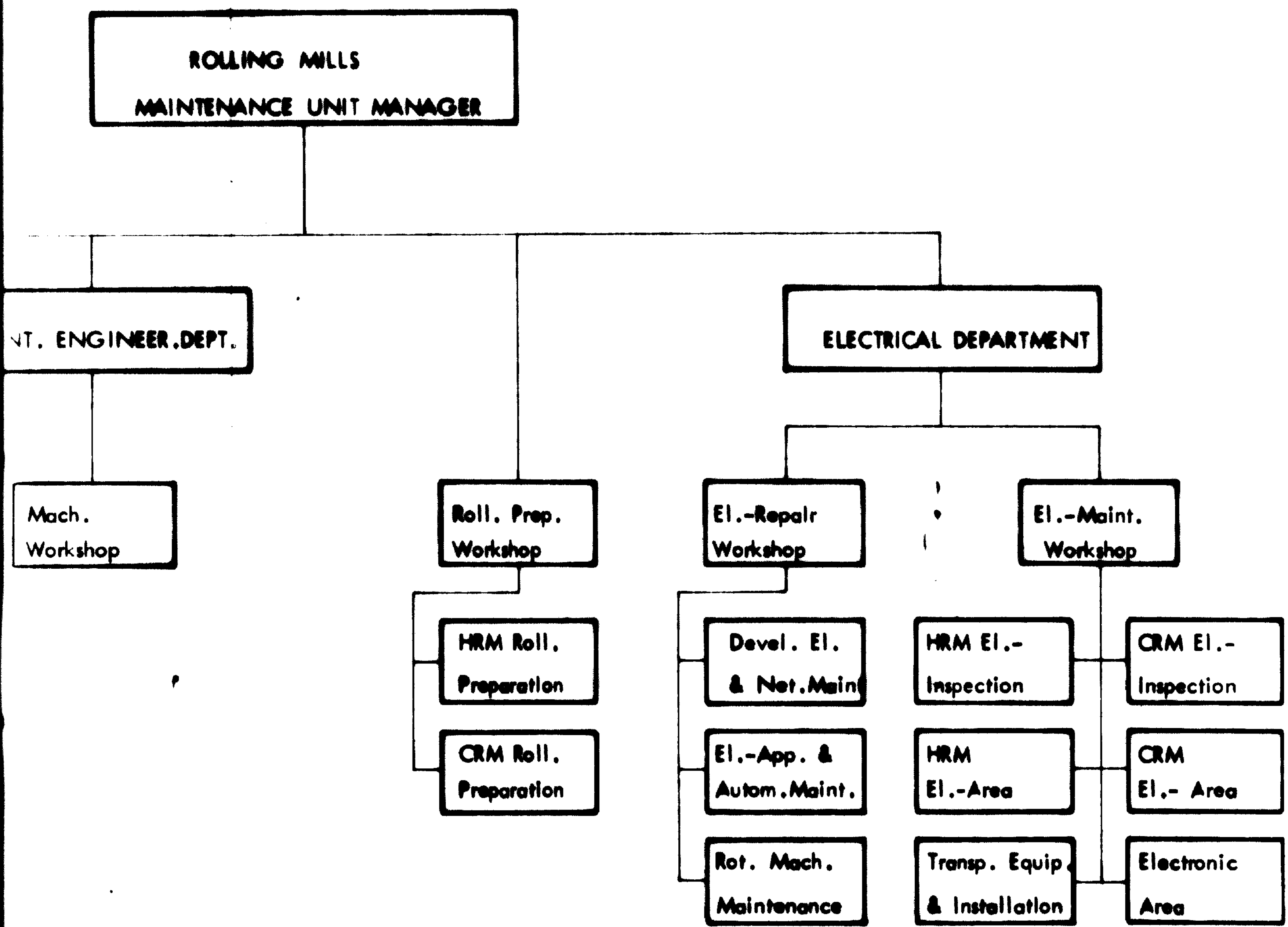


ROLLING MILLS
MAINTENANCE UNIT MANAGER
MECHANICAL DEPT.
MAINT. ENGINEER.DEPT.
Mech. Maint. Workshop
Mech.Repair Workshop
Mach. Workshop
Roll. Prep Workshop
HRM Inspection
CRM Inspection
HRM Mech. Maint. WSH
HRM Roll Preparatio
HRM Mech. Area
CRM Mech. Area
CRM Mech. Maint. WSH
CRM Roll Preparatic
HRM, LUB, EN HYDR.PNEUM VENT.Area
CRM, LUB, TECHN.HYDR Area
HRM, LUB, EN HYDR, PNEUM Workshop
Lifting and Transp.Equipm
Chem, Heat. Treatm. EN. Area
CRM Chem., LUB, EN, Hydr EN Workshop
Lifting & Transp.Equipm Workshop

SECTION 1

ORGANIZATION SCHEME 4.3

ROLLING MILLS - MAINTENANCE UNIT

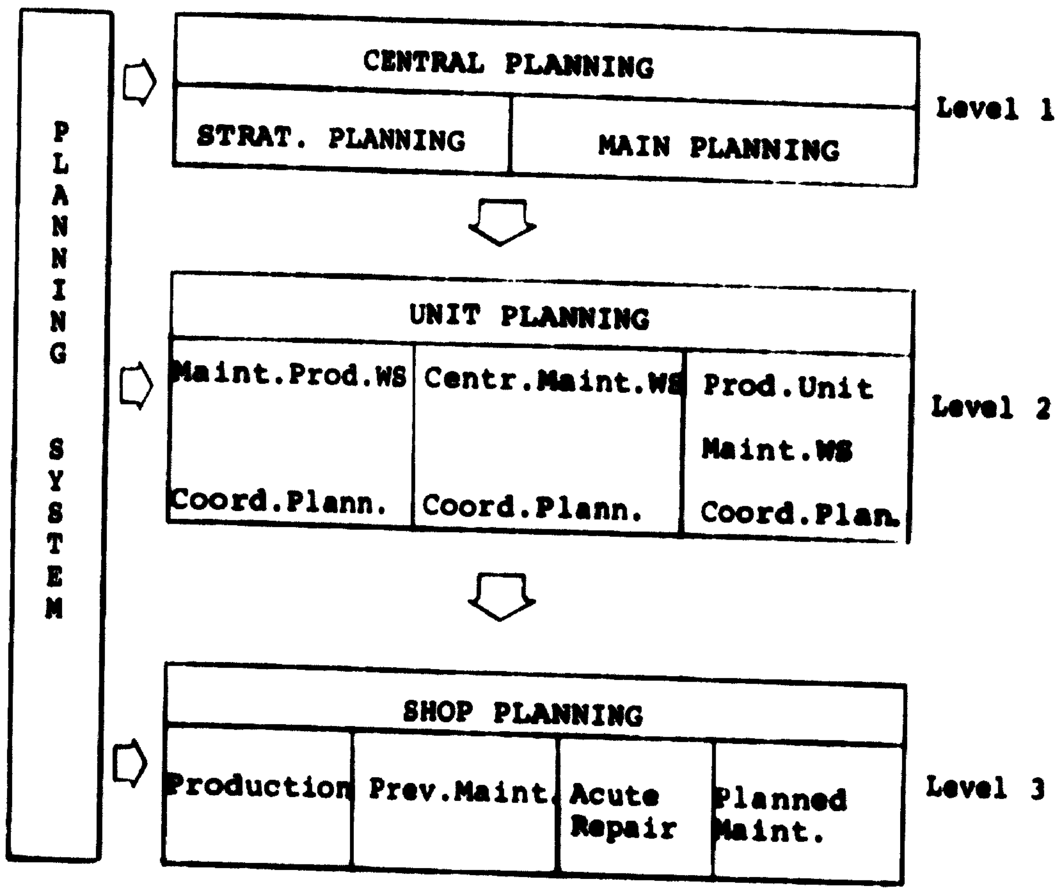


SECTION 2

5. PLANNING SYSTEM

5. PLANNING SYSTEM

The planning system as a part of the future "Managed Maintenance System" of the Danube Iron and Steel Works should be divided into three levels, corresponding to the proposed future maintenance organization.



The basis of the planning system is the work order system and therefore we shall first present our proposal for this.

5.1 WORK ORDER SYSTEM

In order to manage and coordinate the maintenance activities it is necessary to have specific information available. The proposed work order system covers all maintenance jobs performed by

- maintenance staff
- production staff
- sub-contractors

and the system has the following tasks:

- to make clear specific wishes concerning the maintenance job in question.
- to pick up data for managing the maintenance and to form the basis of the planning and job preparation.

To understand the function of the work order system it is necessary to introduce the concepts of:

- P R I O R I T Y
- C A U S E C O D E

5.1.1 Priority

To have a proper basis for planning the job sequence of the maintenance jobs it is necessary that jobs be assigned a priority according to their importance, i.e. all work orders for repair and maintenance jobs should have a priority code, and the priority should always be given by the work order originator.

Below a proposal for priority code and definition is given:

PRIORITY	DEFINITION
1	EMERGENCY: Maintenance requirements which have an immediate effect on production, utilities, and other services. In addition, this classification will also be used for maintenance requirements which have an immediate effect on safety. Immediate start of the requested work is mandatory.
2	URGENT: Maintenance requirements which do not have an immediate effect on production, utilities, or on the services including safety. However, if requested work is not started as soon as possible, it will become PRIORITY 1.

PRIORITY	DEFINITION
3	NORMAL: Maintenance requirements which do not have an immediate effect on production, utilities, or other services.
4	ROUTINE: This priority can be allocated only by the Maintenance Planning Department for maintenance requirements of routine nature. Included in this category are technical inspections and preventive maintenance which must be carried out according to schedule prepared by the Maintenance Function.
5	CHANGES, ALTERATION AND OTHER NON-MAINTENANCE JOBS FOR PRODUCTION: Includes all work orders which are not related to repair or maintenance work, i.e. changes and alterations, spare parts production and jobs normally performed by the production staff.

The following has to be taken into consideration:

- all work orders must be provided with a priority code,
- the definitions and use of respective priority codes must be carefully noted.
- priority must be assigned by the originator,
- priorities 1 and 2 must be used only in the case of absolute need. The jobs in priorities 1 and 2 cannot be pre-planned or prepared and they will, therefore, be much more expensive to perform than the jobs assigned priorities 3 - 5.

5.1.2 Cause Codes

The most efficient way to decrease

1) down-time of production and

2) at the same time, maintenance costs

is to decrease the wear and failures of production equipment.

To achieve this, the maintenance organization must take care of preventive maintenance and break-down cause analysis. It must be informed about the condition of the production equipment and know when special attention is required.

The cause codes provide an important part of this information:

CAUSE CODE	DEFINITION
1	Incorrect operation
2	Insufficient lubrication
3	Insufficient cleaning
4	Improper maintenance
5	Repair carried out too late
6	Materials failure
7	Construction failure
8	Normal wear

- All repair and maintenance jobs must be assigned a cause code after performance.
- The cause codes are given by the performing work group after the completion of the job.
- For"direct orders" (priorities 1 and 2) the work group reports the cause code to the originator, who records it on his Log Sheet.
- For jobs ordered on a work order form, the performing work group will write the cause code in the appropriate place on the sub-work order form.

5.1.3 Work Order Procedure

The work order originator must fill in all necessary information, such as account number, priority, project number, etc. on the different work order forms, as later described.

The source of work order origination should be clearly defined in order to measure and control the volume of maintenance. Work order originators must be established in compliance with the following principles:

- "Maintenance" issues work orders for major overhauls, large repairs, projects and the like. The work order must, however, be authorized by the cost center responsible.

- "Maintenance" issues work orders for all routine jobs, such as preventive maintenance, in cooperation with "Production".

- "Production departments" issue work orders for all remaining required maintenance work according to the rules.

The work order system consists of the following two main routines:

1. DIRECT ORDER(prioritiee 1 and 2)by means of Work Order List (Log Sheet) for issuing smaller work orders of high priority as described later on.

2. WRITTEN WORK ORDERS are to be used for all other maintenance requests, including all requests of priorities 3, 4 and 5,according to description later on. The originator forwards the original and two copies to Maintenance Planning and retains one copy for his own records.

Procedures for Processing Work Order Forms

The work order forms received by the planner will be processed prior to scheduling the requested work to the maintenance work groups. The planner determines the work sequence and, if necessary, the work groupe required to complete the requested work in cooperation with the foremen. The planner estimates the time necessary for carrying out the work and prepares sub-work orders for each work group related to the work order.

Work Order List Procedure

General Rules

The WORK ORDER LISTS will be issued weekly by the maintenance planners to the authorized work order originators and may be used under the following conditions:

- the required maintenance work should be finished within the current week.

- the request must be of priority 1 or 2-type work.

- new week begins,for instance,every Sunday morning at 6 a.m.

- the used Work Order Lists (originals) will be fetched by the maintenance planners every Monday morning. After the planners have checked if any job has still not been noted as completed, and have assigned a cause code, they will go to data processing.

The copies of the used Work Order Lists will be kept by the originator for later comparison with reports.

Work Order List

The Work Order List is shown on the following page

1) The originator fills in:

   - the origin number
   - date of request
   - description of requested work
   - work group number
   - account number (including priority code)

2) The originator orders the job by telephone and gives this information:

   - his name and telephone number
   - priority (1 or 2)
   - job number
   - a clear description of what he wants done.

3) When the job is completed the originator fills in:

   - cause code (given by the work group)
   - his signature.

DUMAI VASMO

Ex 1: Originator Planning Data Processing

WORK ORDER LIST

Department Ordering Work:	Control Planning		Week No.
	Date:	Name:	

Originat No.	Date of request	Description of requested work	Work group	Account No.	Cause code	Job No.	Project No.	Completed, Sign.
						422881		
						422882		
					3	422883		
						422884		

Work gr. Supervisor Originator **SHOP TICKET**

Person Ordering Work	Tel.	Date	O'clock	Priority	Job No.
Description of work					Time consumption
To be filled in after work done					
Date	O'clock	Cause 3	Work, done, name		

The Work Order Form

The Work Order Form is used for issuing larger work orders and work orders of low priority as described earlier.

DUNAI VASMÜ		WORK ORDER		JOB NO. 15306		
To Planning dep.....		Required by (date)	Ord.Work dept.	Name:	Attest sign.:	
Account No	Proj. No.	Acces date	Desired completion date	Estimated costs wanted		
Goods delivered at:	Responsible goods receiver:		Person to contact in Ordering dept.:	Tel.:		

Description of work:	CAUSE:	
	1. Incorr. operation	☐
	2. Lubrication	☐
	3. Cleaning	☐
	4. Inproper maint.	☐
	5. Repair too late	☐
	6. Materials failure	☐
	7. Constr. failure	☐
	8. Normal wear	☐
	9.	☐

To be filled in by the planning dept.

No.		Perform. dept.	Estim. hours	Actual hours	
- -	- - - - - - - - - - - - - - - -	- - - - - -	- - -	- - - -	- - - - -
- -	- - - - - - - - - - - - - - - -	- - - - - -	- - -	- - - -	- - - - -
- -	- - - - - - - - - - - - - - - -	- - - - - -	- - -	- - - -	- - - - -

Estim. date of start	Estimated date of completion	Estimated costs Ft.:	Actual date of completion:	Planner, name:
/	/		/	

Work orders, which have pre-printed job numbers, are issued to authorised work order originators and are to be used under the following conditions:

- All maintenance requests that are not given as direct orders (Work Order List), including all requests of priorities 3, 4 and 5.

- All requests of priorities 1 and 2, which cannot be carried out and completed within the current week.

- The forms are printed on special paper (NCR). The originator forwards the original (white) and two copies (two different colours) to maintenance planning, which in the future organisation, will serve the maintenance group performing the job.

  The fourth copy (different colour) will be kept by the originator for later comparison with the repair report.

The preceding page shows an example of a Work Order Form, which we suggest should be discussed with the relevant persons from the counterpart, It is emphasized that it should be taken as an example which could be the basis for corrections and further development.

<u>Issuing of Work Order Forms</u>

The originator forwards the filled-in Work Order Form to the Maintenance Planner in the area where the job will be performed.

In filling in the form, it should be noted that:

- The Job number is pre-printed.

- If authorisation of the job is required, the signature of authoriser must be filled in.

- Careful attention should be given to correct account number.

- If the originator wants a summary of the total costs for all ordered work, as for instance for major overhauls, all these Work Orders should be given <u>the same project number.</u> Project numbers are provided on demand by the Maintenance Planning.

- If necessary, fill in date and time available for carrying out the work.

- Always fill in requested delivery date. Maintenance Planning and the performing work group, after considering the present backlog, personnel capacity situation, materials and spare parts, etc., can tell if requested delivery date can be met.

- If space is marked by an X for estimated costs it means that the work order must be cost estimated before work has begun.

- If the originator himself has ordered spare parts or other equipment which refers to the Work Order, the delivery location, as well as the person responsible for receiving goods, must be given.

- Always record name and telephone number of the individual, who can give further information about the requested work.

- Try always to give the best possible description of the requested work.

- After completion of the job, the craftsmen (work group) must report:

  - cause code

  - date of performance

  - time consumption (total hours).

Date of performance and time consumption can be either reported via time cards or by giving an oral report to the foreman immediately after the completion of the job. If the latter alternative is choosen, the foreman registrers the given information on the work order form (priorities 3, 4 and 5) or on the shop ticket shown before (priorities 1 and 2).

Work Order Flow is shown on attachment 5.1. Information flow based on work order is shown on attachment 5.2.

5.2 CENTRAL PLANNING

Central planning has been assigned as a staff function of the Director of maintenance, and has the following tasks:

a) To prepare a strategic plan (STP, covering at least 5 years) whose purpose is to create the best possible basis for decisions to be made now, or following long preparation. STP: see "Course of Industrial Maintenance of the Danube Iron and Steel Works" chapter 4, point 4.3.2.

The STP is to be based both on the general policy and the objectives of the company and on the prognosis of the production units concerning foreseen expansion and planned plant lay-outs, expected purchase of new production equipment, the expected degree of utilization of the existing equipment and plants, etc.

Based on these data, an evaluation of the dimensions and form of the future organization must be made. Also the lay-out, the equipment to be purchased, the personnel (resources) needed, and the possibilities of new developments or re-education of the present personnel have to be evaluated.

b) To prepare a yearly plan (main plan) based on the wishes/demands of the production units and the maintenance strategy.

This plan is to be elaborated based on the knowledge of production planned, new installations, the condition of the production equipment, necessary complete overhauls, systematic preventive maintenance, and an evaluation of the amount of acute repairs.

The plan should act as a frame plan for each maintenance unit, i.e.:

- Maintenance production workshops

- Central Maintenance Workshops

- Production unit maintenance workshops.

The yearly plan contains the main activities to be performed, including planned projects, major overhauls, etc., and a time schedule for these activities based on an appropriate utilization of the total resources of the maintenance and possible sub-contractors. The plan is to be followed up every month, and necessary measures to prevent or remedy possible deviations, are to be taken.

c) To maintain and develop the managed maintenance system.

In this section we shall deal only with the principles of b) main planning.

5.2.1 Main Planning

All demands on maintenance work for the coming year, i.e.:

- project
- major overhauls
- planned repairs

are to be channelled through "Central Planning".

The central planning elaborates a proposal for the yearly plan (main plan), including time requirements (adaption of stop-time), priorities, and necessary resources. The plan should be accepted by production as well as by the maintenance management.

The main plan consists of three plans, one for each organisational unit:

Plan 1 - Maintenance production workshops

Plan 2 - Central maintenance workshops

Plan 3 - Production unit maintenance workshops

and acts as a frame plan for the technical/economic planning function placed within each unit.

The basic information in plan 2 and 3 should be the planned activities, scheduled time, and estimated resources needed for these activities.

The planning can be based on the network technique and be processed by means of an existing standard network EDP-program.

This will give the following advantages:

- Easy and prompt plan revisions with corresponding follow-up procedures.
- Possibilities for simulation of the consequences of alternative plans.
- Integrated resource planning.
- Sorting and selecting of output according to need/wishes.

Initially, of course, the main plan can be prepared as a Gantt-activity scheme with corresponding resource loading showing:

- resources available
- resources needed
- free capacity (lack of capacity)
- proposed to be borrowed (lent capacity).

The basic information in plan 1 should be a rough estimation of the capacity needed for each production workshop.

The estimation of needed capacity is based on:

1. Statistics on the capacity needed for store-initiated production of material, tools, equipments, and spare parts.

2. Capacity needed for performance of the planned projects, overhauls, etc.

3. Spare capacity for urgent production and special services.

5.3 UNIT PLANNING

By unit planning we understand that planning done by the techn./economic.staff, for the unit managers.

The planning will concern:

1. Maintenance Production Workshops

- To receive and evaluate the technical possibilities of producing the orders coming to the unit.
- To distribute the orders to the relevant production shops.
- To establish and maintain a survey of the resource categories and the capacities available in the unit.
- To prepare quarterly coordinated plans for the work shops based on the main plan and in-coming orders.
- To establish and maintain relevant centralized files such as, for example:
  - machinery and equipment including technical description,
  - brochures, operation manuals, etc.
- To control the total amount of work hours planned and carried out.

2. Central Maintenance Workshops

- To receive and evaluate requested maintenance work.
- To distribute the work to the relevant maintenance group.
- To establish and maintain a survey of the resource categories and capacities available in the unit.
- To prepare coordinated plans for the workshops (capacities) based on the main plan and the in-coming orders.
- To establish and maintain relevant centralized files such as
  - machinery and equipment
  - tools and aids, etc.
- To control the total number of work hours planned and carried out.

3. Production Unit Maintenance Workshop

- To establish and maintain a survey of the resource categories and capacity available.

- To manage the transference of resources from one section to another.

- To establish and maintain relevant files, such as for instance:

    - machinery and equipment
    - tools and aids, etc.

The main objective for the combined technical and economic planning functions is to secure the intercommunication between the planning and the economic analysis in order to utilise the resources in an optimal way.

5.4 SHOP PLANNING

The shop planning groups are placed in the separate work shops of the units and should have the following tasks:

- job preparation
- detail planning.

Job preparation is the basis of all planning and work performance and will be described in section 5.4.1.

The detail planning system differs from unit to unit and from task to task, but always consists of:

Production planning

Maintenance planning	Preventive maintenance Planned repairs Projects

These systems will be described in the following sections.

5.4.1 Job Preparation

The philosophy of job preparation is the same for the different units and shops, but here we shall distinguish between job preparation (JP) in the Maintenance Production Workshops and the Maintenance Workshops.

Maintenance Production Workshops

Job preparation has to convert the information of the work-orders, drawings, etc. and prepare the workshop documentation in such a way that it suits the work of Detail Planning and serves satisfactorily as job information in the production shops.

The responsibility of Job Preparation is to:

- evaluate the jobs and work out the job descriptions,
- work out the job-tickets and estimate the job time,
- work out material requisitions and make the material check,

In addition, "Job Preparation" intends:

To ensure the right technical documentation and the necessary human resources, materials, and tools at the right place in the right quantity and quality and at the right time necessary to perform the work (job) as planned.

The output of job preparation should be:

- Operation list
- Job tickets
- Material requisitions.

Operation List

The operation list has to be elaborated by product and it has to state all operations including operations that take place in other divisions, with sub-contractors, etc.

The job description can be written on the job tickets and the operation list is composed of the copies of the job tickets.

The operation list has to contain at least the following information:

- operation sequence
- description of the operation (as on the job tickets)
- materials per operation
- operation place (machine, group, etc.)
- time estimation
- product description (identification)
- drawing number.

Job Tickets

The job tickets are more or less prepared through the "operation lists", only general information has to be added. Next to the information on the operation list the following must be added:

- shop
- category of workers
- job number

Materials Requisitions

The materials requisitions have to contain at least the following information:

- materials identification number
- materials requisition number
- specification of materials
- corresponding job number.

Central Maintenance Workshops and Production Unit Maintenance Workshops

An appropriate utilization of resources and materials assumes that the work can be satisfactorily planned. To avoid waiting times and production loss, materials,spare parts, tools, drawings, lifting equipment, etc. have to be available when the job is going to start.

By job preparation in the maintenance shop,we understand the preparation made with the intention of providing all resources and information needed in order to perform an ordered maintenance job with a balanced use of resources and material and without unnecessary loss of time.

The output of job preparation should be:

- issued sub-work orders if necessary
- job descriptions
- material requisitions
- description of necessary tools and aids,
- time estimation of jobs.

Here we shall present a method for time estimation of different kinds of maintenance jobs.

Time Estimation

The time estimation is the basis of the capacity planning. We suggest the time estimation be based on standards obtained by a registration of real consumed time for different kind of jobs in an initial period of approximately ½ year. This method is simple and fully satisfactory.

For the sake of the construction of the standards,the jobs are divided into three groups:

1. Repetitive jobs
2. Non-repetitive jobs
3. Routine maintenance jobs.

The classification of the jobs is defined as follows:

To ensure a systematic and uniform handling of the maintenance jobs it is expedient to classify the jobs. Here we shall propose the maintenance jobs be identified by three classifications:

REPETITIVE JOBS

Maintenance requests which are classified by the Maintenance Planning Department as repetitive should occur at least three times per 4-week period in order to obtain a sufficiently accurate average over a reasonable time.

For these jobs it will be easy to determine a statistical standard for each work group for each repetitive job.

NON-REPETITIVE JOBS

All maintenance activities, except the ones classified as repetitive or as routine maintenance work, will be classified as non-repetitive. Job codes are assigned to non-repetitive jobs in order to indicate in which time interval they should be completed. An example is given below.

ROUTINE MAINTENANCE JOBS

Maintenance activities classified as routine in general are the activities on which a fixed amount of time per week is spent, such as lubricating, routine preventive maintenance, inspection, etc.

In general these activities will be scheduled as **STANDING WORK ORDERS**. The work order form will be used to issue standing work orders.

The standard time for routine activities will be pre-determined by Maintenance Function in cooperation with the work group supervisors. Maintenance Planning will issue the standing work orders with priority 4 and process these as normal work orders with the exception that, in general, no report is made when these jobs are completed.

The construction method of the standards is:

<u>REPETITIVE JOBS (RJ)</u>

All standards for RJ are connected with the performing group and all RJ in a group are assigned a code.

When a certain number of jobs (minimum 20) with the same code has been completed (the dispersion in time may not be too great) an arithmetical average can be calculated:

$$\text{Standard for job } N = \frac{\Sigma \text{ hours consumed}}{\Sigma \text{ no. of jobs}} \text{ h/job}$$

If the work conditions change and the dispersion becomes too great or the definition of RJ is no longer fulfilled, the job should no longer be classified as RJ.

NON-REPETITIVE JOBS (NRJ)

All maintenance jobs, which cannot be classified as RJ and are not Routine Maintenance Jobs, have to be classified as NRJ.

The non-repetitive jobs present the major obstacle for effective workload planning. It is overcome by a statistical approach considering for each work group, all work falling within a given time interval as a job to which standards may be applied.

The time intervals and the corresponding code could be:

Time intervals (hours)	Job Code
0 - 8	1
8.1 - 16	2
16.1 - 32	3
32.1 - 64	4
64.1 - 100	5
100	9

The consumed hours registered on the work orders after performance have to be grouped according to the respective time groups (by EDP processing automatically). During an initial period of approximately ½ year a larger number of values in each group will be collected. Based on this an average time for each group can be calculated:

$$\text{Average time group } N = \frac{\sum \text{hours consumed (in group N)}}{\sum \text{No. of jobs (in group N)}} \quad \text{h/job}$$

An example is shown on the following page.

Work group No. N

Time intervals (hours)	Job Code	Average time of all jobs of this classification (Example)
0 - 8	1	3.4
8.1 - 16	2	12.7
16.1 - 32	3	23.5
32.1 - 64	4	46.0
64.1 - 100	5	81.0
over 100	9	for each individual job an estimated time is given.

Then the PLANNER would know that 12.7 hours is the standard for any non-repetitive work (in Work Group No. N) lasting for over 8 hours, but less than 16 hours.

His plus and minus errors would equalize each other over a week's time for the total work group.

ROUTINE MAINTENANCE JOBS (RMJ)

Maintenance jobs classified as RMJ are jobs which are going to be carried out for a longer period in time and with a fixed estimated consumption of hours per week, e.g. preventive maintenance, such as:

- cleaning
- lubrication
- inspection
- checking conditions
- small adjustments.

The following rules for RMJ have to be kept in mind:

1. RMJ have to be ordered on a work order form.
2. They should be planned in cooperation with the groups carrying out the jobs.
3. They should be approved by those responsible for costs.
4. RMJ are assigned priority 4.
5. Standards have to be based on data from the engineering department and should be expressed in hours per week.

5.4.2 Production Planning

The proposal for the planning system in the maintenance production shops is for the machinery shop.

The system is shown as a manual processed system, but the capacity loading, weekly programs, and follow-up can be processed on EDP as well.

After trial run and implementation of the system in machine shop, of course the system can be adjusted and transferred to other similar production shope.

Detail Planning

Detail Planning (DP) receives the rough loading plans (1/4-year plan) as the basis of the scheduling. Besides, DP receives from job preparation the complete work documentation, i.e.:

a) Operation list, containing the following information:

- operation sequence
- description of the operation (as on job tickets)
- material per operation
- time estimation
- operation place (machine, group, etc.)
- necessary tools
- product description (identification)
- drawing no.

b) Job tickets (work orders)

c) Materials requisitions, containing the following information:

- materials requisition no.
- specification of materials
- quantity
- corresponding job no.

The responsibility of detail planning is to:

- coordinate all activities including activities that take place in other shops or with sub-contractors by working out the "production control card".
- control the capacity of key machines or groups at the earliest possible stage.

- plan the activities according to the "production control card" (coordination plan), the material situation, and the available capacity, by working out the "weekly program" and the corresponding "load survey" per working place.

- follow the production progress by daily or weekly feed-back and conferences with the persons responsible in the production, and to analyse the consequences and adjust the plans according to the feed-back.

The work of Detail Planning is based on:

- workshop documentation
- materials situation
- data such as: capacities, workers, machines, etc.
- feed-back information from production

Attachment 5.3 shows the input, output, and routines of Job Preparation and Detail Planning.

The following areas are treated in Detail Planning:

<u>Production Control Card</u>

On the production control card all jobs (job tickets) for jobs using long transition time, key-(bottle-neck)machines or involving other shops/sub-contractors are listed. The transition time of the "product" is based on the estimated hour consumption per job, the time needed for transportation, and the interrelationship between the jobs.

The production control card has to contain the following information (see attachment 5.4):

- drawing no.
- product description (identification)
- card no.
- date/signature
- delivery date
- job no.
- job identification
- job transition time
- workshop no./group no.

The production control card is to be used as:

- basis of the weekly plans and the load of the workshops,
- coordination plan between the shops, other divisions, sub-contractors, etc.
- follow-up card.

Capacity Control (Key-Machines)

Before the scale of the production control card is fixed, a rough capacity control of the key-machines (bottle-necks) should be made (see attachment 5.5).

Load Survey

In order to secure the right utilisation of the capacity in the shops, the load survey should be prepared. The load survey shows the cumulated loaded hours per week per machine/ machine group. (See attachment 5.6). The load survey is prepared by inserting all job tickets of a product 6-7 weeks ahead.

Weekly Program

After the control of the capacity and the materials, Detail Planning prepares weekly programs (see attachment 5.7) in accordance with the load survey. Programs for 2 weeks ahead will be made each week. The weekly program should be made in 3 copies. One for Detail Planning (following up), one for the foreman, and one for the chief of shop.

Every Friday, the results from the past week and the programs for the coming weeks are discussed at a meeting between the planners and the foremen.

Filing and Dispatching of Prepared Job Tickets

By prepared job tickets are meant job tickets:

- which are dated according to the "control card",
- for which the first materials check has been done,
- which are inserted in the "load surveys"

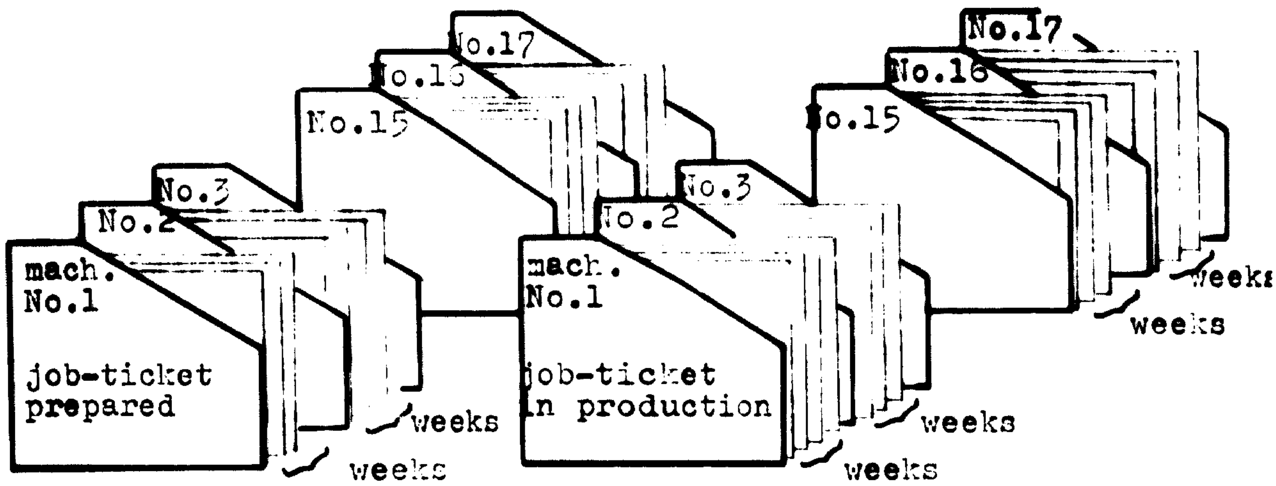
In order to manage and control the realisation of the planned production, the following aids are used:

- operation list
- production control card
- job tickets
- materials requisitions
- load survey
- weekly program.

The production control card remains in Detail Planning and is filed according to the number of the control card.

The job tickets and the corresponding materials requisitions are filed according to:

Machine/group - weeks



When the jobs are ready to start, according to the weekly program decided at the Friday meetings, one copy of the job tickets is filed in the card index for job tickets in production, and two copies are sent to the shop with the weekly program.

<u>Follow-up of the Progress in Production</u>

The collection of information as to which jobs have been finished is one of the most important functions of the planning work. Without a correct feed-back enabling a correction of the planning factor, as well as the coming weekly programs, the planning system cannot work satisfactorily.

The time calculation must be registered in the same order as the plans are prepared, i.e. per machine/machine group (according to the weekly program).

In order to get realistic planning figures, the aim must be that the planned time should be equivalent to the actually consumed time. In order to obtain this, a factor P should be used:

$$\text{estimated time} \times P = \text{planned time}$$

(planned time $\sim$ actual time).

I.e. in order to make the system dynamic, the "actual planning factor" is to be calculated periodically as:

$$P = \frac{\text{actually consumed hours}}{\text{estimated hours}}$$

The calculation of the P factor is made on a special form (see attachment 5.8).

The number of hours (capacity) in which the machine/machine-group is supposed to work within the week has to be stated. The chief of the workshop (or foreman) should approve them, and be responsible for the realization of the plans.

By following the development of the planning factor P, and by comparing the hours actually spent on the jobs with the approved capacity per week, one gets an idea of the efficiency and the progress in production.

The feed-back is obtained by means of weekly meetings (every Friday), "finished" job tickets, and follow-up by the planners. The status of production is registered on the production control card. The "finished" job tickets are removed from the card index for "job tickets in production".

5.4.3 Maintenance Planning

The planning system developed for the Production Unit Maintenance Workshops can be used for the Central Maintenance Workshops as well. The proposals in this section (5.4.3) are prepared for the rolling mill maintenance workshops, but after trial run and implementation of the system in these shops, of course, the system can be adjusted and transferred to other production maintenance workshops.

The job preparation and planning group in the rolling mill maintenance workshops should be placed parallel to the Maintenance Engineering group in the organization. In fact, these groups act as staff functions to the manager.

The planning systems presented in this section are:

1. Project Planning System
2. Preventive Maintenance System
3. Maintenance Planning

5.4.3.1 Project Planning

The project planning, i.e. planning of proper projects, large repairs, main overhauls, etc., should be based on the network technique.

Today this technique is known and in some cases used in the company, but for the moment not EDP processed.

We suggest that smaller projects (< 50 activities) be manually planned by the use of network (activity-oriented version as taught at the project leader course). Large projects (> 50 activities) should be processed on EDP by means of one of the well-known network computer programs. An activity oriented version should be preferred.

5.4.3.2 Preventive Maintenance

Preventive maintenance jobs are ordered by the work order system described in point 5.1. The jobs are assigned priority 4, and are classified as Routine Maintenance Jobs (RMJ) as described earlier.

The resource planning is included in the maintenance planning system, but some of the basic principles of PM will be mentioned here.

Basic Principles of PM

As already mentioned the prime aim of PM is to reduce wear and detect and remedy it before the machinery has to be stopped for one reason or another. The techniques involved in PM have different names and today the following are included:

1. Cleaning
2. Lubrication
3. Inspection
4. Condition checking
5. Adjustments, exchange of parts, and repair of damage observed at pre-planned stops.

PM is not a task for the maintenance function only, it is part of the daily work for all persons within an enterprise, from the managing director to the youngest office boy, from the production planning and managing man to the worker in the tool-crib.

It is really a kind of philosophy which should be introduced and kept alive in all people's minds. Wear of machinery often will result in unusual noises, smells unsafe functioning, change of colour or other unusual events. Anyone observing such changes should find it quite natural to tell the maintenance department or some other responsible party about what he or she has observed. ALL people within an enterprise should be told to do so and one should never reprimand a person for "putting his nose in other people's affairs". Sometimes it has been observed that a person does not report because he or she thinks "this is not my job", in other words the "this-is-not-my-table"-mentality prevents the PM.

A successful introduction of Preventive Maintenance principles will as a consequence also include INFORMATION about the basic principles and measures to encourage people to take an active part in the prevention of losses within the enterprise.

Besides the introduction of a philosophy or policy within the enterprise, the Preventive Maintenance System includes:

1. A control system
2. Good routines
3. Instructions
4. Trained people
5. Aids for the job

The control system consists of:

a. order forms
b. report forms
c. recording system
d. statistics

MAINTENANCE INSTRUCTIONS

Generally speaking there must always be some kind of instruction for any type of job. In some cases it is possible to state before the actual job starts

WHAT is to be done
HOW it should be done
which AIDS are to be used
TECHNICAL SPECIFICATIONS about the job.

This is of course the case in PM. Someone has to state these facts. In many cases the engineer does it, in other cases the foreman, but in too many cases it is left to the worker.

The usual attitude when PM is started is that specially trained workers, lubricators, should be used. PM makes high demand on the technical qualification. But it must also be observed, that especially in the more detailed inspections and in the condition checking operations the demand on technical qualificationsis so high that no worker is capable of doing the work correctly without some kind of information from engineers.

Verbal information about the job is the commonly used method. It is said to be quick, but in most cases the time saving means that not all information is given. In PM most operations are repetitive, sometimes of course at long intervals, and inevitably verbal instructions are quite insufficient. It is not possible for anyone to keep in mind all the different information about PM operations.

If a verbal instruction to a worker is based on a written instruction it ensures that

- all information necessary is included
- the instruction is always the same
- nothing is forgotten
- there is always a reference and a support for the memory.

Instructions for PM have been worked on for many years and it is now possible to find 3 different techniques, each one with its advantages and disadvantages.

1. The instruction is not detailed. The job is described only with the operation definition such as "check", "listen", "inspect". No other information is included.
2. The special instruction is connected to a "methods book" where the different operations are described in more details. No technical data are included.
3. The instruction is complete with method description and technical data.

Instructions of type 2 are actually type 1 instructions combined with the Methods Book.

Of course, there is less work in writing instructions for types 1 and 2, but practical experience has shown that the work necessary to write a usable Methods Book is considerable.

The oldest of the PM instructions is the Lubrication Instruction. In most industrial countries type 3 is used. In some countries, Germany, for example, this form of lubrication instruction is stated in a generally accepted national norm, in Germany DIN 8579. This indicates, that type 3 instructions are the safest and most reliable .

Below are type 1 (or type 2) instructions from an iron and steelworks factory. They were used during an introduction period; the same type was also used in the pulp and paper industry. The reason for choosing this simple type of instructions was, that it is done quickly, is quite sufficient in the early stages of a PM programme, and in this case specially trained inspectors were used. The need for a more detailed description of the different actions was not deemed necessary at this time.

Today, these instructions to a larqe extent have been replaced by type 3 instructions, the reason being that the demand on reliability in the preventive work has been increased and the technical difficulties have increased with the introduction of more automated and more complicated machinery.

The complicated machines require better information in the instructions, and as a consequence also the Methods Book has been replaced by a Methods Record, used when building instructions of type 3.

Shown below are instructions for type 1 or 2. There are only short details about what to inspect, but not very much about the method, technical details etc.

INSPECTION INSTRUCTION								
MAINTENANCE DISTRICT				DATE	ISSUED	CHECKED	DATE	
Insp. at Run	Stop	Code	Machine	Component	Method	Drawing Tool-Instruction number	Rep. at Ch.	Ord.
x			Water pump	Packing	Look, Listen, Feel	105	x	
				Coupling	-"-	105		x
				Bearing	-"-	107		
	x		Vacuum pump	Alignment	-"-	104	x	
				Fastening to base	-"-			
				Coupling to motor	-"-	105		
				Packing	-"-	105		x
				Connections to pipe	-"-	105		
x			Water filter	Connections to pipe	-"-	143		
				Int. pressure drop	Measure	145		
				Leakage	Look, feel	105		

The disadvantages with type 1 instructions may partly be overcome by using some kind of a "Methods Book". Shown below is a page from such a book.

GENERAL INSPECTION

The general inspection covers:

PROTECTION AND SAFETY DEVICES

ALL ACCESSIBLE MACHINE PARTS

Below are listed machine parts and components known as general because they are used in many machines in the factory. When found they should be inspected as per instruction below.

<u>SHAFTS</u>:

Roundness, wear, straightness

<u>BRAKES</u>:

Function, brake bands, brake linings, adjustment screws, lock nuts, wear on other parts.

<u>BEARINGS</u>:

Play, temperature, undue noise. Use a stethoscope.

GENERAL INSPECTION, contd.

The general inspection will usually be done during production and under normal conditions. Shorter stops may be requested by the production foreman.

The general inspection is done by

<u>Looking, Listening, Feeling</u>

The general inspection will cover all accessible parts. The inspector will take off covers, plate protections, etc., take safety precautions; if possible feel the parts to check for undue play, abnormal temperature, noise and vibrations. Determine, if possible, the cause of the abnormal condition.

The general inspection will also cover:

1. The general tidiness of the work place (cleaning, sweeping, etc.)
2. The general exterior condition of the machine (cleaning, painting, dust, dirt).
3. All <u>functions</u> of the machine.
4. The lubrication.

The language used in any type of instructions should be clear and must be easily understood by those for whom it is intended. An engineer usually has his own technical way of expressing himself, and it is most uncertain that the workers will understand it. It must be a precise language, especially when dealing with difficult technical things.

The writer must also try to find the knowledge level amongst the workers. The engineer must never write things he is not completely and definitely sure the workers will understand. It is not enough to state "they should know because of their former training". People forget, especially the things they do not use daily. It must not be left to the worker to make the decision about the method to be used, because he is likely to take the method he knows best and it is quite possible that method will not give the safety the engineer wanted.

MACHINE MANUFACTURERS INSTRUCTION BOOKS

Manufacturers of standard machines often deliver an instruction book. Many maintenance engineers have the opinion that they have to stick to the rules in such an instruction book.

If such a book is carefully analysed, it will often be found that time intervals between maintenance operations are too short. The most revealing example is the interval for changing oil.

In most cases it is stated that the oil should be changed once a year or after 6 months. If the quantity is small it does not mean so much economically, but modern machines very often have systems containing large quantities. The manufacturer's statement is of course based on experience, but the manufacturer must be sure his machine is always well lubricated. In order to achieve that purpose he sets a short interval just to be sure....

In reality the oil may last for more than one period. It has been found under controlled conditions that the oil in a hydraulic system remained in good working condition for more than 6 years instead of the prescribed 1 year.

This fact casts no aspersions on the manufacturer. He does not know that this particular machine will profit from good maintenance. The same applies to other parts of his instructions too.

Purchasers in industry often state that the manufacturer will provide complete instructions concerning preventive maintenance. The reason is that the purchaser believes the manufacturer has the best practical experience with the machines. But that is not true, because the manufacturer has not a single one of his machines under daily observation in his own plant. Practical experience is held by his customers, but if the customer does not keep records properly, many valuable hints will never reach the manufacturer's serviceman. This again is no fault of the manufacturer's as, again, he wanted to be on the safe side.

An instruction book for any type of machinery should be set up to suit the user. The lubrication instructions should be set up according to an accepted standard, such as DIN 8579. If not, the lubrication man does not find them, and the machine will not be properly lubricated. The same applies to other information too.

After long and detailed discussions with those concerned in Sweden, it was found, that an instruction book should be divided in 3 parts and delivered in a varying number of copies to the user.

	Installation instructions	Preventive maintenance instructions	Machine data	Spare parts catalogue	Operators instructions	Drawings	Lubrication instructions
Maintenance department	x	x	x	x	x	x	x
Plant ent.	x		x				
Work study			x		x		
Prod.eng.			x		x		
Prod.plann.			x		x		
Prod.forem.			x		x		
Operator	(x)		x	x			(x)

In this set-up the Installation instructions are those needed to install the machine and give it the initial lubrication, test it before starting production, machine test record, and such things. Also information about how to lift and transport the machine, how to assemble it, etc., is included.

The machine data consist of a general description of the machine and its functions, but also general data such as measurements, weights, cable gauge, demand on facilities, such as electric power, water, compressed air, etc.

The operator's instructions consist of information on how to adjust tools, etc. before operation, how to inspect the machine before start-up and how to watch the machine during operation.

Drawings are usually able to provide such information, if necessary. It should be remembered, that a manufacturer is more willing to do this before the order is signed than after, and also that a good instruction book costs money.

There have also been discussions in Germany about the information a manufacturer should provide when delivering a machine. The result can be read in the "Technische Ausführungsrichtlinien für Werkzeugsmaschinen und ähnliche Fertigungsmittel" (Technical Guide-lines for machine tools and similar production equipment) VDI 3227, 3228, 3229, 3230 and VDI/VDE 3231 issued by the German Association of Engineers.

These guide-lines also contain valuable information about the procedure of machinery. It is amazing to see how different people in industry act when asking for quotations, finding facts about offered machines and analysing the basic facts to find the one machine suitable for the intended purpose, not to mention how the manufacturer and the customer fail to understand each other's problem during delivery and service period. All these situations are described step-by-step in the guidelines.

Even if the manufacturer's instruction book is set up according to accepted rules, it is not always possible to use its information directly as worker's instructions.

The reason is that in most cases the user of the machine rapidly will have access to information that the manufacturer does not have. There will also be changes in intervals for different operations because of the conditions for the machine, time and load utilization etc. But the instruction book contains much valuable information and material for building one's own instructions, such as sketches and photographs.

The manufacturer usually provides a spare parts catalogue when delivering a machine of standard design. The best method used for that is the exploded view. It is easy to see the shape and relative size of the different components and also how they are assembled. The exploded view may be used also as information for the repairmen when disassembling and assembling the machine for repair or exchange of worn or damaged parts. Lines with arrows may add to the value of the exploded view in that case.

The following is an example.

SHAFT SEAL (see figure)

Remove the coupling half with a puller. Remove key (24).
Remove all burrs from the key way and the shaft end.
Unscrew the gland nut (33) and remove all parts up to and including inner washer (20).
Install a new O-ring (16).

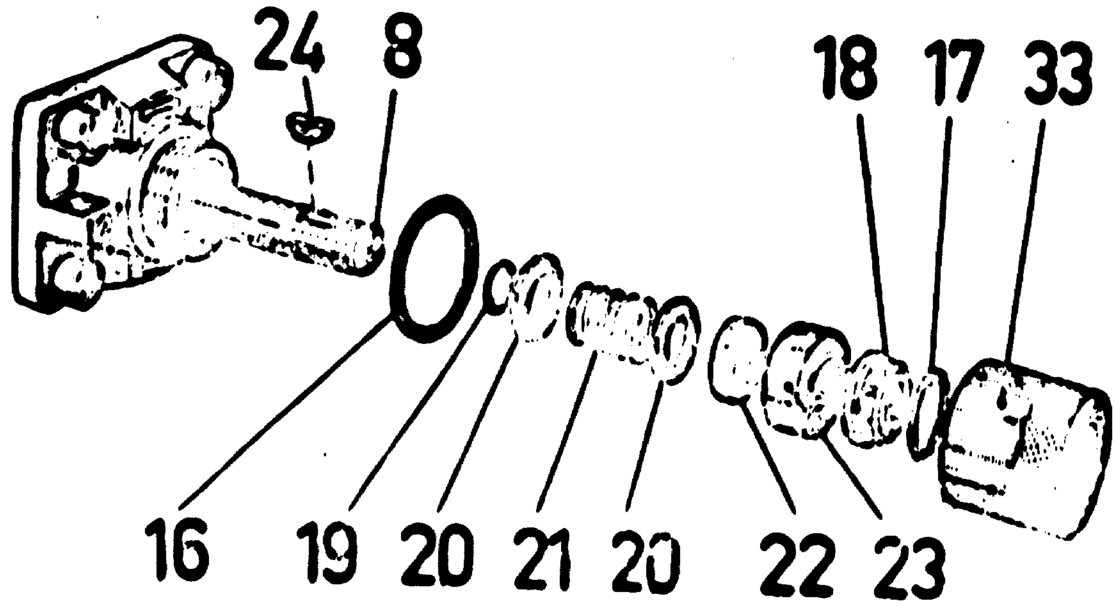
Check that the retaining ring (19) is in its place in the groove in the shaft.
Install the inner washer (20) with the chamfered side towards the ring (19).
Install the spring (21) and the second washer (20).

Install a new rubber ring (22), be careful not to damage it when passing it over the keyway. Install a new sealing disc. (23).

Install a new O-ring (17) in the gland nut (33). Insert a new sleeve (18) into the gland nut and assemble all parts on the shaft. Tighten gland nut securely.

Install the key in the keyway and push the coupling half onto the shaft with light blows of a hammer. Lock with the lock screw.

Be sure the sealing surfaces of the rotor ring (23) and the stator ring (18) are not damaged or scratched.



Exploded view with arrows indicating correct assembly.

For special machines it is too expensive to make exploded views. In such cases prepared assembly drawings should be delivered to facilitate correct repair work.

PERSONNEL FOR PREVENTIVE MAINTENANCE

As always in maintenance, skilled and trained people should be used. When first starting a preventive maintenance plan, it has been more or less a custom to use inspectors, lubricators, machine checkers and similar craftsmen, who work only in the indicated areas.

To get a certain degree of flexibility it will sooner or later become necessary to take other craftsmen into the preventive work.

When using instructions of type 3, this extension becomes fairly easy as the instructions can be used both as the basis for the initial training of new personnel and as an aid for those craftsmen who are not fully trained.

In complicated machines, especially such machines containing hydraulic, pneumatic and electric circuits, the personnel must have knowledge in more than one of these fields. The machine mechanic must know how the electric control circuit acts because he must be able to check the entire function in order to find weak components and failures. The need to train both mechanics and electricians in several new fields becomes more and more obvious. For the complex machines, methods have been developed such as

- logical fault-finding techniques

- test programmes

which have to be handled by trained craftsmen. The time savings with these methods are so great that the cost of training is negligible.

In earlier days the lubricator usually was among the less able. If a man was not capable of working as a production man he was given a job either in the tool-crib or as a lubricator.

Lubrication (and also the job in the tool-crib) is a job to be done with care and strictly according to the instructions. If a poorly trained man is used, safety and accuracy of the work may be jeopardized. The man who does lubrications may also do simple kinds of inspection when lubricating the machines. If he is a skilled craftsman, then, not only does he properly lubricate a machine but he may also contribute importantly to preventive maintenance by inspecting the machine, as well.

In Swedish industries it has been found that older mechanics who do not like to work as repairmen on incentives any longer, will do a very good job as combined lubricators, inspectors and instructors for the operators of the machines. Usually they have a very good knowledge of the machines, collected during long time as mechanics, and personality qualities that make the operators accept them as superiors.

Repair work is done in connection with the inspections, usually up to the predetermined and agreed stop time. Repair work taking more time is done later on, if the failure is not of the nature that calls for immediate action.

When the preventive programme has been in effect some time, more people are trained for the job. In some industries the preventive work is planned and scheduled as a part of the repair work, with a certain priority.

In the long run it will not be necessary to have special workers for most of the preventive maintenance work.

The internal training programme for the personnel working on preventive maintenance should be a continous process as new machines are installed and the workers trained in their use as soon as possible. This applies also to the foremen, both the PM foremen and the repair foremen (in different departments).

The preparation of instructions is usually done by maintenance engineers. They need a training course at the start of the programme, covering

- preventive maintenance techniques
- instruction language
- instruction technique
- use of methods records.

5.4.3.3 Maintenance Planning System

It is generally accepted that careful planning of an operation will improve the results. In general, however, the opinion is that maintenance work cannot be planned to any large extent.

The fact is that in a well organized maintenance department, usually more than 75 per cent of the manhours spent on maintenance jobs can be planned. Even rush jobs can be planned.

Weekly Planning Meeting

A successful maintenance planning is based on:

- a balanced order-stock enabling an equal and optimum utilisation of the maintenance resources.

- greatest possible consideration of the fact that orders (jobs) have to be carried out at the right time without unnecessary delay.

This implies well-organised team-work between the order-originators, the maintenance work-groups, maintenance engineering group, and the maintenance planners.

The introduction of weekly planning meetings between these people will result in a good ongoing relationship in questions such as preparation and priority of maintenance jobs to be carried out during the coming weeks.

The following items should be fixed on the agenda:

- report on the results of the last week's program.

- report on the orders entered last week and the total order stock.

- report on jobs under preparation.

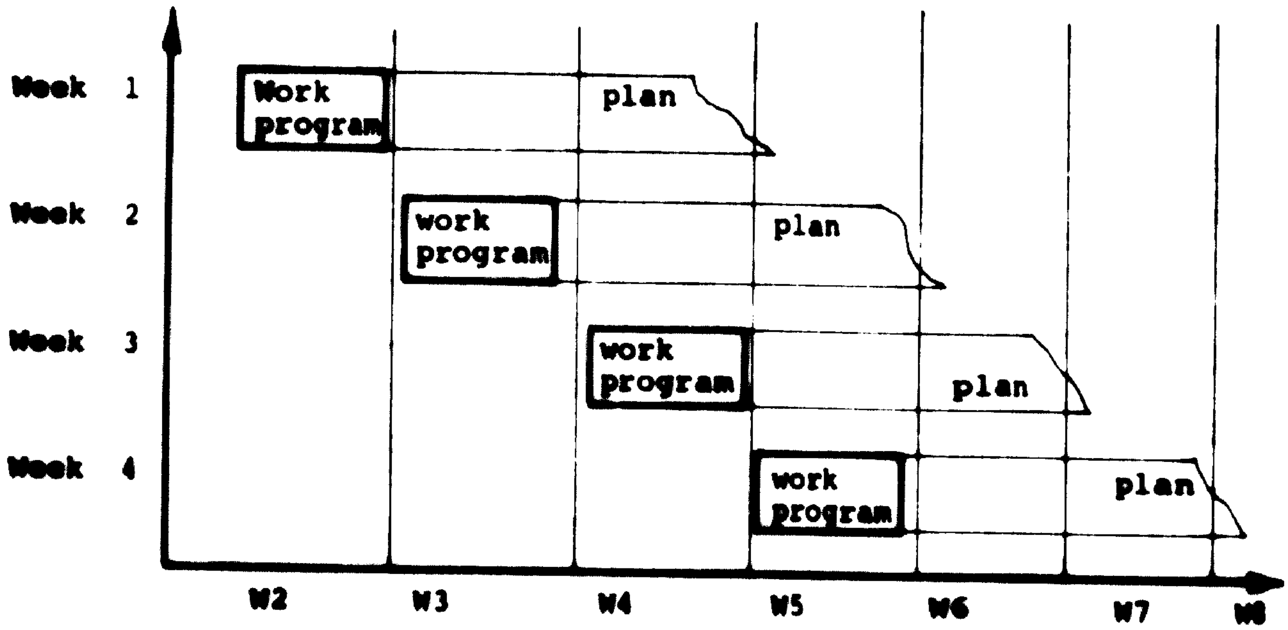
- proposal for work-program for the coming week.

- comments on the proposed work-program. Establishment of the program for the coming week and the plans for the following weeks.

- report on the situation of the other maintenance groups and the central maintenance shops.

- miscellanous.

This means that the work program and the plan of the following weeks are prepared according to the following cyclogram:



The work-program for the next week includes only jobs prepared and ready to start. In the plan for the following weeks all jobs with a scheduled date and requiring a certain amount of resources ought to be included. The plan should serve as a prognosis base for the evaluation of the need for coordination of the various maintenance jobs and maintenance groups, and also indicate the need for extra capacity.

Capacity planning

A good maintenance- economy implies that each maintenance shop has an adequate order-stock enabling it to equalise the order variations of the order-entrance and to have the necessary time for the job-preparation.

The aim of capacity planning is to manage the time and sequence of the ordered jobs within the frame of the priority rules, in such a way that an "optimum" utilisation of the available ressources will be obtained.

To understand the routine of capacity planning, it is necessary to introduce and define some basic concepts.

- Jobs ready to start and jobs not ready to start (priority group 3 and 5)

- Prescribed order stock.

The total maintenance order stock can be divided, once defined, as shown below:

Orders which are time estimated, prepared and ready to start as soon as the necessary resources are available	Orders ready to start	Total order stock
Orders which are time estimated, and prepared but not ready to start during the next two weeks, due to lack of materials, not yet fixed stop-time for production equipment, etc.	Orders not ready to start	

The standard time for orders not ready to start next week is calculated as follows:

Work group N.N.	Week			
Work standard code	Jobs not ready to start	a No. of work orders	b Statis- tical st. time	a + b
1	//// //// //// //// //	22	3.5	77.0
2	//// //// ///	13	11.6	160.8
3	//	2	22.2	44.4
4	///	3	45.3	135.9
5		-		
9	171-106-135			412.0
Hours not ready to start				820.1

Prescribed order stock

By the prescribed order stock expressed in weeks (e.i., the jobs in priority groups 3 and 5 ready to start), we shall understand the order stock ideal compared to real life.

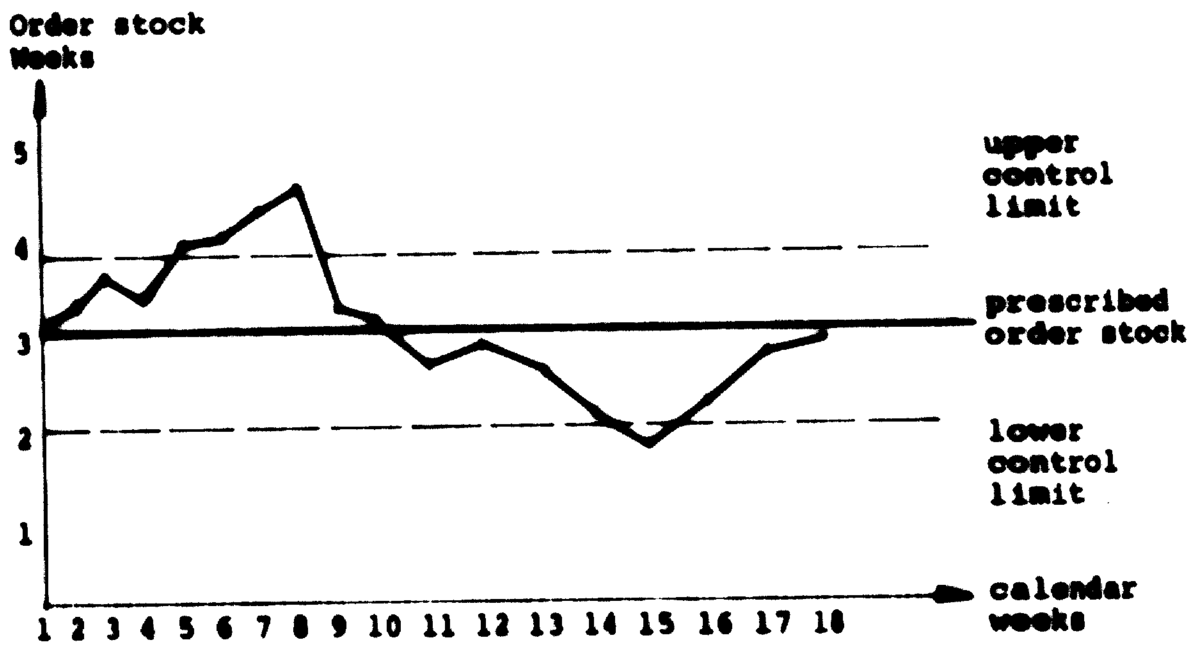
The determination of prescribed order stock for each maintenance workshop ought to be based on a study of the order entrance and the variations during the last 18 - 20 weeks.

The interplay between the order stock and the relevant maintenance capacity makes it necessary to follow up and manage the order stock. In this connection the "prescribed order stock" is important aid.

The stock of orders ready to start ought to fulfil the following requirements:

- the variation of the order entry can be filled up to the capacity limit by the cumulated jobs.
- jobs which, contrary to expectation, cannot start, due to lack of materials or spare parts, alterations in accessibility, etc., can be replaced.
- possibilities of rational combination of jobe.
- give sufficient time to job preparation.

Assuming that the "prescribed order stock" is evaluated/ calculated to be 3 weeks, the following order-stock-control diagram can be made:



The difference between the control limit and the prescribed order stock can be calculated as the greatest deviation from the average of the orders entered during the last 20 weeks.

It is an essential task of the maintenance planning group to understand the order stock information, and in cooperation with respective managers take the necessary measures based on this information.

By fixed control limits and an order trend exceeding the upper limit, the maintenance workshop in question is supposed to be shorthanded. If the order trend exceeds the lower limit, the maintenance workshop in question is supposed to be overmanned. In both cases adjusting measures are necessary.

Capacity calculation

Maintenance jobs in the category routine maintenance jobs (standing work orders priority 4) are planned, and in priorities 1 and 2 jobs are not planned, but draw on the resources.

All other maintenance jobs have to be planned according to the resources available.

To make proper utilization of the resources available for maintenance jobs, it is necessary of course to know the number of resources at one's disposal.

The available resources have to be calculated per period corresponding to planning periods, e.g., per week or 2 weeks.

An example of a capacity calculation is shown below:

WORK GROUP	PERIOD: WEEK 15		
	PLAN	REAL	DEVIATION
Norm capacity	2350	2350	
Calculated absence	-100	- 25	- 75
Lend capacity	- 50	- 25	- 25
Borrowed capacity maintenance	+ 10	+ 10	
Borrowed capacity sub-contractor	+200	+250	- 50
Planned overtime			
Real Capacity A:	2410	2560	-150
For priority 1	225	275	- 50
For priority 2	365	355	+ 10
For priority 4	410	405	+ 5
(1 + 2 + 4) B:	1000	1525	- 35
CAPACITY AVAILABLE (A - B) for priority 3 + 5	1410	1525	-115

Order Stock (week 13)	Weeks	Hours
C: Prescribed order stock	5	6750
D: Order stock ready to start	4.4	5940
Difference (C - D)	0.6	810
Kvot. $\frac{D}{C} = \frac{4.4}{5} = 0.88$		

This capacity plan is set up at the weekly planning meetings.

Explanation of the plan.

(a) Norm capacity: Own resources in hours.

(b) Calculated absence: In advance known absence due to holidays, illness, education, etc.

(c) Lend capacity: Known lending of resources to other services.

(d+e) Borrowed capacity: Known resources borrowed from other maintenance shops, " the production" or other.

(f) Planned over-time: Planned and accepted over-time.

Real capacity A: a + b + c + d + e + f

(g) For priority 1: Calculated as a 5-week running average of priority 1 jobs earlier carried out.

(h) For priority 2: Calculated as priority 1.

(j) For priority 4: Total standard for all priority 4 jobs (standing work orders).

1 + 2 + 4: Total statistical probable hours to be reserved for acute repair of priorities 1 and 2, and the standard work orders priority 4.

Capacity available: Hours which can be used for planned priority 3 and 5 jobs.

In this example the capacity-plan is prepared in week 14, is valid for week 15, and the calculations are based on data information from the situation at the end of week 13.

C Prescribed order stock: As described earlier in weeks

h = weeks x running average of the last lo weeks real available capacity in hours/weeks.

In this example 5 x 1350 = 6750 hours.

D Order stock ready to start: Total order stock minus orders not ready to start (as earlier described) divided by running average of the last 10 weeks real available capacity in hours/weeks.

In this example: 6750 - 820 = 5930 hours

or $\frac{5930}{1350}$ = 4.4 weeks.

Based on the calculated capacity and the stock of orders ready to start, the work program can now be set up.

CONCLUSION:

All the items described in article 5,together with the material administration system and the cost control and budgeting system, form the vital part of the "Managed maintenance system". Of course a number of records and files are needed as a data base. These and the EDP-input and output will be described in a later article.

DESCRIPTION

1. The planners/order-receivers immediately make a cost- and work evaluation on the received work order.

   The work orders are checked, signed and dispatched for further preparation.

2. Work with priorities 3 and 5 and project, requiring no construction work and no external ordering of spare parts and materials, are prepared by the performing group (shop).

3. Planning group arranges the work orders according to the rules and hand over the work-orders to detail planning (5) or asks for external resources (4).

4. The arranged work orders can, considering the load situation in the performing groups (shops), or for other reasons if suitable, be given to external resources, e.g., central maintenance shops.

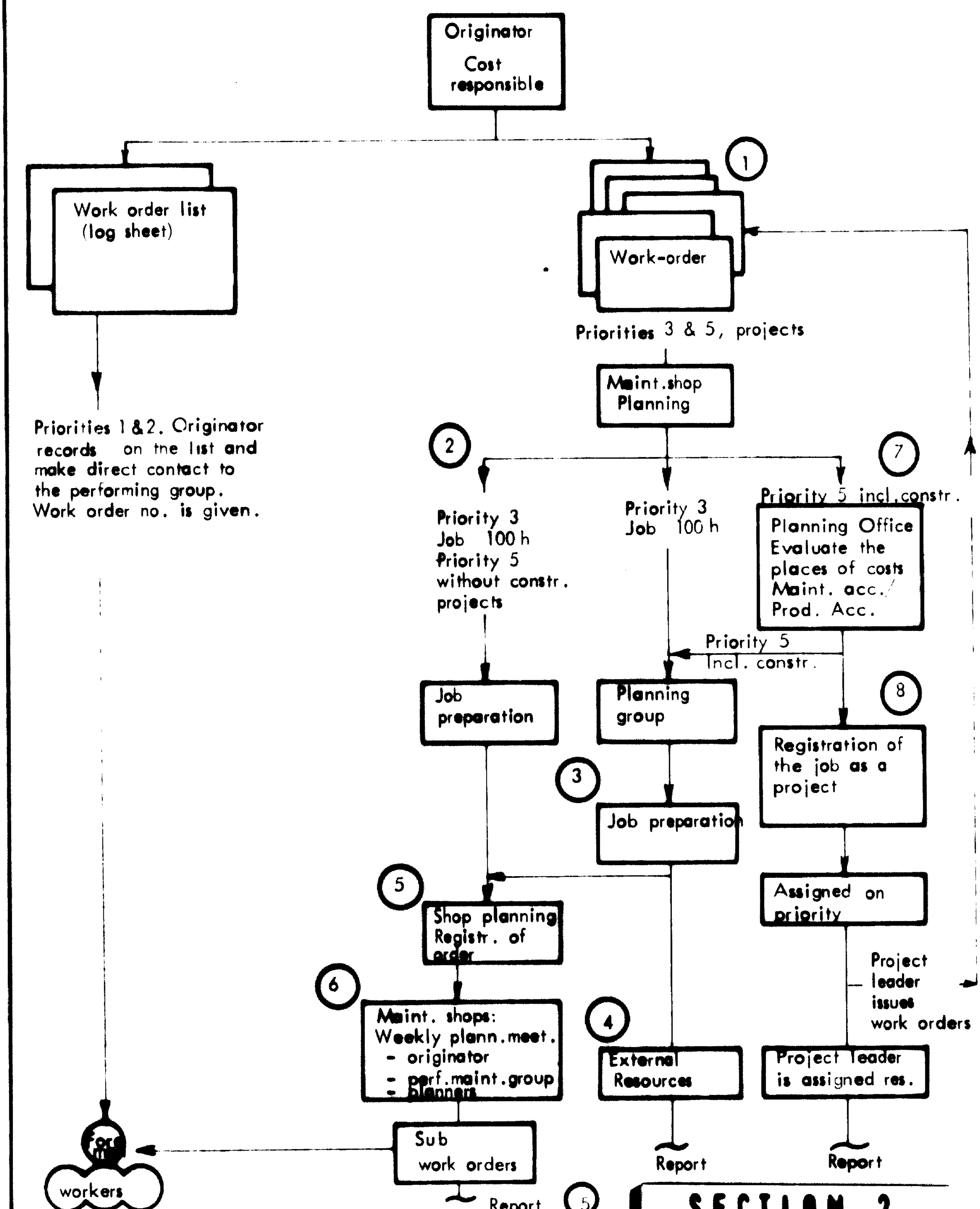
5. The prepared work orders are registered on the respective performing groups, and scheduled according to the planning rules. The planners issue Subwork-orders if necessary to the respective performing groups. The prepared work-orders planned for coming week are set up on the weekly program of the respective performing groups.

6. The work program for the coming week is fixed at the weekly planning meeting.

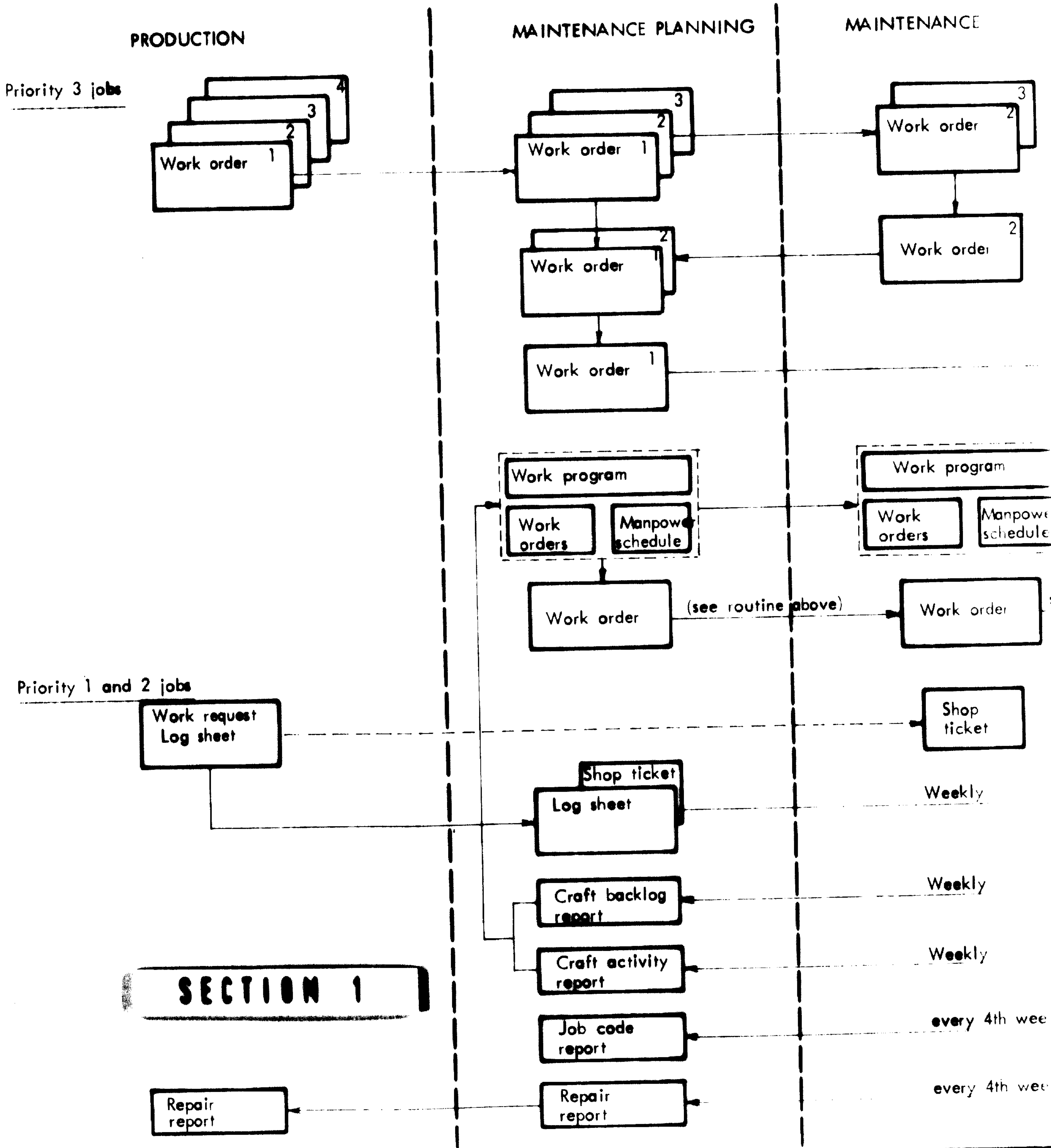
7. The work orders priority 5 which are to be considered as a project, are registered (8) and handed over to the project group. The originator is informed that the order is going to be performed by the project group.

ATTACHMENT 5.1

WORK - ORDER - FLOW

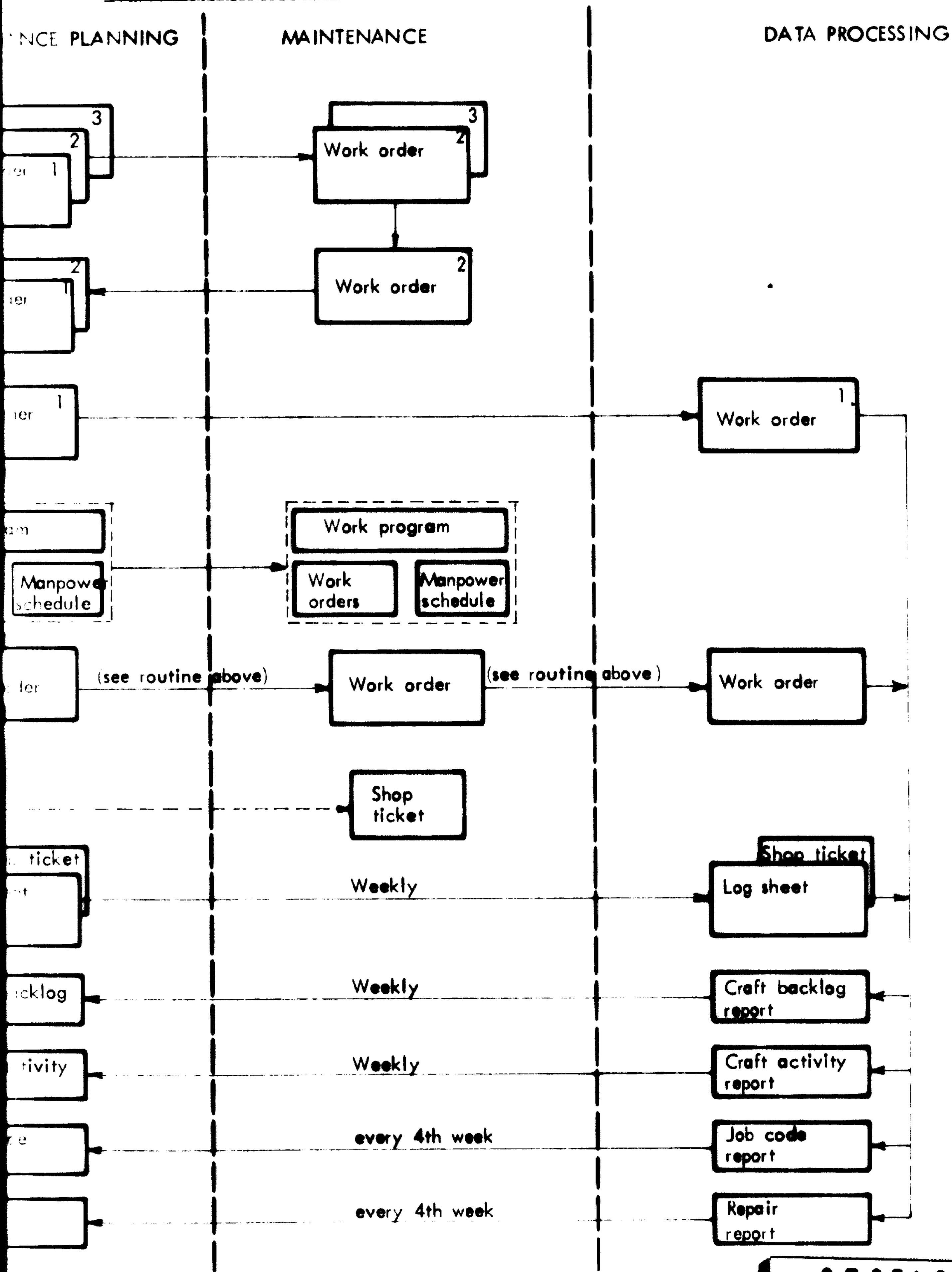


INFORMATION FLOW
PRINCIPAL SKETCH

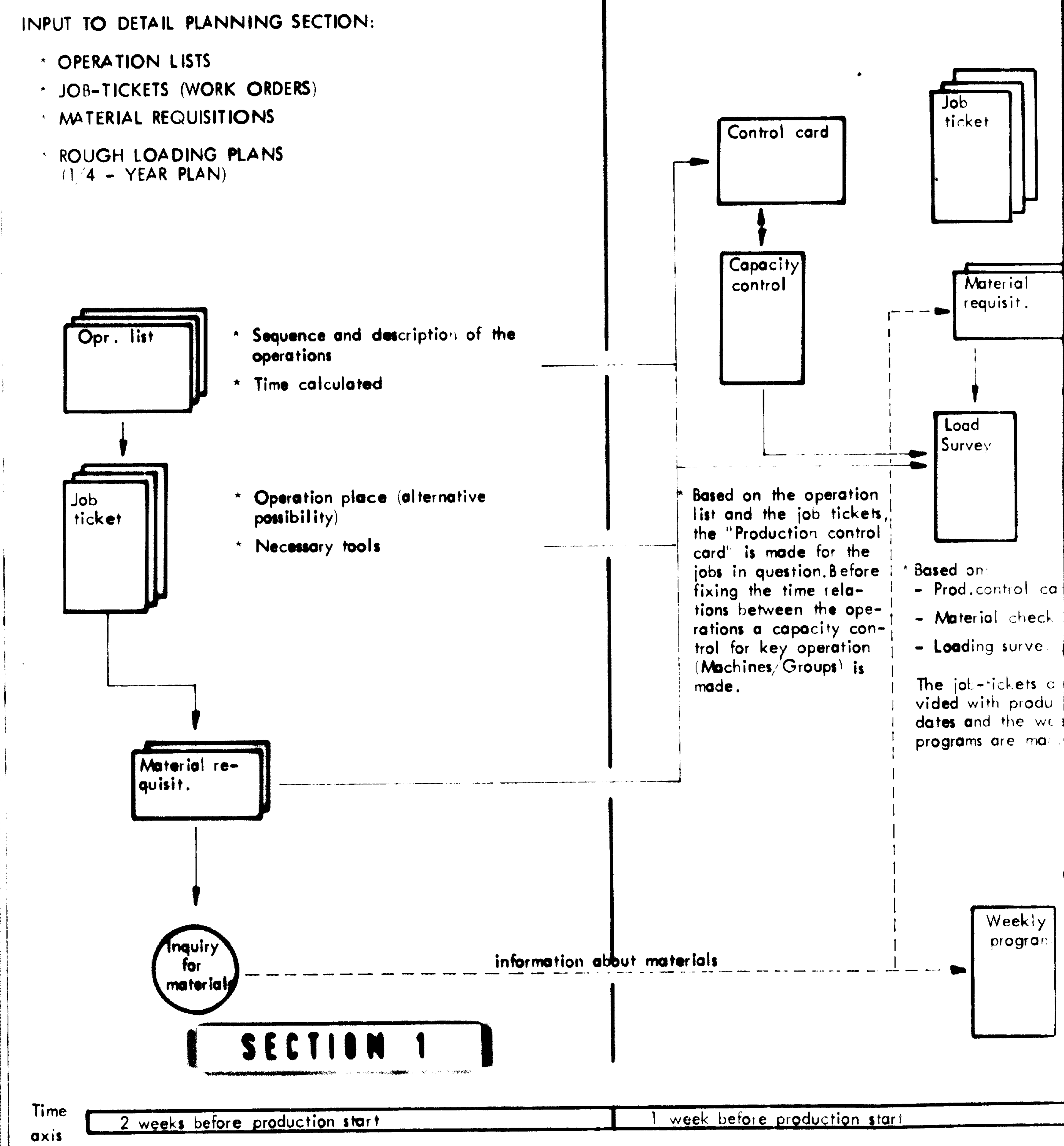


SECTION 1

INFORMATION FLOW
PRINCIPAL SKETCH

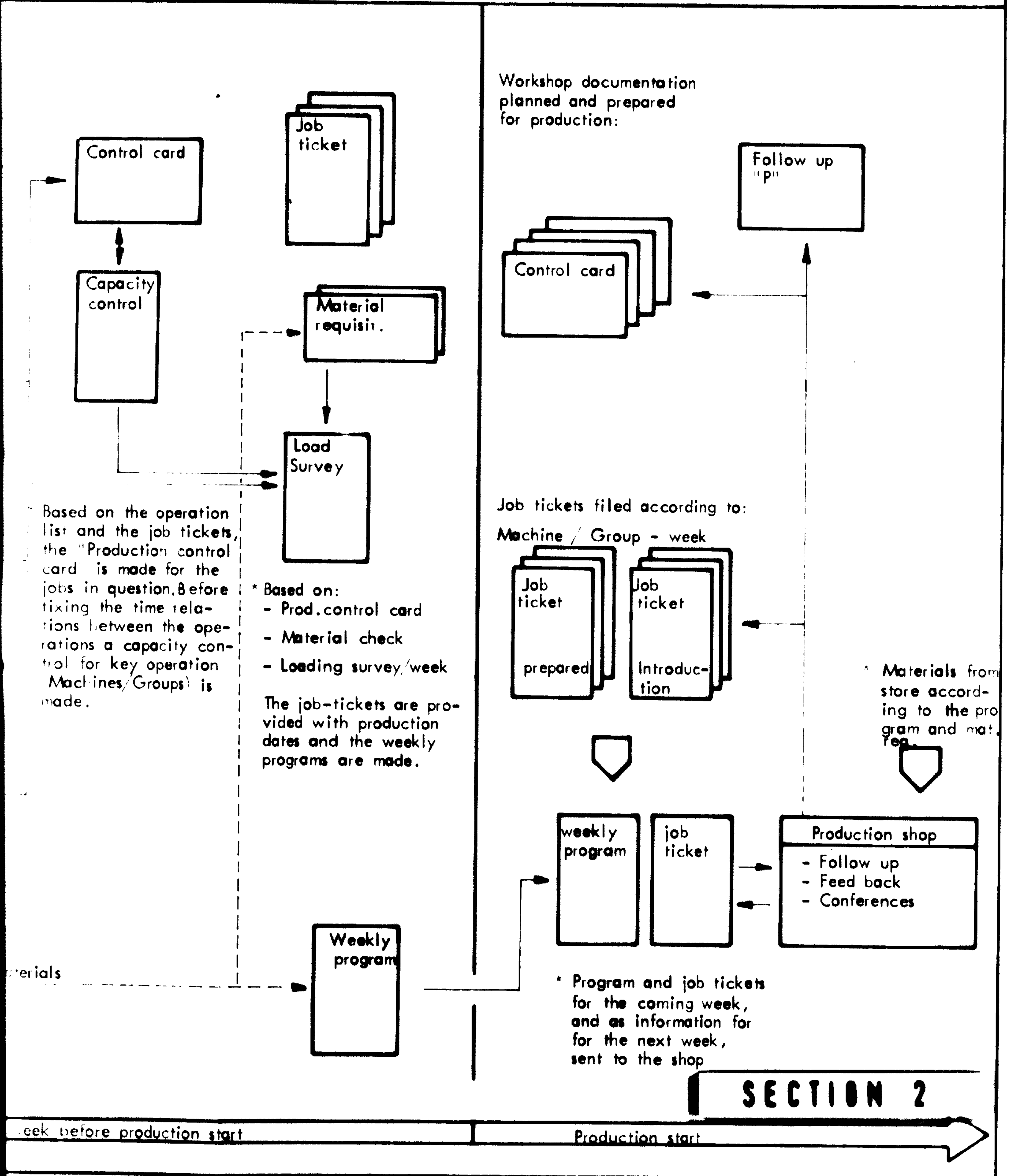


ROUGH SKETCH OF PROPOSAL FOR DETAIL PLANNING IN



ATTACHMENT 5.3

)POSAL FOR DETAIL PLANNING IN MECHANICAL SHOPS



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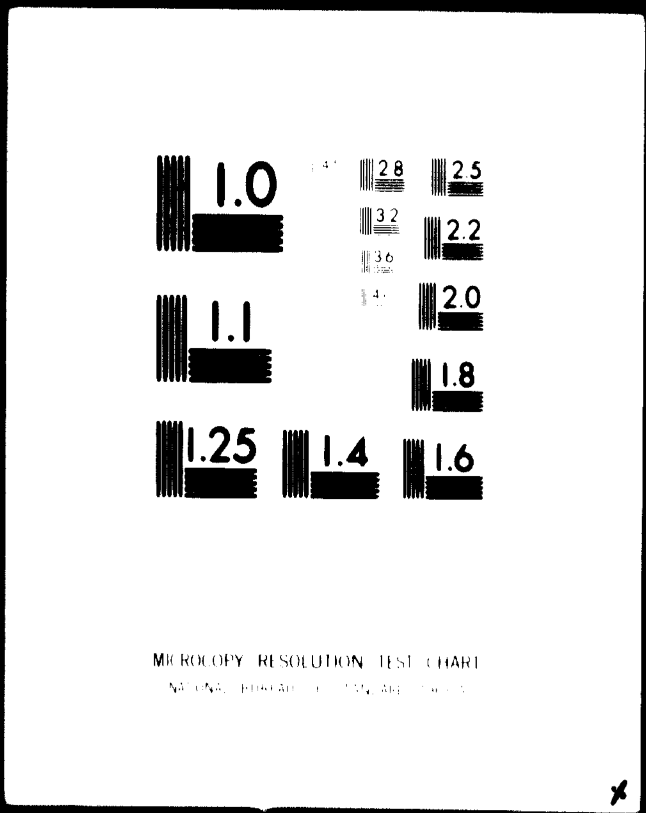
2 OF 10


1.0
2.8
2.5
3.2
2.2
3.6
2.0
1.1
1.8
1.25
1.4
1.6
MICROCOPY RESOLUTION TEST CHART

24x
E

Attachment 5.4

PRODUCTION CONTROL CARD

card no:

date/sign:

Pos	Job ticket	IDENTIFICATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
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REMARKS:

Attachment 5.5

	CAPACITY CONTROL	Planner:

LOADING SURVEY

PAGE: ____ OF ____

DATE: ________

PLANNER: ________

SHOP: ________ FOREMAN: ________________

WEEK No.												
TEORETICAL CAPACITY IN HOURS	H											
ACTUAL CAP.	I											
ACTUAL HOURS	J											
JOB No.	P	C	P	C	P	C	P	C	P	C	P	C
	K	L										

P: PLANNED HOURS PER JOB. C: CUMULATED HOURS FOR THE PERIOD

Load Survey Form

H = Theoretical capacity in hours: Total capacity in man-hours including shifts and planned overtime, but excluding workers on holidays.

I = Actual capacity: The actual capacity is the theoretical capacity corrected by a factor for illness, other absence, and minor breakdowns. The figures of illness and other absence will be found by statistics of the capacity utilization.

We propose the figures of minor breakdowns to be 10% at the beginning. This factor must be discussed with the shop leaders and the foremen. The aim is to reduce these factors in order to get better utilisation of the manpower.

J = Actual hours: Actual hour consumption in connection with jobs. The actual hour consumption of the "follow-up week" (the past week) must be calculated and inserted in this space. Deviations, if any, must be discussed with the foremen at the planning meetings in order to decide, for instance, in case of a delay, whether this delay can be eliminated through overtime. If necessary, the "planned weeks" must be adjusted.

K = Planned hours per job: The planned hours are the expected actual hours.

In order to get these planned hours, the estimated hours are multiplied by a factor

$$P = \frac{\text{actual hours}}{\text{estimated hours}}$$

This factor is found through the feedback of job tickets and calculated as described in point 5.4.2.

L = Cumulated hours per week:	Cumulated hours of the planned jobs must fill up the actual capacity (I).

In order to have a clear survey, the plans must be kept in files for each foreman.

Attachment 5.7

	WEEKLY PROGRAM/FOLLOW-UP	Date: Page 1 Planner: Page ____ of ____
WEEK Nº:	SHOP: GROUP:	Foreman

Pos. No.	Job No.	DESCRIPTION	PLANNED St.	PLANNED Fin.	ACTUAL St.	ACTUAL Fin.	MATERIAL From	MATERIAL To
A	B	C	D		E		F	

WEEKLY PROGRAM/FOLLOWING-UP

A. Pos. No.

B. No. of job.

C. The same description as that of the job ticket.

D. The planned start and finish date of the job.

E. The actual date on which the job was started and finished.

F. Information concerning origin of the materials and their destination point after completion of the job.

FOLLOW-UP PLANNING FACTOR P

PLANNER:

QUARTER No:

GROUP	WEEK No / HOURS					P					P						P
Ⓐ	ACTUAL	Ⓑ				Ⓓ											
	ESTIMATED	Ⓒ															
	ACTUAL																
	ESTIMATED																
	ACTUAL																
	ESTIMATED																
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	ACTUAL																
	ESTIMATED																

FOLLOW-UP THE PLANNING FACTOR P

The planning factor P is: $\frac{\text{Actual hours}}{\text{Estimated hours}}$

This P must be calculated per foreman continuously based on the job tickets of the finished jobs. The form is shown below:

Explanation:

A = Group:	Normally a group consists of the workers and 1 foreman. If some foremen have only a few men it might be expedient to form larger groups by putting together several foremen groups.
B = Actual hours:	The actual hours registered on the job tickets of finished jobs within the stated week.
C = Estimated hours:	The estimated hours registered on the job tickets of finished jobs within the stated week.
D = Planning factor P:	$\frac{\text{Actual hours}}{\text{Estimated hours}}$ of the past 4 or 5 weeks. One form covers one quarter of a year.

Besides using P for the conversion of estimated hours into planned hours, the factor tells something about the efficiency. If the estimated hours are constant and P decreases, it means that the actual hours have been reduced. The reason for higher efficiency can be better methods, better organisation of the transportation, correct manning, etc. It should be the foreman's object to raise the efficiency and keep P on a level corresponding to good efficiency.

6. MATERIAL ADMINISTRATION

ATTACHMENT 6.1	Flow-chart	
	Spare Parts Value	25.000
ATTACHMENT 6.2	Flow-chart	
	Designated Spare Parts	
ATTACHMENT 6.3	Flow-chart	
	Spare Parts in Stock	

6. MATERIALS ADMINISTRATION

The present situation in the materials and spare parts administration of the company calls for close attention.

In this chapter is presented a proposal for future materials management. However, the system as such cannot solve all of the problems. Proper coding systems, efficient procedures, efficient utilization of EDP, and a clear organization are basic elements in efficient materials management. But if we do not know what is on stock today, if we do not know the costs/value of this, if we do not know what is ordered and which delivery times will be met, if we do not know the need for spare parts, and if we do not have a description for materials administration, then this must be changed before a system can function efficiently.

Today the materials administration function of the company controls a value of approximately 400 mill. Forints and at the same time spare parts are often lacking.

We recommend a special survey to be carried out in this area. The objective of such a survey should be:

a. To identify and code all existing materials and spare parts, including such ordered and not yet delivered.

b. To register both weak points in the present situation and demands for changes.

c. To examine possibilities for deletion and propose a policy to the top management.

d. To examine the method for decision-making before ordering and propose similar rules for the whole company. This concerns both number to be ordered and where (buy/make).

e. To elaborate an efficiency improvement program for the materials administration inside the frame of the system presented below.

PROPOSED SYSTEM

The materials administration function in the maintenance organization will be headed by a unit manager responding to the director of maintenance.

The unit manager of materials administration will be responsible for efficient utilization of the capital kept in stocks and for minimizing the direct and indirect costs caused by materials and spare parts. His responsibility is described in more detail in the system descriptions.

Decisions as to what and how much will be kept in stock, what will be manufactured inside the company, and what will be purchased will be made on the basis of the principles set forth at the maintenance courses and presented in the course manual.

Decisions as to deletions of spare parts will be made on the basis of an economical/technical/political decision by the top management. The present method shall be used increasingly until the EDP-materials administration system is functioning. Then no special method is necessary, but for some years a special person will be assigned this responsibility.

The material planning system will ensure that the results of the analyses mentioned above are brought into action and that requirements for materials and spare parts are fulfilled without unnecessary delays.

The basic principles for the material planning system (MPS) are:

- all materials and all spare parts located in the company will be filled in MPS.

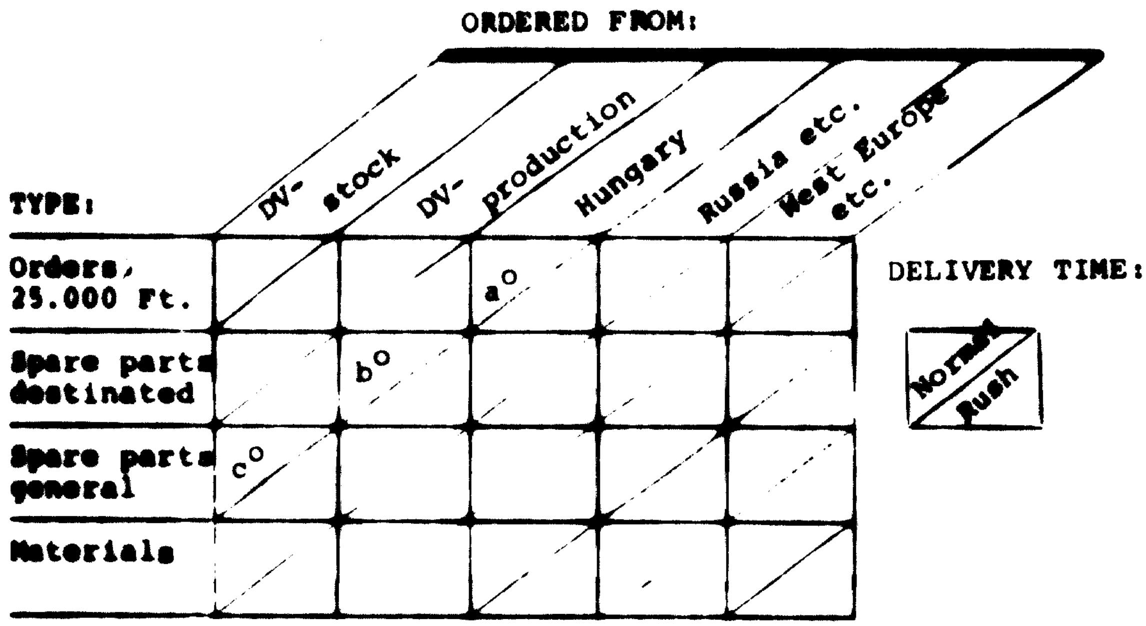
- all utilization of materials and spare parts will be requisitioned from MPS. If there is not time to complete the paper work before a part is used, it must be done immediately thereafter.

- requisitions sent to MPS may be evaluated by MPS, but the user (requestor) decides what he must have.

- MPS acts as an internal purchasing office for the maintenance production workshops and no other department can, normally, order a job to be carried out here.

The MPS routines differ depending on the type of requisitions and materials/spare parts. They are not different for goods placed in central stocks or in production units.

The following scheme shows the 20/40 main variants of routines.

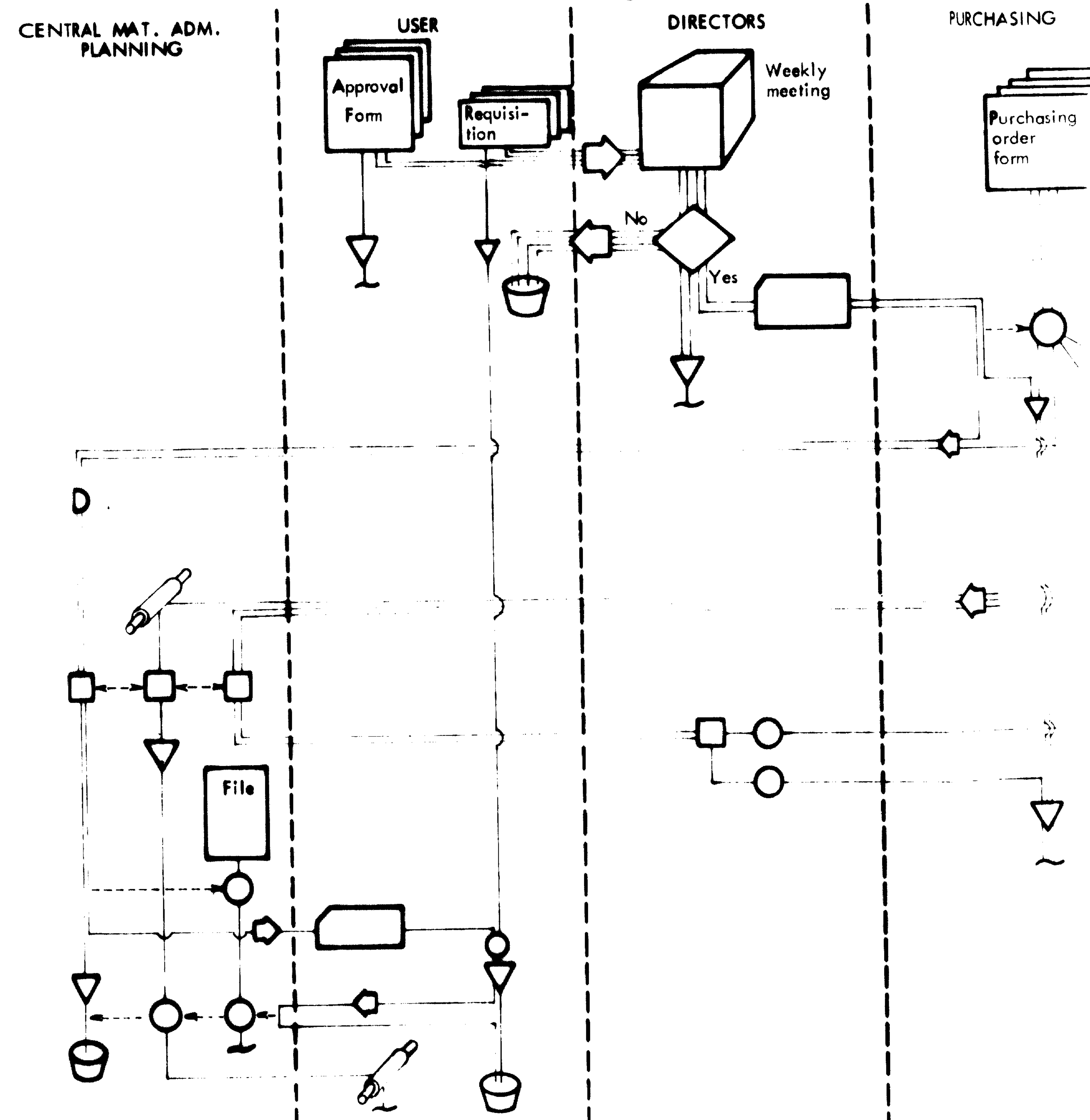


In attachment 6.1 the routine for orders amounting to more than 25.000 Forints and ordered in Hungary with a normal delivery time (a°) is described. In attachment 6.2 the routine for orders of designated spare parts ordered in a workshop within the company with a normal delivery time (b°) is described.

In attachment 6.3 the routine for orders of general spare parts ordered in a stock within the company with a normal delivery time (c°) is described. Routines for rush orders will be the same as for orders with normal delivery time, only ordering and material handling is carried out before the routines are performed

FLOW - CHART .

ROUTINE FOR ADMINISTRATION
OF ITEMS > 25000 Ft. FROM INITIATIVE
UNTIL FINAL USE. (NONE PRODUCTION MATERIAL)

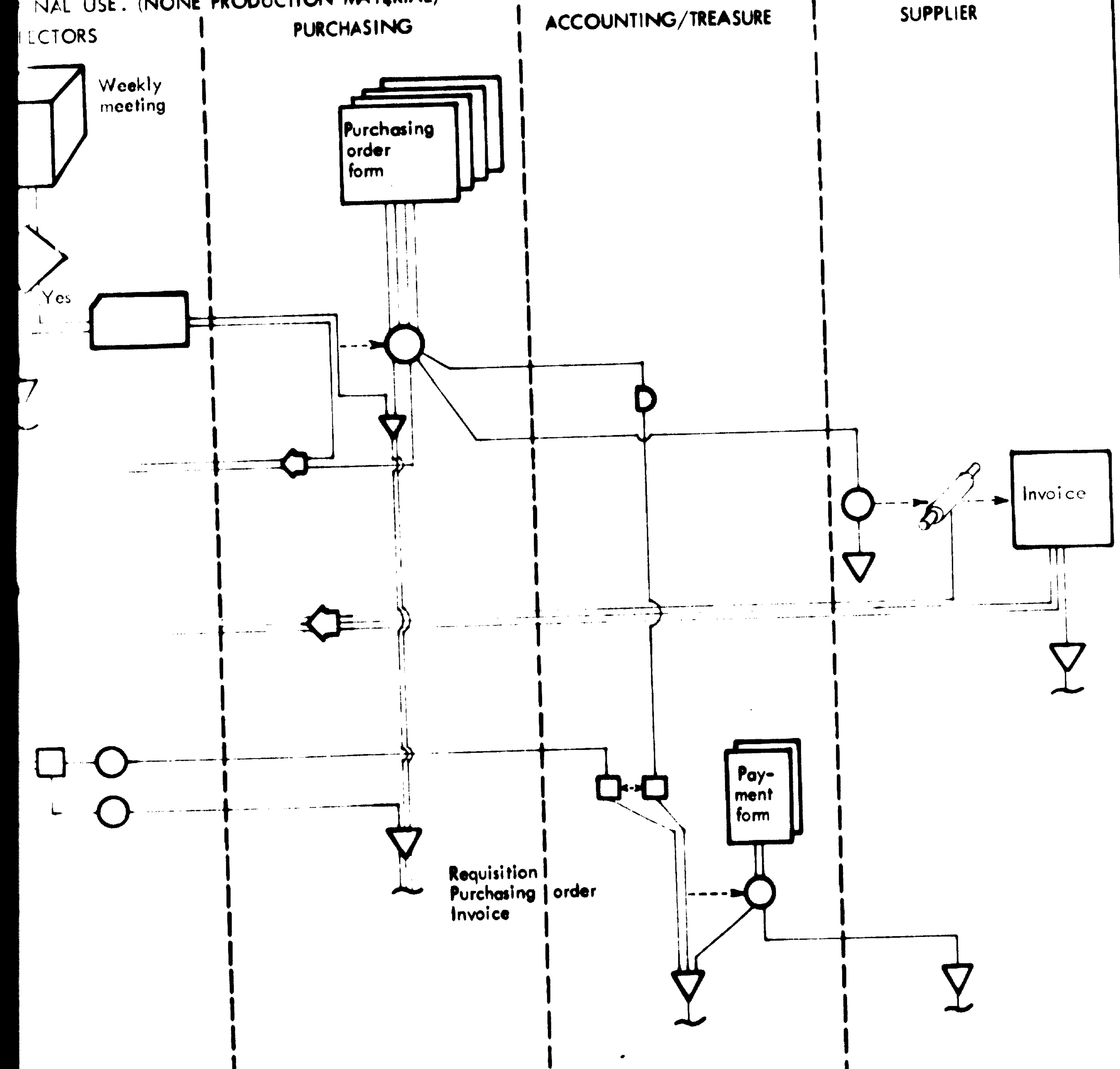


SECTION 1

ATTACHMENT 6.1
MAT. ADM. SYSTEM

FLOW - CHART .

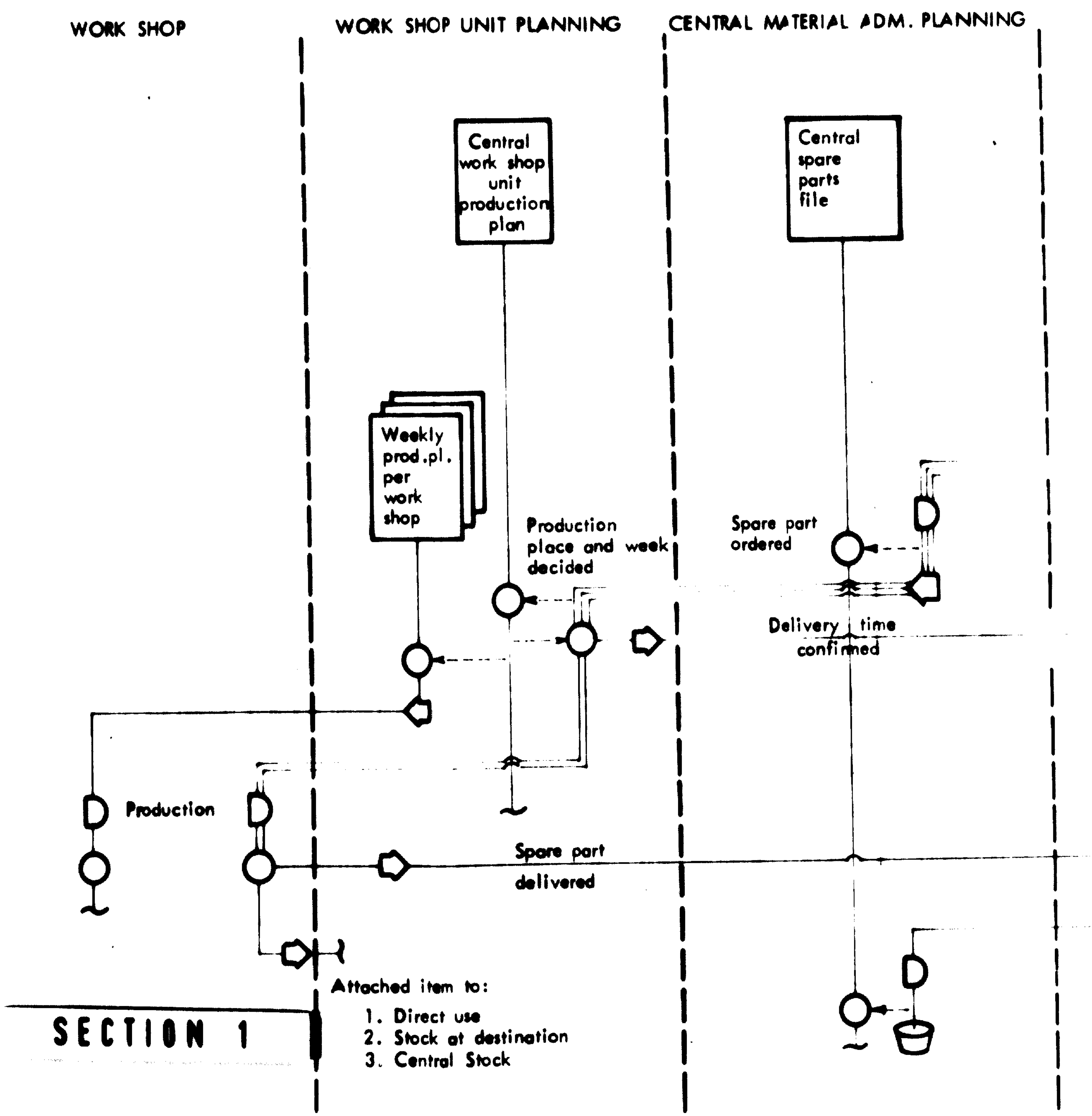
ROUTINE FOR ADMINISTRATION
ITEMS > 25000 Ft. FROM INITIATIVE
NAL USE. (NONE PRODUCTION MATERIAL)



SECTION 2

FLOW - CHART

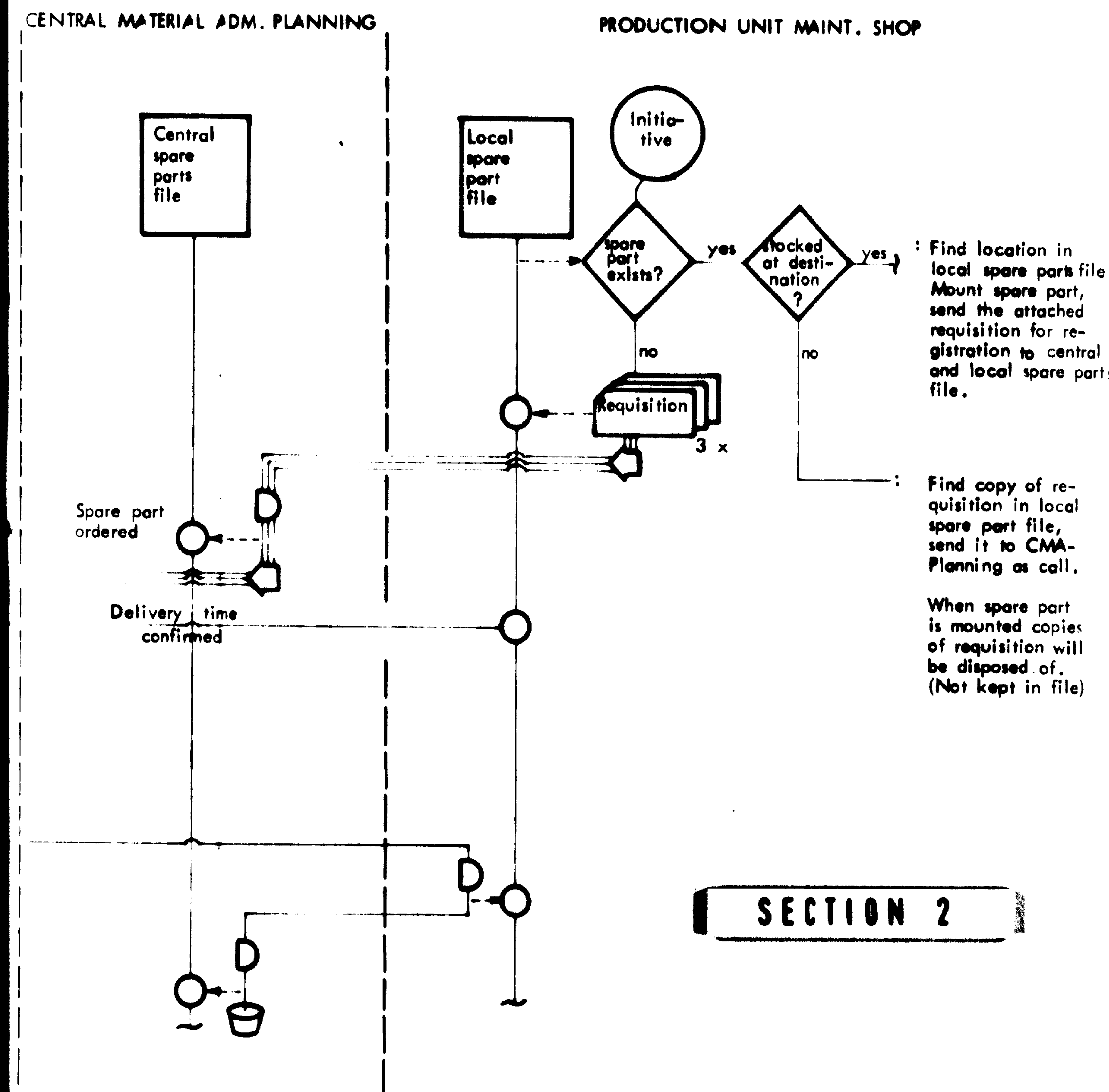
ROUTINE FOR ADMINISTRATION
OF DESIGNATED SPARE PARTS PRODUCED
AT DV. FROM INITIATIVE UNTIL FINAL USE.



ATTACHMENT 6.2
MAT. ADM. SYSTEM

FLOW - CHART

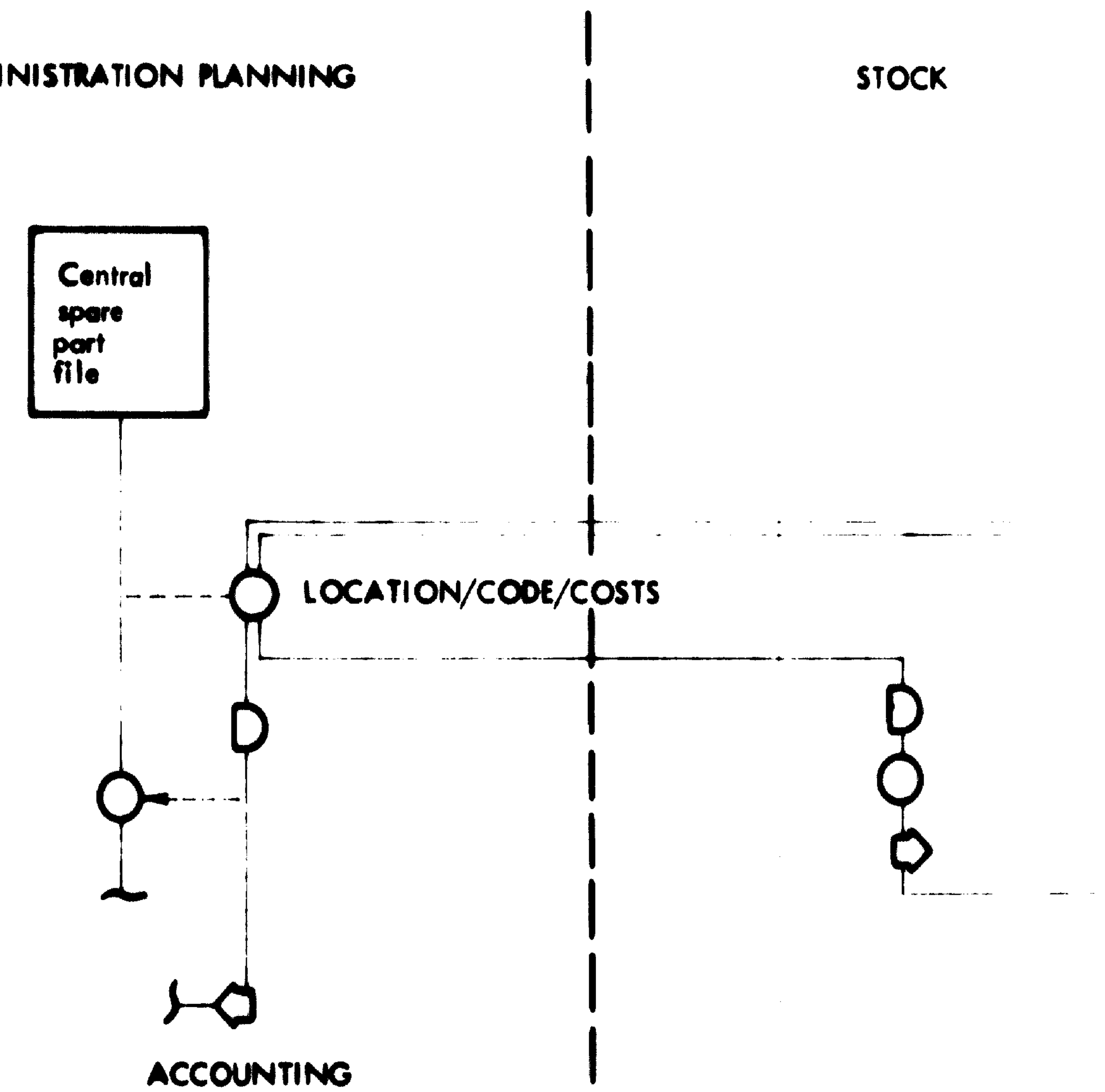
ROUTINE FOR ADMINISTRATION
OF DESIGNATED SPARE PARTS PRODUCED
AT DV. FROM INITIATIVE UNTIL FINAL USE.



FLOW - CHART

ROUTINE FOR ADMINISTRATION
OF GENERAL SPARE PARTS PLACED
IN STOCK IN D.V. FROM INITIATIVE
UNTIL FINAL USE.

CENTRAL MATERIALS ADMINISTRATION PLANNING | STOCK



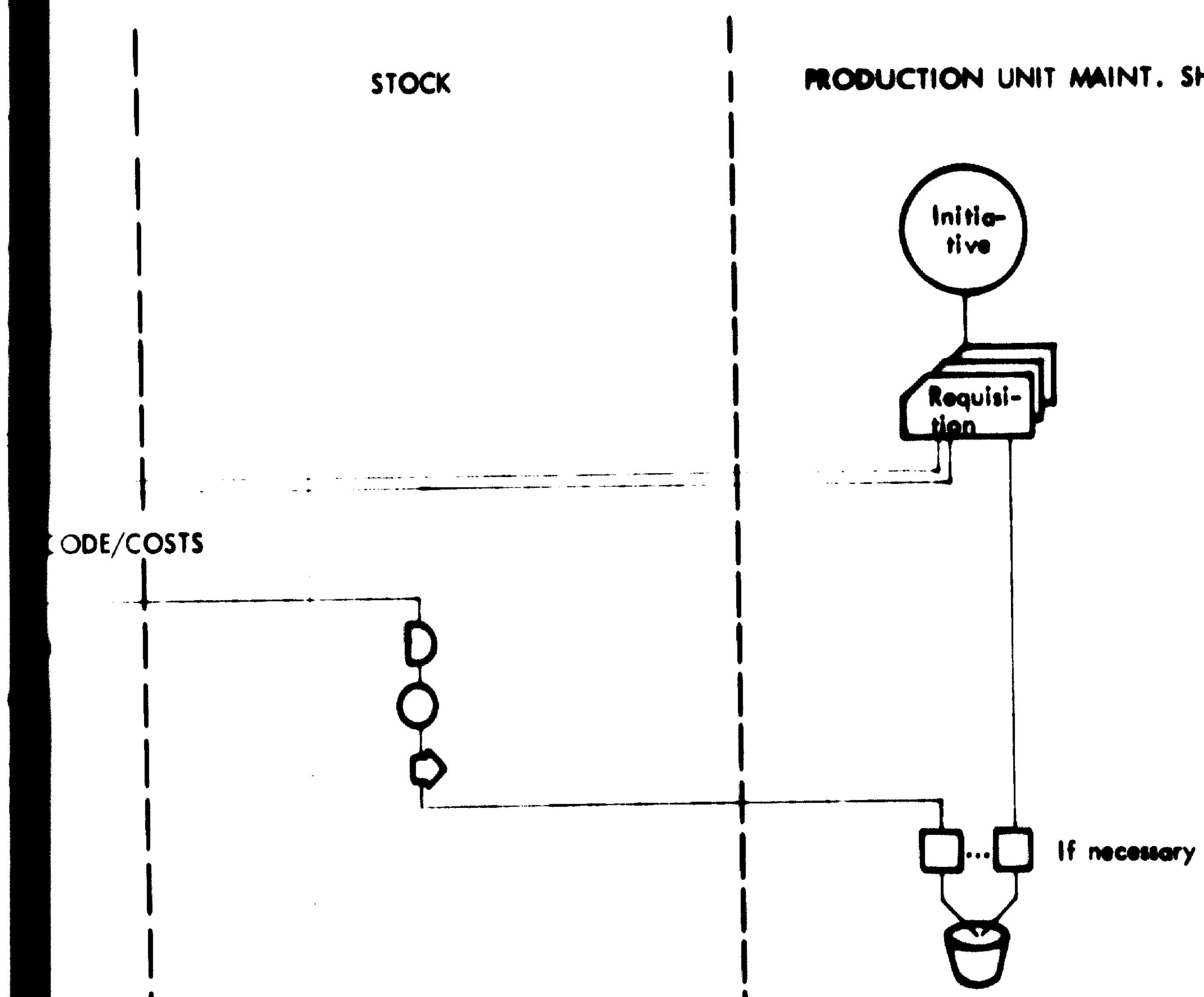
SECTION 1

ATTACHMENT 6.3

FLOW - CHART

ROUTINE FOR ADMINISTRATION
OF GENERAL SPARE PARTS PLACED
IN STOCK IN D.V. FROM INITIATIVE
UNTIL FINAL USE.

STOCK | PRODUCTION UNIT MAINT. SHOP OR OTHER



SECTION 2

7. GENERAL DESCRIPTION OF THE COST CONTROL SYSTEM FOR MAINTENANCE

7. GENERAL DESCRIPTION OF THE COST CONTROL SYSTEM FOR MAINTENANCE

The present cost control system has more weaknesses or inadequacies and the below-mentioned are the most important ones:

1. The paper process concerning the accounting system is long and complex. The introduction of EDP gives further possibilities for simplification.

2. Overhead costs, "regi costs", in the work shops are distributed among the orders through a monthly calculation of overhead costs and direct (=productive) wages and added to the direct wages as a percent. An easier way to distribute these costs would be to divide the yearly budgeted overhead costs, divide these by the yearly planned productive hours and then multiply the resulting amount by the productive hours of the specific orders.

3. A yearly budget for overhead costs is not elaborated. In order to get an effective control of all overhead costs a budgeting system based on cost responsibility areas must be elaborated.

4. Lack of coordination between cost places, standing work orders, and machine numbers.

5. Cost reporting is incomplete.

6. No detailed cost planning and cost distribution on the maintenance functions are made at present.

7. Subcontractors for maintenance jobs are not always ordered or controlled by the maintenance organization.

8. The accounting groups in the various factories and the Central Maintenance Office are working unintegrated following different routines, and not using the same routines as used in the Central Accounting Group.

9. The data processing today is performed partly manual and partly by EDP, and the development of the processing procedure is not coordinated at the various places.

10. The maintenance account numbers are used without authorisation, this giving possibilities for misuse.

7.1 PURPOSE OF THE COST CONTROL SYSTEM

The purpose of the cost control system is to enable both the management and other colleagues to control the economy of their areas of responsibility, i.e.

- to report the costs of each maintenance function,
- to evaluate effectiveness by using own labour force versus cooperation/purchase,
- to evaluate the total maintenance costs distributed according to responsibility areas, functions and jobs, incl. maintenance pricing,

- to give a basis for elaboration of budgets for the total company,
- to evaluate deviations between planned and actual costs as well as causes thereof,
- to evaluate the value of equipment/machines,
- to evaluate the optimum time for replacement of an investment,
- to evaluate costs in down-time for the single works,
- to elaborate key-figures for comparative analysis.

7.2 DEFINITION OF COST CONTROL

Cost control is generally a method enabling the enterprise effectively to control actual and future costs by comparing planned and actual costs. To make the control effective, a precise and careful system for calculation, budgeting (economic planning), registration, and reporting is necessary.

7.3 BUDGETING SYSTEM

7.3.1 Introduction

The purpose of the budgeting system is - in connection with precalculations - to form the planning part of the cost control system for maintenance of the company.

In the budget, the physical plans for maintenance are expressed mainly in financial terms (Forints).

The value of decentralized budgeting, which we are recommending, lies as much in the process as in the resulting documents. Therefore, in order to make cost control function it is absolutely essential that directors and executives at all levels of the organization with maintenance cost or production responsibility be engaged in the development of the budget. The purpose of this multi-level participation is to increase the motivational impact of the resulting budget, as the executives will accept the budget more readily and they will feel a greater responsibility for its fulfilment.

Also the cost consciousness of the executives at all levels will be increased by this participation.

Consequently, the proposed budgeting system is not only a forecasting technique. It is a highly creative process which means vertical and horizontal communication within the management, until the budget has been evaluated, adjusted and readjusted into a set of integrated and realizable objectives consistent with the policies of the company.

7.3.2 General assumptions

The budgeting system must be coordinated with the maintenance planning system, the calculation system, the control reporting system and the registration (book-keeping) system.

The basis for the budget is formed by the maintenance planning system and the precalculations of major projects: materials and work-hour consumption, schedule dates etc., as well as reports from past periods, statistics, price-prognoses etc.

7.3.3 Length of the budget period.

Within the lines of a long range plan, e.g. a 5-year plan, the here described budget system for the first year represents the concrete work frame for the first coming year.

7.3.4 Budget organization.

The establishment of a budget planning and control system necessitates the formation of units with active participation of top management within maintenance and production, responsible for the creation of the budgets.

The following units should be established:

1. A budgeting committee consisting of the maintenance director, production directors, finance director, key persons of maintenance planning, of maintenance in general, and finally of budget coordination staff.

   The function of this budgeting committee is to act as a reviewing and coordination unit in the budgeting procedure. This committee has the greatest responsibility for the budget.

2. A central budgeting coordination, which might consist of one or two persons with economic planning and analysis experience, should be formed. This unit should act as a central information and service center for the line management and other budgeting bodies. It prepares the procedural aspects of the budgeting process, supplies cost information, gives technical and other advice where required, and secures overall coordination.

Furthermore, it pulls together all the budgets, seeks clarification as to the accuracy and reasonableness of the figures, and checks that the budgeting procedures have been followed.

The budgeting coordination is also responsible for the formal budget control, budget analysis, and budget revision, if any, as well as the coordination activities with the investment department, and for the incorporation of additional costs for various jobs planned on maintenance budget (social, safety, etc.).

3. Furthermore, a local budgeting coordination, which might consist of a single person, should be formed within each maintenance unit for the single factory and within central maintenance workshop and maintenance production workshop.

   The tasks of this unit are:

   - to act as the connection between the central budgeting coordination and the local budgeting bodies,

   - to take care of the budgeting technical aspects of the budgeting procedure,

   - to assist the leader of the units in question.

7.3.5 Budgeting procedure.

The basic budgeting process can be divided into four phases:

1. Budget preparation.

2. Budget elaboration.

3. Budget coordination.

4. Budget approval.

The budgeting procedure is illustrated in attachment No. 7.1.

Budget preparation

Within this phase, the maintenance director, assisted by maintenance planning, draws up the framework for the budgeting of the coming year's activities. The maintenance director announces what claims are made on the activities of maintenance in order to fulfill the aims of the budget periods. This is done on the basis of an evaluation of realized or planned investments and dispositions, within the frame of the long range planning, which will influence the activities in the course of the budget year.

The "central budgeting coordination" prepares budget forms, filled in with actual or calculated figures of the past budget periods, assisted by the local budgeting.

Budget elaboration

The budget elaboration is executed by maintenance factory manager, unit managers, workshop manager and eventually foremen within their responsibility areas in order to fulfill the demands for maintenance. The elaboration for the respective production units takes place in consideration of the production leaders' wishes and points of view. This engagement goes as far down in the organization as practical, following the principle, that each person is budgeting the activities and costs for which he is held responsible and which he can influence. The preliminary budgets of each level are approved by the highest management board on that level.

The budgeting is partly based on precalculations of major maintenance projects.

This phase is terminated by submitting the budgets to the "budgeting committee" for review and coordination.

Budget coordination

Now, the budgets are summarized and examined from three points of view:

1. Are the budgets realistic?

2. Are the budgets consistent with the physic/economic aims of the division?

3. Are the budgets feasible in light of the planned maintenance activities?

Budget approval

After approval of the budgets by the budgeting committee , necessary comments are made on the budgets.

By this budgeting procedure, budget realism is obtained by involving people with detailed knowledge.

7.3.6 Budgeting comments.

Budgeting comments should be worked out by the budget committee. The comments ought to deepen or throw light on the planned activities within each responsibility area, e.g. by dealing with:

- present situation,
- general aims,
- expected efficiency improvement.

7.3.7 The structure of the budget system.

The proposed budget system consists of:

1. Personnel budgets

2. Cost budgets.

Personnel budgets

The planned need for man-hours within and outside each organization unit should be charted. For this purpose form 1.1 is used (see attachment 7.2.). This form is modelled like a loading program, charting the planned connections between maintenance units and production - or other receiving - units, expressed in man-hours.

The basis for this elaboration is the physical maintenance planning systems. Also the non-productive hours are planned in this form. In the principal form No. 1.1 in appendix 1 the need for man hours is planned per quarter of a year, but if it is prefered to plan per month, this would not imply a significant difference. Form 1.1 only includes the planning of man hours for workers with productive maintenance hours, but includes all non-productive hours as well for these workers.

Form 1.1 is included in the basis for planning the need for workers and employees throughout the budget year in the various categories of personnel within each organisation unit, form 1.2 (see attachment 7.3.).

Concerning the workers, these plans are transformed into productive and non-productive man hours in form 1.3 (see attachment 7.4.).

The budgeting implies an accurate definition of areas of cost responsibility, so that the budgeting responsibility of each manager is concentrated on personnel and costs included in his sphere of influence. Therefore, an organization numbering system is a condition for the build-up of the system.

The budgets are built up from the bottom, starting with the budgets of the foremen (if these are to be included), then workshop managers, unit managers, and finally maintenance factory manager.

Cost budgets

Based on the personnel budget forms and the expected changes in the average wages per hour for the various categories of personnel, the budget coordination unit calculates the wages in form 2.1 (see attachment 7.5).

Both direct and indirect materials and other costs are also budgeted in form 2.1.

The budget coordination unit has to supply the cost budgeting persons with cost information, telling what account numbers/work numbers and types of costs are to be included in the respective cost budgets.

Each person is budgeting, as previous outlined, only the costs which are influenced by his decisions.

7.5 CALCULATION SYSTEM

For greater maintenance projects, such as renewals and yearly overhauls, it is suggested that precalculations of the costs be made. These precalculations are elaborated on the basis of technical specifications from the project planning system.

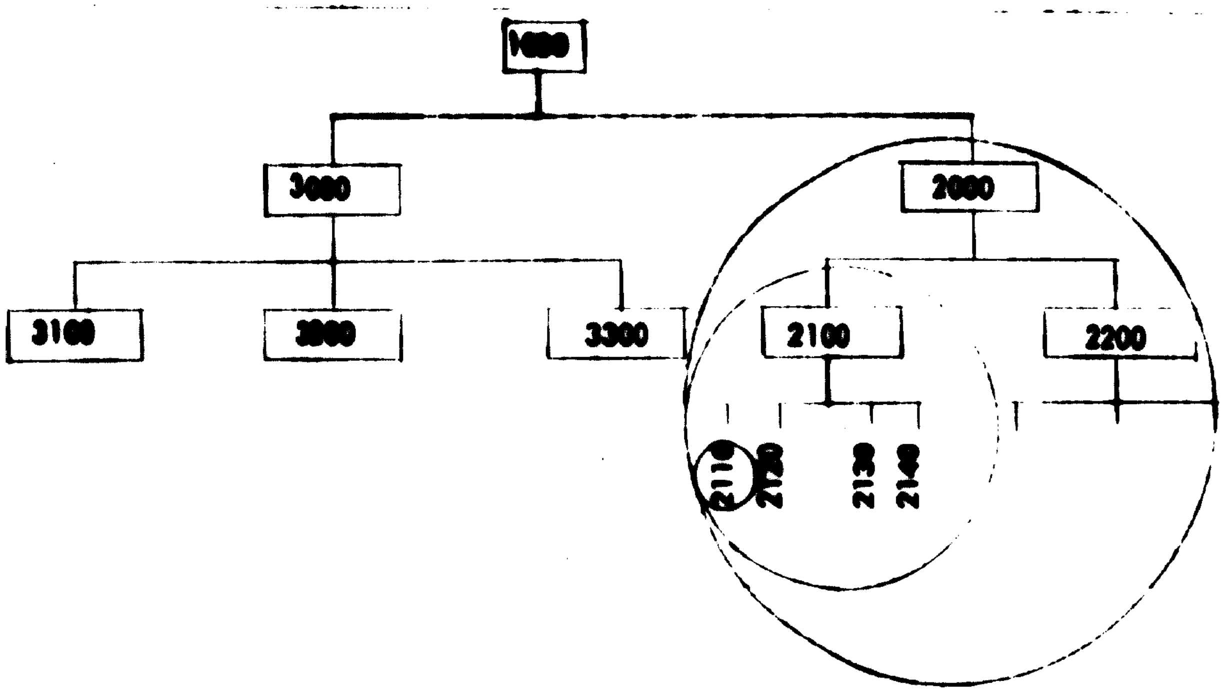
In order to follow the proposed decentralised cost responsibility principle, the person responsible for the project works out the precalculation, assisted by central planning and possibly by an economic specialist.

The precalculations contain a specification of the costs of direct materials, direct wages, direct services including cooperation, (services from other firms), and other direct costs. Indirect ("regi") costs are distributed according to the single, productive work number by multiplying the production hours of the project by a forint-factor. The forint-factor is found for a year by dividing the yearly planned indirect costs by the yearly planned productive hours (see part 5, concerning Weaknesses in the precount system).

The exact form on which the precalculations are to be registered will be worked out in cooperation with the project 2.2.4, concerning Project Planning System. The precalculation data are used as input to EDP for comparison with after-calculation data for the single project.

7.6 REGISTRATION SYSTEM

To enable follow-up with reports for each responsibility area, each organisation unit must have a number, e.g.:



0 = responsibility area.

Normally, a responsibility area will be equal to an organisation unit, but if, for instance, a leader is chief of two organisation units, the responsibility area consists of these two units.

Furthermore, a number system for each machine must exist to follow up the maintenance costs per machine. This number system is dealt with in the Coding System project.

For a maintenance organisation, an organizational classification of cost-types in relation to responsibility areas (organisation unit) should be developed. These costs should include only those indirect ("regi") costs which the leader of the single organisation unit can influence, and which can be distributed according to the single organisation unit without use of distribution keys. This classification of indirect costs will show the single leader which cost-types to budget and how to make decisions, get reports, and to analyse aspects such as the cost-types for which he is held responsible.

In the computer, a file should be established containing the numbers of the maintenance organisation units and for each receiving organisation unit, the work order numbers/project numbers.

The change to EDP book-keeping necessitates new paper routines now being prepared and implies changed work distribution in the effected departments.

7.6 COST REPORTING SYSTEM, GENERAL DESCRIPTION.

7.6.1 INTRODUCTION

As mentioned in the general description of the cost control system the reporting system represents the follow-up on budgets and precalculations by comparison and analysis of deviations. For larger projects the precalculations represent the basis for the follow-up, while the budgets represent the basis for the follow-up on direct and indirect costs for the maintenance departments and the maintenance costs for the receiving units, e.g.hot rolling mill.

7.6.2 PURPOSE

The purpose of the cost information system (= cost reporting system) is to provide the management with information on costs in a form and time suitable for investigating the causes of deviations and to take whatever action looks most appropriate.

7.6.3 PRINCIPLES AND STRUCTURE

The cost control reports will be distributed to the budget responsible managers with a degree of details corresponding to their budgets.

The reports are framed as periodic reports with fixed content. We have experienced that there exists a general need throughout the organization for increased cost control reporting. The volume of the periodic, current information should on the other hand be reduced to cover existing needs only.

It is found most practical to present the proposals for cost control reports in tabular form because it gives a better general view and the tabular form is more suitable as basis for future budgeting purposes. Besides, the possibilities of graphic presentation of periodic and year-to-date figures against planned figures should be considered.

In general, monthly reporting is proposed. Budget deviations can, however, be reported only on a quarterly basis.

7.6.4 Comments on the reporting forms.

The cost control reporting on personnel is executed by two forms: 11.1 and 11.2, see attachment 7.6 and 7.7.

The purpose of form 11.1 is to be a basis for evaluation of maintenance activities and their administration. The content is either hour or wage consumption in all maintenance levels and its distribution on production units or worknumbers. Furthermore, a quarterly budget comparison is made. Report form, 11.1 has connection with form 1.1.

Form 11.2 is basis for evaluation of the total man power situation, both within workshops and offices. It is only used as low in the organization as factory - department level. The form contains the number of personnel per category, increase and decrease of personnel. Budget deviations are calculated quarterly only. The column "Actual need for man-power" is filled in by the report recipient as notification towards his superiors in connextion with the proposed report meetings

At long sight, it is recommended to detail the reports further to establish better control possibilities, especially by building up of relevant experience - and norm data for the activities.

Cost control reports on costs form No. 12.1 and 12.2 (see attachment 7, 8 and 7.9) and 11.1 are intended to cover the need for cost information for the maintenance organization itself as well as for the production and other recieving units. This is obtained by accumulating the costs and reporting the costs by responsibility area.Form No. 11.1 gives a specification of the total wage costs and their application.

In form No. 12.1 the costs are specified with reference to the account numbers and types of costs which are influenced by the dispositions of the leader of each organizational unit. Thus, these cost reports contain the same types of costs as the corresponding cost budgets. The form is used for reporting both direct and indirect costs - the direct costs per recieving unit (e.g. production) and the indirect costs per maintenance unit (e.g. work shop). Furthermore, the form will give the cost specifications per sub-unit within each leader's responsibility area.

Form No. 12.2, see attachment 7.9 is giving the monthly follow-up on the development in the maintenance efficiency, i.e. the follow-up on direct costs. For each work order (= job number) the cause for the maintenance, the actual and planned hours, and the costs are reported, while the costs are accumulated for each account number.

7.6.5 Follow-up routines.

An effective follow-up is a condition of the appropriate functioning of a cost control system.

The proposed cost control reporting system can be defined as a responsibility reporting system: The cost control is obtained by allocation of the responsibility for the deviations to the persons or organization units which are responsible for the costs, as well as by control by the management of the realization of planned activities and dispositions.

Therefore, the follow-up routines must include some pressure on the cost responsible persons in order to secure prompt action on the correct organization level.

This pressure can be obtained by:

- application of efficiency norms/standards or objectives.

- stipulation of deviation limits.

- stipulation of fixed dates for report meetings.

7.6.5.1 Standards and goals.

The cost control reporting system of the company must be integrated with the other reporting systems of the company.

Key figures, ratios and efficiency norms or standards must be elaborated by combining costs with performances. Thereby relevant factors for evaluation of the maintenance costs and indirect costs of each receiving and maintenance unit are obtained, giving help in detecting unwanted trends which require special attention.

For the above-mentioned key figures, ratios, etc., goals or objectives must be stipulated, expressing satisfactory results within a given future period, e.g., the first coming year or within five years.

7.6.5.2 Deviation and reporting limits.

The budgets cannot contain all quantified objectives. We would therefore propose the establishment of a norm data register, containing all actual standards, norms and stipulated goals. This register could also contain the stipulated limits of acceptable deviations from cost and personnel budgets, expressed as percentage limits or related to indices.

7.7.5.3 Report meetings.

The follow-up of the cost control reports in regular report meetings can be carried out in the following order:

1. The reports for the organizational level of workshop manager/foreman and the corresponding administrative units are firstly treated by each leader for his area of responsibility. If the limits of deviation for the costs have been exceeded, the causes of the deviations are analysed and commented on, possibly in cooperation with subordinate leaders. Corrective actions on unfavorable cost development are taken or proposed. This follow-up must take place immediately after receipt of the cost control reports, and the corrective actions can be effected without further formalized procedures.

2. Three days after the receipt of the cost control reports, a meeting is held between each unit manager and his subordinate workshop managers/administrative unit leaders for discussion and commentary on unusual events and deviations from the budgets and plans.

   Furthermore, the comments should concentrate on whether favorable or unfavorable effects are expected to continue and what actions the leaders have taken or have proposed, to cope with the situation.

   The maintenance unit manager of each factory and his closest subordinates meet with the production manager and his closest subordinatss 3 days after the above-mentioned meeting. This meeting is supposed to decide what actions are to be taken.

   The conclusions from the meeting ars presented as minutes to the maintenance director not later than the day after the meetings have been held, indicating which persons are to be held responsible for the execution and follow-up of decided actions.

3. The maintenance director and the maintenance unit managers meet 3 days later. Cost development trends are discussed and commented on and the actions to be taken are coordinated, where necessary.

This monthly follow-up procedure, as outlined above, must be established as a regular, fixed procedure.

The daily operation and coordination problems are not to be treated by this involved follow-up procedure.

7.7.6 **Final comments**

In the proposed cost control reporting system, effective use of the reported information depends on the report recipiants knowing the background of the reported figures. Each leader is provided with only those figures that are clearly traceable to his operation area, without arbitrary distribution of costs.

Therefore, the introduction of the cost control system must be followed by general information about the principles and ideas of the system.

I K O CONSULTING GROUP

BUDGETING PROCEDURE FOR MAINTENANCE OF DUNAI VASMÜ

PROJECT NO. 2.2.7, 2.3.8 and 2.4.5.

COST CONTROL

KEA/75.07.02.

Symbol List:

R = Takes the initiative and is Responsible for Carrying out the Activity
A = Assists and/or Takes Part in the Activity
I = Is to be Kept Informed about the Activity

BUDGETING PROCEDURE

ACTIVITY CALENDAR/INITIATIVE- AND COOPERATION DIAGRAM

WEEK NO. IN THE 4th QUARTER OF THE YEAR: 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13.

PARTICIPANTS / WORK DISTRIBUTION

ACTIVITIES:	Maintenance Director	Directors of Independent Ec. Unit.	Managers of Recieving units	Maintenance Planning	Purchasing Department	Maintenance Factory Managers	Unit Managers	Workshop Managers	Foremen	Budget Coordination Staff	Finance Director
BUDGET PREPARATION:											
Preparation and Distribution of General Maintenance Plans	R	A		A						I	A
Preparation and Distribution of Budget Forms										R	
BUDGET ELABORATION:											
Preparation of Plan for Maintenance/Production Activities		R	A	A	A		A				
Evaluation & Selection of Maintenance/Production Plans		R	A	A			A				
Elaboration of Personnel Budgets for Foremen Areas								I	R	A	
Elaboration of Personnel Budgets for Workshops			A				I	R		A	
Elaboration of Personnel Budgets for Unit Managers	I	I	A				R			A	
Elaboration of Personnel Budgets for Maintenance Factory	I			A		R				A	
Summarization, Harmonization of Total Personnel Budg.	R	I		A		A	A			A	
Preparation of Cost Information for Cost Budgeting					A					R	(A)
Elaboration of Cost Budgets for Foremen Areas								I	R	A	
Elaboration of Cost Budgets for Workshops			A				I	R		A	
Elaboration of Cost Budgets for Unit Managers	I	I	A				R			A	
Elaboration of Cost Budgets for Maintenance Factory	I			A		R				A	
Elaboration of Purchasing Budgets					R						
BUDGET COORDINATION:											
Coordination, Examination and Control of Budgets		A	A	A		A				R	
Elaboration of Maintenance Budget Comments per Independent Economic Unit		A		A		R	R				
Approval of Budgets per Independent Economic Unit		A	A	A			R				
Summarization and Central Coordination				A						R	
Elaboration of Total Comments				A						R	
BUDGET APPROVAL:											
Central Evaluation of Budgets	R	A		A					A	A	A
Central Approval of Budgets	R	A									

SECTION 1

SECTION 2

FORM NO. 1.1

Organization Unit No.: Chief:		Budget Year:										Date: Ref.:								PERSONNEL BUDGET: Hour Consumption - Productive Maintenance Hours						
Maintenance Unit No.: Receiving Unit No./Work No.		Unit No.:					Unit No.:					Unit No.:					Unit No.:					Unit No.:				
		Number of Hours					Number of Hours					Number of Hours					Number of Hours					Number of Hours				
		TOTAL	1.G.T.	2.G.T.	3.G.T.	4.G.T.	TOTAL	1.G.T.	2.G.T.	3.G.T.	4.G.T.	TOTAL	1.G.T.	2.G.T.	3.G.T.	4.G.T.	TOTAL	1.G.T.	2.G.T.	3.G.T.	4.G.T.	TOTAL	1.G.T.	2.G.T.	3.G.T.	4.G.T.
	TOTAL:																									

Attachment 7.2

FORM NO. 1.2

Organization Unit No.: Chief:	Budget Year:	Date: Ref.:	PERSONNEL BUDGET: Number of Workers & Employees

Sub-unit No.	Categories of Personnel	No. of Work. & Empl.		Planned number of Workers and of Employees in the Budget year											
		31/12 last year	Calcul. 31/12 this year	1st quarter			2nd quarter			3rd quarter			4th quarter		
				+	-	31/3	+	-	30/6	+	-	30/9	+	-	31/12
	Total														
	Total														
	Total														
Total for the Unit															
	Total														

Attachment 7.3

ATTACHMENT 7.4

FORM NO. 1.3

Organization Unit No.: Chief:	Budget Year	Date: Ref.:	**PERSONNEL BUDGET:** Productive & Non-prod. Hours

Sub-unit No.:	Categories of Personnel	Planned Hours									
		Total		1st qt.		2nd qt.		3rd qt.		4th qt.	
		Prod. Hours	Non-p Hours	Prod. Hours	Non-p Hours	Prod. Hours	Non-p Hours	Prod. Hours	Non-p Hours	Prod. Hours	Non-p Hours
	Total Hours:										
	Overtime Hours:										
	Cooperation " :										
	Total Hours:										
	Overtime Hours:										
	Cooperation " :										
	Total Hours:										
	Overtime Hours:										
	Cooperation " :										
	Total Hours:										
	Overtime Hours:										
	Cooperation " :										
	Total Hours:										
	Overtime Hours:										
	Cooperation " :										
Total for the Unit:											
	Total Hours:										
	Overtime Hours:										
	Cooperation " :										

FORM NO.: 2.1

Organization Unit No. Chief:	Budget Year:	Date: Ref.:	**COST BUDGET:** Direct and indirect Costs

Account No. / Unit No.	Cost Specification / Orgn. Sub-units	Actual costs last year		Calculat. costs this year		Planned Costs for Budget Year										Index			
						Total		1st qt.		2nd qt.		3rd qt.		4th qt.					
		Amount	Per Hour	Amount	Per Hour	Amount	Per Hour	Amount	Per Hour	Amount	Per Hour	Amount	Per Hour	Amount	Per Hour	5 : 3	6 : 4	7 : 5	8 : 6
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Total Planned Costs																		
	Total Planned Hours																		

Attachment 7.5

Attachment 7.6

Org. Unit No.: Chief:	Period:	Date: Ref.:	Cost Control Report Personnel - Distribution of Hours/Wages in Maintenance Units.

Maintenance Unit No. / Receiving Unit No./Work No.							Total			[illegible]
							Hours/ Wages	% Actual	% Budget	
Total										
Total										
Total										
Internal Operations in own Unit:										
Total Internal Oper.										
Sales-Production Orders										
Investment Order										
Total Hours/ Wages								100	100	

FORM NO. 11.1

Organisation Unit No. Chief	Period				Ref.				COST CONTROL REPORT Personnel - Number of Workers & Employees		
Sub Unit No	Categories of Personnel	Actual Period			Accumulated this Year				Budget Deviation		Actual Need for Man-Power
		Gross (Absolute) increase	Gross (Absolute) reduction	Net change	Number 31 12	Gross increase	Gross reduction	Number actual	Number	%	
	Total										
	Total										
	Total										
Total for the Unit											
	Total										

Attachment 7.2

FORM NO. 11.2

Attachment 7.8

Organization Unit No.: Chief:		Period:			Date: Ref.:			COST CONTROL REPORT Costs per. Org. Unit.			
		Actual Quarter			Accumulated this Year			Index: Actual Costs: Budget Costs			
								Actual Quarter		Accumulated	
Acc. No. / Unit No.	Cost Specificat. / Org. Sub-units:	Actual Costs:	Budget Deviation	Costs Per Hour:	Actual Costs	Budget Deviation	Costs Per Hour	Total	Per Hour	Total	Per Hour
1	2	3	4	5	6	7	8	9	10	11	12
	Total:										

FORM NO. 12.1

FORM NO. 12.2

Organization Unit No. Chief:		Period:		Date: Ref.:		COST CONTROL REPORT MAINTENANCE COSTS	
				Hours		Costs	
Acc. No. / Unit No.	Cost Specification	Job No.	Cause Code	Actual	Planned	Actual this Month	Accumulated this Year
1.	2.	3.	4.	5.	6.	7.	8.

Attachment 7.9

8. CODING SYSTEM

8. CODING SYSTEM

This chapter contains the following parts:

8.1 General Paper on Coding System

8.2 Coding System. Specific Codes

8.3 Re: Numbers for Registration of Maintenance Costs,etc., the so-called Work-numbers.

8.4 Re: Materials and Spare Parts Numbers.

8.1 GENERAL PAPER ON CODING SYSTEM

The purpose of this paper is to give a general description of the construction of a coding system to be used by EDP.

8.1.1 Analysis of the Information Demand

The work group firstly should find the answers to the following questions in order to solve its task:

1. Who is responsible for bringing up to date the data, and who is using the information ?
2. For what is the information used, and in which order is it to be presented ?
3. How much information does the single user want/need (management by exeption) ?
4. How often must the information be used ?
5. Is the information sufficiently detailed ?
6. Will the information cover the future needs ?
7. How is the EDP executed ?

8.1.2 Coding System Construction

It must be stressed that it can be a large task to elaborate a coding system or to alter an existing one. Therefore, it should be investigated if existing systems can be preserved, possibly by using the old system as a part of the new one or by adding a check-digit.

8.1.3 General Rules for Coding

8.1.3.1 All numbering systems should be documented and the documentation should be filed in a central place in the organization, e.g. in a planning function in central organization of the maintenance or in the EDP organization. One person should be responsible for this file and when new numbering systems are developed or old ones changed, this person should be consulted in order to avoid mistakes and to ensure coordination.

8.1.3.2 Integration of Identification and Information Should be Avoided when Possible*

A practical, economical reason must be given if integration is to be used. Integration of information and identification means:

a) Less flexibility, both in use and in development, It is more difficult to take out a new number. To change the meaning of a part of the information often is difficult or impossible because the numbering system will not be unique after the change.

b) Larger number, which is more difficult to use. There are more characters to be transferred from one document to another, more characters to be punched, etc., increasing the likelihood of errors.

c) Difficulty in development and maintenance. Different departments have to agree and the end result often is a compromise, which satisfies nobody.

8.1.3.3 Separation of Identification and Information may give the Serial Number Semi-Informative Function

The serial numbers often will be divided into groups and be used independently by different departments, functions, etc. They will provide a type of information, but should not be used systematically or be as standard references in routine procedures.

*See attachment 8.1: Serial and classification numbers.

8.1.3.4 CHECK-DIGITS SHOULD BE USED IN NUMBERS, WHICH ARE RECORD NUMBERS IN A FILE*

The data are registrated in the file under the record number and are sent into the EDP system through the record number. If the record number is not transferred correctly, the data will be filed in the wrong place and cause inaccuracy when the file is used. When using a check-digit system, however, a record number which is incorrectly transferred may be detected and corrected in the filing process. Check-digits for record numbers for files which are derived from other files are not necessary.

8.1.3.5 DIGITS OR LETTERS ?

If information is included in the identification, people often want to use letters, because they find them easier to memorize. But letters only complicate the codes and make file sorting more difficult. Instead, the number can be divided into groups, so that they are easier to memorize. E.g.:

XX XX XX or | XX | XX | XX | or XX - XX - XX

If letters are preferred, not more than one position should be used to separate digit-groups.

8.1.3.6 PROCEDURES FOR REMOVING A NUMBER FROM A NUMBERING SYSTEM SHOULD BE DOCUMENTED

By anulment of numbers no longer used one can avoid building a file in which a larger and larger part of the file is idle. The number can be used again and through this procedure the number of characters is kept to a minimum level.

8.1.3.7 UNIQUENESS

It is important to avoid having one number, e.g., 1234, designate two parts/documents/persons/etc., or one part/document/person/etc. having two numbers, e.g. 1234 and 5678. This is more important within record numbers than other numbers.

*See attachment 8.2: Check-digits

8.1.3.8 STEPWISE DEVELOPMENT

When constructing a new numbering system it is often a good idea to do it step by step. For example, the first step can be an identification number and an information number of two or three characters. Additional characters should be reserved for further information. Then the system can be used in practice and later additional information can be constructed and incorporated into the system.

8.1.4. RULES FOR DOCUMENTATION

8.1.4.1 DOCUMENTATION OBJECTIVES

The documentation and the filing of this in a central place in the organization is done in order to ensure that:

- the general rules of new numbering systems are followed,
- a new system is coordinated with existing systems,
- mistakes are avoided, e.g. double numbers overlapping,
- documentation location is known and constant.

8.1.4.2 DOCUMENTATION FILE

The person in central organization of maintenance or in the EDP organization who is made responsible for the file shall ensure that changes in numbering systems and new numbering systems are documented by the department or project group changing or constructing the system. He should instruct and advise the department or project group concerning the documentation content (see point 8.1.4.3)

8.1.4.3 DOCUMENTATION CONTENT

The documentation should provide the following information:

1. The name of the numbering system.
2. The objective of the numbering system.
3. The coding structure, that is, a definition of each character or group of characters of the code.

4. If a check-digit is used, then its calculation should be defined.

5. If the code contains a serial number, then it should be mentioned how many characters are in use and the maximum number of characters possible.

6. If letters are used in the number, mention should be made if there are more than ten possibilities in any one alpha-numeric position.

7. The spacing of the number (element separation).

8. If the numbering system is coordinated with another numbering system, this coordination should be defined and the department responsible for the coordination should be mentioned.

9. The department(s) issuing new numbers should be defined. If there is more than one department, the division of the number between the departments should be indicated.

10. The procedure for taking out a new number should be described.

11. The procedure for annulment of a number (when the number is no longer used) should also be described.

12. The department in which a complete register of the content of the information number is kept should be defined. The procedure for alternatives or additions in the information content of the number should be described.

13. A short description about where the number is being used, on what documents, etc., should be made.

14. The documentation should be illustrated by different examples.

8.1. 5. MAINTENANCE RESPONSIBILITY

Responsibility for maintenance of the coding system is divided among the respective user-organization-units and the person responsible for the central file. That is, while the ultimate documentation responsibility lies with the person responsible for the central file, the user-organization-units are charged with actually providing the central file with new or updated documentation whenever additions or modifications are made to the systems.

The person in charge of the central file is responsible for:

- having in the file complete and correct documentation of the numbering systems,
- adherence to the accepted documentation rules by the respective user-organization-units or this representing project-groups,
- providing user's documentation of existing system and assist him in elaboration of modifications or additions,
- informing all users when changes or additions are made in the numbering system.

The users of the system are responsible for:

- familiarizing themselves with the "General Paper on Coding System" and the documentation of the system in question before instituting activities which will necessitate changes or additions in the existing numbering system. If so desired, the person responsible for the central file may be consulted or asked to assist in the elaboration of new documentation.
- actually working out the documentation whenever changes or additions are made in the existing system,
- providing the person responsible for the central file with copies of any changes made in the documentation of the existing system.

8.2. CODING SYSTEM. SPECIFIC CODES

8.2. 1. INTRODUCTION

Within this project the following specific codes have been prepared:

1. Machine numbers
2. Account numbers for maintenance
3. Drawing numbers

and

4. Spare parts numbers
5. Materials numbers

1: Machine numbers, and 2: Account numbers are described in a special paper on account numbers for maintenance.

Account numbers for registration of costs for:

- Production of spare parts
- Investments and other projects

are not integrated in the account numbers for maintenance. A special account numbering should be elaborated for the production of spare parts (production or order account numbers). Also a special code must be made for investments and other projects (investment or project account numbers).

3: Drawing numbers are treated in point 2.

4: Spare parts numbers and 5: Materials numbers are dealt with in a separate paper.

The connection between the codes can be illustrated as follows:

xxxx	cost place no.
//	
xxxx - xx	machine no.
// //	
xxxx - xx - xx	account no. for maintenance costs
// //	
xxxx - xx - xxx	drawing no.
xx - xx - xxxx - x	spare part and material no.

8.2. 2. DRAWING NUMBERS

The drawing number should be constructed as follows:

xxxx - xx - xxx

- xxxx → the existing cost place number
- xx → machine number, i.e. the two last numbers of the existing machine number
- xxx → a serial number

When the supplier of the single piece of equipment has given the drawings numbers, these codes should also be used by the company. When no numbering system has been constructed, by a third person, the company must elaborate its own, and this is then only a serial number preceded by the account and machine number.

The basis for finding a specific drawing number will hereafter be on of the following, a list of the drawing numbers with text, user's manual for the machine, main drawing, main drawing position number, and PM instructions. Descriptions of the machines must be filed by the same system.

If two or more machines have the same drawings, a reference must be made to one of them.

8.3. Re: NUMBERS FOR REGISTRATION OF COSTS ETC., THE SO-CALLED WORK NUMBERS

Firstly, it is proposed to change the terminology of these numbers because the primary function of the numbers is to record the maintenance costs. Therefore, in the following they are called account numbers. The term "work-number" (or job-number) is used for the serial number attached to the work orders made by maintenance planning for the maintenance workers describing the single job to be done.

The existing numbering system for registration of costs, planning, etc. - the account numbers - does not give sufficiently detailed information about the maintenance costs. The same is the case for the existing machine numbers. If costs are registered only for the existing machine numbers, it is not possible, for instance, to analyse unusually high costs to see what part or function of the machine is the cost creating part.

However, the machine numbers can be used as a basis for a new account numbering system, which must be formed as a further specification of the machine numbers. The persons responsible for maintenance, who must analyse break-downs, for instance, must build up the new account numbering system following the two principles:

- a part or a function of the machine with high maintenance costs must have its own independent account number,

- a vital part or function of the machine must have its own independent account number.

For instance, it is found appropriate to divide a coiler in the hot rolling mill in 5-10 parts or functions.

It is proposed that the future account numbering system be constructed as shown below:

XXXX - XX - XX - X

- XXXX → the existing cost place number
- XX → machine number, i.e. the two last serial numbers of the existing machine number
- XX → machine part number for identification of a part or function of the machine
- X → check-digit (see general description on coding system)

8.4. B: MATERIAL AND SPARE PART NUMBERS

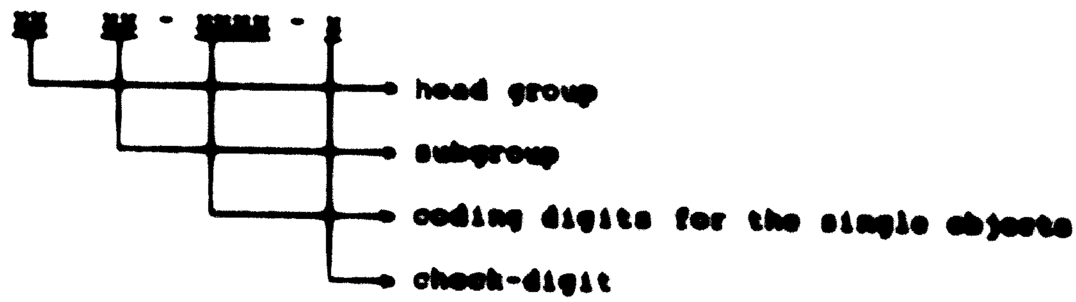
8.4. 1. THE EXISTING SYSTEM FOR NUMBERING OF MATERIALS AND SPARE PARTS

The existing system is different from store to store. This implies that it is impossible to control the size of the stocks efficiently and that control of stock by EDP is complicated substantially.

Therefore, it is recommended that a new, common numbering system be constructed.

8.4. 2. THE NEW NUMBERING SYSTEM

The new system will be developed according to the following principles:



The head groups will consist of 3 parts:

Code 00 - xx:		Spare parts
Code xx - 98:		Usual materials, including standardised spare parts
Code	99:	Fire-proof materials

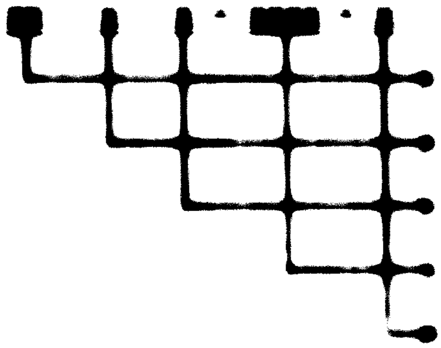
8.4. 2.1 Spare Parts

Code 00 - xx contains only:

Spare parts which are special for a single part of equipment. This means that only equipment which is found in a single factory or main division, is registered here.

Spare parts for equipment, which is found within more factories/main divisions, are defined as materials. Also standard spare parts (i.e. standard washers, bolts and nuts) included in materials.

Spare parts are given these codes:



Factory/main division (digit 1-2) can for instance be:

00 Coke Plant
01 Steel Plant
02 Hot Rolling Mill, Dunaujvaros
03 Cold Rolling Mill, Dunaujvaros
04 Rolling Mill, Budapest
05 Plate Plant
06 Energy Supply Plant
07 Transport Plant
08 Maintenance Division
09 Electrical Equipment, Hot Rolling Mill, Dunaujvaros
10 Electrical Equipment, Cold Rolling Mill, Dunaujvaros

Machine group/machine (digit 3) could for instance for Hot Rolling Mill be:

020 Mill stands and drive shafts
021 Manipulators
022 Roller table
023 Skid gears
024 Billet shear
025 Billet bank
026 Hot saws
027 Bloom furnaces inc. equipment/auxiliary equipment
028 Cold saw, straightening equipment, roller lathes
029 Miscellaneous equipment for Hot Rolling Mill

Machine/main spare parts (digit 4) can for skid gears within the Hot Rolling Mill be:

0231 Shafts and couplings

0233 Bearings

0235 Wirss

0237 Wirs wheels and drums

0239 Miscellanous equipment

Single spare part (digit 5-8)

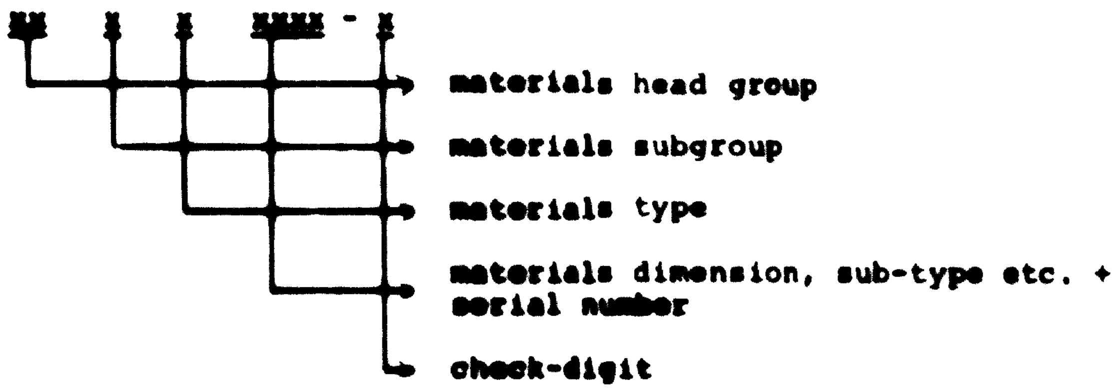
Where appropriate, the single spare part within these last 4 digits can be classified according to type, material, dimension, etc. The last digits contain a simpls serial number.

Through this coding system a single spare part will be given one number only. Each spare part number must have a reference to the machine number or the drawing number in the EDP file. Thus, it is possible to get an overall view of which machines need the single spare part.

The codes for spare parts must be constructed by the maintenance people, who are responsible for the different head groups of spare parts.

8.4. 2.2 Materials

Materials are given the codes mentioned below:



Materials head group (digit 1 - 2) might be:

15 Building materials (not wood)

16 Building articles

17 Distribution network for CO-gas

18 Drive belts and drive belt materials

19 Electric material I

20 Electric material II

21 Gas distribution, heating and ventilation equipment

22 Instruments, measuring devices etc. (non-electronic devices)

Materials subgroup (digit 3) can for electric material I, be:

190 Lighting, cooking, and heating equipment etc.

191 Fuses, fuse boxes

192 Sockets and plugs

193 Cable and wire material etc.

194 Insulators and accessories, lead-in insulators, insulation material

Etc.

Materials type (digit 4) can for 194: Insulators incl. accessories etc. be:

1941 High tension insulators

1943 Low tension insulators (below 2000 V)

1945 Pin insulators

1947 Lead-in insulators

1949 Insulation material

8.4. 2.3 Fire-proof Materials

Fire-proof materials are data processed in the same way as both materials and spare parts. There is a special need for planning of brick and mortar supply for the furnaces because of the interval between the building up of the furnaces; therefore a special group should be reserved for these materials.

8.4. 3. CONCLUSION

Before constructing a new coding system, it must be carefully evaluated how many head groups (how much capacity) are needed for spare parts and materials respectively. After constructing head groups, the same evaluation must be done with respect to subgroups and further classification.

Concerning the coding of usual materials, it must be investigated whether the principles contained in the national Material Code System of Hungary, constructed for statistical purposes, can advantagously be used by the company.

SERIAL AND CLASSIFICATION NUMBERS

The possible numbering divisions are the following:

Serial numbers

Classification numbers

Combined numbers

1. SERIAL NUMBERS

These numbers, which mainly give identification, can be divided into two types:

1) Pure serial numbers
2) Numbers inside certain blocks

Ad. 1)

This principle is a simple numerical listing, mostly used as a subdivision in other systems.

Advantages: Control of numbers simple, numbers short, suitable for EDP

Ad. 2)

Used as 1), but numbers can partly give information.

Advantage: Short numbers.

2. CLASSIFICATION OF NUMBERS

These numbers consist of a number of digits or groups of digits, each having a certain significance, i.e., the numbers give information.

Two types of these numbers are used:

1) Group-classified numbers
2) Decimal-classified numbers

Ad. 1)

The single digits/digit-groups may be used alone, but a connection to the proceeding or succeeding digits/digit-groups may exist.

Advantage: Flexibility

Bei..2)

Every single digit has a specific significance, and a succeeding digit has a subordinate relationship to a preceding digit.

Advantage: Very detailed number may be constructed.

3. COMBINED NUMBERS

These numbers consist of a combination of serial and classification numbers and are the types most common.

CHECK-DIGITS

Check-digits are one or more digits added to the original number, making it "self-controlling".

The check-digit has a special mathematical connection with all other digits in the original number. By punching or by data input to the computer, it is then possible by a corresponding calculation to calculate the check-digit and thereby decide if the number is correct. By this method punch and writing errors are detected in 99% of the cases.

The error frequency from punching is about one per one thousand.

1. PRACTICAL ASPECTS

If the alternative to check-digits is to punch all once again to check errors, the punch work can be reduced by 30 - 40% by using check-digits. As the punch work is an expensive phase in EDP, this saving can be substantial.

The "self-controlling" activity may take place:

1) in connection with the punching, as the punching machine is equiped with an electronic circuit, which makes a control calculation on the check-digit. If an inconsistency exists, the punching machine is stopped. The great advantage of this method is that errors are detected at an early stage.

2) in connection with the data input to the computer, which is programmed to execute control calculation and list invalid numbers on a list. Discovering of error comes later than in 1) above.

3) in connection with both the punching and the data input.

2. CHECK-DIGIT SYSTEMS

Here, only two known and widespread methods are described.

These two methods are both based on a multiplication of each digit in the original number by a factor different from digit to digit. On the basis of these products a sum is caluclated and to this sum the check-digit is added. This final sum is dividable with a certain modulus.

In the following, two examples based on modulus 10 and modulus 11 are expounded.

2.1 The Modulus 10 Method

As an example of this method a materials number is used.

Original number excluding the check-digit	8	7	4	/	7
Each digit is multiplied by a factor (/ is calculated as a digit with the value of 0)	2	1	2	1	2
The products are calculated to	16	7	8	0	14
If the products are > 10, the sum is calculated like this	7 +	(7) +	(8) +	(0) +	5
The total sum is	27				
27 divided by modulus 10 =	2, remainder 7				
The check-digit = modulus 10 less remainder 7 =	3				
The final number becomes	<u>874/73</u>				

The total calculation is executed by giving the check-digit the factor 1, and the calculation must, thereby, give a total sum, which - divided by modulus 10 - gives 0 as remainder.

The resulting error finding ability is expected to be approx. 98,8% of all errors by

- only one digit
- inversion of two digits
- random deviations

by use of the modulus 10 method with the factors 1, 2, 1, 2, etc.

Also other factors can be applied. E.g. 1, 3, 1, 3, etc. or 1, 3, 7, 1, 3, 7, etc. depending on the nature of the errors in the numbers.

2.2 The Modulus 11 Method

Example:

The original number	1	3	0	6	4	3 -	2	5	6
Each digit multiplied by a factor	4	3	2	7	6	5	4	3	2
The products are calculated to	4	9	0	42	24	15	8	15	12
The sum of the products is calculated to	129								
Sum 129 divided by modulus 11 =	11, remainder 8								
The check-digit = modulus 11 less remainder =	8 = 3								
The final number then becomes	13 06 43 - 2563								

The control calculation of the final number is done as described under the modulus 10 method.

The error finding ability is calculated to be approx. 99,1%.

Other factors may be applied.

2.3 Selection of Method

The modulus 11 method has a better error finding ability than the modulus 10 method, but the difference is only 0,3%. On the other hand, the modulus 11 method gives check-digits from 0 to 10, and as the check-digit 10 normally is not desired, all numbers with this check-digit have to be cancelled, which is often a great disadvantage.

As a conclusion it is recommended that modulus 11 method be chosen if 9% of all numbers can be cancelled. Where numbers cannot be cancelled, the modulus 10 method is chosen.

9. INFORMATION BASE AND FILES

9. INFORMATION BASE AND FILES

The establishment of the bases and files necessary for processing the managed maintenance system on EDP* is set forth within the description of each sub-system.

In this article the content of the bases and files is illustrated by important main data of the main bases and files, i.e., the listed data are not supposed to be exhaustive. Furthermore, the bases and files cannot be constructed until the final desired reporting system has been designed.

9.1 Files on EDP

MACHINE ACCOUNT NO. FILE

- machine account no.
- job no.
- cause code
- priority code
- actual hours, per month and quarter
- planned hours
- actual wages, per month and quarter
- costs actual month
- costs this year
- planned costs, per quarter

* As the system is foreseen to be introduced as a manual system which rapidly will be converted into EDP, we have presented this essential article as the future goal for information base and files. Some parts of it can not be executed in the manual system but have to wait for the EDP development of the counterparts organization.

PROJECT ACCOUNT NO. FILE	- project account no. - job no. - planned costs - actual direct wages - actual direct materials - actual direct cooperation - actual other direct costs
MAINTENANCE PRODUCTION ACCOUNT NO. FILE	- maintenance production account no. - planned direct hours - actual direct hours - planned direct costs - actual direct costs

MAINTENANCE ORG. UNIT ACCOUNT NO. FILE

- maintenance unit account no.
- actual direct hours, per month and quarter
- actual direct wages, per month and quarter
- planned direct hours per quarter
- planned direct wages per quarter
- actual number of personnel
- gross reduction of personnel, per month and cumulated this year
- gross increase of personnel, per month and cumulated this year
- number of personnel as of 31st December last year
- planned number of personnel per quarter
- number of personnel is filed by category of personnel
- indirect cost account numbers
- actual indirect costs per quarter, and cumulated this year.
- budgeted indirect costs per quarter

MACHINE NO. FILE

- machine no.
- machine designation
- shop costs per hour
- initial year
- initial value
- calculated replacement year
- last and next overhaul year
- spare part numbers
- drawing no.
- manufacture
- type - model - manufacture no.
- supplier
- PM instruction numbers
- main dimensions:
  - height
  - length
  - breadth
  - weight
- location
- connected systems (oil, el., compressed air, etc.)
- tools, specifications, descriptions.

[illegible]
[illegible]
[illegible] File

- machine code
- machine no.
- machine element
- PD job code
- PD instruction
- tools
- reference to instruction manual
- PD cycle
- drawing no.

[illegible]
[illegible]
File

- material no.
- material description
- weight in kg per unit
- material strength [illegible]
- [illegible] stock
- [illegible] stock
- average price
- supplier no.
- [illegible]
- delivery time in weeks
- warehouse location

SPARE PART NO. FILE

- spare parts no.
- spare parts description
- weight in kg per unit
- spare parts account no.
- min. stock
- max. stock
- drawing no.
- model no.
- machine numbers
- repairable
- average price
- supplier no.
- yearly consumption
- delivery time in weeks
- storehouse location

9.2 Input to EDP

DELIVERY NOTE — daily

- supplier
- material description
- quantity
- material/spare part no.
- receiving store no.

MATERIAL REQUISI-TION — daily

- account no.
- job no.
- store no.
- quantity
- material/spare part no.

INVOICE — daily

- account no.
- amount
- supplier

[illegible] NO. 1.1 — yearly

- productive maintenance hours
- per maintenance unit
- per receiving unit

PERSONNEL
BUDGET
NO. 1.2 yearly

- number of workers and employees
- per maintenance unit

PERSONNEL
BUDGET
NO. 1.3 yearly

- productive and non-productive maintenance hours
- per category of personnel
- per maintenance unit

COST
BUDGET
NO. 2.0 yearly

- direct costs
- indirect costs
- per maintenance account no.
- per maintenance unit no.

WORK ORDER — daily

JOB OPENING INFORM.

- work order no. (job no.)
- project no.
- machine account no.
- week of request
- priority code
- estimated job time (standard code)
- performing maint. group

WORK ORDER — weekly

JOB CLOSING INFORM.

- work order no.
- job completed week
- actual consumed hours
- cause code
- stop time (if any)

WORK ORDER LIST — weekly

- job no.
- machine account no.
- week no.
- actual consumed hours
- priority
- cause code
- stop time (if any)

9.3 Output from EDP

monthly → COST REPORT NO. 11.1

- hour/wage consumption
- per maintenance unit
- per receiving unit
- budget comparison

monthly → COST REPORT NO. 11.2

- number of personnel
- per category
- per maintenance unit
- increase and reduction
- budget deviation

quarterly → COST REPORT NO. 12.1

- costs in total and per hour
- budget deviations
- indices
- per account no.
- per unit no.

monthly → COST REPORT NO. 12.2

- costs of maintenance
- hours of maintenance
- cause code
- per job no.
- per account no.
- per unit no.

weekly → WORK ORDER

- performing maint. group
- work order no./job no.
- machine account no.
- priority
- requested week
- estimated time
- actual consumed hours
  - in this week
  - acc. up to this week

weekly → ORDER STOCK

- performing maint. group
- work order no./job no.
- machine account no.
- priority
- requested week
- work week (last week worked on the job)
- standard time
- consumed hours
- order volume in hours
- remark on no. of weeks from requested week

weekly → WORK ORDERS PER ACCOUNT

- machine account no.
- work order no.
- performing maint. group
- priority
- cause code
- standard time
- actual consumed hours

monthly → STANDARD CODE

- performing maint. group
- work order no.
- machine account no.
- standard code
- no. of jobs
- standard/estimated time
- actual consumed hours

In attachment 9.1 please find some examples of EDP-based reports.

EXAMPLES OF REPORTS

WORK REPORT WEEK 5071 — 14-12-71 page 16.

Perf. maint. group	Job No.	Machine account No.		Pri-ori-ty	Week ordered	Week comple-ted	Stan-dard time	Actual consumed hours This w.	Actual consumed hours Total
6841	[illegible]96	560100	100	1	5071	5071		5,0	5,0
	[illegible]721	561100	074	1	5071	5071		9,0	9,0
	[illegible]	[illegible]26	[illegible]	1	5071	5071		2,5	2,5
	[illegible]43	[illegible]	[illegible]	1	5071	5071		8,5	8,5
				SUM PER PRIORITY				25,0	
6841	41[illegible]	[illegible]	[illegible]	2	4971	[illegible]	[illegible],0	17,5	[illegible],5
	[illegible]	561200	[illegible]	2	5071	5071		3,0	3,0
	[illegible]	[illegible]010	125	2	5071	5071		14,0	14,0
				SUM PER PRIORITY				34,5	
6841	[illegible]61	560100	100	3	4971	[illegible]	[illegible],0	[illegible],0	[illegible],5
	101197	561200	201	3	4171	5071	[illegible],0	7,0	27,0
	101198	[illegible]	413	3	4971	[illegible]	[illegible],0	0,5	[illegible],0
	102109	[illegible]	[illegible]	3	4971	5071	[illegible],5	24,0	24,0
	[illegible]	561010	151	3	4971	[illegible]	12,0	4,0	4,0
	[illegible]715	[illegible]	421	3	4971	5071	3,5	3,0	3,0
	[illegible]	561010	[illegible]	3	4971	[illegible]	12,0	3,0	6,0
	[illegible]16	561200	011	3	4971	5071	3,5	2,5	2,5
				SUM PER PRIORITY				[illegible],0	
6841	[illegible]	561400	110	4	4971	[illegible]	[illegible],0	[illegible],0	[illegible],0
	[illegible]	[illegible]	[illegible]	4	5071	[illegible]	21,0	[illegible],0	[illegible],0
	101140	[illegible]	142	4	4971	[illegible]	40,0	[illegible],0	[illegible],0
				SUM PER PRIORITY				[illegible],0	
6841	[illegible]	560100	100	5	4971	[illegible]	200,0	14,5	[illegible],5
				SUM PER PRIORITY				14,5	
6841	[illegible]	[illegible]	[illegible]	6	3971	[illegible]	100,0	[illegible],5	[illegible],5
	[illegible]	[illegible]	[illegible]	6	4171	[illegible]	12,0	3,0	10,5
				SUM PER PRIORITY				[illegible],5	
6841				SUM PER PERF. MAINT. GROUP				[illegible],5	

ORDER STOCK REPORT PER PERF. MAINT. GROUP
WEEK 4471

3-11-71
page 19

Perf. maint. group	Job No.	Machine account No.	Pri-ori-ty	Week ordered	Week worked on	Standard time	Actual cons. hours	Order stock	Remark
[illegible]	101686	361010 [illegible]	3	4471	4471	12,5	4,5	8,0	
[illegible]									
[illegible]	101117	361100 [illegible]	3	3771	[illegible]				
	101118	361100 010	3	3771	4171		2,5	2,5-	
	[illegible]	361100 [illegible]	3	3771	4171	[illegible],0	42,5	39,5	
	[illegible]	361100 072	3	3771	4471	4,0	8,0	4,0-	
	[illegible]	361100 [illegible]	3	3771	4471	12,0	5,0	7,0	
	101119	361100 311	3	4471	4471	48,0	84,5	38,5-	
[illegible]				Orderstock per account				44,5	
[illegible]	[illegible]	361300 151	3	4471	[illegible]	28,0		28,0	
	[illegible]	361300 [illegible]	3	4471	4471	110,0	2,5	107,5	
				Orderstock per account				135,5	
[illegible]	101770	361400 110	3	4471	4471	48,0	73,0	25,0	
[illegible]				Orderstock per account					
[illegible]	[illegible]	361300 011	3	3771	[illegible]				
	[illegible]	[illegible]	3	3771	[illegible]	12,0		12,0	4 PER
	[illegible]	[illegible]	3	4171	4171	12,0	17,0	5,0-	
	[illegible]	[illegible]	3	3771	[illegible]	4,0		4,0	
	[illegible]	[illegible]	3	3771	[illegible]	12,0	6,5	5,5	
	[illegible]	[illegible]	3	4471	4471	[illegible]	17,5	[illegible]	
[illegible]				Orderstock per account				[illegible]	
[illegible]	[illegible]	361700 011	3	3771	[illegible]	24,0	9,0	[illegible]	
	[illegible]	[illegible]	3	[illegible]	[illegible]	3,0	7,0	4,0-	
	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	10,0	72,0	
	[illegible]	[illegible]	3	[illegible]	[illegible]	12,0	4,0	[illegible]	
	[illegible]	[illegible]	3	[illegible]	[illegible]	3,0	6,5	[illegible]	
	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]		[illegible]	
	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]		[illegible]	
	[illegible]	[illegible] 160	3	[illegible]	[illegible]	[illegible]	3,5	[illegible]	
[illegible]				Orderstock per account				[illegible]	
[illegible]		Orderstock per perf. maint. group						[illegible]	

Attachment 9.1
page 3.

WORK ORDERS PER ACCOUNT WEEK [illegible] 14-12-71 Page 10

Mach. account No.		Job No.	Perf. maint. group	Prio-rity	Cause code	Standard time	Actual consumed hours
[illegible]	[illegible]	100151	[illegible]	3	1	completed	
	[illegible]	100176	[illegible]	3		3,5	
	201	104101	[illegible]	2	1	completed	3,0
	201	[illegible]	[illegible]	1	1	completed	10,0
	201	[illegible]	[illegible]	1	1	completed	5,0
	201	[illegible]	6311	1	1	completed	4,0
	[illegible]	100101	6311	1	1	completed	
	[illegible]	[illegible]	[illegible]	3		12,0	5,0
	[illegible]	[illegible]	[illegible]	2	0	completed	14,0
	210	[illegible]	[illegible]	2	1	completed	7,5
	210	[illegible]	[illegible]	3		[illegible]	
	214	[illegible]	[illegible]	3		[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	2	1	completed	
	[illegible]	[illegible]	[illegible]	1	1	completed	
	[illegible]	101415	[illegible]	1	3	completed	[illegible]
	[illegible]	[illegible]	[illegible]	3		[illegible]	
	[illegible]	[illegible]	[illegible]	3		[illegible]	
	[illegible]	[illegible]	[illegible]	3			
	[illegible]	[illegible]	[illegible]	3			
	[illegible]	[illegible]	[illegible]	3		[illegible]	
	[illegible]	[illegible]	[illegible]	3		[illegible]	
	[illegible]	[illegible]	[illegible]	3		[illegible]	
	[illegible]	[illegible]	[illegible]	3		[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	3		[illegible]	4,5
	[illegible]	[illegible]	[illegible]	3		[illegible]	
	[illegible]	[illegible]	[illegible]	3		[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	3	1	completed	[illegible]
	[illegible]	[illegible]	[illegible]	2	1	completed	[illegible]
	[illegible]	[illegible]	[illegible]	1	[illegible]	completed	[illegible]
[illegible]	[illegible]						[illegible]
	[illegible]						[illegible]

STANDARD CODE REPORT WEEK 44 - 48 5-11-71 page 13

Perf. maint. group	Job No.	Mach. account No.		Standard code	No..	Standard time	Actual consumed time
6311	406583	563250	965	1	1	2,5	4,0
		Sum standard code			73	182,5	170,5
6311			average =			2,5	2,3
6311	408330	561100	018	2	1	9,9	8,0
	408331	562600	201	2	1	9,9	8,5
	403451	563250	951	2	1	9,9	8,5
	404101	563200	791	2	1	9,9	8,0
	404438	561500	481	2	1	9,9	9,5
	404899	563600	046	2	1	9,9	10,0
	405398	566255	110	2	1	9,9	14,0
	406233	561300	333	2	1	9,9	13,0
	406487	561400	330	2	1	9,9	8,5
	406931	566241	141	2	1	9,9	10,5
	407001	563200	934	2	1	9,9	14,5
		Sum standard code			11	108,9	112,5
6311			average =			9,9	10,2
6311	104396	563200	700	3	1	22,5	16,5
	104442	561100	051	3	1	22,5	27,5
	104899	562300	132	3	1	22,5	16,5
	105825	563600	385	3	1	22,5	21,0
	106169	561500	361	3	1	22,5	20,5
	107084	[illegible]	[illegible]	3	1	22,5	30,5
	107422	561200	019	3	1	22,5	18,0
	107900	563700	212	3	1	22,5	27,5
		Sum standard code			8	180,0	177,5
6311			average =			22,5	22,2
6311	108197	563700	386	4	1	48,0	46,5
	108615-	561100	230	4	1	48,0	53,5
	[illegible]	[illegible]	301	4	1	48,0	47,0
	[illegible]	561700	041	4	1	48,0	32,0
		Sum standard code			4	192,0	178,0
6311			average =			48,0	44,5
6311	[illegible]	[illegible]	712	9	1	110,0	118,0
		Sum standard code			1	110,0	118,0
6311			average =			110,0	118,0
6311	[illegible]	[illegible]	613	[illegible]	4	[illegible]	[illegible]
		Sum standard code			4	[illegible]	[illegible]
6311			average =			[illegible]	13,4
6311	[illegible]	[illegible]	[illegible]	[illegible]	4	[illegible]	[illegible]
		Sum standard code			4	[illegible]	[illegible]
			average =			[illegible]	[illegible]
6311	Sum per perf. maint. group					[illegible]	[illegible]

REPORT SUMMARY

WEEK 12 1974

Part order group	Working hours in the week: 1 Prior. 1	2 Prior. 2	3 Prior. 3	4 Prior. 4	5 Prior. 5	6 Total 6	7 Hours available P3 + P5	8 %	9 Average hours available last year	Performed by: 10 DV	11 Sub-contr.	12 Order entr. in the week	13 Total order stock in the week	14 Stock of orders ready to start in the week	15 Loading in weeks against average
						1-5	3,5	7/6x100							15/10
[illegible]	[illegible]	791	[illegible]	777	10	[illegible]	722	27	580	2443	215	2843	2789	2789	4,8
[illegible]	165	[illegible]	136	165	-	672	134	20	220	569	108	530	767	767	3,2
[illegible]	72	92	257	274	-	695	257	37	250	695	-	651	622	622	2,5
[illegible]	26	161	71	78	-	316	111	35	125	316	-	279	541	541	4,3
[illegible]	366	171	[illegible]	[illegible]	-	2221	811	36	550	1942	279	2347	3634	3346	6,1
[illegible]	170	129	[illegible]	[illegible]	-	1349	448	33	480	1080	269	2188	4388	3944	8,2
[illegible]	12	146	170	410	-	752	184	24	310	752	-	799	898	898	2,9
[illegible]	46	138	[illegible]	226	80	1088	1397	77	1050	1088	-	3198	11253	10553	10,1
[illegible]	170	212	785	127	60	1501	1082	67	1050	1448	63	971	4788	2937	2,7
[illegible]	186	216	572	391	75	1466	758	51	510	1466	-	1825	3140	2990	5,9
[illegible]	55	225	1407	76	165	2262	2086	85	1080	2262	-	2164	16940	16940	9,4
[illegible]	162	416	[illegible]	178	37	1075	379	35	290	1075	-	840	3399	3312	11,4
[illegible]	3	11	46	61	3	124	49	40	170	124	-	167	910	910	5,4
[illegible]	7	48	[illegible]	10	8	578	510	88	490	578	-	344	1990	1650	3,4
[illegible]	-	1	570	1	-	1406	1404	100	570	596	840	565	1709	1109	1,9
[illegible]	113	251	[illegible]	229	59	1534	941	61	860	1391	143	1325	4029	3779	4,4
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[illegible]	-	-	816	43	-	859	816	95	700	859	-	161	1153	1153	1,6
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[illegible]	40	62	39	150	-	291	39	13	80	291	-	372	335	335	4,2
1710	-	16	[illegible]	376	-	1176	782	67	340	889	336	1530	942	942	2,8
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1. INTRODUCTION [illegible]

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[illegible] DESIGN OF THE SYSTEMS TO BE IMPLEMENTED

[illegible]

[illegible]

- **Organisation**

  [illegible]

- **Work Order System**

  [illegible]

- **Preventive Maintenance System**

  [illegible]

- **Maintenance Planning System**

  [illegible]

  [illegible]

- **Production Planning System**

  A system for planning work, production of spare parts, etc. in the central workshops. The proposed system consists of a general production planning system well-suited to the actual production of spare parts.

- **Material Administration System**

  [illegible]
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- **Cost Control System**

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- **Coding System**

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- **Information Base and Files**

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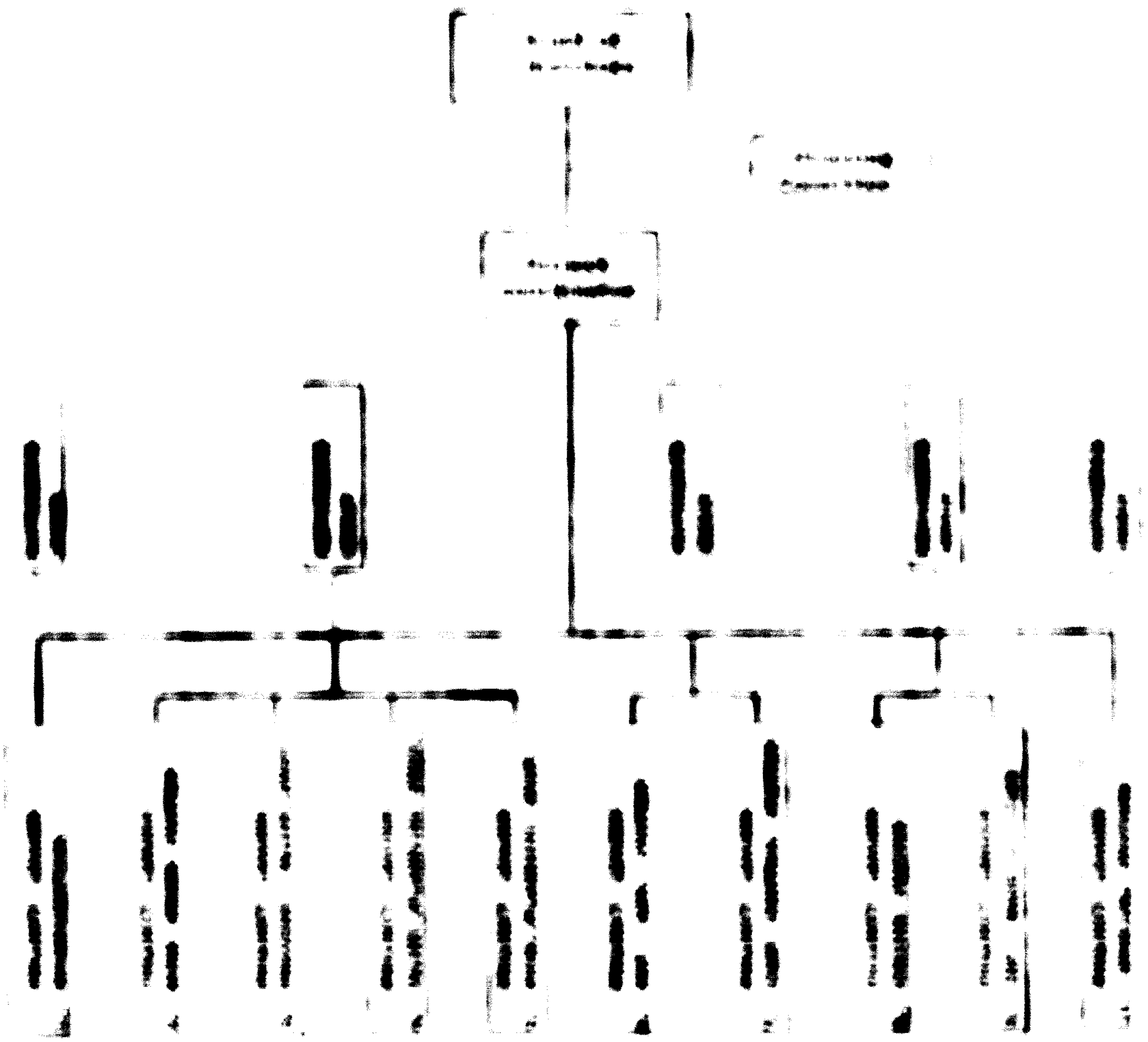
10. **Special Systems and Techniques**

    Method for [illegible]
    Method for [illegible]
    Method for [illegible]
    Method for [illegible]
    [illegible], etc.

[illegible] PROJECT ORGANISATION

[illegible]



1.1 Steering Committee

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1.2 Project [illegible]

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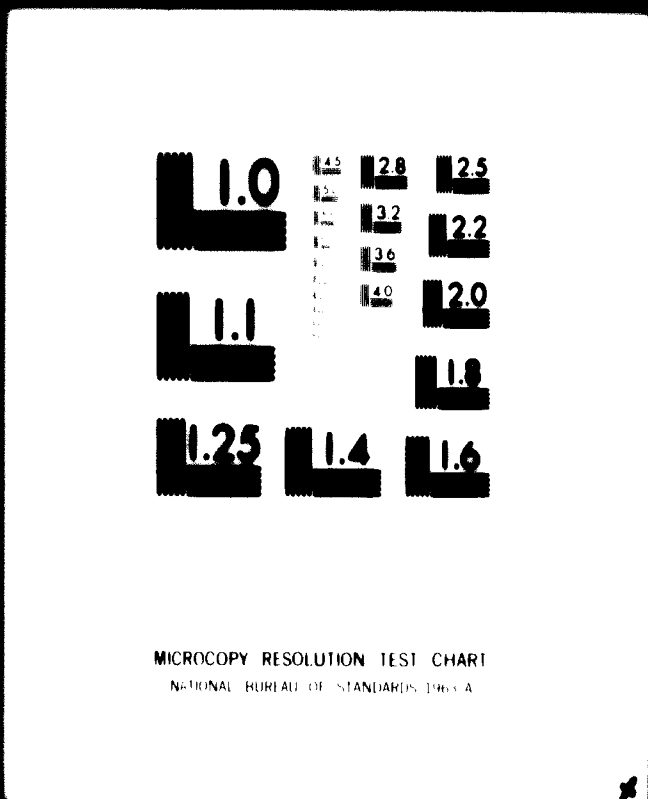
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

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207	Cost Control System	(Work Plan Att. 7)
208	Coding System	(Work Plan Att. 8)
209	Information Base and Files	(Work Plan Att. 9)
210	Special Systems and Techniques	(Work Plant Att. 10)

The time schedule for this area appears in Attachment 11.2.

4.3 Central Spare Part Production

The implementation of the managed maintenance system in this area is calculated to last 51 weeks. Due to interdependencies between other areas and the limitation of resources, the implementation in this area should not begin before 25 weeks after the first implementation project has been started.

The implementation in this area consists of the following projects:

301	Organisation	(Work Plan Att. 1)
303	Preventive Maintenance System	(Work Plan Att. 3)
305	Production Planning System	(Work Plan Att. 5)
306	Material Administration System	(Work Plan Att. 6)
307	Cost Control System	(Work Plan Att. 7)
308	Coding System	(Work Plan Att. 8)
309	Information Base and Files	(Work Plan Att. 9)
310	Special Systems and Techniques	(Work Plan Att. 10)

The time schedule for this area appears in Attachment 11.3.

4.4 Maintenance Unit of Factories

The implementation of the managed maintenance system in this area is calculated to last 42 weeks. Due to interdependencies between other areas and the limitation of resources, the implementation in this area should not commence before 100 weeks after the first implementation project has been started.

The implementation in this area consists of the following projects:

401	Organisation	(Work Plan Att. 1)
402	Work Order System	(Work Plan Att. 2)
403	Preventive Maintenance System	(Work Plan Att. 3)
404	Maintenance Planning System	(Work Plan Att. 4)
406	Material Administration System	(Work Plan Att. 6)
407	Cost Control System	(Work Plan Att. 7)
408	Coding System	(Work Plan Att. 8)
409	Information Base and Files	(Work Plan Att. 9)

The time schedule for this area appears in Attachment 11.4.

4.5 Cold and Hot Rolling Mills

The implementation of the managed maintenance system in this area is calculated to last 74 weeks.

This project can start immediately.

The implementation in this area consists of the following projects:

501	Organisation	(Work Plan Att. 1)
502	Work Order System	(Work Plan Att. 2)
503	Preventive Maintenance System	(Work Plan Att. 3)
504	Maintenance Planning System	(Work Plan Att. 4)
505	Production Planning System	(Work Plan Att. 5)
506	Material Administration System	(Work Plan Att. 6)
507	Cost Control System	(Work Plan Att. 7)
508	Coding System	(Work Plan Att. 8)
509	Information Base and Files	(Work Plan Att. 9)

The time schedule for this area appears in Attachment 11.5.

4.6 Metallurgical Factory

The implementation of the managed maintenance system in this area is calculated to last 69 weeks. Due to interdependencies between other areas and the limitation of resources, implementation in this area should not commence until 63 weeks after the first implementation project has been started.

The implementation in this area consists of the following projects:

601	Organisation	(Work Plan Att. 1)
602	Work Order System	(Work Plan Att. 2)
603	Preventive Maintenance System	(Work Plan Att. 3)
604	Maintenance Planning System	(Work Plan Att. 4)
605	Production Planning System	(Work Plan Att. 5)
606	Material Administration System	(Work Plan Att. 6)
607	Cost Control System	(Work Plan Att. 7)
608	Coding System	(Work Plan Att. 8)
609	Information Base and Files	(Work Plan Att. 9)

The time schedule for this area appears in Attachment 11.6.

4.7 Transportation Factory

The implementation of the managed maintenance system in this area is calculated to last 69 weeks. Due to interdependencies between other areas and the limitation of resources, implementation in this area should not commence until 76 weeks after the first implementation project has been started.

The implementation in this area consists of the following projects:

701	Organisation	(Work Plan Att. 1)
702	Work Order System	(Work Plan Att. 2)
703	Preventive Maintenance System	(Work Plan Att. 3)
704	Maintenance Planning System	(Work Plan Att. 4)
705	Production Planning System	(Work Plan Att. 5)
706	Material Administration System	(Work Plan Att. 6)
707	Cost Control System	(Work Plan Att. 7)
708	Coding System	(Work Plan Att. 8)
709	Information Base and Files	(Work Plan Att. 9)

The time schedule for this area appears in Attachment 11.7.

4.8 Sheet Processing Factory

The implementation of the managed maintenance system in this area is calculated to last 69 weeks. Due to interdependencies between other areas and the limitation of resources, implementation in this area should not commence until 84 weeks after the first implementation project has been started.

The implementation in this area consists of the following projects:

801	Organisation	(Work Plan Att. 1)
802	Work Order System	(Work Plan Att. 2)
803	Preventive Maintenance System	(Work Plan Att. 3)
804	Maintenance Planning System	(Work Plan Att. 4)
805	Production Planning System	(Work Plan Att. 5)
806	Material Administration System	(Work Plan Att. 6)
807	Cost Control System	(Work Plan Att. 7)
808	Coding System	(Work Plan Att. 8)
809	Information Base and Files	(Work Plan Att. 9)

The time schedule for this area appears in Attachment 11.8.

4.9 Coking Factory

The implementation of the managed maintenance system in this area is calculated to last 69 weeks. Due to interdependencies between other areas and the limitation of resources, implementation in this area should not commence until 92 weeks after the first implementation project has been started.

The implementation in this area consists of the following projects:

901	Organisation	(Work Plan Att. 1)
902	Work Order System	(Work Plan Att. 2)
903	Preventive Maintenance System	(Work Plan Att. 3)
904	Maintenance Planning System	(Work Plan Att. 4)
905	Production Planning System	(Work Plan Att. 5)
906	Material Administration System	(Work Plan Att. 6)
907	Cost Control System	(Work Plan Att. 7)
908	Coding System	(Work Plan Att. 8)
909	Information Base and Files	(Work Plan Att. 9)

The time schedule for this area appears in Attachment 11.9.

4.10 Energy Factory

The implementation of the managed maintenance system in this area is calculated to last 69 weeks. Due to interdependencies between other areas and the limitation of resources, implementation in this area should not commence until 100 weeks after the first implementation project has been started.

The implementation in this area consists of the following projects:

1001	Organisation	(Work Plan Att. 1)
1002	Work Order System	(Work Plan Att. 2)
1003	Preventive Maintenance System	(Work Plan Att. 3)
1004	Maintenance Planning System	(Work Plan Att. 4)
1005	Production Planning System	(Work Plan Att. 5)
1006	Material Administration System	(Work Plan Att. 6)
1007	Cost Control System	(Work Plan Att. 7)
1008	Coding System	(Work Plan Att. 8)
1009	Information Base and Files	(Work Plan Att. 9)

The time schedule for this area appears in Attachment 11.10.

4.11 Rolling Mill - Budapest

The implementation of the managed maintenance system in this area is calculated to last 69 weeks. Due to interdependencies between other areas and the limitation of resources, implementation in this area should not commence until 108 weeks after the first implementation project has been started.

The implementation in this area consists of the following projects:

1101	Organisation	(Work Plan Att. 1)
1102	Work Order System	(Work Plan Att. 2)
1103	Preventive Maintenance System	(Work Plan Att. 3)
1104	Maintenance Planning System	(Work Plan Att. 4)
1105	Production Planning System	(Work Plan Att. 5)
1106	Material Administration System	(Work Plan Att. 6)

1107 Cost Control System (Work Plan Att. 7)
1108 Coding System (Work Plan Att. 8)
1109 Information Base and Files (Work Plan Att. 9)

The time schedule for this area appears in Attachment 11.11.

5. TIME SCHEDULE

The implementation planning and scheduling are processed on a standard EDP programme based on the network technique.

- The time schedule, the project leader resources and the structure (that is the interdependencies between the activities) for the implementation of all areas are presented in Attachment 11.0.

- The time schedule, shown in table form and as Gantt charts for each area, is presented in Attachments 11.1 to 11.11.

- A special time schedule listed per project leader and the necessary project leader resources for each project, shown in histogram form and table form, is presented in Attachment 11.12.

The total project time is calculated to be 177 weeks. Project start is set for 1 December 1975, which gives the calculated finishing date of the total project as 3 August 1979.

6. EXPECTED RESULTS

It is expected that the counterpart, using the proposed project organisation, work programmes, and implementation plan presented in this report, should be able to implement the proposed Managed Maintenance System within approximately four years.

This implies that the counterpart will be given consultants' aid in the first period of the implementation.

7. CONCLUSION

The implementation organisation and the implementation plan have been established in close cooperation with the management and the staff of the Danube Iron and Steel Works. It is our opinion that the implementation plan presented is realistic. However, we must emphasise that this is a major organisation task for the company, which must be realised as such if optimal results are to be obtained.

With this report we consider that Phase 3, the implementation planning phase, is completed.

STANDARD WORK/ACTIVITY PLANS

1. ORGANISATION

1.1 Objective:

To implement the proposed new concept of organisation and to carry out the necessary adjustments.

1.2 Activities:

1.2.1

The new concept will be discussed with all managers influenced by it. If any major changes in the existing principles are requested, they will be discussed with the project coordinator before being accepted.

1.2.2

The objective of the organisational unit will be described and as far as possible quantified.

1.2.3

The functions covered by the organisational unit will be described and logically divided into main functions.

1.2.4

The distribution of tasks to be performed, the authority and responsibility, coordination and information for all managers will be stated in job descriptions.

1.2.5

General rules for managers at different levels will be worked out.

1.2.6

Description of committees, fixed work groups, etc., who are acting in the organisation.

1.2.7

Establishment of an Organisation Handbook (OH), containing the above-mentioned papers and descriptions of administrative systems and other organisational rules.

1.2.8

Practical production of the OH and distribution to the most important managers.

1.2.9

Guidance for the organisational unit during the period of changes, for instance by orientation meetings etc.

1.2.10

Follow-up of the implementation, adjustments.

1.3. Resources

Project leader: Csinády Gabór

Project group:

Calculated input from project leader: 253 weeks.

2. WORK ORDER SYSTEM

2.1 Objective:

To implement the proposed new work order system in accordance with the principles presented in the "System Development Report" Part 5.1, and to follow up on the system in use and make necessary adjustments.

2.2 Activities:

2.2.1

Detailing of the proposed work order system, including re-evaluation of the necessary formulas.

2.2.2

Detailed description of necessary files.

2.2.3

Discussions with the future users to secure their final acceptance. Major changes of the principles must be discussed with the project coordinator before they are made.

2.2.4

Preliminary printing of the work order formulas and lists, purchase of necessary equipment, such as distribution envelopes, archives, etc.

2.2.5

Trial run of the new system in a secondary area parallel to the present system.

2.2.6

Training of the planning office staff in using and administering the new system. Briefing of production leaders, maintenance foremen and other persons affected by the functioning of the new system.

2.2.7

Training of the workers in using the new system ("understanding" the work order information, making the correct registrations, etc.).

2.2.8

Guidance in using the statistics required by the work order system.

2.2.9

Final printing of the necessary work order papers, total switch-over to the tested and adjusted new work order system.

2.2.10

Follow-up.

2.3 Resources:

Project leader: Páli Ferenc

Project group: Vidák Ferenc
Farkas József
Bertok István

Calculated input from project leader: 123 weeks.

3. PREVENTIVE MAINTENANCE

3.1 Objective:

To implement the proposed system for preventive maintenance (PM) in accordance with the principles presented in the "System Development Report" Part 5.4.3.2 and to follow up on the system in use and make necessary adjustments.

3.2 Activities:

3.2.1

Detailing of the proposed PM system, including evaluation and design of the necessary formulas.

3.2.2

Detailed description of necessary files.

3.2.3

Discussion with the production and maintenance management to obtain their final acceptance.

3.2.4

Preliminary printing of PM formulas and lists, purchase of necessary equipment.

3.2.5

Selection of several (for instance 10) important areas of the plant in order to test the system. Describe inspections and their frequency and elaborate the PM instructions for the selected parts.

3.2.6

Selection and training of the future inspectors, who will test the proposed method in the areas selected. Inform all persons affected by the system.

3.2.7

Establish a planning system for the inspections, including reporting routines.

3.2.8

Elaborate a plan for expansion of PM, including all important machinery.

3.2.9

Final printing of the necessary PM papers, step-wise working out of the files and implementation of the PM according to the plan.

3.2.10

Guide the managers in using the statistics/information from the PM system.

3.2.11

Follow-up.

3.3 Resources:

Project leader: Páli Ferenc

Project group: Vidák Ferenc
Farkas József
Bertok István

Calculated input from project leader: 372 weeks.

4. MAINTENANCE PLANNING

4.1 Objective:

To implement the proposed new maintenance planning system in accordance with the principles presented in the "System Development Report" Part 5.4.3, and to follow up on the system in use and make necessary adjustments.

4.2 Activities:

4.2.1

Detailing of the proposed maintenance planning system.

4.2.2

Explain and define the relations between and the responsibilities of central planning, project planning, shop planning and job preparation.

4.2.3

Detailed description of necessary files.

4.2.4

Discussion with future users to secure their final acceptance. Major changes of the principles must be discussed with the project coordinator before they are made.

4.2.5

Preliminary printing of planning sheets, loading forms, time estimate forms, etc., and purchase of equipment such as tables, archives, etc. necessary to run the system.

4.2.6

Final run of the job preparation and planning system in a secondary but representative area. The trial run is to be made parallel to the system functioning at present.

4.2.7

Training of the planning office staff in using and administering the new system. Brief production leaders, maintenance foremen and other persons affected by the functioning of the new system.

4.2.8

Final printing of the necessary planning sheets and formulas, and step-wise implementation of the tested and adjusted system in all relevant areas.

4.2.9

Guidance in using the statistics/information of the maintenance planning system.

4.2.10

Follow-up.

4.3 Resources:

Project leader:	Páli Ferenc
Project group:	Vidák Ferenc Farkas József Bertok István

Calculated input from project leader: 147 weeks.

5. PRODUCTION PLANNING

5.1 Objective:

To implement the proposed new production planning system in accordance with the principles presented in the "System Development Report" Parts 5.4.1 and 5.4.2, and to follow up on the system in use and make necessary adjustments.

5.2 Activities:

5.2.1

Detailing of the proposed job preparation and production planning system, including re-evaluation of the necessary formulas.

5.2.2

Definition of the relation between and the responsibility for job preparation and production planning.

5.2.3

Detailed description of necessary files.

5.2.4

Discussions with the future users to secure their final acceptance. Major changes of the principles must be discussed with the project coordinator before being made.

5.2.5

Preliminary printing of planning sheets, loading forms, time estimate forms, etc., and purchase of equipment such as tables, archives, etc. necessary to run the system.

5.2.6

Final run of the job preparation and production planning system in a secondary but representative area. The trial run is to be made parallel to the system functioning at present.

5.2.7

Training of the planning office staff in using and administering the new system. Brief production leaders and foremen.

5.2.8

Training of the workers in using the new system ("understanding" the work order information, making the correct registrations, etc.

5.2.9

Clearing of order stock and re-evaluation of priority of the remaining orders.

5.2.10

Final printing of the necessary planning sheets and formulas, and step-wise implementation of the tested and adjusted system in all relevant areas.

5.2.11

Guidance in using the statistics/information from the production planning system.

5.2.12

Follow-up.

5.3 Resources:

Project leader:	Páli Ferenc
Project group:	Vidák Ferenc Farkas József Bertok István

Calculated input from project leader: 52 weeks.

6. MATERIAL ADMINISTRATION

6.1 Objective:

To implement the proposed new material administration system in accordance with the principles presented in the "System Development Report" Part 6, and to follow up on the system in use and make necessary adjustments.

6.2 Activities:

6.2.1

Detailing of the proposed routines and definition of the various policies to be followed for specific materials/spare parts.

6.2.2

Detailed description of necessary files.

6.2.3

Discussions with the future users to secure their final acceptance. Major changes of the principles must be discussed with the project coordinator before being made.

6.2.4

Preliminary printing of formulas and purchase of equipment necessary to run the material administration system.

6.2.5

Trial run of the material administration system parallel to the system functioning at present.

6.2.6

Training of the material administration staff in using the new system. Brief the future users and all other persons affected by the system.

6.2.7

Step-wise clearing of the existing material/spare part stock, deletion of obsolete materials/spare parts (according to principles and rules presented in a special paper) and coding of the remaining items according to the new coding system (Project 8).

6.2.8

Establishment of a decision model (company policy) for deletion of obsolete spare parts.

6.2.9

Final printing of necessary formulas and step-wise implementation of the tested and adjusted system.

6.2.10

Guidance in using the statistics/information from the new material administration system.

6.2.11

Follow-up.

6.3 Resources:

Project leader: Páger Lászlo

Project group: Zömbik István

Calculated input from project leader: 259 weeks.

7. COST CONTROL

7.1 Objective:

To implement the proposed budgeting and cost control system in accordance with the principles presented in the "System Development Report" Part 7 and to follow up on the system in use and make necessary adjustments.

7.2 Activities:

7.2.1

Detailing of the proposed budgeting and cost control system including re-evaluation of the necessary formulas.

7.2.2

Define the relation between and the responsibilities of the organisational units participating in the budgeting and cost control procedure.

7.2.3

Work out detailed description of necessary files.

7.2.4

Discussion with the future users to secure their final acceptance. Major changes of the principles must be discussed with the project coordinator before being made.

7.2.5

Preliminary printing of budgeting schemes and cost control report forms and purchase of equipment necessary to run the system.

7.2.6

Trial run of the system in a secondary but representative area.

7.2.7

Training of the staff in using and administering the new system. Brief managers, production leaders and all other persons affected by the system.

7.2.8

Final printing of the necessary schemes and formulas, and step-wise implementation of the tested and adjusted system.

7.2.9

Guide the managers in using the statistics/reports from the system.

7.2.10

Follow-up.

7.3 Resources:

Project leader: Páger László

Project group: Zömbik István

Calculated input from project leader: 98 weeks.

8. CODING SYSTEM

8.1 Objective:

To implement the proposed new coding system in accordance with the principles presented in the "System Development Report" Part 8 and to follow up on the system in use and make necessary adjustments.

8.2 Activities:

8.2.1

Re-evaluation of the proposed coding systems and detailed description and definition of the modules.

8.2.2

Define the relation between the various coding systems.

8.2.3

Detailed description of necessary files, catalogues, etc.

8.2.4

Discussion with the future users to secure their final acceptance. Major changes of the principles must be discussed with the project coordinator before being made.

8.2.5

Simulation of coding in all functions to test the uniqueness, intelligibility and suitability of the chosen system. Make adjustments, if any.

8.2.6

Training of the staff responsible to implement and maintain the system. Brief the future users and all other persons affected by the system.

8.2.7

Elaborate a plan for step-wise implementation of the new coding systems in all relevant areas; begin the conversion to it.

8.2.8

Establish the necessary files and catalogues and the routines for maintaining them.

8.2.9

Follow-up.

8.3 Resources:

Project leader: Tóth Dezső

Project group: Aszallár Zoltán

Calculated input from project leader: 85 weeks.

9. INFORMATION BASE AND FILES

9.1 Objective:

To establish the information bases and files necessary to process the managed maintenance system on EDP, in accordance with the framework set up in the "System Development Report" Part 9.

9.2 Activities:

9.2.1

Re-evaluation and detailing of the proposed

- Files on EDP
- Input to EDP
- Output from EDP (possibly report design)

9.2.2

Discussion with the future users to obtain their final comments and acceptance.

9.2.3

Elaborate a plan for establishment of the necessary files.

9.2.4

Collect data and build up the files according to the plan.

9.2.5

Develop and establish maintenance (up-dating) routines for the files.

9.2.6

Prepare the system and routines for data coding and flow in order to get necessary EDP reports.

9.2.7

Brief all persons involved, from data researchers to final report writers, on the necessity for strict data discipline and on the functioning of the system.

9.2.8

Guide the manager in using the statistics/information from the reports.

9.2.9

Follow up on the system and make necessary adjustments according to the higher degree of systems being processed by EDP.

9.3 Resources:

Project leader: Tóth Dezsö

Project group: Szallar Zoltán

Calculated input from project leader: 186 weeks.

10. SPECIAL SYSTEMS AND TECHNIQUES

10.1 Objective:

To realise and implement special systems and techniques necessary to obtain a suitable and efficient processing of the proposed main systems. These special systems and techniques are presented in special papers and mentioned in the "System Development Report" Part 10.

10.2 Activities:

10.2.1

Systematise the knowledge of relevant special systems and techniques.

10.2.2

Evaluate the areas which can use these advantageously.

10.2.3

Train the relevant persons in using these techniques and introduce the techniques in the respective areas.

10.2.4

Follow up on the use and the results of using the techniques. Propose changes if necessary.

10.3 Resources:

Project leader: Kovacs Gyula

Project group: Mate Sandor

Calculated input from project leader: 17 weeks.

SA FINISH

** RESULT OF TIME CALCULATION **

** PROJECT NO. 1 **

```
PLANNED    START:     0   1DEC75
COMPUTED   START:     0   1DEC75
SECONDARY  START:
PLANNED    FINISH:
COMPUTED   FINISH:  177   3AUG79
SECONDARY  FINISH:
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PROJECT NO. 1
DANUBE IRON • STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79

TIME UNIT: WEEK

ACTIVITY IDENTIFICATION	ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
A01	•••••• START CENTRAL ORGAN.	0	1MAR76		6AUG79		165	0	165	
B01	CENTRAL ORGAN. FINISH ••••••	0	8AUG77				0	0	0	
A02	•••••• START CENTR.MAINT.FAC.	0	5APR76				0	0	0	
B02	CENTR.MAINT.FAC. FINISH ••••••	0	9MAY77		25JUL77		6	0	0	
A03	•••••• START CENT.SPAREP.PR.	0	7JUN76				0	0	0	
B03	CENT.SPAREP.PR. FINISH ••••••	0	25JUL77				0	0	0	
A04	•••••• START MAINT.UNIT FACT.	0	16JAN78				0	0	0	
B04	MAINT.UNIT FACT. FINISH ••••••	0	4DEC78				0	0	0	
A05	•••••• START ROLLING MILLS	0	1DEC75				0	0	0	
B05	ROLLING MILLS FINISH ••••••	0	13JUN77				0	0	0	
A06	•••••• START METALL FACTORY	0	28MAR77				0	0	0	
B06	METALL FACTORY FINISH ••••••	0	25SEP78				0	0	0	
A07	•••••• START TRANSP.FACTORY	0	25JUL77				0	0	0	
B07	TRANSP.FACTORY FINISH ••••••	0	25DEC78				0	0	0	
A08	•••••• START SHEET PROC.FACT.	0	19SEP77				0	0	0	
B08	SHEET PROC FACT. FINISH ••••••	0	19FEB79				0	0	0	
A09	•••••• START COOKING FACTORY	0	14NOV77				0	0	0	
B09	COOKING FACTORY FINISH ••••••	0	16APR79				0	0	0	
A10	•••••• START ENERGY FACTORY	0	16JAN78				0	0	0	
B10	ENERGY FACTORY FINISH ••••••	0	11JUN79				0	0	0	
A11	•••••• START BUDAPEST ROLLMILL	0	13MAR78				0	0	0	
B11	BUDAPEST ROLMILL FINISH ••••••	0	6AUG79				0	0	0	

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PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79

TIME UNIT: WEEK

ACTIVITY IDENTIFICATION		ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
A05	****** START	ROLLING MILLS	0	1DEC75				0	0	0	
A01	****** START	CENTRAL ORGAN.	0	1MAR76		6AUG79		165	0	165	
A02	****** START	CENTR.MAINT FAC.	0	5APR76				0	0	0	
A03	****** START	CENT.SPAREP.PR.	0	7JUN76				0	0	0	
A06	****** START	METALL FACTORY	0	28MAR77				0	0	0	
A07	****** START	TRANSP.FACTORY	0	25JUL77				0	0	0	
A08	****** START	SHEET PROC.FACT.	0	19SEP77				0	0	0	
A09	****** START	COOKING FACTORY	0	14NOV77				0	0	0	
A04	****** START	MAINT.UNIT FACT.	0	16JAN78				0	0	0	
A10	****** START	ENERGY FACTORY	0	16JAN78				0	0	0	
A11	****** START	BUDAPEST ROLLMILL	0	13MAR78				0	0	0	

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PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79

TIME UNIT: WEEK

ACTIVITY IDENTIFICATION	ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIN.	FLOAT SEC.	FLOAT FREE	UP DATE
B02	CENTR.MAINT.FAC. FINISH ******	0	9MAY77		25JUL77		0	0	0	
B05	ROLLING MILLS FINISH ******	0	13JUN77				0	0	0	
B03	CENT.SPAREP.PR. FINISH ******	0	25JUL77				0	0	0	
B01	CENTRAL ORGAN. FINISH ******	0	8AUG77				0	0	0	
B06	METALL FACTORY FINISH ******	0	25SEP78				0	0	0	
B04	MAINT.UNIT FACT. FINISH ******	0	4DEC78				0	0	0	
B07	TRANSP.FACTORY FINISH ******	0	25DEC78				0	0	0	
B08	SHEET PROC FACT. FINISH ******	0	19FEB79				0	0	0	
B09	COOKING FACTORY FINISH ******	0	16APR79				0	0	0	
B10	ENERGY FACTORY FINISH ******	0	11JUN79				0	0	0	
B11	BUDAPEST ROLMILL FINISH ******	0	6AUG79				0	0	0	

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PROJECT NO. 1
DANUBE IRON • STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79

TIME UNIT: WEEK

ACTIVITY IDENTIFICATION		ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
501	CG	RM ORGANIZATION	ROLLING MILLS	13	1DEC75	5MAR76	8MAR76	11JUN76	13	0	0	
108	TD	CO CODING SYSTEM	CENTRAL ORGAN.	39	1DEC75	1OCT76			0	0	0	
503	PF	RM PREVENTIVE MAINTENANCE	ROLLING MILLS	73	1DEC75	10JUN77			0	0	0	
505	PF	RM PRODUCTION PLANNING	ROLLING MILLS	52	1DEC75	7JAN77	10MAY76	10JUN77	21	0	21	
506	PL	RM MATERIAL ADMINISTRATION	ROLLING MILLS	52	1DEC75	7JAN77	10MAY76	10JUN77	21	0	21	
508	TD	RM CODING SYSTEM	ROLLING MILLS	52	1DEC75	7JAN77	10MAY76	10JUN77	21	0	21	
110	KG	CO SPECIAL SYSTEMS AND TECHNIQUES	CENTRAL ORGAN.	65	1DEC75	8APR77	8MAR76	5AUG77	13	0	13	
101	CG	CO ORGANIZATION	CENTRAL ORGAN.	78	1DEC75	5AUG77	15MAR76	11NOV77	14	0	0	
502	PF	RM WORK ORDER SYSTEM	ROLLING MILLS	43	2FEB76	24DEC76	2AUG76	10JUN77	22	0	22	
104	PF	CO MAINTENANCE PLANNING	CENTRAL ORGAN.	43	2FEB76	24DEC76	6SEP76	5AUG77	27	0	27	
105	PF	CO PRODUCTION PLANNING	CENTRAL ORGAN.	26	2FEB76	27AUG76	10JAN77	5AUG77	44	0	44	
106	PL	CO MATERIAL ADMINISTRATION	CENTRAL ORGAN.	56	2FEB76	1APR77	17MAY76	5AUG77	14	0	14	
107	PL	CO COST CONTROL	CENTRAL ORGAN.	43	2FEB76	24DEC76	6SEP76	5AUG77	27	0	27	
504	PF	RM MAINTENANCE PLANNING	ROLLING MILLS	47	8MAR76	4MAR77	14JUN76	10JUN77	13	0	0	
201	CG	CM ORGANIZATION	CENTR.MAINT.FAC	26	5APR76	29OCT76			0	0	0	
507	PL	RM COST CONTROL	ROLLING MILLS	26	5APR76	29OCT76	29NOV76	10JUN77	30	0	30	
509	TD	RM INFORMATION BASE AND FILES	ROLLING MILLS	43	5APR76	4MAR77	2AUG76	10JUN77	13	0	13	
301	CG	CS ORGANIZATION	CENT.SPAREP.PR.	26	7JUN76	24DEC76			0	0	0	
206	PL	CM MATERIAL ADMINISTRATION	CENTR.MAINT.FAC	26	7JUN76	24DEC76	30AUG76	4MAR77	9	0	0	
204	PF	CM MAINTENANCE PLANNING	CENTR.MAINT.FAC	26	7JUN76	24DEC76	20DEC76	22JUL77	25	0	17	
205	PF	CM PRODUCTION PLANNING	CENTR.MAINT.FAC	43	7JUN76	6MAY77	23AUG76	22JUL77	8	0	0	
207	PL	CM COST CONTROL	CENTR.MAINT.FAC	26	7JUN76	24DEC76	20DEC76	22JUL77	25	0	17	
208	TD	CM CODING SYSTEM	CENTR.MAINT.FAC	26	7JUN76	24DEC76	20DEC76	22JUL77	25	0	17	
210	KG	CM SPECIAL SYSTEMS AND TECHNIQUES	CENTR.MAINT.FAC	43	7JUN76	6MAY77	23AUG76	22JUL77	8	0	0	
209	TD	CM INFORMATION BASE AND FILES	CENTR.MAINT.FAC	34	23AUG76	22APR77	25OCT76	22JUL77	9	0	1	
303	PF	CS PREVENTIVE MAINTENANCE	CENT.SPAREP.PR.	34	23AUG76	22APR77	25OCT76	22JUL77	9	0	9	
305	PF	CS PRODUCTION PLANNING	CENT.SPAREP.PR.	43	23AUG76	22JUL77			0	0	0	
306	PL	CS MATERIAL ADMINISTRATION	CENT.SPAREP.PR.	34	23AUG76	22APR77	25OCT76	22JUL77	9	0	0	
308	TD	CS CODING SYSTEM	CENT.SPAREP.PR.	43	23AUG76	22JUL77			0	0	0	
310	KG	CS SPECIAL SYSTEMS AND TECHNIQUES	CENT.SPAREP.PR.	34	23AUG76	22APR77	25OCT76	22JUL77	9	0	9	
109	TD	CO INFORMATION BASE AND FILES	CENTRAL ORGAN.	39	4OCT76	5AUG77			0	0	0	
307	PL	CS COST CONTROL	CENT.SPAREP.PR.	26	18OCT76	22APR77	20DEC76	22JUL77	9	0	0	
309	TD	CS INFORMATION BASE AND FILES	CENT.SPAREP.PR.	17	13DEC76	15APR77	28FEB77	22JUL77	10	0	10	
601	CG	MF ORGANIZATION	METALL FACT.	17	28MAR77	19AUG77	22AUG77	16DEC77	17	0	0	
603	PF	MF PREVENTIVE MAINTENANCE	METALL FACT.	69	28MAR77	22SEP78			0	0	0	
605	PF	MF PRODUCTION PLANNING	METALL FACT.	52	28MAR77	28APR78	22AUG77	22SEP78	17	0	17	
606	PL	MF MATERIAL ADMINISTRATION	METALL FACT.	52	28MAR77	28APR78	22AUG77	22SEP78	17	0	17	
608	TD	MF CODING SYSTEM	METALL FACT.	52	28MAR77	28APR78	22AUG77	22SEP78	17	0	17	
701	CG	TF ORGANIZATION	TRANSP.FACTORY	17	25JUL77	18NOV77	21NOV77	24MAR78	17	0	0	
602	PF	MF WORK ORDER SYSTEM	METALL FACT.	39	25JUL77	28APR78	21NOV77	22SEP78	17	0	17	
703	PF	TF PREVENTIVE MAINTENANCE	TRANSP.FACTORY	69	25JUL77	22DEC78			0	0	0	
705	PF	TF PRODUCTION PLANNING	TRANSP.FACTORY	52	25JUL77	25AUG78	21NOV77	22DEC78	17	0	17	
706	PL	TF MATERIAL ADMINISTRATION	TRANSP.FACTORY	52	25JUL77	25AUG78	21NOV77	22DEC78	17	0	17	
708	TD	TF CODING SYSTE	TRANSP.FACTORY	52	25JUL77	25AUG78	21NOV77	22DEC78	17	0	17	
604	PF	MF MAINTENANCE PLANNING	METALL FACT.	34	22AUG77	21APR78	2JAN78	22SEP78	18	0	0	

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PROJECT NO. 1
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THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79

TIME UNIT: WEEK

ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
609	TD	WF	INFORMATION BASE AND FILES	METALL FACT.	34	22AUG77	21APR78	2JAN78	22SEP78	18	0	18	
801	CG	SF	ORGANIZATION	SHEET PROC.FACT	17	19SEP77	20JAN78	23JAN78	26MAY78	17	0	0	
803	PF	SF	PREVENTIVE MAINTENANCE	SHEET PROC.FACT	69	19SEP77	16FEB79			0	0	0	
805	PF	SF	PRODUCTION PLANNING	SHEET PROC.FACT	52	19SEP77	20OCT78	23JAN78	16FEB79	17	0	17	
806	PL	SF	MATERIAL ADMINISTRATION	SHEET PROC.FACT	52	19SEP77	20OCT78	23JAN78	16FEB79	17	0	17	
808	TD	SF	CODING SYSTEM	SHEET PROC.FACT	52	19SEP77	20OCT78	23JAN78	16FEB79	17	0	17	
607	PL	WF	COST CONTROL	METALL FACT.	26	17OCT77	21APR78	27FEB78	22SEP78	18	0	18	
702	PF	TF	WORK ORDER SYSTEM	TRANSP.FACTORY	30	24OCT77	25AUG78	27FEB78	22DEC78	17	0	17	
901	CG	CF	ORGANIZATION	COOKING FACTORY	17	14NOV77	17MAR78	20MAR78	11AUG78	17	0	0	
903	PF	CF	PREVENTIVE MAINTENANCE	COOKING FACTORY	69	14NOV77	13APR79			0	0	0	
905	PF	CF	PRODUCTION PLANNING	COOKING FACTORY	52	14NOV77	15DEC78	20MAR78	13APR79	17	0	17	
906	PL	CF	MATERIAL ADMINISTRATION	COOKING FACTORY	52	14NOV77	15DEC78	20MAR78	13APR79	17	0	17	
908	TD	CF	CODING SYSTEM	COOKING FACTORY	52	14NOV77	15DEC78	20MAR78	13APR79	17	0	17	
704	PF	TF	MAINTENANCE PLANNING	TRANSP.FACTORY	34	21NOV77	18AUG78	3APR78	22DEC78	18	0	0	
709	TD	TF	INFORMATION BASE AND FILES	TRANSP.FACTORY	34	21NOV77	18AUG78	3APR78	22DEC78	18	0	18	
802	PF	SF	WORK ORDER SYSTEM	SHEET PROC.FACT	39	19DEC77	20OCT78	24APR78	16FEB79	17	0	17	
401	CG	MU	ORGANIZATION	MAINT UNIT FACT	8	16JAN78	10MAR78			0	0	0	
1001	CG	CF	ORGANIZATION	COOKING FACTORY	17	16JAN78	19MAY78	22MAY78	6OCT78	17	0	0	
1003	PF	EF	PREVENTIVE MAINTENANCE	ENERGY FACTORY	69	16JAN78	8JUN79			0	0	0	
1005	PF	EF	PRODUCTION PLANNING	ENERGY FACTORY	52	16JAN78	9FEB79	22MAY78	8JUN79	17	0	17	
1006	PL	EF	MATERIAL ADMINISTRATION	ENERGY FACTORY	52	16JAN78	9FEB79	22MAY78	8JUN79	17	0	17	
1008	TD	EF	CODING SYSTEM	ENERGY FACTORY	52	16JAN78	9FEB79	22MAY78	8JUN79	17	0	17	
707	PL	TF	COST CONTROL	TRANSP.FACTORY	26	23JAN78	18AUG78	5JUN78	22DEC78	18	0	18	
804	PF	SF	MAINTENANCE PLANNING	SHEET PROC.FACT	34	23JAN78	13OCT78	5JUN78	16FEB79	18	0	0	
809	TD	SF	INFORMATION BASE AND FILES	SHEET PROC.FACT	34	23JAN78	13OCT78	5JUN78	16FEB79	18	0	18	
902	PF	CF	WORK ORDER SYSTEM	COOKING FACTORY	39	20FEB78	15DEC78	17JUL78	13APR79	17	0	17	
1101	CG	BF	ORGANIZATION	BUDAPEST ROLMI	17	13MAR78	4AUG78	7AUG78	1DEC78	17	0	0	
402	PF	MU	WORK ORDER SYSTEM	MAINT UNIT FACT	34	13MAR78	1DEC78			0	0	0	
403	PF	MU	PREVENTIVE MAINTENANCE	MAINT UNIT FACT	34	13MAR78	1DEC78			0	0	0	
404	PF	MU	MAINTENANCE PLANNING	MAINT UNIT FACT	34	13MAR78	1DEC78			0	0	0	
406	PL	MU	MATERIAL ADMINISTRATION	MAINT UNIT FACT	34	13MAR78	1DEC78			0	0	0	
408	TD	MU	CODING SYSTEM	MAINT UNIT FACT	34	13MAR78	1DEC78			0	0	0	
1103	PF	BF	PREVENTIVE MAINTENANCE	BUDAPEST ROLMI	69	13MAR78	3AUG79			0	0	0	
1105	PF	BF	PRODUCTION PLANNING	BUDAPEST ROLMI	52	13MAR78	6APR79	7AUG78	3AUG79	17	0	17	
1106	PL	BF	MATERIAL ADMINISTRATION	BUDAPEST ROLMI	52	13MAR78	6APR79	7AUG78	3AUG79	17	0	17	
1108	TD	BF	CODING SYSTEM	BUDAPEST ROLMI	52	13MAR78	6APR79	7AUG78	3AUG79	17	0	17	
807	PL	SF	COST CONTROL	SHEET PROC.FACT	26	20MAR78	13OCT78	21AUG78	16FEB79	18	0	18	
904	PF	CF	MAINTENANCE PLANNING	COOKING FACTORY	34	20MAR78	8DEC78	21AUG78	13APR79	18	0	0	
909	TD	CF	INFORMATION BASE AND FILES	COOKING FACTORY	34	20MAR78	8DEC78	21AUG78	13APR79	18	0	18	
1002	PF	EF	WORK ORDER SYSTEM	ENERGY FACTORY	39	17APR78	9FEB79	11SEP78	8JUN79	17	0	17	
407	PL	MU	COST CONTROL	MAINT UNIT FACT	26	15MAY78	1DEC78			0	0	0	
907	PL	CF	COST CONTROL	COOKING FACTORY	26	22MAY78	8DEC78	16OCT78	13APR79	18	0	18	
1004	PF	EF	MAINTENANCE PLANNING	ENERGY FACTORY	34	22MAY78	2FEB79	16OCT78	8JUN79	18	0	0	
1009	TD	EF	INFORMATION BASE AND FILES	ENERGY FACTORY	34	22MAY78	2FEB79	16OCT78	8JUN79	18	0	18	
409	TD	MU	INFORMATION BASE AND FILES	MAINT UNIT FACT	21	12JUN78	24NOV78	19JUN78	1DEC78	1	0	1	

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PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79

TIME UNIT: WEEK

ACTIVITY IDENTIFICATION		ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
1102	PF	BF WORK ORDER SYSTEM	BUDAPEST ROLNI	39	19JUN78	6APR79	6NOV78	3AUG79	17	0	17	
1007	PL	EF COST CONTROL	ENERGY FACTORY	26	7AUG78	2FEB79	11DEC78	8JUN79	18	0	18	
1104	PF	BF MAINTENANCE PLANNING	BUDAPEST ROLNI	34	7AUG78	30MAR79	11DEC78	3AUG79	18	0	0	
1109	TD	BF INFORMATION BASE AND FILES	BUDAPEST ROLNI	34	7AUG78	30MAR79	11DEC78	3AUG79	18	0	18	
1107	PL	BF COST CONTROL	BUDAPEST ROLNI	26	2OCT78	30MAR79	5FEB79	3AUG79	18	0	18	

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• • • TOTAL RESOURCES IN HISTOGRAM FORM • • •

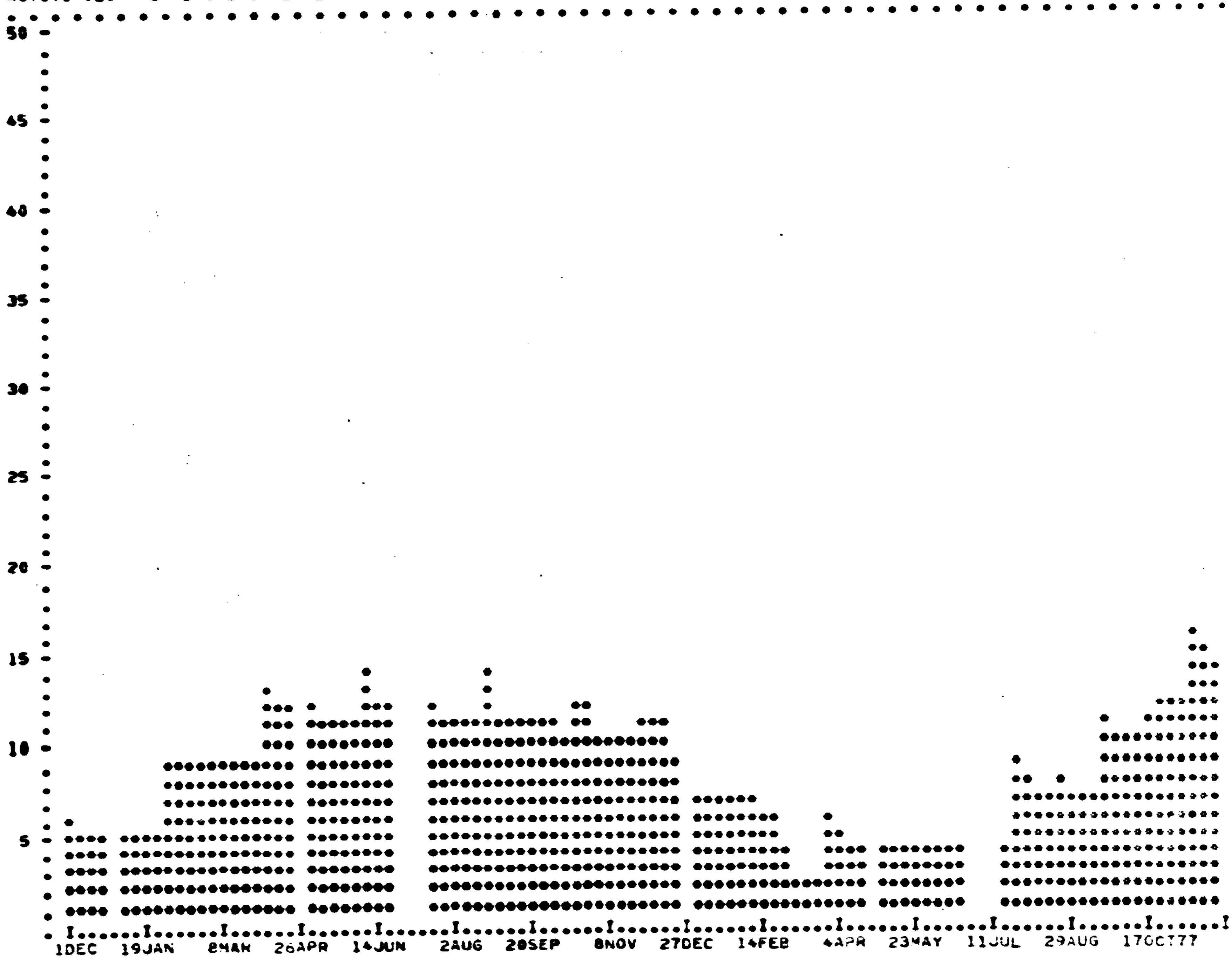
COSTCATEGORIES: ACTIVITYCOST • OVERHEADCOST • RESOURCECOST

PROJECT NO. 1
DANUBE IRON • STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

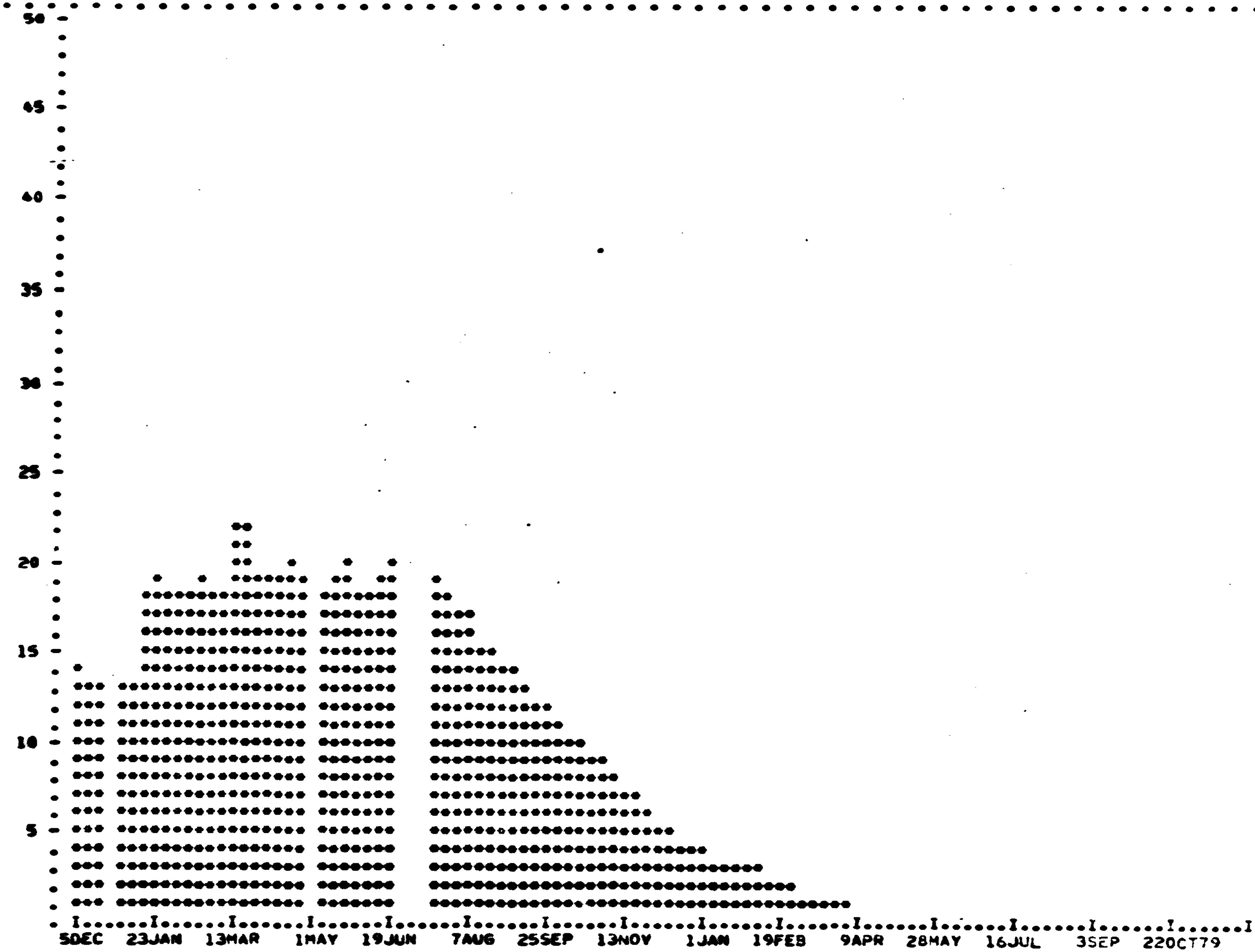
PAGE 1
C.U: 1W.WEEK

OUTPUT START: 1DEC75
OUTPUT FINISH: 3AUG79

T.U. INPUT: WEEK
T.U. OUTPUT: WEEK



OPTIMA ... TOTAL RESOURCES IN HISTOGRAM FORM PAGE 2
NORWEGIAN COSTCATEGORIES: ACTIVITYCOST . OVERHEADCOST . RESOURCECOST C.U: 1M.WEEK
COMPUTING PROJECT NO. 1
CENTER DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN OUTPUT START: 1DEC75 T.U. INPUT: WEEK
03 DEC 75 THE ACTIVITIES ARE PLACED IN EARLIEST POSITION OUTPUT FINISH: 3AUG79 T.U. OUTPUT: WEEK



OPTIMA
NORWEGIAN
COMPUTING CENTER
03 DEC 75

• • • ACCUMULATED RESOURCES IN TABLE FORM • • •

COSTCATEGORIES: ACTIVITYCOST , OVERHEADCOST , RESOURCECOST

PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

OUTPUT START: 1DEC75
OUTPUT FINISH: 3AUG79

PAGE 1
C.U: 1M.WEEK
T.U. INPUT: WEEK
T.U. OUTPUT: WEEK

									ACCUM. LOAD
1DEC75	6	5	5	5	******	5	5	.	31.
19JAN76	5	5	[illegible]	[illegible]	9	9	9	.	86.
[illegible]	9	9	[illegible]	[illegible]	13	12	12	.	159.
26APR76	******	12	11	11	11	11	14	.	229.
14JUN76	12	12	******	******	******	12	11	.	276.
2AUG76	11	11	11	10	11	11	11	.	356.
20SEP76	11	11	11	10	12	12	10	.	433.
[illegible]	10	10	10	11	11	11	9	.	535.
27DEC76	******	7	7	7	7	7	7	.	547.
14FEB77	6	[illegible]	[illegible]	8	8	8	6	.	575.
[illegible]	5	[illegible]	[illegible]	******	[illegible]	4	4	.	608.
23MAY77	4	[illegible]	4	[illegible]	4	******	******	.	628.
11JUL77	******	[illegible]	[illegible]	[illegible]	7	7	8	.	663.
29AUG77	7	7	7	11	10	10	10	.	725.
17OCT77	11	12	12	12	16	15	14	.	817.
5DEC77	16	13	13	******	13	13	10	.	901.
23JAN78	10	16	16	18	19	16	18	.	1029.
13MAR78	22	22	19	19	19	20	19	.	1169.
1MAY78	******	16	18	20	18	18	19	.	1281.
19JUN78	20	******	******	******	20	18	17	.	1355.
7AUG78	17	18	18	16	14	13	12	.	1455.
25SEP78	12	11	10	10	[illegible]	[illegible]	8	.	1524.
13NOV78	7	7	6	8	8	6	4	.	1562.
1JAN79	4	3	3	3	3	3	2	.	1583.

... ACCUMULATED RESOURCES IN TABLE FORM ...

PAGE 2

[illegible] ACTIVITY [illegible] . [illegible]

C.U. [illegible] WEEK

COMPUTING PROJECT NO. 1

[illegible] : [illegible] PLAN

[illegible] THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

OUTPUT START: [illegible]

OUTPUT FINISH: [illegible]

T.U. INPUT: WEEK

T.U. OUTPUT: WEEK

									ACCUM. LOAD
[illegible]	2	2	1	1	1	1	1	.	1592.
[illegible]	.	.	.	[illegible]	[illegible]	[illegible]	[illegible]	.	1592.

OPTIMA
NORWEGIAN
COMPUTING
CENTER
08 DEC 75

*** S T R U C T U R E ***

PAGE 1

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO INTERNAL REPRESENTATION

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3MAY78

TIME UNIT: WEEK

P R E D E C E S S O R S				ACTIVITY(DURATION)		S U C C E S S O R S		
		A10	--	1001(0)	--	1000	1004	ST(13)1002
						810		
		ST(13)1001	--	1002(10)	--	810		
		A10	--	1003(9)	--	810		
		1001	--	1004(10)	--	ST(0)1007	810	
		A10	--	1005(9)	--	810		
		A10	--	1006(9)	--	810		
		ST(0)1004	--	1007(11)	--	810		
		A10	--	1008(9)	--	810		
		1001	--	1009(10)	--	810		
		A11	--	1101(10)	--	1100	1104	ST(13)1102
						811		
		ST(13)1101	--	1102(11)	--	811		
		A11	--	1103(10)	--	811		
		1101	--	1104(11)	--	ST(0)1107	811	
		A11	--	1105(10)	--	811		
		A11	--	1106(10)	--	811		
		ST(0)1104	--	1107(12)	--	811		
		A11	--	1108(10)	--	811		
		1101	--	1109(11)	--	811		
			--	A01(0)	--			
		A01	--	A02(1)	--	201		
		A02	--	A03(2)	--	301		
		A03	--	A04(0)	--	401		
			--	A05(0)	--	508	506	505
						503	501	
		A04	--	A06(4)	--	608	606	605
						603	601	
		A05	--	A07(5)	--	708	706	705
						703	701	
		A06	--	A08(6)	--	808	806	805
						803	801	
		A07	--	A09(7)	--	908	906	905
						903	901	
		A08	--	A10(8)	--	1008	1006	1005
						1003	1001	
		A09	--	A11(9)	--	1108	1106	1105
						1103	1101	
106	105	104	--	B01(2)	--	201		
109	108	107						
		110						
205	204	201	--	B02(5)	--	202		
208	207	206						
	210	209						

CONTINUES ./.

*** STRUCTURE ***

PAGE 2

OPTIMA
NORWEGIAN
COMPUTING
CENTER
03 DEC 75

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO INTERNAL REPRESENTATION

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79

TIME UNIT: WEEK

PREDECESSORS				ACTIVITY(RANK)		SUCCESSORS		
305	303	301	**	B03(7)	**	Z03		
308	307	306						
	310	309						
403	402	401	**	B04(13)	**	Z04		
407	406	404						
	409	408	**	B05(4)	**	Z05		
503	502	501						
506	505	504						
509	508	507	**	B06(8)	**	Z06		
603	602	601						
606	605	604						
609	608	607	**	B07(9)	**	Z07		
703	702	701						
706	705	704						
709	708	707	**	B08(10)	**	Z08		
803	802	801						
806	805	804						
809	808	807	**	B09(11)	**	Z09		
903	902	901						
906	905	904						
909	908	907	**	B10(12)	**	Z10		
1003	1002	1001						
1006	1005	1004						
1009	1008	1007	**	B11(13)	**	Z11		
1103	1102	1101						
1106	1105	1104						
1109	1108	1107						
			**	X01(0)	**	X02	A02	
		X01	**	X02(1)	**	X03	A03	
		X02	**	X03(2)	**	X04		
		X03	**	X04(3)	**	X05	A06	
		A04	**	X05(4)	**	X06	A07	
		A05	**	X06(5)	**	X07	A08	
		X06	**	X07(6)	**	A09	X08	A04
		X07	**	X08(7)	**	X09	A10	
		X08	**	X09(8)	**	A11		
		B01	**	Z01(3)	**			
		B02	**	Z02(6)	**			
		B03	**	Z03(8)	**			
		B04	**	Z04(14)	**			
		B05	**	Z05(5)	**			
		B06	**	Z06(9)	**			
		B07	**	Z07(10)	**			
		B08	**	Z08(11)	**			
		B09	**	Z09(12)	**			
		B10	**	Z10(13)	**			

CONTINUES ./.

NORWEGIAN
COMPUTING CENTER
03 DEC 75

PROJECT NO. 1
DANUBE IRON • STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO INTERNAL REPRESENTATION

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79
TIME UNIT: WEEK

PREDECESSORS		ACTIVITY(RANK)	SUCCESSORS		
	B11	211(14)			
		101(0)	ST(8)107	ST(8)106	ST(8)105
			ST(8)104		
	ST(8)101	104(1)	B01		
	ST(8)101	105(1)	B01		
	ST(8)101	106(1)	B01		
	ST(8)101	107(1)	B01		
		108(0)	109	B01	
	108	109(1)	B01		
		110(0)	B01		
	A02	201(2)	ST(8)301	ST(8)210	ST(8)208
			ST(8)207	ST(8)206	ST(8)205
			ST(8)204	B02	
	ST(8)201	204(3)	B02		
	ST(8)201	205(3)	B02		
	ST(8)201	206(3)	ST(8)209	B02	
	ST(8)201	207(3)	B02		
	ST(8)201	208(3)	B02		
	ST(8)206	209(4)	B02		
	ST(8)201	210(3)	B02		
ST(8)201	A03	301(3)	ST(8)310	ST(8)308	ST(8)306
			ST(8)305	ST(8)303	B03
	ST(8)301	303(4)	B03		
	ST(8)301	305(4)	B03		
	ST(8)301	306(4)	ST(8)307	B03	
	ST(8)306	307(5)	ST(8)309	B03	
	ST(8)301	308(4)	B03		
	ST(8)307	309(6)	B03		
	ST(8)301	310(4)	B03		
	A04	401(9)	408	406	404
			403	402	B04
	401	402(10)	B04		
	401	403(10)	B04		
	401	404(10)	B04		
	401	406(10)	ST(8)407	B04	
	ST(4)406	407(11)	ST(4)409	B04	
	401	408(10)	B04		
	ST(4)407	409(12)	B04		
	A05	501(1)	504	ST(8)502	B05
	ST(8)501	502(2)	B05		
	A05	503(1)	B05		
	501	504(2)	ST(4)509	ST(4)507	B05
	A05	505(1)	B05		
	A05	506(1)	B05		
	ST(4)504	507(3)	B05		
	A05	508(1)	B05		

CONTINUES ./.

OPTIMA
NORWEGIAN
COMPUTING CENTER
03 DEC 75

● ● ● S T R U C T U R E ● ● ●

PAGE 4

PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO INTERNAL REPRESENTATION

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79
TIME UNIT: WEEK

PREDECESSORS		ACTIVITY(RANK)		SUCCESSORS		
ST(4)504	**	509(3)	**	B05		
A06	**	601(5)	**	609	604	ST(13)602
				B06		
ST(13)601	**	602(6)	**	B06		
A06	**	603(5)	**	B06		
601	**	604(6)	**	ST(8)607	B06	
A06	**	605(5)	**	B06		
A06	**	606(5)	**	B06		
ST(8)604	**	607(7)	**	B06		
A06	**	608(5)	**	B06		
601	**	609(6)	**	B06		
A07	**	701(6)	**	709	704	ST(13)702
				B07		
ST(13)701	**	702(7)	**	B07		
A07	**	703(6)	**	B07		
701	**	704(7)	**	ST(8)707	B07	
A07	**	705(6)	**	B07		
A07	**	706(6)	**	B07		
ST(8)704	**	707(8)	**	B07		
A07	**	708(6)	**	B07		
701	**	709(7)	**	B07		
A08	**	801(7)	**	809	804	ST(13)802
				B08		
ST(13)801	**	802(8)	**	B08		
A08	**	803(7)	**	B08		
801	**	804(8)	**	ST(8)807	B08	
A08	**	805(7)	**	B08		
A08	**	806(7)	**	B08		
ST(8)804	**	807(9)	**	B08		
A08	**	808(7)	**	B08		
801	**	809(8)	**	B08		
A09	**	901(8)	**	909	904	ST(13)902
				B09		
ST(13)901	**	902(9)	**	B09		
A09	**	903(8)	**	B09		
901	**	904(9)	**	ST(8)907	B09	
A09	**	905(8)	**	B09		
A09	**	906(8)	**	B09		
ST(8)904	**	907(10)	**	B09		
A09	**	908(8)	**	B09		
901	**	909(9)	**	B09		

- TIME SCHEDULE SORTED ACCORDING TO AREA 1-11

- GANTT-CHART SORTED ACCORDING TO AREA 1-11

OPTIMA
NORWEGIAN
COMPUTING CENTER
03 DEC 75

••• TIME LISTING •••

PAGE 4
ALPHACODE: CO
TIME UNIT: WEEK

PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79

ACTIVITY IDENTIFICATION		ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
108	TD	CO CODING SYSTEM	CENTRAL ORGAN.	39	1DEC75	1OCT76			0	0	0	
110	KG	CO SPECIAL SYSTEMS AND TECHNIQUES	CENTRAL ORGAN.	65	1DEC75	8APR77	8MAR76	5AUG77	13	0	13	
101	CG	CO ORGANIZATION	CENTRAL ORGAN.	78	1DEC75	5AUG77	15MAR76	11NOV77	14	0	0	
105	PF	CO PRODUCTION PLANNING	CENTRAL ORGAN.	26	2FEB76	27AUG76	10JAN77	5AUG77	44	0	44	
104	PF	CO MAINTENANCE PLANNING	CENTRAL ORGAN.	43	2FEB76	24DEC76	6SEP76	5AUG77	27	0	27	
107	PL	CO COST CONTROL	CENTRAL ORGAN.	43	2FEB76	24DEC76	6SEP76	5AUG77	27	0	27	
106	PL	CO MATERIAL ADMINISTRATION	CENTRAL ORGAN.	56	2FEB76	1APR77	17MAY76	5AUG77	14	0	14	
109	TD	CO INFORMATION BASE AND FILES	CENTRAL ORGAN.	39	4OCT76	5AUG77			0	0	0	

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                                         • • •   G A N T T - D I A G R A M   • • •                             PAGE      5
 OPTIMA                                                                                                        ALPHACODE:      CO
NORWEGIAN
COMPUTING  PROJECT NO.  1                                                              PROJECT   START:  1DEC75
 CENTER    DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN                               PLANNED  FINISH:              T.U.  INPUT: WEEK
03 DEC 75  THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME                  COMPUTED FINISH:  3AUG79     T.U. OUTPUT: WEEK
• • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • •
  K : CRITICAL ACTIVITY           - : TOTAL(PRIMARY) FLOAT       D : DUMMY ACTIVITY       < : NEGATIVE    HORIZONTAL PART NO.   4
  A : ACTIVITY WITH FLOAT         * : FREE FLOAT                 F : SPECIFIED HOLIDAY      TOT. FLOAT    VERTICAL   PART NO.   1
• • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • •
  ACTIVITY              •
IDENTIFICATION          • 1DEC   19JAN   8MAR  26APR  14JUN   2AUG  20SEP   8NOV  27DEC  14FEB   4APR  23MAY  11JUL  29AUG  17OCT77
                        •
     108  TD  CO        • KKKKFKKKKKKKKKKKKKKKKKFKKKKKKKKFFFKKKKKKKKKKK
     110  KG  CO        • AAAAFAAAAAAAAAAAAAAAAAFAAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAAFAAAAAAAAAAAAAA**F**********FFF***
     101  CG  CO        • AAAAFAAAAAAAAAAAAAAAAAFAAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAAFAAAAAAAAAAAAAAAAFAAAAAAAAAAFFFAAA-------------
     105  PF  CO        •          AAAAAAAAAAAAAFAAAAAAAAFFFAAAAAA****************F****************F**********FFF***
     104  PF  CO        •          AAAAAAAAAAAAAFAAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAAF****************F**********FFF***
     107  PL  CO        •          AAAAAAAAAAAAAFAAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAAF****************F**********FFF***
     106  PL  CO        •          AAAAAAAAAAAAAFAAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAAFAAAAAAAAAAAAAA**F**********FFF***
     109  TD  CO        •                                              KKKKKKKKKKKFKKKKKKKKKKKKKKKKFKKKKKKKKKKFFFKKK
```

OPTIMA
NORWEGIAN
COMPUTING
CENTER
03 DEC 75

*** TIME LISTING ***

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79

PAGE 3
ALPHACODE: CM
TIME UNIT: WEEK

ACTIVITY IDENTIFICATION		ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
201	CG	CM ORGANIZATION	CENTR.MAINT.FAC	26	5APR76	29OCT76			0	0	0	
204	PF	CM MAINTENANCE PLANNING	CENTR.MAINT.FAC	26	7JUN76	24DEC76	20DEC76	22JUL77	25	0	17	
206	PL	CM MATERIAL ADMINISTRATION	CENTR.MAINT.FAC	26	7JUN76	24DEC76	30AUG76	4MAR77	9	0	0	
207	PL	CM COST CONTROL	CENTR.MAINT.FAC	26	7JUN76	24DEC76	20DEC76	22JUL77	25	0	17	
208	TD	CM CODING SYSTEM	CENTR.MAINT.FAC	26	7JUN76	24DEC76	20DEC76	22JUL77	25	0	17	
205	PF	CM PRODUCTION PLANNING	CENTR.MAINT.FAC	43	7JUN76	6MAY77	23AUG76	22JUL77	8	0	0	
210	KG	CM SPECIAL SYSTEMS AND TECHNIQUES	CENTR.MAINT.FAC	43	7JUN76	6MAY77	23AUG76	22JUL77	8	0	0	
209	TD	CM INFORMATION BASE AND FILES	CENTR.MAINT.FAC	34	23AUG76	22APR77	25OCT76	22JUL77	9	0	1	

Attachment 11.3

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                                  *** GANTT-DIAGRAM ***                                   PAGE      4
 OPTIMA                                                                                   ALPHACODE:      CM
NORWEGIAN                                                               PROJECT   START:   1DEC75
COMPUTING  PROJECT NO.  1                                               PLANNED   FINISH:            T.U.  INPUT: WEEK
 CENTER    DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN                COMPUTED FINISH:   3AUG79    T.U. OUTPUT: WEEK
03 DEC 75  THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  K : CRITICAL ACTIVITY          - : TOTAL(PRIMARY) FLOAT         D : DUMMY ACTIVITY       < : NEGATIVE    HORIZONTAL PART NO.  3
  A : ACTIVITY WITH FLOAT        * : FREE FLOAT                   F : SPECIFIED HOLIDAY      TOT. FLOAT    VERTICAL   PART NO.  1
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  ACTIVITY        .
IDENTIFICATION    . 1DEC   19JAN   8MAR  26APR  14JUN   2AUG  20SEP   8NOV  27DEC  14FEB   4APR  23MAY  11JUL  29AUG  17OCT77
                  .   .      .       .      .      .      .      .      .      .      .      .      .      .      .      .
     201  CG  CM  .                  .   KKAFKKKKKKKKKFFFKKKKKKKKKKKKKKK
     204  PF  CM  .                  .          AAAFFFAAAAAAAAAAAAAAAAAAAAAAAF***************F--------FFF-             .
     206  PL  CM  .                  .          AAAFFFAAAAAAAAAAAAAAAAAAAAAAAF---------                                 .
     207  PL  CM  .                  .          AAAFFFAAAAAAAAAAAAAAAAAAAAAAAF***************F--------FFF-             .
     208  TD  CM  .                  .          AAAFFFAAAAAAAAAAAAAAAAAAAAAAAF***************F--------FFF-             .
     205  PF  CM  .                  .          AAAFFFAAAAAAAAAAAAAAAAAAAAAAAFAAAAAAAAAAAAAAAAFA--------FFF-             .
     210  KG  CM  .                  .          AAAFFFAAAAAAAAAAAAAAAAAAAAAAAFAAAAAAAAAAAAAAAAFA--------FFF-             .
     209  TD  CM  .                  .                   AAAAAAAAAAAAAAAAAAFAAAAAAAAAAAAAAAAF*--------FFF-             .
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OPTIMA
NORWEGIAN
COMPUTING
CENTER
03 DEC 75

••• T I M E   L I S T I N G •••

PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79

PAGE 5
ALPHACODE: CS
TIME UNIT: WEEK

ACTIVITY IDENTIFICATION		ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
301	CG	CS ORGANIZATION	CENT.SPAREP.PR.	26	7JUN76	24DEC76			0	0	0	
303	PF	CS PREVENTIVE MAINTENANCE	CENT.SPAREP.PR.	34	23AUG76	22APR77	25OCT76	22JUL77	9	0	9	
306	PL	CS MATERIAL ADMINISTRATION	CENT.SPAREP.PR.	34	23AUG76	22APR77	25OCT76	22JUL77	9	0	0	
310	KG	CS SPECIAL SYSTEMS AND TECHNIQUES	CENT.SPAREP.PR.	34	23AUG76	22APR77	25OCT76	22JUL77	9	0	9	
305	PF	CS PRODUCTION PLANNING	CENT.SPAREP.PR.	43	23AUG76	22JUL77			0	0	0	
308	TD	CS CODING SYSTEM	CENT.SPAREP.PR.	43	23AUG76	22JUL77			0	0	0	
307	PL	CS COST CONTROL	CENT.SPAREP.PR.	26	18OCT76	22APR77	20DEC76	22JUL77	9	0	0	
309	TD	CS INFORMATION BASE AND FILES	CENT.SPAREP.PR.	17	13DEC76	15APR77	28FEB77	22JUL77	10	0	10	

```
                                        ••• GANTT-DIAGRAM •••                                                    PAGE      6
                                                                                                                 ALPHACODE:        CS
OPTIMA
NORWEGIAN                                                                              PROJECT   START:   1DEC75
COMPUTING   PROJECT NO.  1                                                             PLANNED   FINISH:            T.U.   INPUT: WEEK
 CENTER     DANUBE IRON • STEEL WORKS IMPLEMENTATION PLAN                              COMPUTED  FINISH:  3AUG79    T.U.  OUTPUT: WEEK
03 DEC 75   THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME
• • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • •
  K : CRITICAL ACTIVITY              - : TOTAL(PRIMARY) FLOAT        D : DUMMY ACTIVITY       < : NEGATIVE    HORIZONTAL  PART NO.  5
  A : ACTIVITY WITH FLOAT            • : FREE FLOAT                  F : SPECIFIED HOLIDAY      TOT. FLOAT    VERTICAL    PART NO.  1
• • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • •
   ACTIVITY          •                                                                                          
IDENTIFICATION       • 1DEC  19JAN  8MAR  26APR  14JUN  2AUG  20SEP  8NOV  27DEC  14FEB  4APR  23MAY  11JUL  29AUG  17OCT77
                     •   •     •      •     •      •      •     •      •     •      •      •     •      •      •      •
     301  CG   CS    •              •          KKKFFFKKKKKKKKKKKKKKKKKKKKKKKKK.                                      •
     303  PF   CS    •              •                    AAAAAAAAAAAAAAAAAAFAAAAAAAAAAAAAAAAF••••••••FFF•            •
     306  PL   CS    •              •          •         AAAAAAAAAAAAAAAAAAFAAAAAAAAAAAAAAAAF--------FFF-            •
     310  KG   CS    •              •          •         AAAAAAAAAAAAAAAAAAFAAAAAAAAAAAAAAAAF••••••••FFF•            •
     305  PF   CS    •              •          •         KKKKKKKKKKK<KKKKKKKFKKKKKKKKKKKKKKKKFKKKKKKKKFFFK           •
     308  TD   CS    •              •          •         KKKKKKKKKKKKKKKKKKKFKKKKKKKKKKKKKKKKFKKKKKKKKFFFK           •
     307  PL   CS    •              •          •          •        AAAAAAAAAFAAAAAAAAAAAAAAAAAF--------FFF-       •
     309  TD   CS    •              •          •          •              AAFAAAAAAAAAAAAAAA•F••••••••FFF•         •
```

OPTIMA
NORWEGIAN
COMPUTING
CENTER
03 DEC 75

••• TIME LISTING •••

PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79

PAGE 8
ALPHACODE: MU
TIME UNIT: WEEK

ACTIVITY IDENTIFICATION		ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
401	CG	MU ORGANIZATION	MAINT UNIT FACT	8	16JAN78	10MAR78			0	0	0	
402	PF	MU WORK ORDER SYSTEM	MAINT UNIT FACT	34	13MAR78	1DEC78			0	0	0	
403	PF	MU PREVENTIVE MAINTENANCE	MAINT UNIT FACT	34	13MAR78	1DEC78			0	0	0	
404	PF	MU MAINTENANCE PLANNING	MAINT UNIT FACT	34	13MAR78	1DEC78			0	0	0	
406	PL	MU MATERIAL ADMINISTRATION	MAINT UNIT FACT	34	13MAR78	1DEC78			0	0	0	
408	TD	MU CODING SYSTEM	MAINT UNIT FACT	34	13MAR78	1DEC78			0	0	0	
407	PL	MU COST CONTROL	MAINT UNIT FACT	26	15MAY78	1DEC78			0	0	0	
409	TD	MU INFORMATION BASE AND FILES	MAINT UNIT FACT	21	12JUN78	24NOV78	19JUN78	1DEC78	1	0	1	

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                                        *** GANTT-DIAGRAM ***                                   PAGE   10
OPTIMA                                                                                          ALPHACODE:      MW
NORWEGIAN                                                                  PROJECT   START:    1DEC75
COMPUTING   PROJECT NO. 1                                                  PLANNED   FINISH:             T.U.  INPUT: WEEK
CENTER      DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN                  COMPUTED  FINISH:   3AUG79    T.U. OUTPUT: WEEK
.. DEC 75   THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  X : CRITICAL ACTIVITY           - : TOTAL (PRIMARY) FLOAT     D : DUMMY ACTIVITY      < : NEGATIVE    HORIZONTAL PART NO.  #
  A : ACTIVITY WITH FLOAT         F : FREE FLOAT                / : SPECIFIED HOLIDAY     TOT. FLOAT    VERTICAL   PART NO.  2
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  ACTIVITY      . 1DEC  20JAN  13MAR  1MAY  19JUN  7AUG  25SEP  13NOV  1JAN  19FEB  9APR  28MAY  16JUL  3SEP  22OCT76
IDENTIFICATION  .   .      .      .     .      .     .      .      .     .      .     .      .      .     .      .
                .                                                           .            .            .                .
      401 CG MW .        ==========.                                        .            .            .                .
      402 PF MW .                  XXXXXXXX/XXXXXXXXFFXXXXXXXXXXXXXXXXXXXXXX .            .            .                .
      403 PF MW .                  XXXXXXXX/XXXXXXXXFFXXXXXXXXXXXXXXXXXXXXXX .            .            .                .
      404 PF MW .                  XXXXXXXX/XXXXXXXXFFXXXXXXXXXXXXXXXXXXXXXX .            .            .                .
      405 PL MW .                  XXXXXXXX/XXXXXXXXFFXXXXXXXXXXXXXXXXXXXXXX .            .            .                .
      406 TD MW .                  XXXXXXXX/XXXXXXXXFFXXXXXXXXXXXXXXXXXXXXXX .            .            .                .
      407 PL MW .                  .            AAAAAFFAAAAAAAAAAAAAAAAAAAAA .            .            .                .
      408 TD MW .                  .              AAFFAAAAAAAAAAAAAAAAAAAAAA .            .            .                .
```

*** TIME LISTING ***

[illegible]

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                                   *** GANTT-DIAGRAM ***                                 PAGE    11
OPTIMA                                                                                   ALPHACODE:      RM
NORWEGIAN
COMPUTING  PROJECT NO.  1                                        PROJECT   START:  1DEC75
CENTER     DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN         PLANNED  FINISH:            T.U.  INPUT: WEEK
03 DEC 75  THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME   COMPUTED FINISH:  3AUG79  T.U. OUTPUT: WEEK
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 K : CRITICAL ACTIVITY       - : TOTAL (PRIMARY) FLOAT    D : DUMMY ACTIVITY      < : NEGATIVE   HORIZONTAL PART NO.  9
 A : ACTIVITY WITH FLOAT     * : FREE FLOAT               F : SPECIFIED HOLIDAY     TOT. FLOAT   VERTICAL   PART NO.  1
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   ACTIVITY           .
IDENTIFICATION        . 1DEC  19JAN  8MAR  26APR  14JUN  2AUG  20SEP  8NOV  27DEC  14FEB  4APR  23MAY  11JUL  29AUG  17OCT77
                        .     .      .     .      .      .     .      .     .      .      .     .      .      .      .
                      .
     561  CO  RM      . AAAAFAAAAAAAAA--------F-------.
     505  PF  RM      . AAAAFAAAAAAAAAAAAAAAAAFAAAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAAAAAFA***************F******   .    .
     506  PL  RM      . AAAAFAAAAAAAAAAAAAAAAAFAAAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAAAAAFA***************F******   .    .
     508  TD  RM      . AAAAFAAAAAAAAAAAAAAAAAFAAAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAAAAAFA***************F******   .    .
     503  PF  RM      . KKKKFKKKKKKKKKKKKKKKKKFKKKKKKKKKFFFKKKKKKKKKKKKKKKKKKKKKKKKKFKKKKKKKKKKKKKKKKFKKKKKK   .    .
     502  PF  RM      .           AAAAAAAAAAAAFAAAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAAAAAF****************F******   .    .
     504  PF  RM      .               AAAAAAAFAAAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAAAAAAFAAAAAAAAA-------F------   .    .
     507  PL  RM      .                   AAAFAAAAAAAAAFFFAAAAAAAAAAAAAAA***********FAAAAAAAAAAAAAAAAF******   .    .
     509  TD  RM      .                   AAAFAAAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAAAAAFAAAAAAAAA*******F******   .    .
```

OPTIMA
NORWEGIAN
COMPUTING
CENTER
03 DEC 75

••• TIME LISTING •••

PAGE 7
ALPHACODE: MF

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79

TIME UNIT: WEEK

ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION			ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
601	CS	MF	ORGANIZATION	METALL	FACT.	17	28MAR77	19AUG77	22AUG77	16DEC77	17	0	0	
605	PF	MF	PRODUCTION PLANNING	METALL	FACT.	52	28MAR77	28APR78	22AUG77	22SEP78	17	0	17	
606	PL	MF	MATERIAL ADMINISTRATION	METALL	FACT.	52	28MAR77	28APR78	22AUG77	22SEP78	17	0	17	
608	TD	MF	CODING SYSTEM	METALL	FACT.	52	28MAR77	28APR78	22AUG77	22SEP78	17	0	17	
603	PF	MF	PREVENTIVE MAINTENANCE	METALL	FACT.	69	28MAR77	22SEP78			0	0	0	
602	PF	MF	WORK ORDER SYSTEM	METALL	FACT.	39	25JUL77	28APR78	21NOV77	22SEP78	17	0	17	
604	PF	MF	MAINTENANCE PLANNING	METALL	FACT.	34	22AUG77	21APR78	2JAN78	22SEP78	18	0	0	
609	TD	MF	INFORMATION BASE AND FILES	METALL	FACT.	34	22AUG77	21APR78	2JAN78	22SEP78	18	0	18	
607	PL	MF	COST CONTROL	METALL	FACT.	26	17OCT77	21APR78	27FEB78	22SEP78	18	0	18	

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OPTIMA                                  *** G A N T T - D I A G R A M ***                                PAGE      8
NORWEGIAN                                                                                                ALPHACODE:        MF
COMPUTING  PROJECT NO.  1                                                   PROJECT   START:   1DEC75
 CENTER    DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN                    PLANNED   FINISH:            T.U.  INPUT: WEEK
03 DEC 75  THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME       COMPUTED FINISH:   3AUG79   T.U. OUTPUT: WEEK
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 K : CRITICAL ACTIVITY              - : TOTAL(PRIMARY) FLOAT      D : DUMMY ACTIVITY      < : NEGATIVE   HORIZONTAL PART NO.  7
 A : ACTIVITY WITH FLOAT            * : FREE FLOAT                F : SPECIFIED HOLIDAY     TOT. FLOAT   VERTICAL   PART NO.  1
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  ACTIVITY
IDENTIFICATION  . 1DEC  19JAN  8MAR  26APR  14JUN  2AUG  20SEP  8NOV  27DEC  14FEB  4APR  23MAY  11JUL  29AUG  17OCT77
                .  .     .      .     .      .      .     .      .     .      .      .     .      .      .      .
     601  CG  MF  .                                                                  AAAAFAAAAAAAAFFFAAAAA--------------
     605  PF  MF  .           .          .          .          .                     AAAAFAAAAAAAAFFFAAAAAAAAAAAAAAAAAAAA
     606  PL  MF  .           .          .          .          .                     AAAAFAAAAAAAAFFFAAAAAAAAAAAAAAAAAAAA
     608  TD  MF  .           .          .          .          .                     AAAAFAAAAAAAAFFFAAAAAAAAAAAAAAAAAAAA
     603  PF  MF  .           .          .          .          .                     AAAAFAAAAAAAAFFFAAAAAAAAAAAAAAAAAAAA
     602  PF  MF  .           .          .          .          .                     KKKKFKKKKKKKKFFFKKKKKKKKKKKKKKKKKKKK
     604  PF  MF  .           .          .          .          .                     .          . AAAAAAAAAAAAAAAAAAA
     609  TD  MF  .           .          .          .          .                     .          .    AAAAAAAAAAAAAAA
     607  PL  MF  .           .          .          .          .                     .          .    AAAAAAAAAAAAAAA
                                                                                     .          .          AAAAAAA
```

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                                   ••• GANTT-DIAGRAM •••                                      PAGE     9
OPTIMA                                                                                         ALPHACODE:      MF
NORWEGIAN                                                                 PROJECT   START:   1DEC75
COMPUTING   PROJECT NO.  1                                               PLANNED   FINISH:            T.U.  INPUT: WEEK
 CENTER     DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN                COMPUTED  FINISH:  3AUG79   T.U.  OUTPUT: WEEK
03 DEC 75   THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME
• • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • •
  K : CRITICAL ACTIVITY          - : TOTAL(PRIMARY) FLOAT     D : DUMMY ACTIVITY      < : NEGATIVE    HORIZONTAL  PART NO.  7
  A : ACTIVITY WITH FLOAT        • : FREE FLOAT               F : SPECIFIED HOLIDAY   TOT. FLOAT     VERTICAL    PART NO.  2
• • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • •
   ACTIVITY
IDENTIFICATION   • 3DEC  23JAN  13MAR  1MAY  19JUN  7AUG  25SEP  13NOV  1JAN  19FEB  9APR  28MAY  16JUL  3SEP  22OCT79

     601  CS  MF  •  --
     605  MF  MF  •  AAAFAAAAAAAAAAAAAAAAAF•••••••FFF••••••••••.
     606  PL  MF  •  AAAFAAAAAAAAAAAAAAAAAF•••••••FFF••••••••••.
     608  TD  MF  •  KKKFKKKKKKKKKKKKKKKKKF•••••••KKFFFKKKKKKKKKK.
     603  PF  MF  •  AAAFAAAAAAAAAAAA-AAAAF•••••••FFF••••••••••.
     602  PF  MF  •  AAAFAAAAAAAAAAAAAAAA-F-------FFF----------.
     604  PF  MF  •  AAAFAAAAAAAAAAAAAAAA-F•••••••FFF••••••••••.
     609  TD  MF  •  AAAFAAAAAAAAAAAAAAAAAF•••••••FFF••••••••••.
     607  PL  MF  •
```

OPTIMA
NORWEGIAN
COMPUTING
CENTER
13 DEC 78

*** TIME LISTING ***

PAGE 11
ALPHACODE: TF

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79

TIME UNIT: WEEK

ACTIVITY IDENTIFICATION		ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
	OG	TF ORGANIZATION	TRANSP.FACTORY	17	25JUL77	18NOV77	21NOV77	24MAR78	17	0	0	
705	PF	TF PRODUCTION PLANNING	TRANSP.FACTORY	52	25JUL77	25AUG78	21NOV77	22DEC78	17	0	17	
736	PL	TF MATERIAL ADMINISTRATION	TRANSP.FACTORY	52	25JUL77	25AUG78	21NOV77	22DEC78	17	0	17	
708	TD	TF CODING SYSTE	TRANSP.FACTORY	52	25JUL77	25AUG78	21NOV77	22DEC78	17	0	17	
703	PF	TF PREVENTIVE MAINTENANCE	TRANSP.FACTORY	69	25JUL77	22DEC78			0	0	0	
702	PF	TF WORK ORDER SYSTEM	TRANSP.FACTORY	39	24OCT77	25AUG78	27FEB78	22DEC78	17	0	17	
704	PF	TF MAINTENANCE PLANNING	TRANSP.FACTORY	34	21NOV77	18AUG78	3APR78	22DEC78	18	0	8	
709	TD	TF INFORMATION BASE AND FILES	TRANSP.FACTORY	34	21NOV77	18AUG78	3APR78	22DEC78	18	0	18	
707	PL	TF COST CONTROL	TRANSP.FACTORY	26	23JAN78	18AUG78	5JUN78	22DEC78	18	0	18	

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                                        ***  GANTT-DIAGRAM  ***                                  PAGE   14
OPTIMA                                                                                           ALPHACODE:     TF
NORWEGIAN                                                                PROJECT   START:  1DEC75
COMPUTING  PROJECT NO.  1                                                PLANNED   FINISH:          T.U.  INPUT: WEEK
 CENTER    DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN                 COMPUTED  FINISH:  3AUG79  T.U.  OUTPUT: WEEK
13 DEC 75  THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  K : CRITICAL ACTIVITY          - : TOTAL(PRIMARY) FLOAT     D : DUMMY ACTIVITY      < : NEGATIVE   HORIZONTAL PART NO.  11
  A : ACTIVITY WITH FLOAT        * : FREE FLOAT               F : SPECIFIED HOLIDAY     TOT. FLOAT   VERTICAL   PART NO.   1
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  ACTIVITY     . 1DEC  19JAN  8MAR  26APR  14JUN  2AUG  20SEP  8NOV  27DEC  14FEB  4APR  23MAY  11JUL  29AUG  17OCT77
IDENTIFICATION .   *     *     *     *      *      *     *      *     *      *     *     *      *      *      *
               .
    761  CS  TF .             .            .            .            .            .            . AAAAAAAAAAAAAAAAA--
    765  PF  TF .             .            .            .            .            .            . AAAAAAAAAAAAAAAAAAA
    736  PL  TF .             .            .            .            .            .            . AAAAAAAAAAAAAAAAAAA
    798  TD  TF .             .            .            .            .            .            . AAAAAAAAAAAAAAAAAAA
    793  PF  TF .             .            .            .            .            .            . KKKKKKKKKKKKKKKKKKK
    792  PF  TF .             .            .            .            .            .            .            .AAAAAA
    794  PF  TF .             .            .            .            .            .            .            .     AA
    789  TD  TF .             .            .            .            .            .            .            .     AA
    787  PL  TF .             .            .            .            .            .            .            .
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                                                                                    PAGE   15
                                  . . .   G A N T T - D I A G R A M   . . .          ALPHACODE:      TF
 OPTIMA
 NORWEGIAN                                                   PROJECT   START:   1DEC75   T.U.  INPUT: WEEK
 COMPUTING  PROJECT NO.  1                                   PLANNED   FINISH:           T.U.  OUTPUT: WEEK
  CENTER    DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN    COMPUTED FINISH:   3AUG79
 03 DEC 75  THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME
 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   K : CRITICAL ACTIVITY          - : TOTAL(PRIMARY) FLOAT      D : DUMMY ACTIVITY       < : NEGATIVE   HORIZONTAL PART NO.  11
   A : ACTIVITY WITH FLOAT        * : FREE FLOAT                F : SPECIFIED HOLIDAY        TOT. FLOAT VERTICAL   PART NO.   2
 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   ACTIVITY        . 8DEC   23JAN   13MAR   1MAY  19JUN   7AUG  25SEP  13NOV   1JAN  19FEB   9APR  20MAY  16JUL   3SEP  22OCT79
 IDENTIFICATION    .   .      .       .      .      .       .     .      .      .      .      .      .      .      .      .
       701  CS  TF  .  ---F-----------                                           .            .            .            .
       705  PF  TF  .  AAAFAAAAAAAAAAAAAAAAAFAAAAAAAFFFAAAAAA*******************   .            .            .            .
       706  PL  TF  .  AAAFAAAAAAAAAAAAAAAAAFAAAAAAAFFFAAAAAA*******************   .            .            .            .
       706  TD  TF  .  AAAFAAAAAAAAAAAAAAAAAFAAAAAAAFFFAAAAAA*******************   .            .            .            .
       703  PF  TF  .  KKKFKKKKKKKKKKKKKKKKKFKKKKKKKFFFKKKKKKKKKKKKKKKKKKKKKKKKK   .            .            .            .
       702  PF  TF  .  AAAFAAAAAAAAAAAAAAAAAFAAAAAAAFFFAAAAAA*******************   .            .            .            .
       704  PF  TF  .  AAAFAAAAAAAAAAAAAAAAAFAAAAAAAFFFAAAAA--------------------   .            .            .            .
       709  TD  TF  .  AAAFAAAAAAAAAAAAAAAAAFAAAAAAAFFFAAAAA*******************   .            .            .            .
       707  PL  TF  .          AAAAAAAAAAAAAAFAAAAAAAFFFAAAAA*******************   .            .            .            .
```

*** T I M E   L I S T I N G ***

PAGE 10
ALPHACODE: SF

OPTIMA
NORWEGIAN
COMPUTING CENTER
03 DEC 75

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79

TIME UNIT: WEEK

ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
801	CS	SF	ORGANIZATION	SHEET PROC.FACT	17	19SEP77	20JAN78	23JAN78	26MAY78	17	0	0	
805	PF	SF	PRODUCTION PLANNING	SHEET PROC.FACT	52	19SEP77	20OCT78	23JAN78	16FEB79	17	0	17	
806	PL	SF	MATERIAL ADMINISTRATION	SHEET PROC.FACT	52	19SEP77	20OCT78	23JAN78	16FEB79	17	0	17	
808	TD	SF	CODING SYSTEM	SHEET PROC.FACT	52	19SEP77	20OCT78	23JAN78	16FEB79	17	0	17	
803	PF	SF	PREVENTIVE MAINTENANCE	SHEET PROC.FACT	69	19SEP77	16FEB79			0	0	0	
802	PF	SF	WORK ORDER SYSTEM	SHEET PROC.FACT	39	19DEC77	20OCT78	24APR78	16FEB79	17	0	17	
804	PF	SF	MAINTENANCE PLANNING	SHEET PROC.FACT	34	23JAN78	13OCT78	5JUN78	16FEB79	18	0	0	
809	TD	SF	INFORMATION BASE AND FILES	SHEET PROC.FACT	34	23JAN78	13OCT78	5JUN78	16FEB79	18	0	18	
807	PL	SF	COST CONTROL	SHEET PROC.FACT	26	20MAR78	13OCT78	21AUG78	16FEB79	18	0	18	

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                                  *** G A N T T - D I A G R A M ***                                PAGE   12
 OPTIMA                                                                                            ALPHACODE:       SF
NORWEGIAN
COMPUTING  PROJECT NO.  1                                                  PROJECT   START:  1DEC75
 CENTER    DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN                   PLANNED   FINISH:            T.U.  INPUT: WEEK
03 DEC 75  THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME      COMPUTED FINISH:  3AUG79   T.U. OUTPUT: WEEK
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  K : CRITICAL ACTIVITY           - : TOTAL(PRIMARY) FLOAT      D : DUMMY ACTIVITY       < : NEGATIVE   HORIZONTAL PART NO.  10
  A : ACTIVITY WITH FLOAT         * : FREE FLOAT                F : SPECIFIED HOLIDAY      TOT. FLOAT   VERTICAL   PART NO.   1
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   ACTIVITY        .
IDENTIFICATION     . 1DEC  19JAN  8MAR  26APR  14JUN  2AUG  20SEP  8NOV  27DEC  14FEB  4APR  23MAY  11JUL  29AUG  17OCT77
                   .   .     .     .     .      .      .     .      .     .      .     .     .      .      .      .
                   .
      801  CG  SF  .               .            .            .            .            .            .      AAAAAAAAAAA
      805  PF  SF  .               .            .            .            .            .            .      AAAAAAAAAAA
      806  PL  SF  .               .            .            .            .            .            .      AAAAAAAAAAA
      806  TD  SF  .               .            .            .            .            .            .      AAAAAAAAAAA
      803  PF  SF  .               .            .            .            .            .            .      KKKKKKKKKKK
      802  PF  SF  .               .            .            .            .            .            .           .
      804  PF  SF  .               .            .            .            .            .            .           .
      609  TD  SF  .               .            .            .            .            .            .           .
      807  PL  SF  .               .            .            .            .            .            .           .
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                                      ••• G A N T T - D I A G R A M •••                                              PAGE   13
 OPTIMA                                                                                                               ALPHACODE:      SF
NORWEGIAN                                                                           PROJECT   START:   1DEC75
COMPUTING   PROJECT NO.  1                                                          PLANNED  FINISH:                  T.U.  INPUT: WEEK
 CENTER     DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN                           COMPUTED FINISH:   3AUG79         T.U. OUTPUT: WEEK
03 DEC 75   THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME
• • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • •
  K : CRITICAL ACTIVITY             - : TOTAL(PRIMARY) FLOAT        D : DUMMY ACTIVITY       < : NEGATIVE     HORIZONTAL  PART NO.  10
  A : ACTIVITY WITH FLOAT           + : FREE FLOAT                  F : SPECIFIED HOLIDAY    TOT. FLOAT       VERTICAL    PART NO.   2
• • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • •
   ACTIVITY             •
IDENTIFICATION          • 5DEC  23JAN  13MAR   1MAY  19JUN   7AUG  25SEP  13NOV   1JAN  19FEB   9APR  28MAY  16JUL   3SEP  22OCT79
                        •   •     •      •      •      •      •      •      •      •      •      •      •      •      •      •
                        •                                                                                   
     801  CG   SF       • AAAFAAA-------------F---                                                    •             •             •
     805  PF   SF       • AAAFAAAAAAAAAAAAAAAAFAAAAAAAFFFAAAAAAAAAAAAA+++++++++++++++++               •             •             •
     806  PL   SF       • AAAFAAAAAAAAAAAAAAAAFAAAAAAAFFFAAAAAAAAAAAAA+++++++++++++++++               •             •             •
     808  TD   SF       • AAAFAAAAAAAAAAAAAAAAFAAAAAAAFFFAAAAAAAAAAAAA+++++++++++++++++               •             •             •
     803  PF   SF       • KKKFKKKKKKKKKKKKKKKKFKKKKKKKFFFKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK               •             •             •
     802  PF   SF       •   AFAAAAAAAAAAAAAAAAFAAAAAAAFFFAAAAAAAAAAAAA+++++++++++++++++               •             •             •
     804  PF   SF       •        AAAAAAAAAAAAAAFAAAAAAAFFFAAAAAAAAAAAA------------------               •             •             •
     809  TD   SF       •        AAAAAAAAAAAAAAFAAAAAAAFFFAAAAAAAAAAAA++++++++++++++++++               •             •             •
     807  PL   SF       •               .AAAAAAFAAAAAAAFFFAAAAAAAAAAAA++++++++++++++++++               •             •             •
```

OPTIMA
NORWEGIAN
COMPUTING
CENTER
03 DEC 75

*** TIME LISTING ***

PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79

PAGE 2
ALPHACODE: CF
TIME UNIT: WEEK

ACTIVITY IDENTIFICATION		ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
901	CG	CF ORGANIZATION	COOKING FACTORY	17	14NOV77	17MAR78	20MAR78	11AUG78	17	0	0	
905	PF	CF PRODUCTION PLANNING	COOKING FACTORY	52	14NOV77	15DEC78	20MAR78	13APR79	17	0	17	
906	PL	CF MATERIAL ADMINISTRATION	COOKING FACTORY	52	14NOV77	15DEC78	20MAR78	13APR79	17	0	17	
908	TD	CF CODING SYSTEM	COOKING FACTORY	52	14NOV77	15DEC78	20MAR78	13APR79	17	0	17	
903	PF	CF PREVENTIVE MAINTENANCE	COOKING FACTORY	69	14NOV77	13APR79			8	0	0	
902	PF	CF WORK ORDER SYSTEM	COOKING FACTORY	30	20FEB78	15DEC78	17JUL78	13APR79	17	0	17	
904	PF	CF MAINTENANCE PLANNING	COOKING FACTORY	34	20MAR78	8DEC78	21AUG78	13APR79	18	0	0	
909	TD	CF INFORMATION BASE AND FILES	COOKING FACTORY	34	20MAR78	8DEC78	21AUG78	13APR79	18	0	18	
907	PL	CF COST CONTROL	COOKING FACTORY	26	22MAY78	8DEC78	16OCT78	13APR79	18	0	18	

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OPTIMA                              * * *   G A N T T - D I A G R A M   * * *                            PAGE      2
NORWEGIAN                                                                                                ALPHACODE:        CF
COMPUTING  PROJECT NO.  1                                                   PROJECT   START:  1DEC75
 CENTER    DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN                    PLANNED  FINISH:          T.U.  INPUT: WEEK
03 DEC 75  THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME       COMPUTED FINISH:  3AUG79  T.U. OUTPUT: WEEK
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
 K : CRITICAL ACTIVITY       - : TOTAL (PRIMARY) FLOAT     D : DUMMY ACTIVITY      < : NEGATIVE   HORIZONTAL PART NO.  2
 A : ACTIVITY WITH FLOAT     * : FREE FLOAT                F : SPECIFIED HOLIDAY     TOT. FLOAT   VERTICAL   PART NO.  1
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
  ACTIVITY          .
IDENTIFICATION      . 1DEC  19JAN  8MAR  26APR  14JUN  2AUG  20SEP  8NOV  27DEC  14FEB  4APR  23MAY  11JUL  29AUG  17OCT77
                    .   *     *     *     *      *     *      *     *     *     *     *     *     *     *     *
                    .                                                                                        .
     901  CG  CF    .              .             .            .           .           .           .           .  AAA
     905  PF  CF    .              .             .            .           .           .           .           .  AAA
     906  PL  CF    .              .             .            .           .           .           .           .  AAA
     908  TD  CF    .              .             .            .           .           .           .           .  AAA
     903  PF  CF    .              .             .            .           .           .           .           .  KKK
     902  PF  CF    .              .             .            .           .           .           .           .
     904  PF  CF    .              .             .            .           .           .           .           .
     909  TD  CF    .              .             .            .           .           .           .           .
     907  PL  CF    .              .             .            .           .           .           .           .
```

*** GANTT-DIAGRAM ***

PAGE 3
ALPHACODE: [illegible]

PROJECT NO. 1
[illegible]

PROJECT START: [illegible]
PLANNED FINISH:
COMPUTED FINISH: [illegible]
T.U. INPUT: [illegible]
T.U. OUTPUT: [illegible]

C : CRITICAL ACTIVITY
A : ACTIVITY WITH FLOAT
- : TOTAL [illegible] FLOAT
* : FREE FLOAT
D : DUMMY ACTIVITY
/ : SPECIFIED HOLIDAY
< : NEGATIVE TOT. FLOAT
HORIZONTAL PART NO. 2
VERTICAL PART NO. 2

ACTIVITY

[illegible]

*** TIME LISTING ***

PAGE 1

[illegible]

PROJECT START: [illegible]

PLANNED FINISH: [illegible]

COMPUTED FINISH: [illegible]

TIME UNIT: WEEK

ACTIVITY IDENTIFICATION	ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT [illegible]	FLOAT SEC.	FLOAT FREE	UP DATE
[illegible]	[illegible]	17	[illegible]	[illegible]	[illegible]	[illegible]	17	0	0	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	17	0	17	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	17	0	17	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	17	0	17	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			0	0	0	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	17	0	17	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10	0	0	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10	0	10	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10	0	10	

*** GANTT-DIAGRAM ***

PAGE 1
ALPHABASE: [illegible]

PROJECT NO. 1 PROJECT START: [illegible]
[illegible] PLANNED FINISH: T.U. INPUT: [illegible]
[illegible] COMPUTED FINISH: [illegible] T.U. OUTPUT: [illegible]

CRITICAL ACTIVITY : TOTAL FLOAT [illegible] DUMMY ACTIVITY [illegible] NEGATIVE HORIZONTAL PART NO. 1
ACTIVITY WITH FLOAT : FREE FLOAT [illegible] SPECIFIED HOLIDAY TOT. FLOAT VERTICAL PART NO. 2

[illegible]

Pages

PAGE 1
ALPHACODE: [illegible]

PROJECT START: 1DEC75 TIME UNITS: [illegible]
PLANNED FINISH: [illegible]
COMPUTED FINISH: [illegible]

*** TIME LISTING ***

[illegible] PROJECT NO. 1 [illegible]
[illegible]

ACTIVITY IDENTIFICATION				ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
[illegible]	[illegible]	[illegible]	ORGANIZATION	[illegible] CELLS	13	1DEC75	[illegible]76	[illegible]76	11[illegible]76	13	0	0	
[illegible]	[illegible]	[illegible]	ORGANIZATION	CENTRAL [illegible]	70	1DEC75	5AUG77	[illegible]76	13NOV77	14	0	0	
[illegible]	[illegible]	[illegible]	ORGANIZATION	CENT.-MAINT.FAC	26	[illegible]APR76	29OCT76			0	0	0	
[illegible]	[illegible]	[illegible]	ORGANIZATION	CENT.SPARE[illegible].[illegible]	26	7JUN76	26DEC76			0	0	0	
[illegible]	[illegible]	[illegible]	ORGANIZATION	METAL FACT.	17	29MAR77	19AUG77	20AUG77	16DEC77	17	0	0	
[illegible]	[illegible]	[illegible]	ORGANIZATION	[illegible] FACTORY	17	[illegible]JUL77	10NOV77	21NOV77	2[illegible]78	17	0	0	
[illegible]	[illegible]	[illegible]	ORGANIZATION	[illegible]	17	[illegible]77	[illegible]78	[illegible]78	[illegible]78	17	0	0	
[illegible]	[illegible]	[illegible]	ORGANIZATION	[illegible]	17	[illegible]77	17MAR78	[illegible]78	11AUG78	17	0	0	
[illegible]	[illegible]	[illegible]	ORGANIZATION	[illegible] FACTORY	17	[illegible]NOV77	[illegible]78			0	0	0	
[illegible]	[illegible]	[illegible]	ORGANIZATION	[illegible]	0	[illegible]78	[illegible]78	[illegible]78	[illegible]OCT78	17	0	0	
[illegible]	[illegible]	[illegible]	ORGANIZATION	[illegible] FACTORY	17	[illegible]78	[illegible]78	[illegible]78	[illegible]DEC78	17	0	0	
[illegible]	[illegible]	[illegible]	ORGANIZATION	[illegible]	17	13[illegible]78	[illegible]78						

*** TIME LISTING ***

PAGE 3
ALPHACODE: [illegible]

[illegible] PROJECT NO. 1
[illegible] - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79
TIME UNIT: WEEK

ACTIVITY IDENTIFICATION	ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
[illegible]	PRODUCTION PLANNING	ROLLING MILLS	90	1DEC75	7JAN77	10MAY76	10JAN77	21	0	21	
[illegible]	PREVENTIVE MAINTENANCE	ROLLING MILLS	73	1DEC75	10JAN77			0	0	0	
[illegible]	PRODUCTION PLANNING	CENTRAL ORGAN.	26	2FEB76	27AUG76	10JAN77	5AUG77	44	0	44	
[illegible]	MAINTENANCE PLANNING	CENTRAL ORGAN.	43	2FEB76	2DEC76	6SEP76	5AUG77	27	0	27	
[illegible]	WORK ORDER SYSTEM	ROLLING MILLS	43	2FEB76	2DEC76	2AUG76	10JUN77	22	0	22	
[illegible]	MAINTENANCE PLANNING	ROLLING MILLS	47	[illegible]MAR76	[illegible]MAR77	14JUN76	10JUN77	13	0	3	
[illegible]	MAINTENANCE PLANNING	CENTR.MAINT.FAC	26	7JUN76	2DEC76	20DEC76	22JUL77	25	0	17	
[illegible]	PRODUCTION PLANNING	CENTR.MAINT.FAC	48	7JUN76	6MAY77	23AUG76	22JUL77	8	0	0	
[illegible]	PREVENTIVE MAINTENANCE	CENT.SPARE.PR.	36	23AUG76	22APR77	29OCT76	22JUL77	9	0	9	
[illegible]	PRODUCTION PLANNING	CENT.SPARE.PR.	48	23AUG76	22JUL77			0	0	0	
[illegible]	PRODUCTION PLANNING	METALL. FACT.	52	28MAR77	28APR78	22AUG77	22SEP78	17	0	17	
[illegible]	PREVENTIVE MAINTENANCE	METALL. FACT.	60	28MAR77	22SEP78			0	0	0	
[illegible]	WORK ORDER SYSTEM	METALL. FACT.	30	25JUL77	28APR78	21NOV77	22SEP78	17	0	17	
[illegible]	PRODUCTION PLANNING	TRANSP.FACTORY	52	25JUL77	25AUG78	21NOV77	22DEC78	17	0	17	
[illegible]	PREVENTIVE MAINTENANCE	TRANSP.FACTORY	60	25JUL77	22DEC78			0	0	0	
[illegible]	MAINTENANCE PLANNING	METALL. FACT.	36	28AUG77	21APR78	2JAN78	22SEP78	18	0	0	
[illegible]	PRODUCTION PLANNING	SHEET PROC.FACT	52	19SEP77	20OCT78	23JAN78	16FEB79	17	0	17	
[illegible]	PREVENTIVE MAINTENANCE	SHEET PROC.FACT	60	19SEP77	16FEB79			0	0	0	
[illegible]	WORK ORDER SYSTEM	TRANSP.FACTORY	30	24OCT77	25AUG78	27FEB78	22DEC78	17	0	17	
[illegible]	PRODUCTION PLANNING	COOKING FACTORY	52	14NOV77	15DEC78	20MAR78	13APR79	17	0	17	
[illegible]	PREVENTIVE MAINTENANCE	COOKING FACTORY	60	14NOV77	13APR79			0	0	0	
[illegible]	MAINTENANCE PLANNING	TRANSP.FACTORY	36	21NOV77	18AUG78	3APR78	22DEC78	18	0	0	
[illegible]	WORK ORDER SYSTEM	SHEET PROC.FACT	30	19DEC77	20OCT78	24APR78	16FEB79	17	0	17	
[illegible]	PRODUCTION PLANNING	ENERGY FACTORY	52	16JAN78	9FEB79	22MAY78	4JUN79	17	0	17	
[illegible]	PREVENTIVE MAINTENANCE	ENERGY FACTORY	60	16JAN78	4JUN79			0	0	0	
[illegible]	MAINTENANCE PLANNING	SHEET PROC.FACT	36	23JAN78	13OCT78	5JUN78	16FEB79	18	0	0	
[illegible]	WORK ORDER SYSTEM	COOKING FACTORY	30	20FEB78	15DEC78	17JUL78	13APR79	17	0	17	
[illegible]	WORK ORDER SYSTEM	JOINT UNIT FACT	36	13MAR78	1DEC78			0	0	0	
[illegible]	PREVENTIVE MAINTENANCE	JOINT UNIT FACT	36	13MAR78	1DEC78			0	0	0	
[illegible]	MAINTENANCE PLANNING	JOINT UNIT FACT	36	13MAR78	1DEC78			0	0	0	
[illegible]	PRODUCTION PLANNING	BUDAPEST HOUSE	52	13MAR78	6APR79	7AUG78	3AUG79	17	0	17	
[illegible]	PREVENTIVE MAINTENANCE	BUDAPEST HOUSE	60	13MAR78	3AUG79			0	0	0	
[illegible]	MAINTENANCE PLANNING	COOKING FACTORY	36	20MAR78	8DEC78	21AUG78	13APR79	18	0	0	
[illegible]	WORK ORDER SYSTEM	ENERGY FACTORY	30	17APR78	9FEB79	11SEP78	4JUN79	17	0	17	
[illegible]	MAINTENANCE PLANNING	ENERGY FACTORY	36	22MAY78	2FEB79	16OCT78	4JUN79	18	0	0	
[illegible]	WORK ORDER SYSTEM	BUDAPEST HOUSE	30	19JUN78	6APR79	6NOV78	3AUG79	17	0	17	
[illegible]	MAINTENANCE PLANNING	BUDAPEST HOUSE	36	7AUG78	30MAR79	11DEC78	3AUG79	18	0	0	

[illegible] *** TIME LISTING *** PAGE 4
[illegible] ALPHACODE: PL
[illegible] PROJECT NO. 1 PROJECT START: 1DEC75
[illegible] [illegible] PLANNED FINISH: TIME UNIT: WEEK
[illegible] [illegible] COMPUTED FINISH: 3AUG79

ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
[illegible]	PL	[illegible]	MATERIAL ADMINISTRATION	ROLLING MILLS	30	1DEC75	7JAN77	30MAY76	10JAN77	21	0	21	
[illegible]	PL	[illegible]	COST CONTROL	CENTRAL ORGAN.	43	7FEB76	24DEC76	6SEP76	5AUG77	27	0	27	
[illegible]	PL	[illegible]	MATERIAL ADMINISTRATION	CENTRAL ORGAN.	56	7FEB75	1APR77	17MAY76	5AUG77	14	0	14	
[illegible]	PL	[illegible]	COST CONTROL	ROLLING MILLS	26	5APR76	29OCT76	29NOV76	10JUN77	30	0	30	
[illegible]	PL	[illegible]	MATERIAL ADMINISTRATION	CENTR.MAINT.FAC	26	7JUN76	24DEC76	30AUG76	4MAR77	9	0	0	
[illegible]	PL	[illegible]	COST CONTROL	CENTR.MAINT.FAC	26	7JAN76	24DEC76	20DEC76	22JUL77	25	0	17	
[illegible]	PL	[illegible]	MATERIAL ADMINISTRATION	CENT.SPARE P.PR.	36	23AUG76	22APR77	25OCT76	22JUL77	9	0	0	
[illegible]	PL	[illegible]	COST CONTROL	CENT.SPARE P.PR.	30	18OCT76	22APR77	20DEC76	22JUL77	9	0	0	
[illegible]	PL	[illegible]	MATERIAL ADMINISTRATION	METALL FACT.	58	20MAR77	28APR78	22AUG77	22SEP78	17	0	17	
[illegible]	PL	[illegible]	MATERIAL ADMINISTRATION	TRANSP.FACTORY	52	25JUL77	25AUG78	21NOV77	22DEC78	17	0	17	
[illegible]	PL	[illegible]	MATERIAL ADMINISTRATION	SHEET PROC.FACT	52	19SEP77	20OCT78	23JAN78	16FEB79	17	0	17	
[illegible]	PL	[illegible]	COST CONTROL	METALL FACT.	26	17OCT77	21APR78	27FEB78	22SEP78	18	0	18	
[illegible]	PL	[illegible]	MATERIAL ADMINISTRATION	COOKING FACTORY	58	30AUG77	15DEC78	20MAR78	13APR79	17	0	17	
[illegible]	PL	[illegible]	MATERIAL ADMINISTRATION	ENERGY FACTORY	58	16JAN78	9FEB79	22MAY78	8JUN79	17	0	17	
[illegible]	PL	[illegible]	COST CONTROL	TRANSP.FACTORY	26	23JAN78	18AUG78	5JUN78	22DEC78	18	0	18	
[illegible]	PL	[illegible]	MATERIAL ADMINISTRATION	MAINT UNIT FACT	36	13MAR78	1DEC78			0	0	0	
[illegible]	PL	[illegible]	MATERIAL ADMINISTRATION	BUDAPEST [illegible]	52	13MAR78	6APR79	7AUG78	3AUG79	17	0	17	
[illegible]	PL	[illegible]	COST CONTROL	SHEET PROC.FACT	26	20MAR78	13OCT78	21AUG78	16FEB79	18	0	18	
[illegible]	PL	[illegible]	COST CONTROL	MAINT UNIT FACT	26	15MAY78	1DEC78			0	0	0	
[illegible]	PL	[illegible]	COST CONTROL	COOKING FACTORY	26	[illegible]	8DEC78	16OCT78	13APR79	18	0	18	
[illegible]	PL	[illegible]	COST CONTROL	ENERGY FACTORY	26	7AUG78	2FEB79	11DEC78	8JUN79	18	0	18	
[illegible]	PL	[illegible]	COST CONTROL	[illegible]	26	2OCT78	30MAR79	5FEB79	3AUG79	18	0	18	

*** TIME LISTING ***

[illegible]
[illegible]
[illegible] PROJECT NO. 1
[illegible] [illegible] - [illegible] IMPLEMENTATION PLAN
[illegible] THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79

PAGE 5
ALPHACODE: TD
TIME UNIT: WEEK

ACTIVITY IDENTIFICATION	ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
[illegible] TO [illegible]	CODING SYSTEM	GENERAL ORGAN.	30	1DEC75	1OCT76			0	0	0	
[illegible] TO [illegible]	CODING SYSTEM	ROLLING MILLS	52	1DEC75	7JAN77	10MAY76	10JUN77	21	0	21	
[illegible] TO [illegible]	INFORMATION BASE AND FILES	ROLLING MILLS	43	5APR76	4MAR77	2AUG76	10JUN77	13	0	13	
[illegible] TO [illegible]	CODING SYSTEM	CENTR.MAINT.FAC	26	7JUN76	24DEC76	20DEC76	22JUL77	25	0	17	
[illegible] TO [illegible]	INFORMATION BASE AND FILES	CENTR.MAINT.FAC	34	23AUG76	22APR77	25OCT76	22JUL77	9	0	1	
[illegible] TO [illegible]	CODING SYSTEM	CENT.SPARE?.PR.	43	23AUG76	22JUL77			0	0	0	
[illegible] TO [illegible]	INFORMATION BASE AND FILES	GENERAL ORGAN.	30	4OCT76	5AUG77			0	0	0	
[illegible] TO [illegible]	INFORMATION BASE AND FILES	CENT.SPARE?.PR.	17	13DEC76	15APR77	20FEB77	22JUL77	10	0	10	
[illegible] TO [illegible]	CODING SYSTEM	METALL FACT.	52	20MAR77	20APR78	22AUG77	22SEP78	17	0	17	
[illegible] TO [illegible]	CODING SYSTEM	TRANSP.FACTORY	52	25JUL77	25AUG78	21NOV77	22DEC78	17	0	17	
[illegible] TO [illegible]	INFORMATION BASE AND FILES	METALL FACT.	34	22AUG77	21APR78	2JAN78	22SEP78	18	0	18	
[illegible] TO [illegible]	CODING SYSTEM	SHEET PROC.FACT	52	19SEP77	20OCT78	23JAN78	16FEB79	17	0	17	
[illegible] TO [illegible]	CODING SYSTEM	COOKING FACTORY	52	14NOV77	15DEC78	20MAR78	13APR79	17	0	17	
[illegible] TO [illegible]	INFORMATION BASE AND FILES	TRANSP.FACTORY	36	21NOV77	18AUG78	3APR78	22DEC78	18	0	18	
[illegible] TO [illegible]	CODING SYSTEM	ENERGY FACTORY	52	16JAN78	9FEB79	22MAY78	8JUN79	17	0	17	
[illegible] TO [illegible]	INFORMATION BASE AND FILES	SHEET PROC.FACT	36	23JAN78	13OCT78	5JUN78	16FEB79	18	0	18	
[illegible] TO [illegible]	CODING SYSTEM	MAINT UNIT FACT	36	13MAR78	1DEC78			0	0	0	
[illegible] TO [illegible]	CODING SYSTEM	BUDAPEST [illegible]	52	13MAR78	6APR79	7AUG78	3AUG79	17	0	17	
[illegible] TO [illegible]	INFORMATION BASE AND FILES	COOKING FACTORY	36	20MAR78	8DEC78	21AUG78	13APR79	18	0	18	
[illegible] TO [illegible]	INFORMATION BASE AND FILES	ENERGY FACTORY	36	22MAY78	2FEB79	16OCT78	8JUN79	18	0	18	
[illegible] TO [illegible]	INFORMATION BASE AND FILES	[illegible] UNIT FACT	[illegible]	[illegible]	[illegible]	[illegible]	1DEC78	1	0	1	
[illegible] TO [illegible]	INFORMATION BASE AND FILES	[illegible]	36	[illegible]	[illegible]	[illegible]	3AUG79	18	0	18	

[illegible] *** TIME LISTING *** PAGE 2

[illegible] ALPHACODE: [illegible]

[illegible] PROJECT NO. 1 PROJECT START: 1DEC75

[illegible] PLANNED FINISH: TIME UNIT: WEEK

[illegible] THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME COMPUTED FINISH: [illegible]

ACTIVITY [illegible]	ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
100 [illegible]	SPECIAL SYSTEMS AND TECHNIQUES GENERAL [illegible]	66	1DEC75	[illegible]	8MAR76	5AUG77	13	[illegible]	13	
[illegible]	SPEC.. SYSTEMS AND TECHNIQUES [illegible]	[illegible]	7JUN76	[illegible]	23AUG76	22JUL77	[illegible]	[illegible]	[illegible]	
[illegible]	SPECIAL SYSTEMS AND TECHNIQUES [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	22JUL77	[illegible]	[illegible]	[illegible]	

RESOURCE LOADING IN HISTOGRAM FORM

PAGE 1

RESOURCE: ORG

PROJECT NO. 1

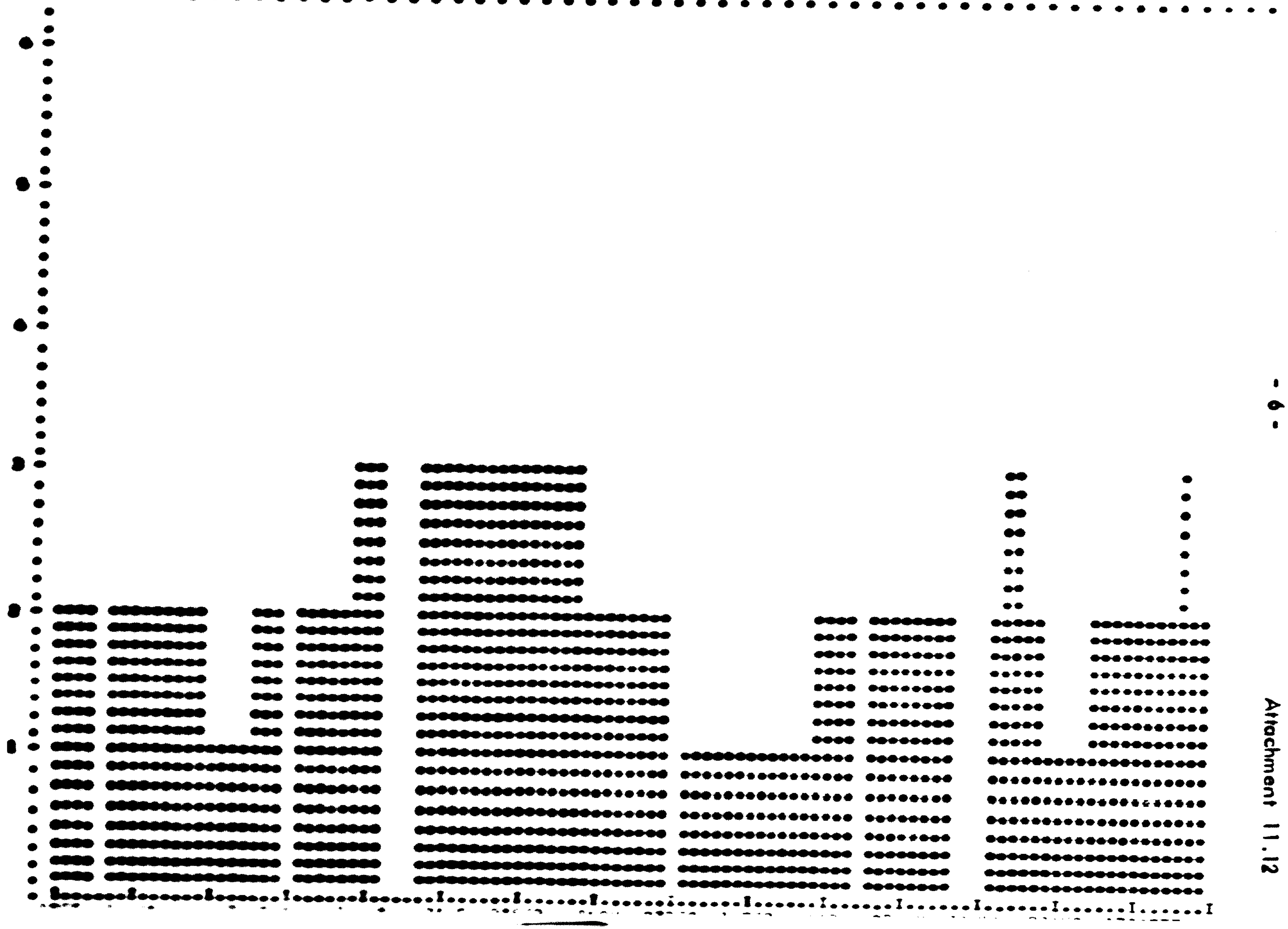
IMPLEMENTATION PLAN

OUTPUT START: 1DEC75

OUTPUT FINISH: 6AUG76

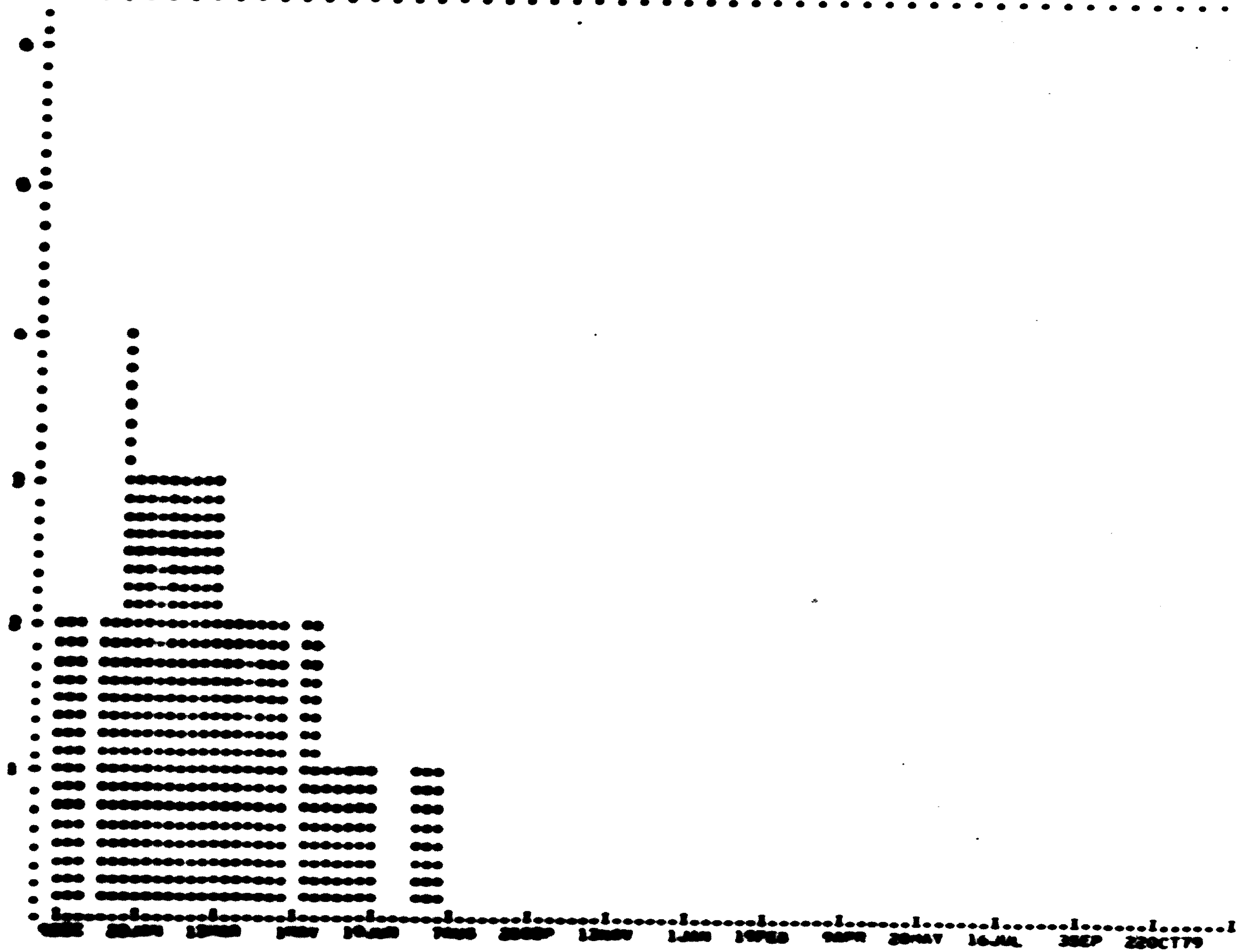
T.U. INPUT: WEEK

T.U. OUTPUT: WEEK



RESOURCE: ORB

OUTPUT START: 1DEC75 T.U. INPUT: WEEK
OUTPUT FINISH: 6AUG79 T.U. OUTPUT: WEEK



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[illegible]
[illegible] [illegible] 1
[illegible] [illegible] - [illegible] PLAN
[illegible]

****RESOURCE LOADING IN TABLE FORM****

PAGE 1
RESOURCE: DRG

OUTPUT START: 1DEC75
OUTPUT FINISH: [illegible]

T.U. INPUT: WEEK
T.U. OUTPUT: WEEK

									ACCUM. LOAD											ACCUM. LOAD
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[illegible]	1	1	1	1	2	2	2	.	[illegible]	[illegible]	****	2	2	2	2	2	3	.	49.
[illegible]	3	3	****	****	****	3	3	.	61.	[illegible]	3	3	3	3	3	3	3	.	82.
[illegible]	3	3	3	3	3	3	2	.	102.	[illegible]	2	2	2	2	2	2	2	.	116.
[illegible]	****	1	1	1	1	1	1	.	[illegible]	[illegible]	1	1	1	1	1	1	2	.	130.
[illegible]	2	2	2	****	2	2	2	.	[illegible]	[illegible]	2	2	2	2	2	****	****	.	152.
[illegible]	****	2	3	3	2	2	1	.	[illegible]	[illegible]	1	1	1	2	2	2	2	.	176.
[illegible]	2	2	2	2	3	2	2	.	[illegible]	[illegible]	2	2	2	****	2	2	4	.	205.
[illegible]	3	3	3	3	3	3	3	.	[illegible]	[illegible]	3	2	2	2	2	2	2	.	241.
[illegible]	****	2	2	1	1	1	1	.	[illegible]	[illegible]	1	****	****	****	1	1	1	.	283.

[illegible] PROJECT NO. 1 [illegible] IMPLEMENTATION PLAN [illegible] ARE PLACED IN EARLIEST POSITION

OUTPUT START: [illegible]
OUTPUT FINISH: [illegible]

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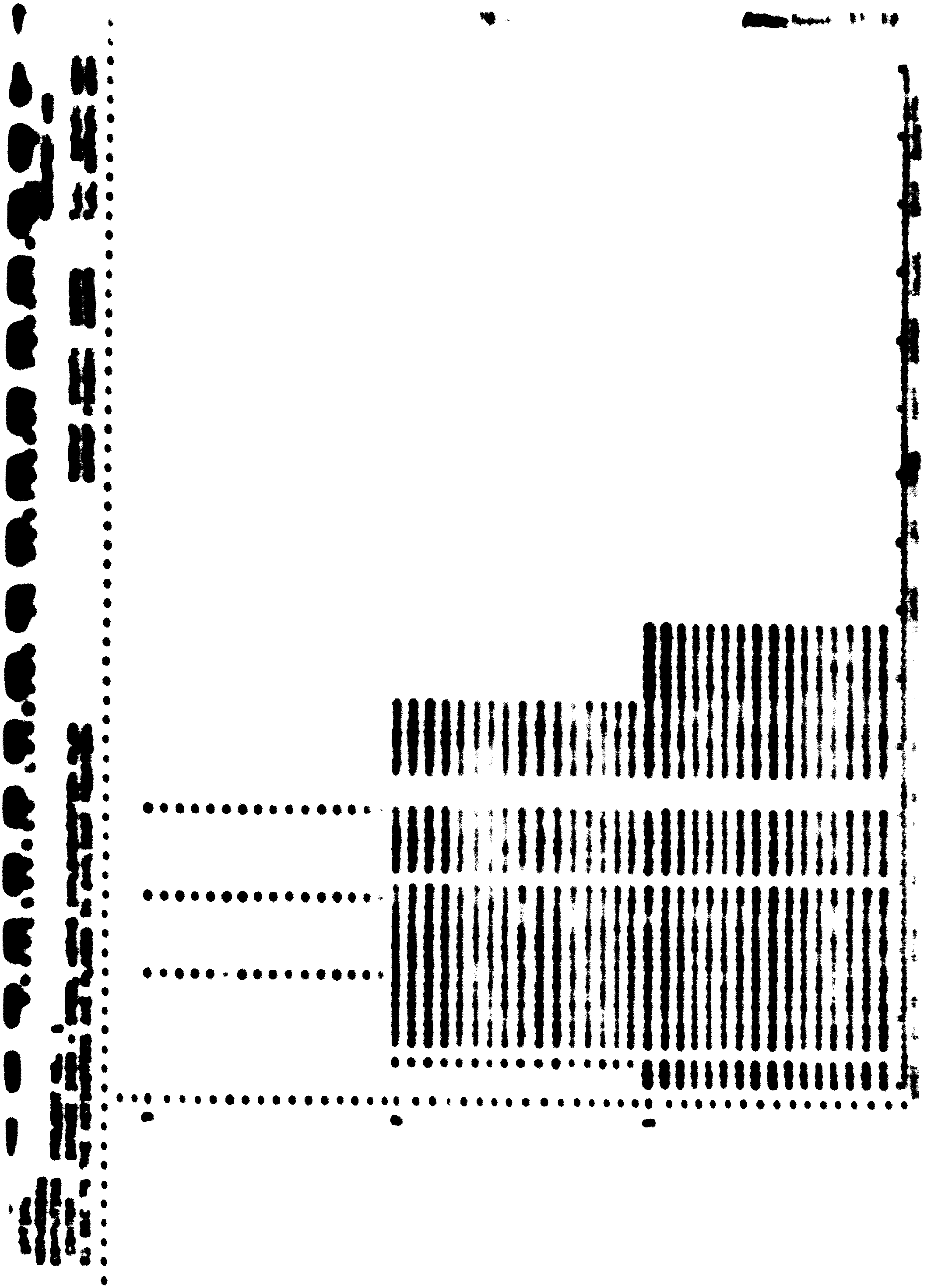
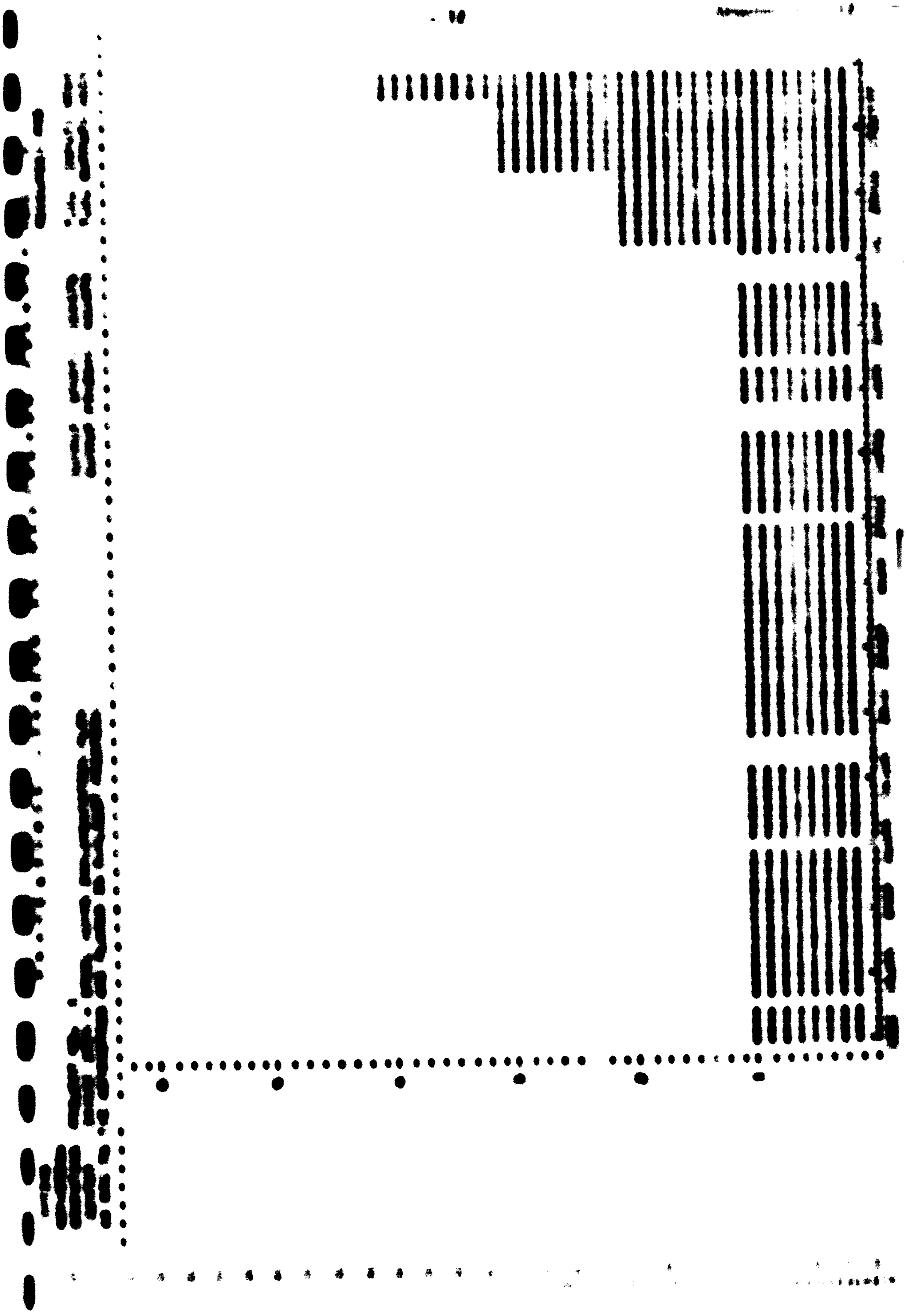
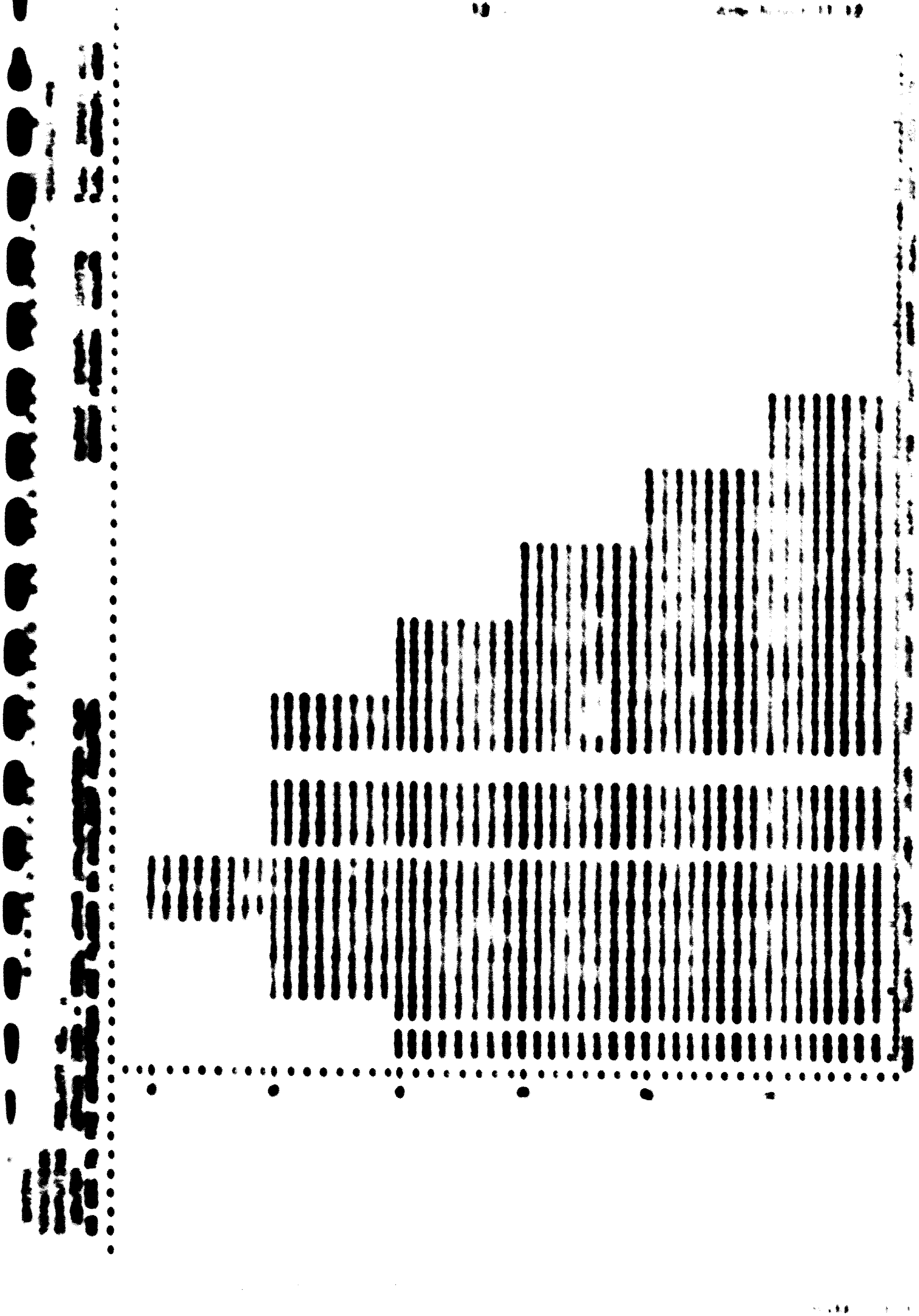
TOTAL OUTPUT: [illegible]

RESOURCE: [illegible]

[illegible]







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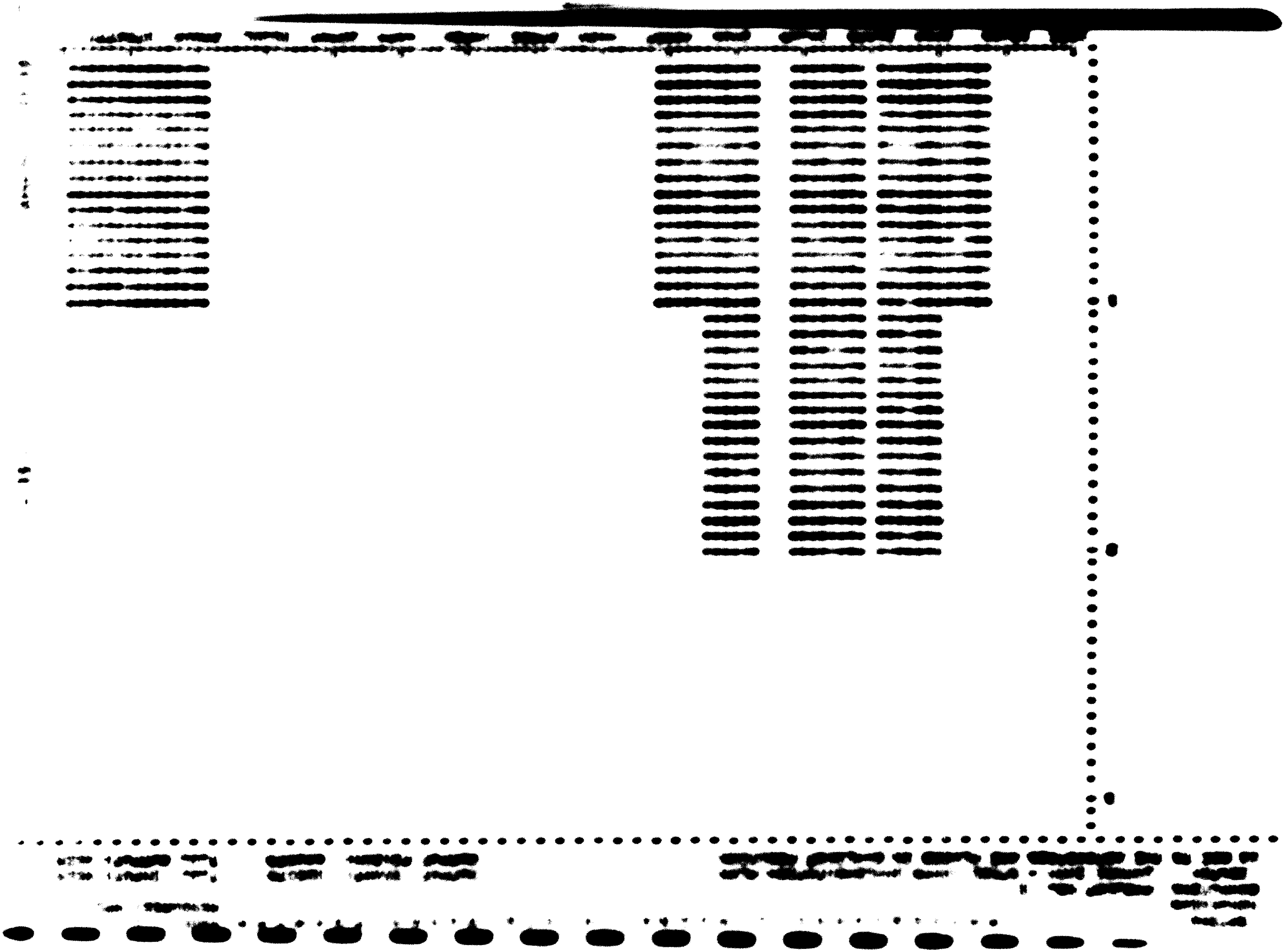

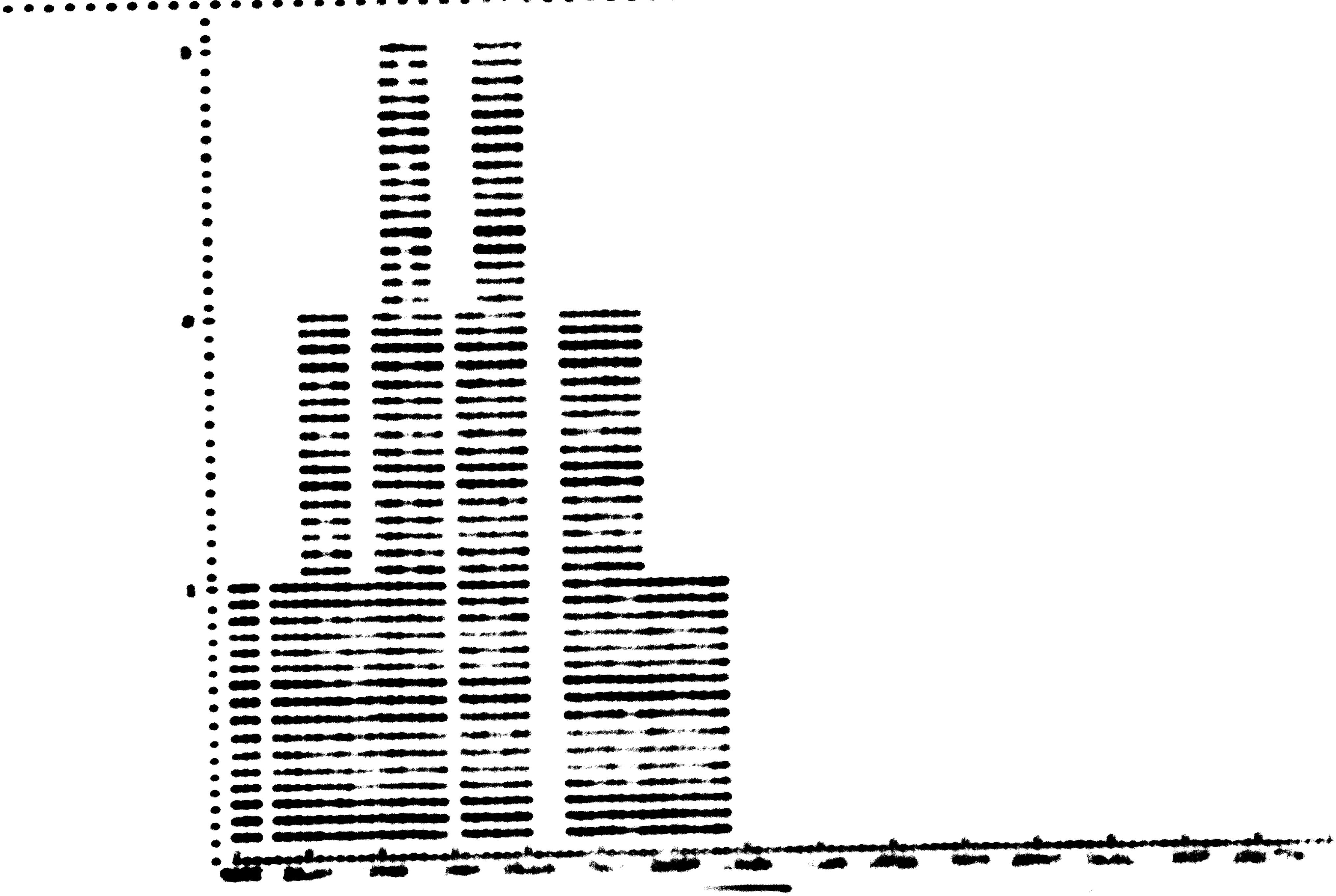

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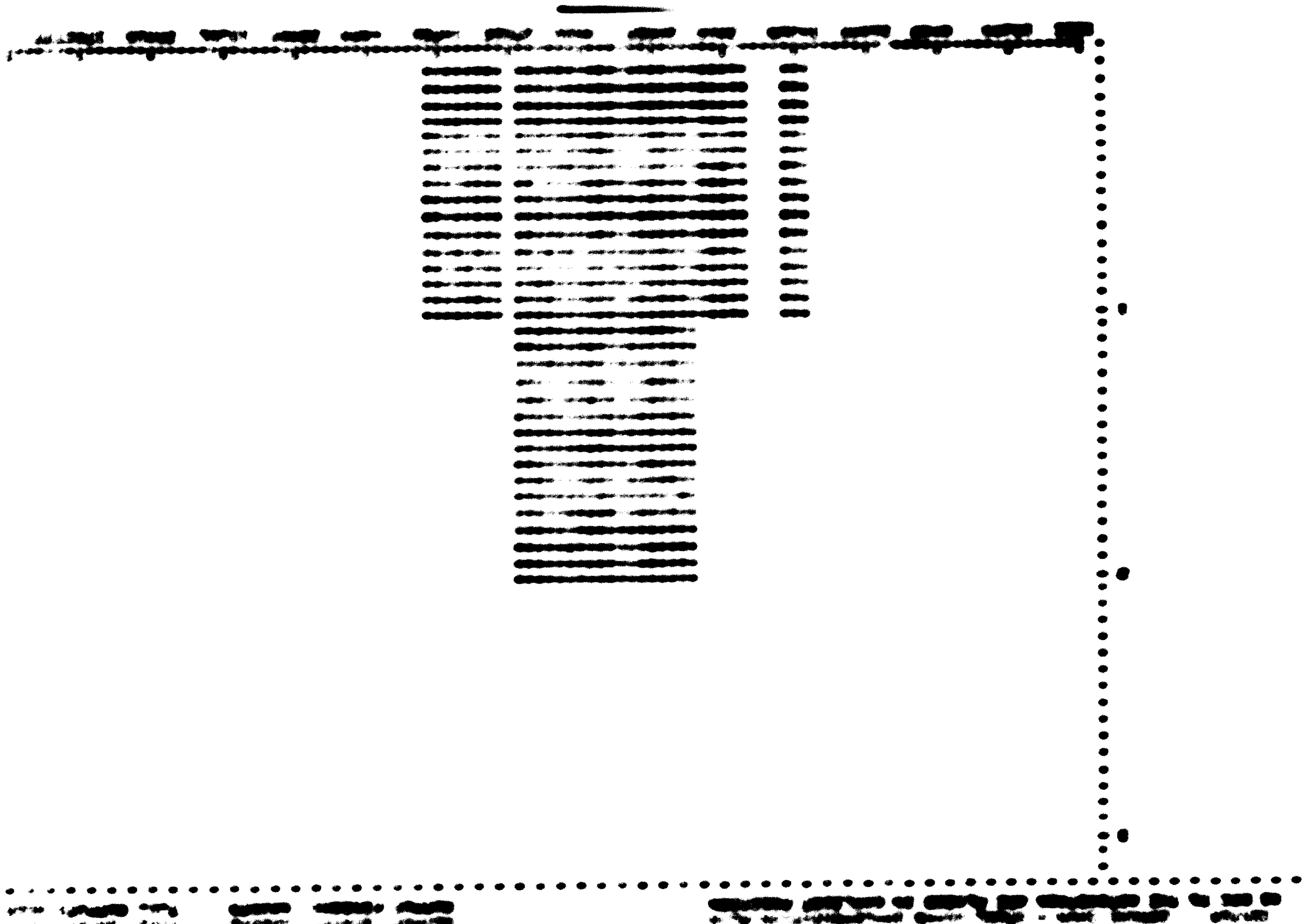

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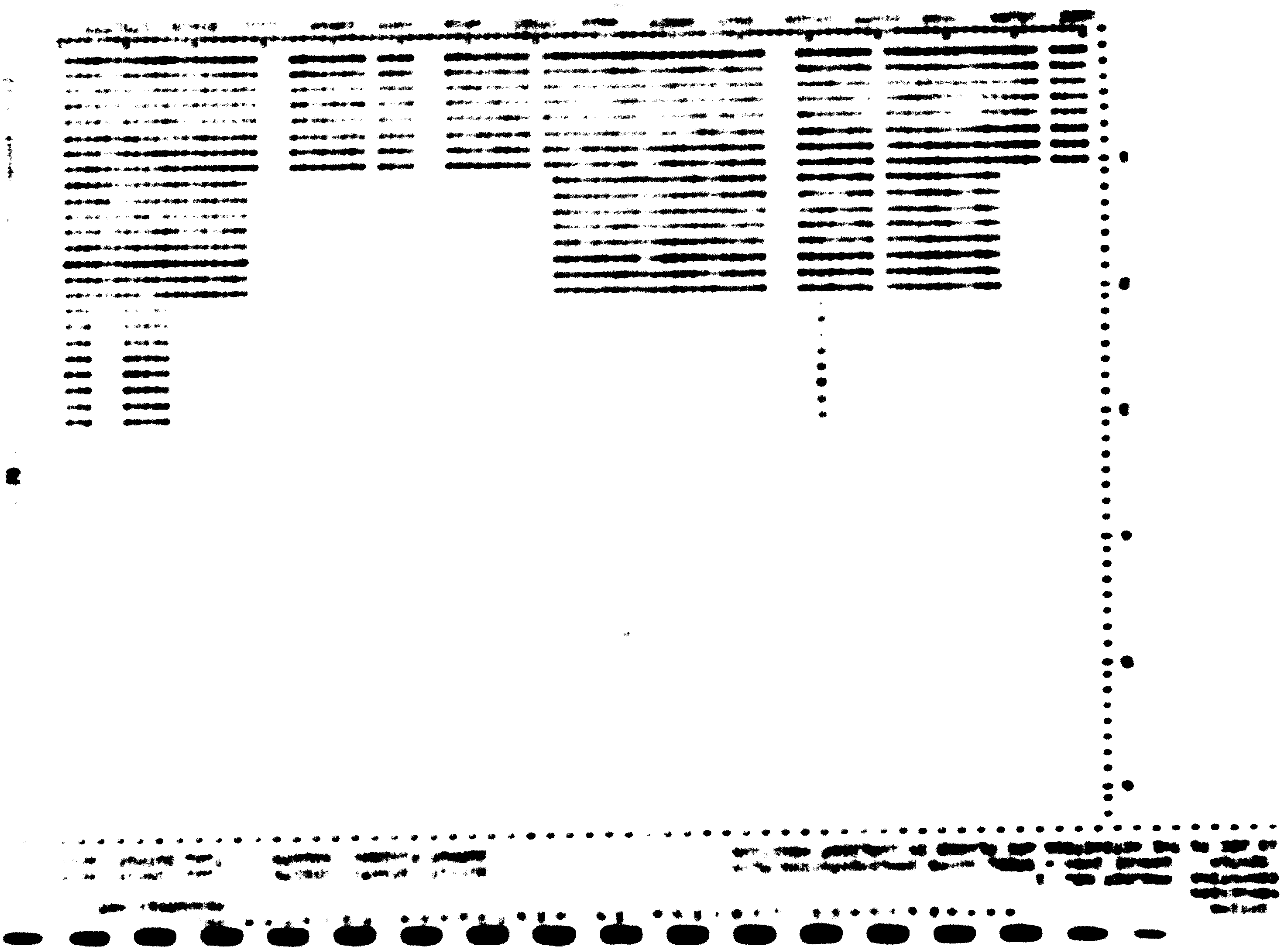
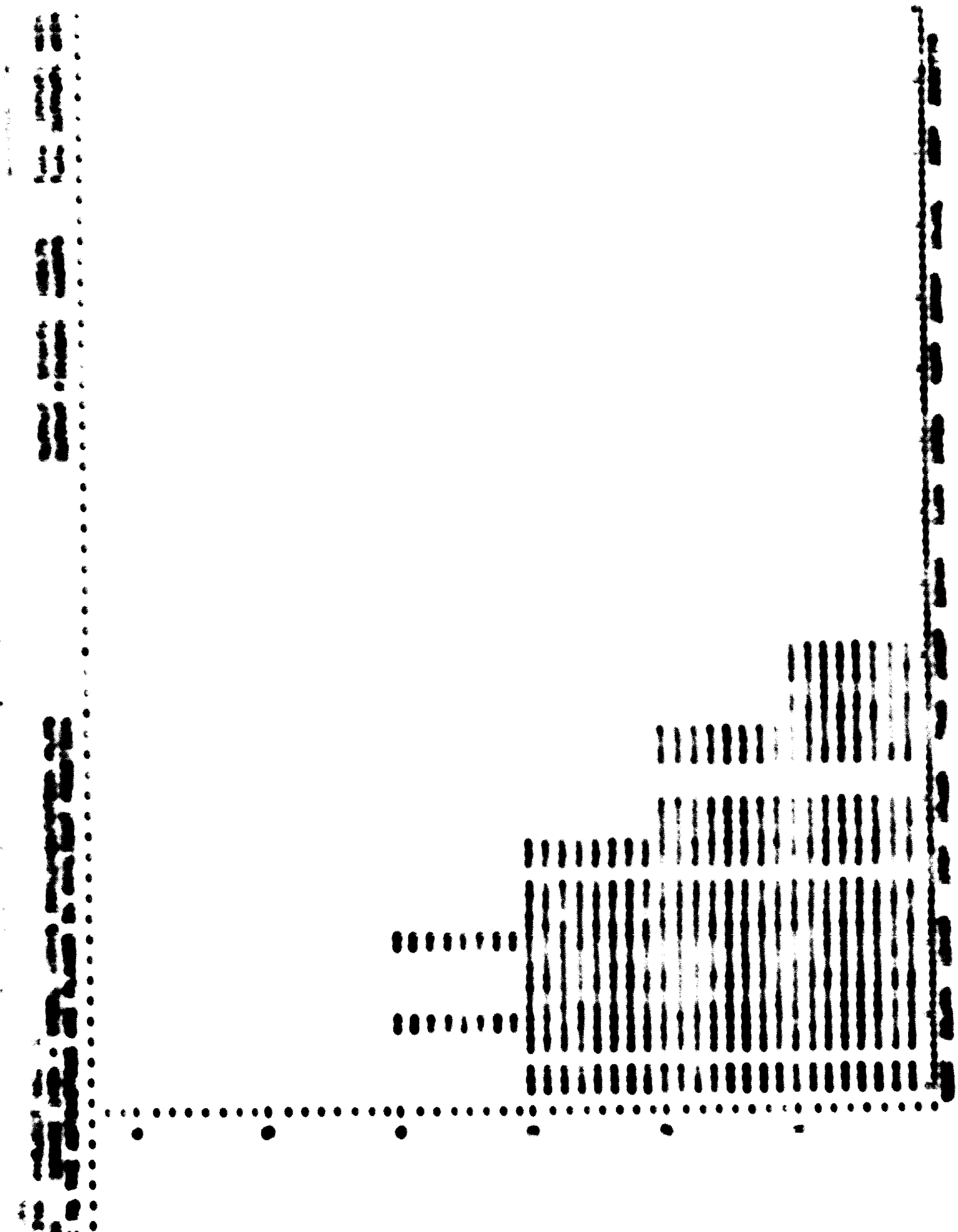
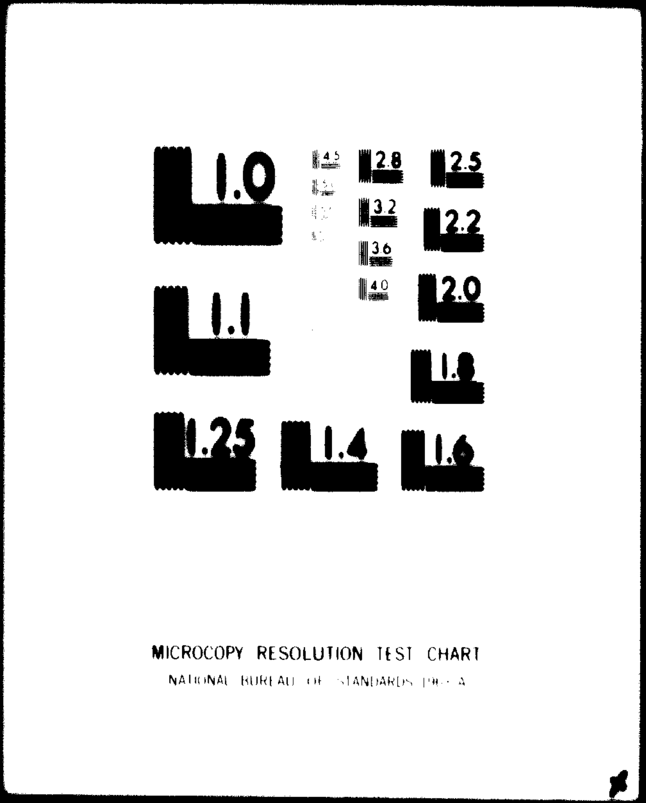




1-821

82.06.21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2.8
2.5
3.2
2.2
3.6
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1.1
1.8
1.25
1.4
1.6
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

24x
E

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OPTIMA                    * * * R E S O U R C E   L O A D I N G   I N   H I S T O G R A M   F O R M * * *   PAGE   1
NORWEGIAN                                                                                                   RESOURCE: CST
COMPUTING  PROJECT NO.  1
 CENTER    DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN                OUTPUT  START:   1DEC75     T.U.  INPUT: WEEK
03 DEC 75 THE ACTIVITIES ARE PLACED IN EARLIEST POSITION                OUTPUT FINISH:   6AUG79     T.U. OUTPUT: WEEK
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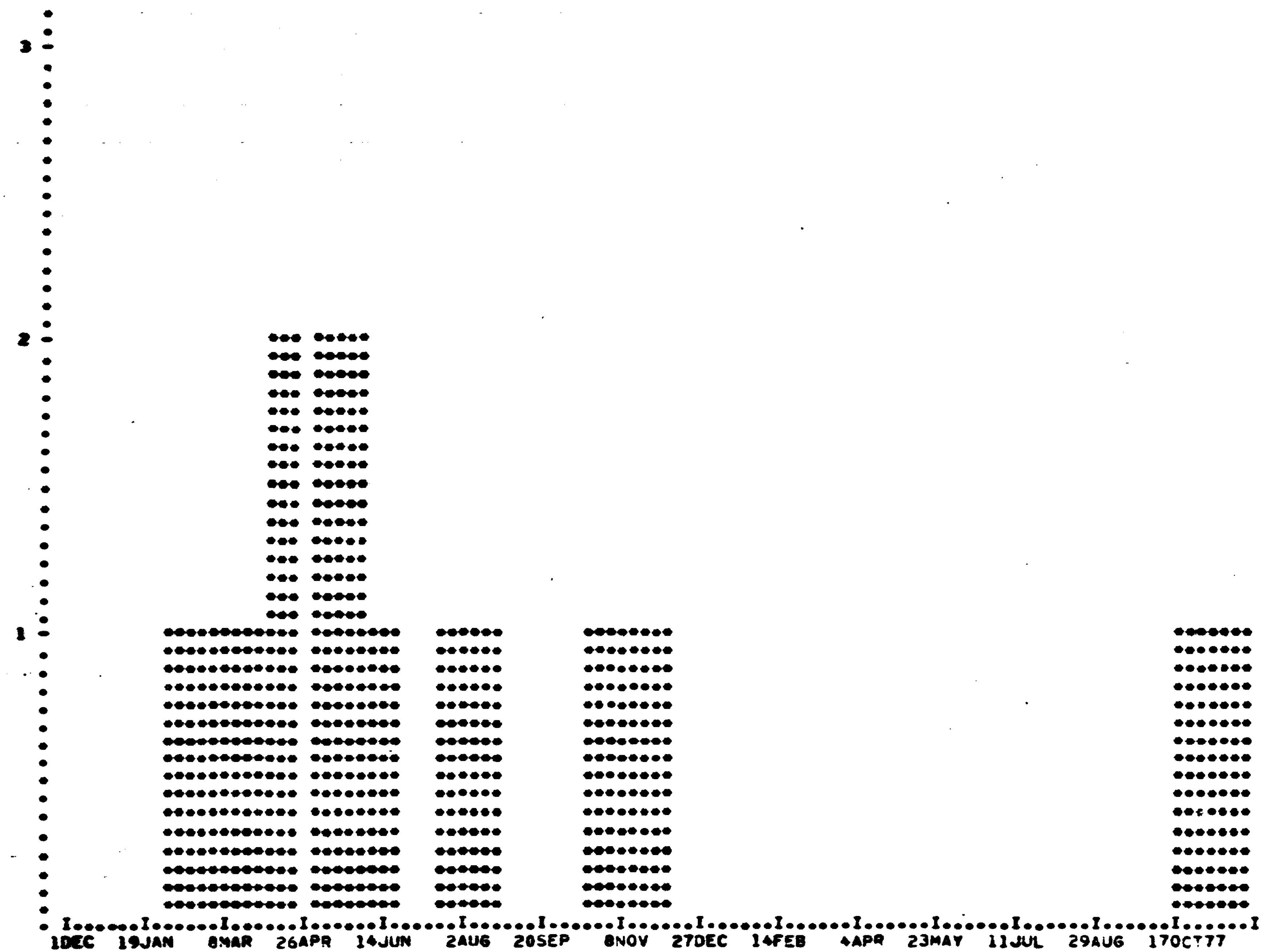


1 [redacted]

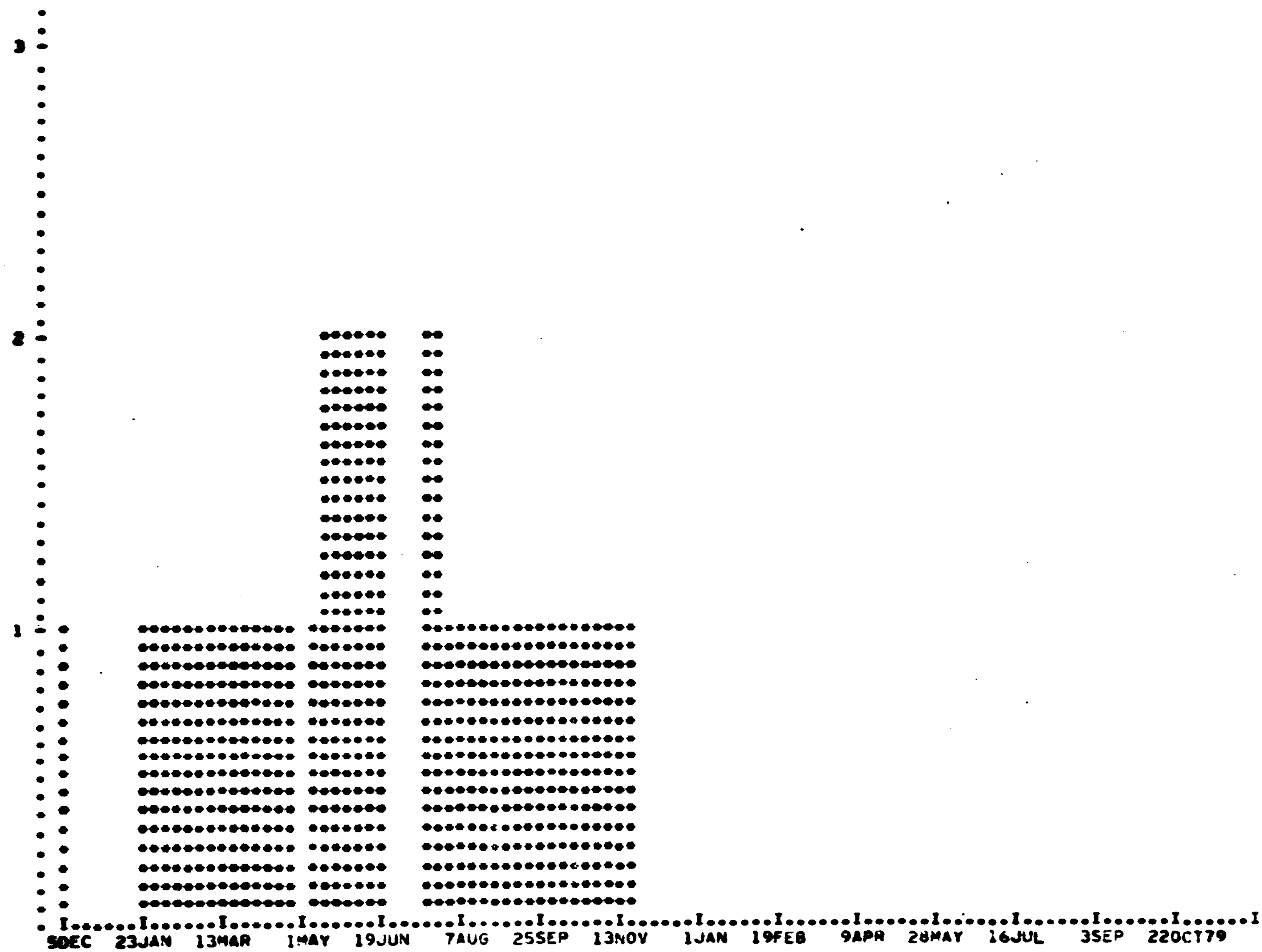
OPTIMA
NORWEGIAN
COMPUTING
CENTER
03 DEC 75

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

RESOURCE: CST

OUTPUT START: 1DEC75
OUTPUT FINISH: 6AUG79

T.U. INPUT: WEEK
T.U. OUTPUT: WEEK



OPTIMA ***RESOURCE LOADING IN TABLE FORM*** PAGE 1
NORWEGIAN RESOURCE: CST
COMPUTING PROJECT NO. 1
CENTER DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN OUTPUT START: 1DEC75 T.U. INPUT: WEEK
03 DEC 75 THE ACTIVITIES ARE PLACED IN EARLIEST POSITION OUTPUT FINISH: 6AUG79 T.U. OUTPUT: WEEK

									ACCUM. LOAD										ACCUM. LOAD
1DEC75	0	0	0	0	*000	0	0	.	0.	19JAN76	0	0	1	1	1	1	1	.	5.
8MAR76	1	1	1	1	2	2	2	.	15.	26APR76	*000	2	2	2	2	2	1	.	26.
14JUN76	1	1	*000	*000	*000	1	1	.	30.	2AUG76	1	1	1	1	0	0	0	.	34.
20SEP76	0	0	0	0	1	1	1	.	37.	8NOV76	1	1	1	1	1	0	0	.	42.
17OCT77	1	1	1	1	1	1	1	.	49.	5DEC77	1	0	0	*000	0	0	0	.	50.
23JAN78	1	1	1	1	1	1	1	.	57.	13MAR78	1	1	1	1	1	1	1	.	64.
1MAY78	*000	1	2	2	2	2	2	.	75.	19JUN78	2	*000	*000	*000	2	2	1	.	82.
7AUG78	1	1	1	1	1	1	1	.	89.	25SEP78	1	1	1	1	1	1	1	.	96.
13NOV78	1	1	0	0	0	0	0	.	98.	1JAN79	0	0	0	0	0	0	0	.	98.

* * * R E S O U R C E   L O A D I N G   I N   H I S T O G R A M   F O R M * * *

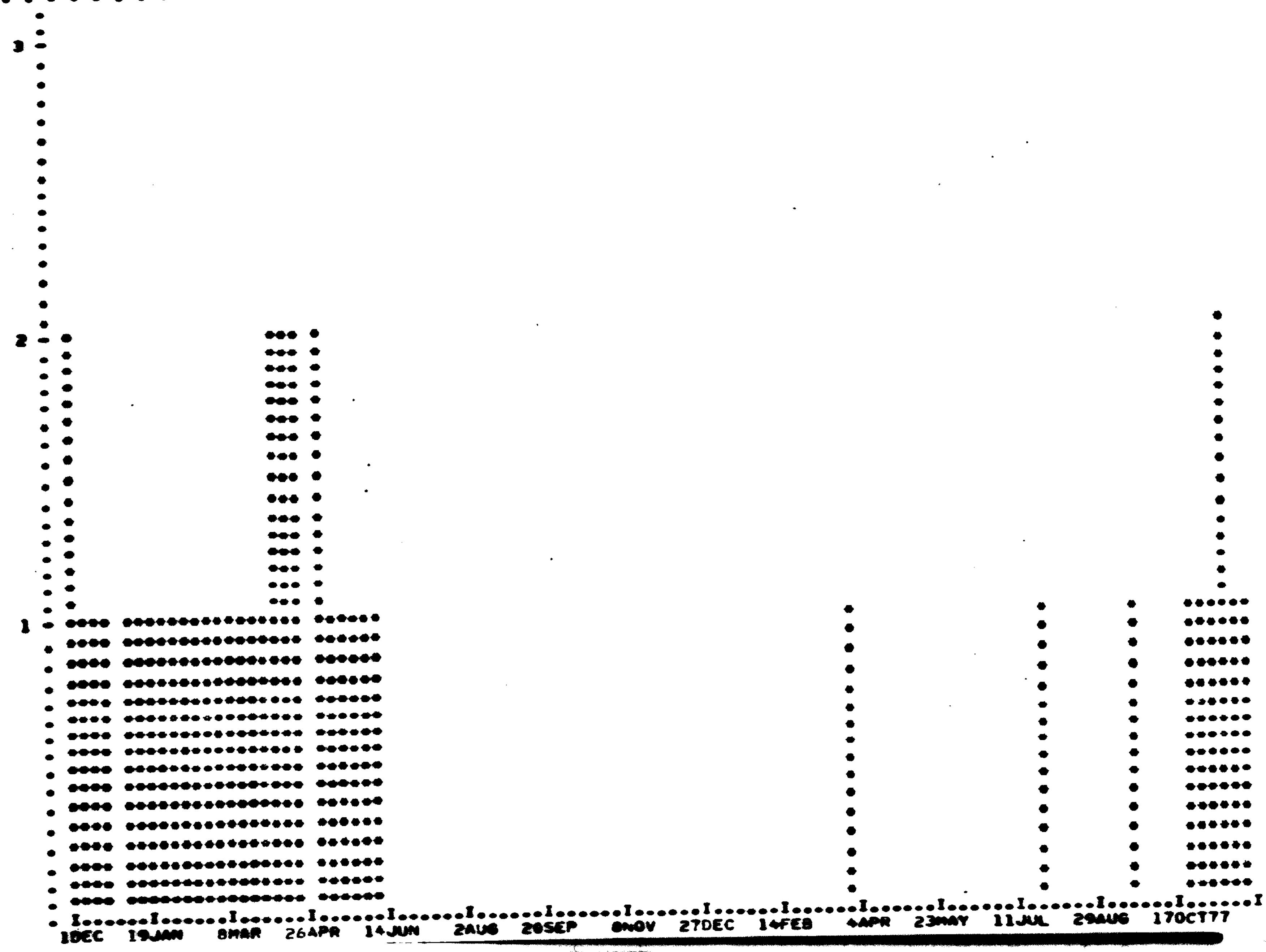
PAGE 1
RESOURCE: COD

OPTIMA
NORWEGIAN
COMPUTING
CENTER
03 DEC 75

PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

OUTPUT START: 1DEC75
OUTPUT FINISH: 6AUG79

T.U. INPUT: WEEK
T.U. OUTPUT: WEEK



OPTIMA
NORWEGIAN
COMPUTING CENTER
03 DEC 75

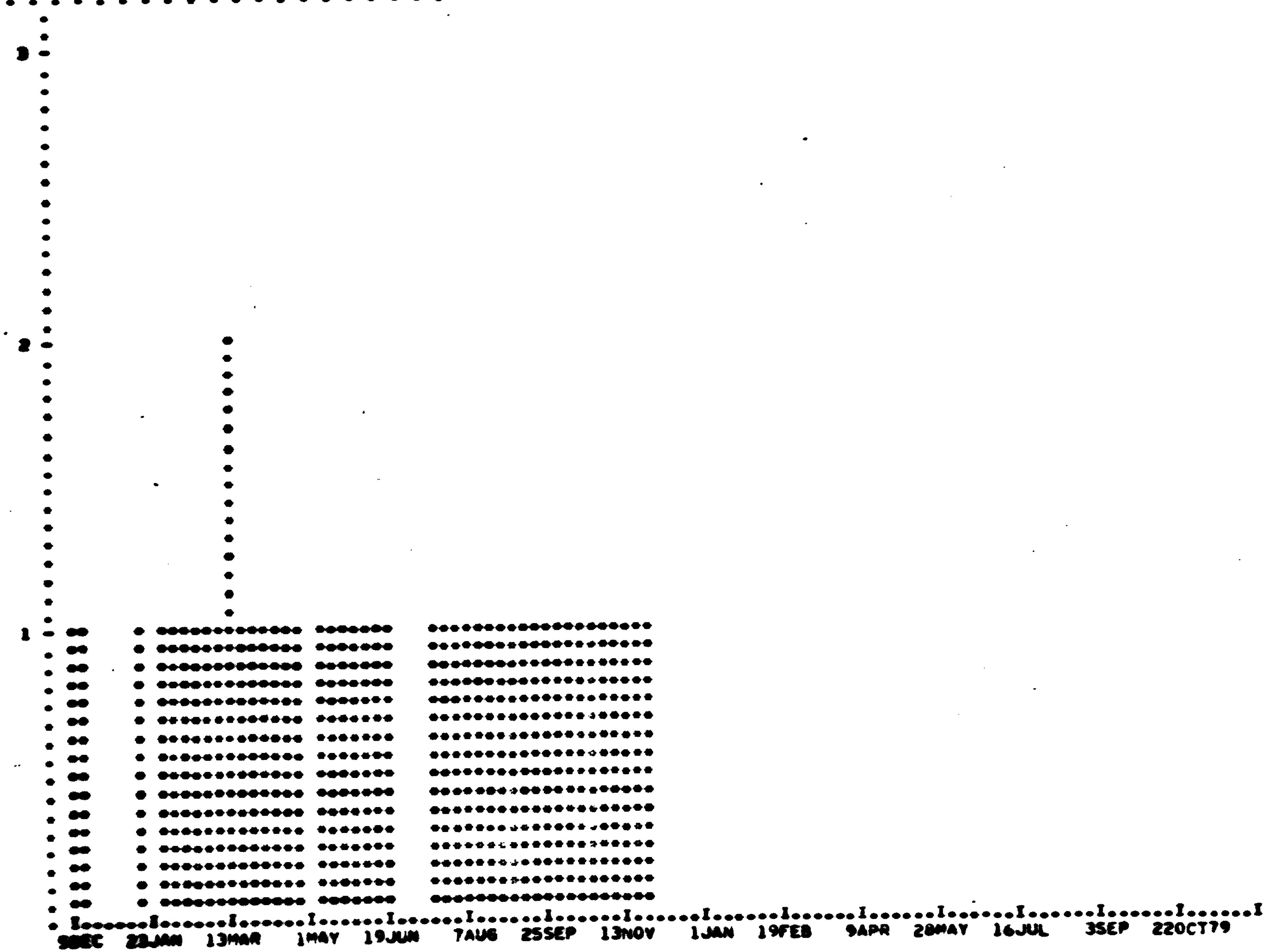
RESOURCE LOADING IN HISTOGRAM FORM

PAGE 2
RESOURCE: COD

PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

OUTPUT START: 1DEC75
OUTPUT FINISH: 6AUG79

T.U. INPUT: WEEK
T.U. OUTPUT: WEEK



OPTIMA NORWEGIAN COMPUTING CENTER

RESOURCE LOADING IN TABLE FORM

PAGE 1
RESOURCE: COD

PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
03 DEC 75 THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

OUTPUT START: 1DEC75 T.U. INPUT: WEEK
OUTPUT FINISH: 6AUG79 T.U. OUTPUT: WEEK

									ACCUM. LOAD										ACCUM. LOAD
1DEC75	2	1	1	1	*000	1	1	.	7.	19JAN76	1	1	1	1	1	1	1	.	14.
8MAR76	1	1	1	1	2	2	2	.	24.	26APR76	*000	2	1	1	1	1	1	.	31.
27DEC76	*000	0	0	0	0	0	0	.	31.	14FEB77	0	0	0	0	0	0	1	.	32.
11JUL77	*000	0	1	0	0	0	0	.	33.	29AUG77	0	0	0	1	0	0	0	.	34.
17OCT77	.0	1	1	1	2	1	1	.	41.	5DEC77	1	1	0	*000	0	0	1	.	44.
23JAN78	0	1	1	1	1	1	1	.	50.	13MAR78	2	1	1	1	1	1	1	.	58.
1MAY78	*000	1	1	1	1	1	1	.	64.	19JUN78	1	*000	*000	*000	1	1	1	.	68.
7AUG78	1	1	1	1	1	1	1	.	75.	25SEP78	1	1	1	1	1	1	1	.	82.
13NOV78	1	1	1	0	0	0	0	.	85.	1JAN79	0	0	0	0	0	0	0	.	85.

OPTIMA
NORWEGIAN
COMPUTING
CENTER

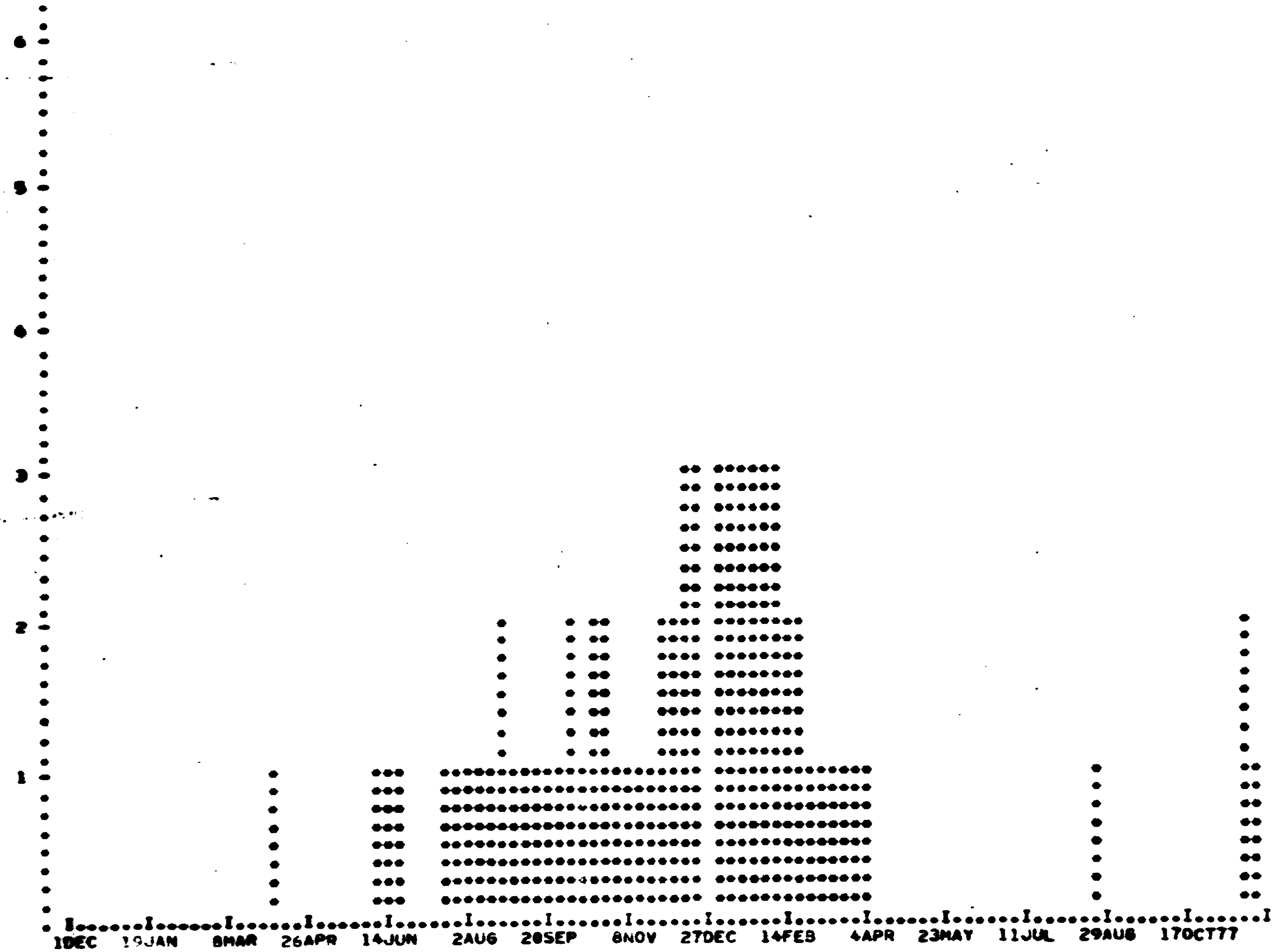
* * * R E S O U R C E   L O A D I N G   I N   H I S T O G R A M   F O R M * * *

PAGE 1
RESOURCE: INF

PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
08 DEC 75 THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

OUTPUT START: 1DEC75
OUTPUT FINISH: 6AUG79

T.U. INPUT: WEEK
T.U. OUTPUT: WEEK



• • • R E S O U R C E   L O A D I N G   I N   H I S T O G R A M   F O R M • • •

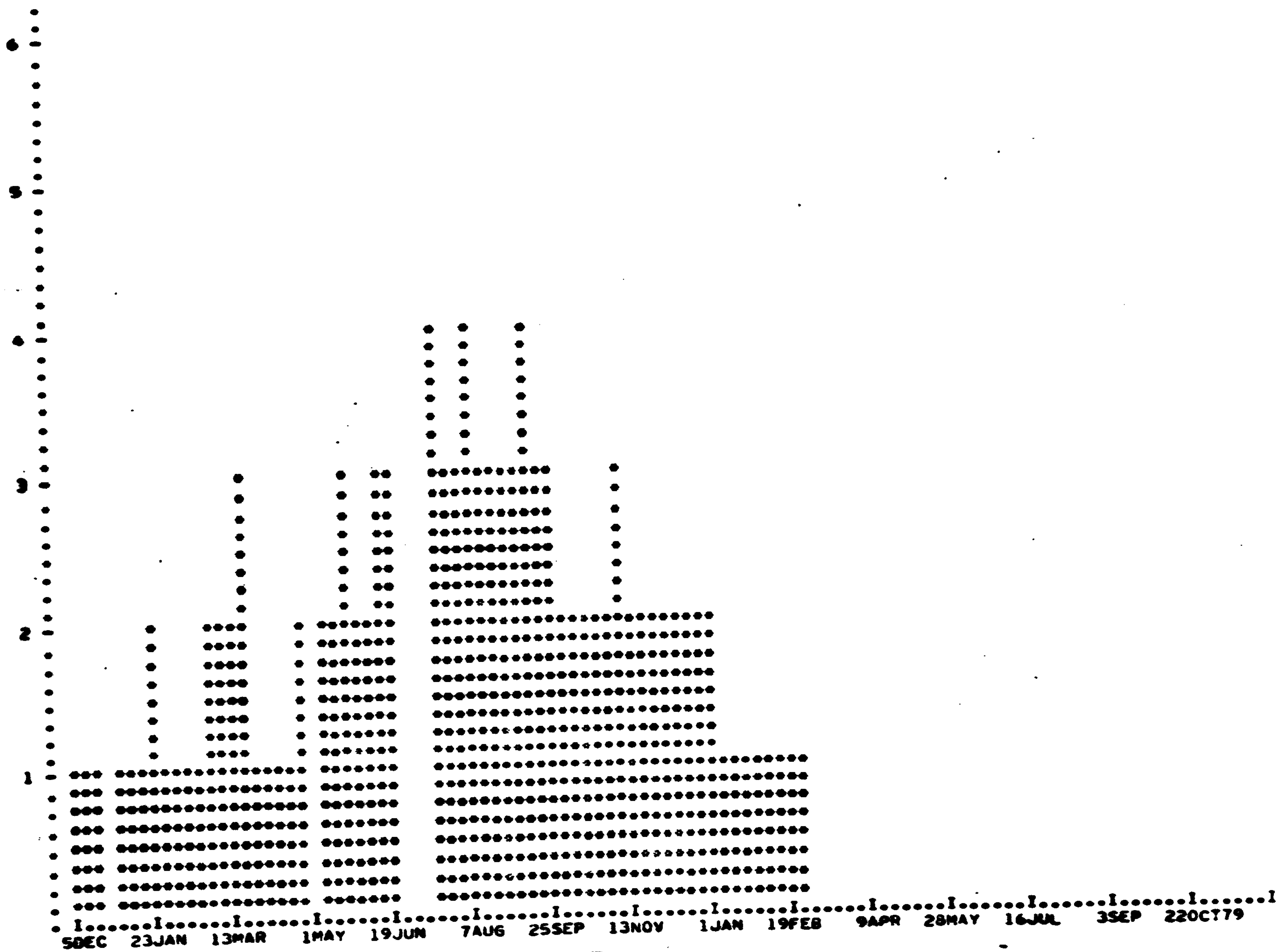
PAGE 2
RESOURCE: INF

OPTIMA
NORWEGIAN
COMPUTING
CENTER
03 DEC 75

PROJECT NO. 1
GARDE IRON • STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

OUTPUT START: 1DEC75
OUTPUT FINISH: 6AUG79

T.U. INPUT: WEEK
T.U. OUTPUT: WEEK



OPTIMA NORWEGIAN COMPUTING CENTER 03 DEC 75

RESOURCE LOADING IN TABLE FORM

PAGE 1
RESOURCE: INF

PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

OUTPUT START: 1DEC75
OUTPUT FINISH: 6AUG79

T.U. INPUT: WEEK
T.U. OUTPUT: WEEK

									ACCUM. LOAD
8MAR76	0	0	0	0	1	0	0	.	1.
14JUN76	1	1	*000	*000	*000	1	1	.	6.
20SEP76	1	1	2	1	2	2	1	.	24.
27DEC76	*000	3	3	3	3	3	3	.	55.
4APR77	1	0	0	*000	0	0	0	.	65.
11JUL77	*000	0	0	0	0	0	1	.	66.
17OCT77	0	0	0	0	0	2	1	.	69.
23JAN78	2	1	1	1	1	2	2	.	85.
1MAY78	*000	2	2	3	2	2	3	.	110.
7AUG78	4	3	3	3	3	4	3	.	146.
13NOV78	2	2	2	2	2	2	2	.	176.
19FEB79	1	1	0	0	0	0	0	.	186.

									ACCUM. LOAD
26APR76	*000	0	0	0	0	0	1	.	2.
2AUG76	1	1	1	2	1	1	1	.	14.
8NOV76	1	1	1	2	2	3	3	.	37.
14FEB77	2	2	1	1	1	1	1	.	64.
23MAY77	0	0	0	0	0	*000	*000	.	65.
29AUG77	0	0	0	0	0	0	0	.	66.
5DEC77	1	1	1	*000	1	1	1	.	75.
13MAR78	2	3	1	1	1	1	2	.	96.
19JUN78	3	*000	*000	*000	4	3	3	.	123.
25SEP78	3	2	2	2	2	2	3	.	162.
1JAN79	2	1	1	1	1	1	1	.	184.
9APR79	0	0	0	0	0	0	0	.	186.

Attachment 11.12

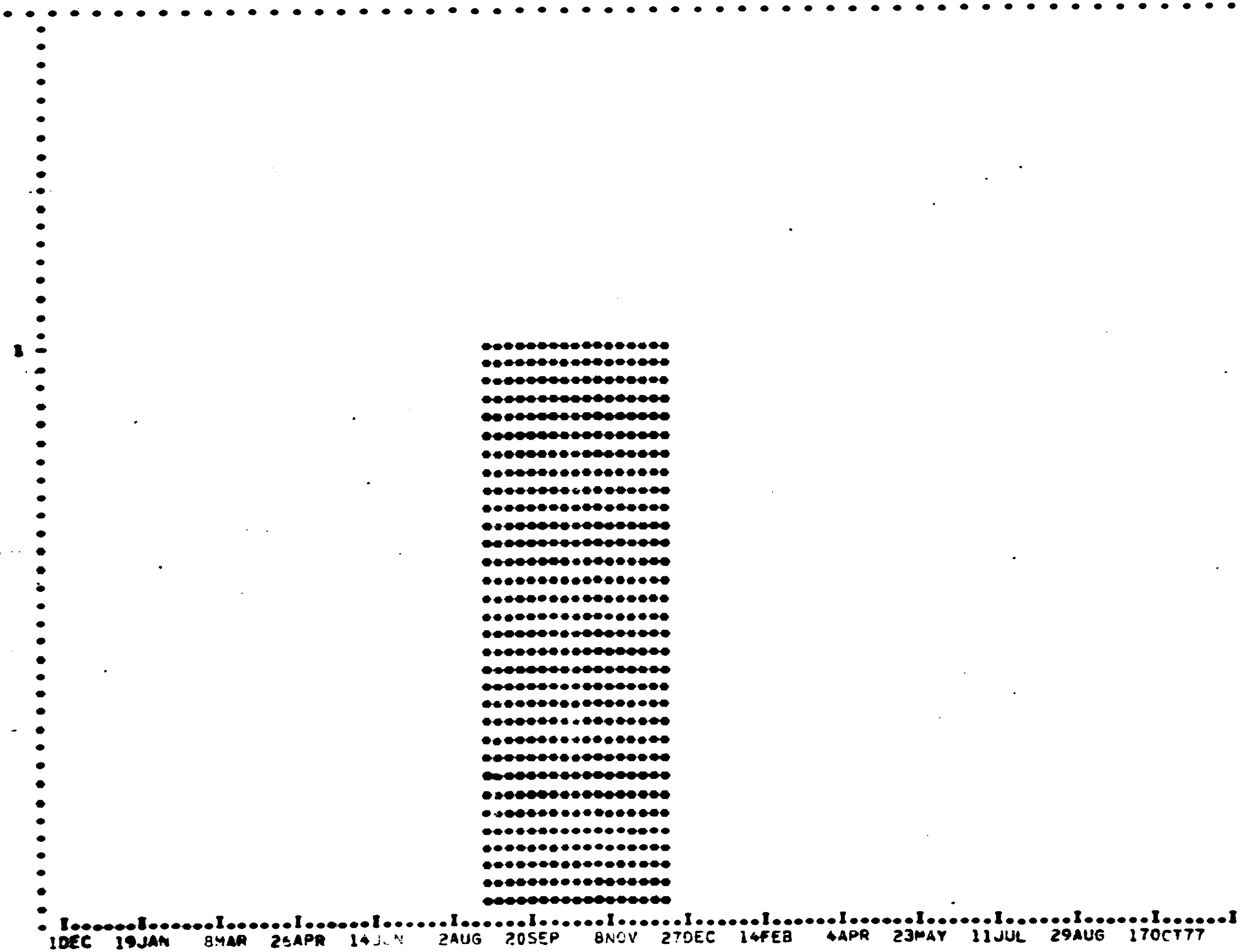
OPTIMA NORWEGIAN COMPUTING CENTER

•••RESOURCE LOADING IN HISTOGRAM FORM•••

PAGE 1
RESOURCE: SPC

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
03 DEC 75 THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

OUTPUT START: 1DEC75 T.U. INPUT: WEEK
OUTPUT FINISH: 6AUG79 T.U. OUTPUT: WEEK



RESOURCE LOADING IN TABLE FORM

PAGE 1
RESOURCE: SPC

[illegible] PROJECT NO. 1
[illegible] - [illegible] IMPLEMENTATION PLAN
[illegible] TO THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

OUTPUT START: 1DEC75
OUTPUT FINISH: 6AUG76

T.U. INPUT: WEEK
T.U. OUTPUT: WEEK

								ACCUM. LOAD									ACCUM. LOAD
[illegible]	0	0	*000	*000	*000	0	0 .	0.	[illegible]	0	0	0	1	1	1	1 .	4.
[illegible]	1	1	1	1	1	1	1 .	11.	[illegible]	1	1	1	1	1	1	0 .	17.

02342

(3 41)

IMPLEMENTATION COUNSELLING REPORT
FOR
[illegible] IRON & STEEL WORKS

[illegible] 19[illegible]

02342
(3 of 6)

IMPLEMENTATION COUNSELLING REPORT FOR DANUBE IRON & STEEL WORKS

December 197[illegible]

[illegible]

[illegible]

IMPLEMENTATION COUNSELLING REPORT

FOR

DANUBE IRON & STEEL WORKS

DECEMBER, 1975

TABLE OF CONTENTS

ATTACHMENTS

1. INTRODUCTION

The implementation counselling for the managed maintenance system of the Danube Iron and Steel Works has been completed. A group of 18 future users of the new systems during the total project time of nine months has been trained in operation of the systems.

A great number of meetings have been arranged in order to secure the total organisation's acceptance of the changes recommended.

Some of the proposals are adjusted in order to meet wishes from the different organisational units.

The implementation plan is now accepted by all key persons in the company and authorised by the highest Hungarian authorities.

On request of the Minister of Metallurgical and Mechanical Industry of Hungary, a study has been conducted to determine the consultants' evaluation of the present situation in the company, the proposed managed maintenance system and its potential. This study is attached to this report as Attachment 1.

In connection with the implementation counselling, there is a number of special studies dealing with the implementation of different techniques and methods. To demonstrate this, the following papers are attached to this report:

- Attachment 2, a paper concerning the principles of modern project management; it is a guide for organising the implementation of the managed maintenance system integrated with another main project concerning expansion of the production facilities.

- Attachment 3, a paper concerning a mathematical method for evaluation of optimum spare part stock.

- Attachment 4, a paper concerning a method for introduction of microfilm.

- Attachment 5, a paper concerning the principles of value analyses.

2. SUMMARY OF METHOD OF IMPLEMENTATION COUNSELLING

The idea of the total project has been counselling.

Phase 1 of the project "Introduction to Managed Maintenance" resulted in a 300-page teacher's handbook in managed maintenance and an education programme for all personnel of the Danube Iron and Steel Works who will attend courses in managed maintenance. See UNIDO report: Introduction to Managed Maintenance, July 1975, proposed by IKO-Konsulent A/S.

This advanced training system was elaborated in close cooperation with the person responsible for the training activities. The content of the lectures has been carefully discussed and the special techniques of this type of training have been presented.

Phase 2 of the project "System Development" resulted in a complete description of all systems necessary for introduction of the managed maintenance system. See UNIDO report: System Development Report for the Danube Iron and Steel Works, September 1975, proposed by IKO-Konsulent A/S.

All systems have been developed in close cooperation with the future users. Major systems, such as those for cost control, preventive maintenance, etc. have been tested by trial implementation.

The implementation counselling has been an integrated part of the system development phase of the project.

Phase 3 of the project "Work Plan Preparation" resulted in a detailed plan for implementation of the managed maintenance system in the Danube Iron and Steel Works, to take place over a period of almost four years, beginning in December 1975.

The work plan preparation has been elaborated by use of EDP network technique and is carried out in close cooperation with the management and the staff of the Danube Iron and Steel Works.

The implementation counselling has been an integrated part of the Work Plan Preparation phase of the project.

3. SUMMARY OF THE RESULTS OF THE IMPLEMENTATION COUNSELLING

Implementation counselling seeks to achieve the following:

- Establishment and execution of a completed advanced training programme in managed maintenance.
- Complete description of all systems necessary to form a managed maintenance system.
- Testing and adjustments of the systems to meet special requests from the company.
- Thorough education of 18 future users of the systems.
- Acceptance of the proposed systems by all organisational units of the company.
- Acceptance by all company managers of an implementation plan for the whole project.
- Set-up of an implementation organisation.
- Guarantee that this organisation will be given the tools necessary to manage the implementation.

4. CONCLUSION

With the system implementation, the field work of the project is completed.

It is our opinion that this project has been carried out successfully. However, we want to stress two important points. This success is a result of very good cooperation between UNIDO staff members and the consultants, and we want to thank UNIDO for invaluable assistance. Furthermore, it is our opinion that the counterpart will meet major difficulties in attempts to introduce the proposed systems, due to lack of experience in implementation of such large, sophisticated systems; therefore, we think further UNIDO assistance should be offered.

Attachment 1

MEMO CONCERNING IMPROVEMENT POSSIBILITIES IN THE DANUBE IRON AND STEEL WORKS BY INTRODUCTION OF A NEW MANAGED MAINTENANCE SYSTEM

MEMO CONCERNING IMPROVEMENT POSSIBILITIES IN DUNAI VASMÜ (DV) BY INTRODUCTION OF A NEW MANAGEMENT MAINTENANCE SYSTEM

The meeting in DV on 14 October with Mr. Talyigas and Mr. Sömjen and representatives of DU dealt with the following:

1) Our impression of present maintenance conditions in DU

2) The proposed systems to be implemented in a new managed maintenance system

3) Our rough estimation concerning the effect of the proposed changes.

1. PRESENT SITUATION

There are many positive factors in the company's present situation. The technological achievements and past expansion of production show the high quality of workers and management. The continuous improvement of the plant demonstrates the high technical quality of the technical staff.

The programmes for further technological development and expansion of production will ensure even greater improvements in the future. The opportunities for obtaining them at reasonable cost depend mostly on how well the company solves its management problems and in which way Hungarian industry is developed.

Compared with similar plants in Western Europe, we must state that plant conditions are considerably lower and maintenance costs considerably higher than normal. The reasons for this are in our opinion:

- Production has expanded to a level much higher (+25% to +75%) than foreseen when the plant was originally projected. This results in an overload on several points throughout the production line.

  As an example, the hot rolling mill during the first eight months of this year had had 28 breakdowns caused by broken rolls. This is a very high figure and indicates extremely poor quality of the rolls, and/or considerable overload, and/or poor instruction of the operators.

- The description of the present organisation is old and outdated. Job descriptions and descriptions of functions are not coordinated and do not correspond to reality. The quality of the system descriptions varies greatly, and as they are made up individually, they are not well integrated as a whole.

For example, it has been necessary to make new descriptions of all existing systems which we wanted to study. We have never seen an "in-use" description of a system.

- The function of the organisation for the total company is very unclear. There is a lot of overlapping between production and maintenance. Responsibilities are often impossible to place in one organisational unit. The same situation exists within the maintenance function.

  For example, decisions about a major repair involve some 20 different persons and nobody has the final responsibility.

- The organisation is established in such a way as to give priority to production, maintenance possibilities to influence decisions about repair time and conditions in the plant. This is also significant in planning maintenance work and in keeping the maintenance staff efficient.

  For example, in January of this year a large repair demanding approximately 860 maintenance workers in the hot steel mill was decided and planned, in cooperation between production and maintenance staff. The workers were taken from the normal shift, the work was prepared, but then the repair was called off because the production plan had not been fulfilled.

- The level of instruction, education, and motivation of the production workers is not sufficient. User's manuals exist for the equipment, but are not sufficiently developed. Maintenance people are at present instructing production workers in proper operation, even though this is the responsibility of the production foremen.

  For example, blocks coming down the roll table in the hot steel mill are often not properly planed and have large burrs on them. The operator should refuse such blocks, as they harm the equipment and cause down-time and unnecessary maintenance costs.

- The demand for service from the central maintenance shops is unrealistic. The total yearly demand for spare parts amounts to approximately 250 million forints; approximately 40% of this is imported, approximately 30% is bought in Hungary, and approximately 30% is produced by the counterpart.

  Any item used at the plant can in principle be ordered from the central workshops, but:

  - The delivery time for imported spare parts ranges between one and two years

  - The capacity of the Hungarian machine industry often is limited so that delivery is impossible.

- The Hungarian machine industry is not sufficiently equipped for manufacturing many of the spare parts needed by the counterpart.

- The spare parts administration is weak. This causes major difficulties, in some cases poor quality, and often very high costs.

As an example, rolls for the sheet straightener are to be hardened before use. This usually is done by heating the rolls in an induction furnace; but this size furnace does not exist in Hungary. The central maintenance workshops perform the hardening by heating the rolls one by one in a pit furnace. The temperature range cannot be properly controlled and the results are not good. The rolls will have a shorter life and be more expensive.

- The central maintenance workshops are nor efficient. They receive orders from a number of sources (about 30) and each ordering unit can demand delivery time by requiring priority. The existing equipment is often not suitable for the requested jobs, and to use it requires expensive modifications. The documentation, in general, is poor.

  Drawings are not separated by operation, with the result that the blueprints contain many corrections made with different coloured pencils. The workshops in general are not suited for efficient production, the machinery and equipment are inadequate to meet the greatly varying demands for spare parts by the counterpart; heating systems are insufficient in some factories; transport facilities are poor. The tools are not properly organised and their quality varies considerably.

- The administration of spare parts and materials is at present decentralised, poorly organised, and inefficient.

  Often it is impossible to get a realistic delivery time when ordering a spare part. In our samples we found deviations in delivery time from one month to one year for spare parts purchased from outside. Also, we found that some orders given to the central workshops are years old and not filled.

  At present the total value of spare parts in the company amounts to approximately 400 million forints. Approximately 70% of this is produced outside the company and requires delivery times from a few months to two years. Taking this into consideration, the rate of turnover for spare parts is not bad, and the total number of spare parts in stock probably too small. This view is underscored by the fact that approximately 15% of the present spare parts have had no turnover since 1972.

- The technical staff for maintenance is too small. All technicians we talked to mentioned an overload of work. The missing documentation and inefficient planning activities prove this.

  For example, when this UNIDO project was started, 18 technicians from the counterpart were allocated for the different sub-projects and were told by the top management to concentrate on this job. However, their normal functions were not taken over by others, because there is no spare capacity. Therefore, none of these people has been full time on the project and the systems developed are not as integrated as intended.

- The use of modern management tools has been started by the company, but the progress is insufficient. Three years ago the network-planning technique was introduced. However, still today it is used only as a description of the logical structure in a job and not for planning control.

  The use of EDP is minimal. There is sufficient computer capacity with some 40 persons working in this function.

  However, for the maintenance and materials administration no input or output proposals have been presented, and the coding systems used today are unsuitable for EDP. No plans exist for the introduction of EDP in the maintenance function, and no calculations have been made concerning the efforts required.

The present situation, partially described above, forms part of the background for our proposals concerning a new organisation and a new management system for the maintenance function of the Danube Iron and Steel Works.

We are convinced that the introduction of this system will be very advantageous to the company. Improvements can be made in the technical conditions of the plant, the quality of production, and the volume of production, while specific maintenance costs can be reduced.

2. SUMMARY OF THE PROPOSALS

The managed maintenance system of the Danube Iron and Steel Works is completed according to the contract between UNIDO and Norconsult/IKO. The terms of reference for the project are accordingly respected.

Close cooperation between the counterpart and the consultants resulted in a complete system for managed maintenance consisting of:

a) A proposal for future organisation of the maintenance function and its relation to the other parts of the company. The proposed concept includes a centralisation of the maintenance function, a clear separation of responsibilities between production and maintenance, and a division of the maintenance function into logical units according to functions.

b) A system for central planning of all maintenance activities. The proposed system consists of a yearly plan coordinating all maintenance activities by means of a network planning technique.

c) A system for planning of maintenance work to be carried out within each production unit. The proposal consists of a system for planning of projects and repair jobs based on a work-order approach.

d) A system for planning of work, production of spare parts, etc. in the central workshops. The proposed system consists of a general production planning system well suited to the actual production of spare parts.

e) A system for preventive maintenance. The proposed system includes a registration and information system, as well as necessary routines and instructions.

f) A system for administration of spare parts and material. The proposed system consists of a centralised and coordinated material administration based on central files, uniform routines and a simplified decision-making procedure.

g) A cost control system covering all maintenance activities. The proposed system is based on the proposed organisational concept and distributes responsibilities, reporting and control accordingly. Its main objective is to improve cost consciousness throughout the organisation.

h) Coding system for:

Machine numbers
Account numbers
Drawing numbers
Spare parts numbers
Materials numbers

The proposed systems are elaborated as modular systems covering the whole enterprise.

i) Proposals for contents of all necessary data bases and files.

k) Description of EDP files, input and output request necessary for a later conversion to EDP.

l) Recommendation of a method for determining size of stocks and spare parts (see Article 10).

m) Recommendation of a method for project planning by use of EDP network (see Article 10).

n) Recommendation of a method for re-evaluation of plant layout (see Article 10).

o) Recommendation of a method for modern information files, copying equipment, etc. (see Article 10).

p) A complete education programme in maintenance management for both production and maintenance managers. This system is described in a report delivered for UNIDO in July 1975 under contract 75/2-13 (HUN/72/804).

The managed maintenance system is a manual system which can be brought rapidly into action, but a later conversion to EDP has been taken into consideration.

1. RESULTS

The implementation of the above-mentioned systems over a period of approximately three to four years will in our opinion change the situation of DV radically.

The following results will be expected by us as the minimum acceptable performance:

a) Higher quality organisation and maintenance managers to ensure better maintenance.

b) The administrative system will be improved and result in a better utilisation of the maintenance budget.

c) The lifetime of the production equipment, by unchanged production volume, will be improved by 10%.

d) The average breakdown time will be reduced by 15% of present value.

e) The quality of the finished products will be considerably improved.

f) The present maintenance level is below an economic optimum, therefore the demand for maintenance will increase. The new systems will improve maintenance efficiency by 10%; however, this improvement will show up as a higher level of maintenance. No reduction of the maintenance labour force is expected.

g) The efficiency of the central maintenance workshops, that is output per man-hour, will be improved by 10%.

h) A spare part stock will be established based on realistic, economic analyses. This probably means an expansion of the present stock level.

i) The new systems will release the highly technically educated persons in the maintenance function from some of their present time-consuming tasks. However, a large number of tasks demanding highly educated people remain, and we expect the technical staff in the maintenance function to be expanded.

However, we must stress that this is a major task for the organisation of the company, which must be recognised as such if optimum results are to be obtained. The system development phase of this project has been injuriously affected by lack of capacity from the counterpart's organisation. In order to achieve successful implementation of the proposed systems, it will be necessary to allocate qualified full-time personnel to the project for a number of years.

In addition, there are three important conditions:

- The top management of the Danube Iron and Steel Works must consider the implementation of these systems as a responsibility demanding priority.

- The need for maintenance and the potential of the maintenance organisation to meet the demands must be realistically analysed, and changes in capacity must be carried out accordingly.

- The advanced training of managers in modern management techniques must be accelerated at all levels.

The duration of the complete implementation is preliminarily estimated to require approximately four years. This estimate is based on the above-mentioned conditions and some participation by the consultants.

4. CONCLUSION

The proposed time schedule is based on the following assumptions:

1. A group of 8-10 highly qualified engineers and economists working full time on the project.

2. Consultants' participation during the first year of implementation.

3. Considerable participation by other DV personnel, i.e. the EDP Department, Accounting Department and Organisation Department.

4. Considerable participation of the future users of the system, such as maintenance and production managers.

However, the participation of others should not be so great that it will disturb their normal duties.

If the scheduled time is to be reduced to about two years, the project group should be expanded to about 20 men on full-time basis. Furthermore, we estimate that the staff's and the users' participations should be considerably expanded.

For instance, the EDP Department should be supplied with approximately 10 trained system development engineers and at least 15 trained programmers. In addition, some software should be bought from outside.

Each production and maintenance manager should participate in the project at least one day per week. In order not to disturb the production demands, some hundreds supplementary managers will be required.

We must stress that such a schedule seems unrealistic to us.

PROJECT MANAGEMENT PRINCIPLES

MEMO CONCERNING PROJECT MANAGEMENT

To Mr. Répásy, G., director from IKO-Konsulent, Frydensberg, G.

According to our discussions in the meeting of September 4, I hereby as promised give my comments on organization of the large investment project planned for D.V.

IKO has assisted a number of companies with project management. The method we are using is based on the method developed in the USA for managing the space programs. However, it is adjusted for practical commercial use. For instance, we have developed a large EDP-network program which enables us to control time schedule, use of resources and cost development. This model has been developed over more than 5 years. The large EDP-company UNIVAC has investigated world-wide all existing large EDP-network programs in order to buy the best. In January they bought our program.

The philosophy of our method for project management is simple. A project is a large activity, which normally shall be carried out one time only. A project has a clear objective and it is controlled independently. A project is a development task which shall end up as a running enterprise. A project is defined both in time and in costs.

Therefore a project is very different from the daily work in an enterprise and shall be organized and controlled in a different way.

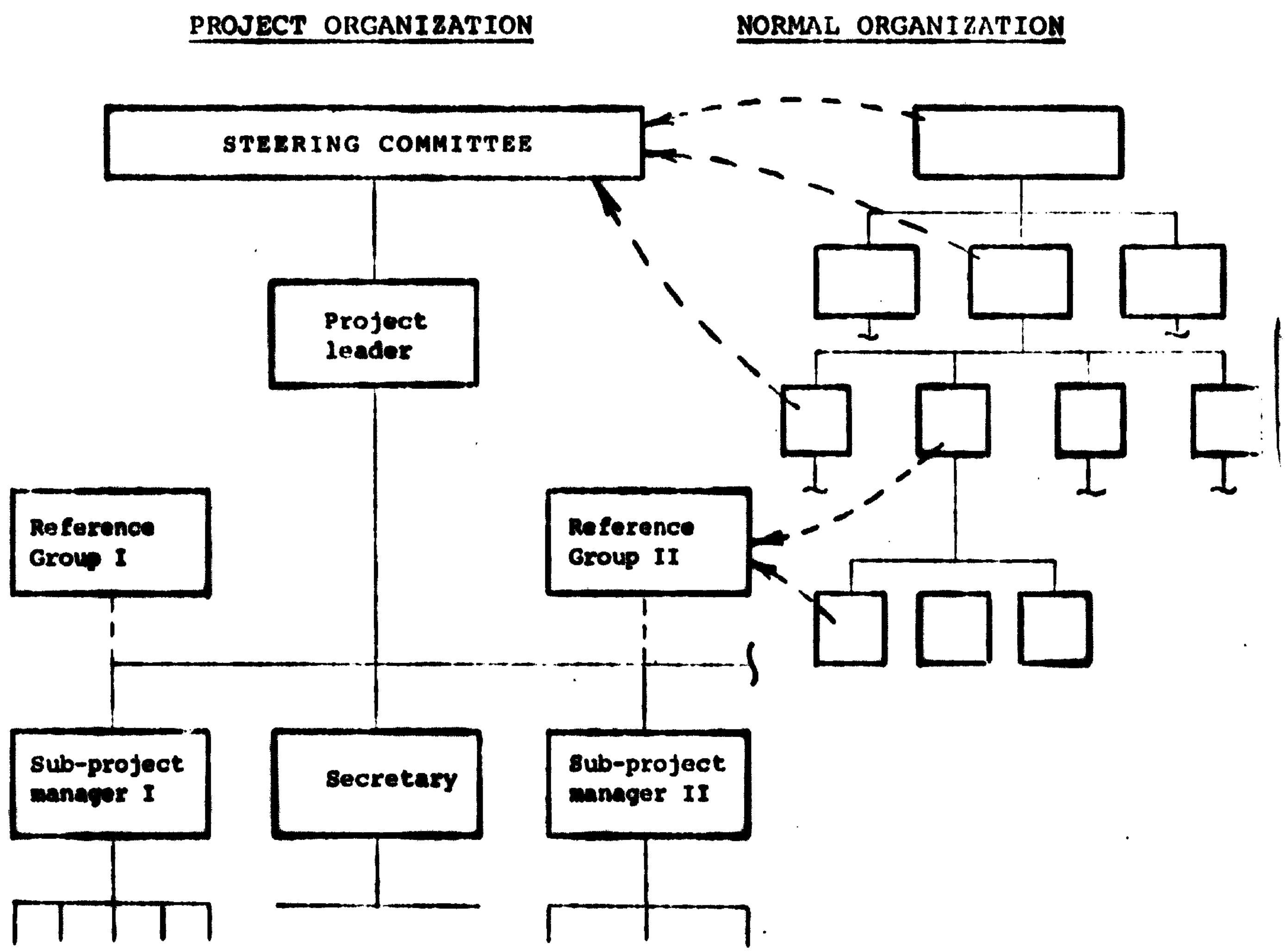
The head of a major project shall be a Steering Committee consisting of 5-10 persons. One person is chairman of this group. The Steering Committee (SC) makes the major decisions, esrablishes the objective of the project, gives the economical frames, and the basis time schedule.

Responding to the SC is the project leader. He will be the same man during all the project time. His first duty is to form and guide a planning group for executing the time scheduling and economical plans. He will break the project down to a number of first-degree sub-projects (approx. 20) and a large number of second-degree sub-projects (approx. 100), each of which is again divided into activities.

Responding to the project leader are the managers of the sub-projects. Each manager, managing one or more sub-projects, will define his sub-projects corresponding to the overall objectives of the project. The definition will be controlled by the project leader. The sub-project manager then will complete detailed work plans for his sub-projects. He shall also establish contact to the future user-organization and to all existing units which are involved in or are disturbed by the project.

2/...

This leads to the following structure:



Working on the project are three different kinds of persons:

1) Those who are participating part time in reference groups, etc.

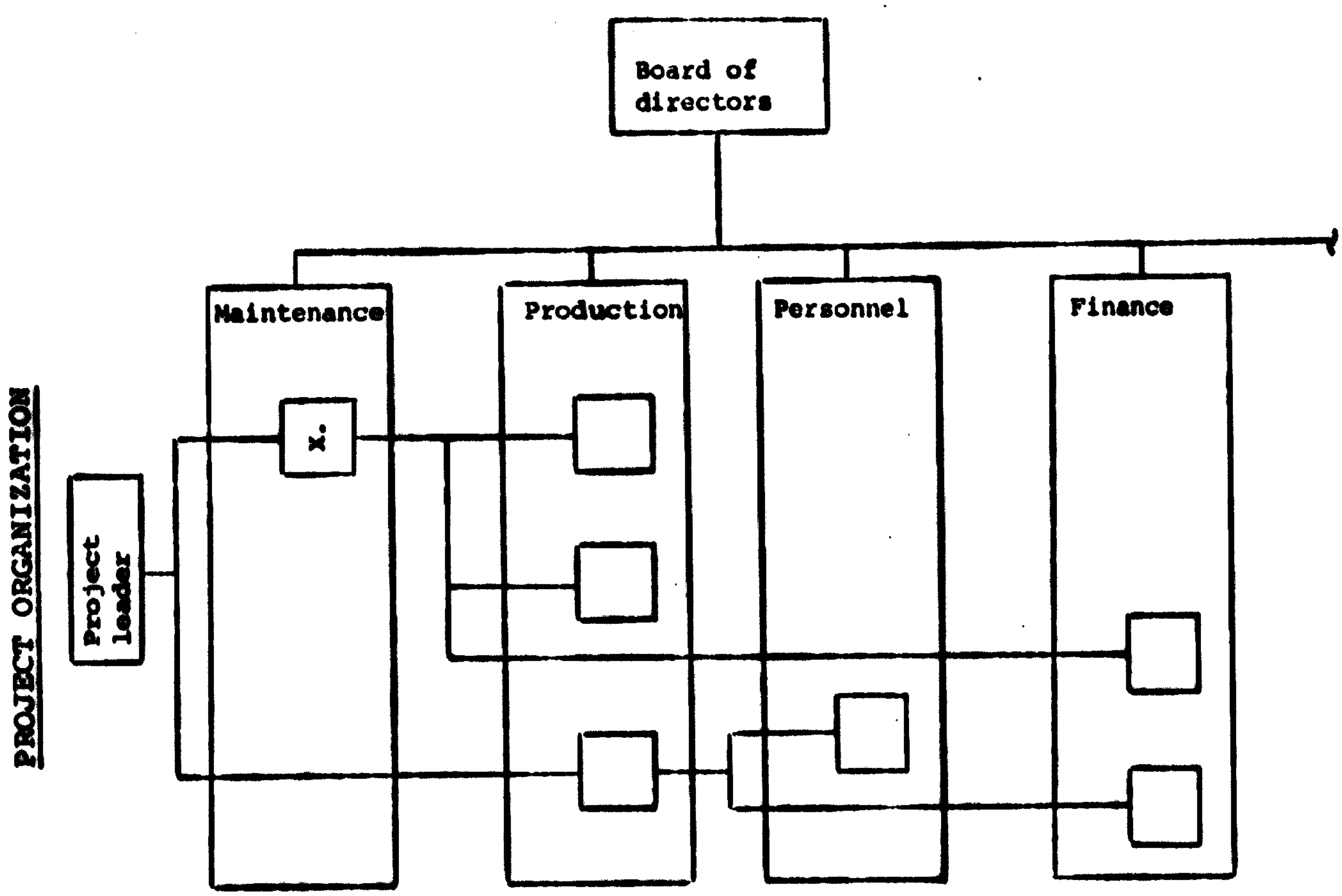
2) Those who are transferred to the project organization for a period of time.

3) Those who must work at the same time on the existing production and on the project.

Groups 1) and 2) cause no other problem than to evaluate who is the best person for a certain sub-project taking into consideration both the viewpoints of the existing production, and the project, and the future organization in order to utilize the experience from the project in the best way.

Group 3) often causes problems and therefore a matrix-organization for this is established. The structure is as follows:

NORMAL ORGANIZATION



Each person in group 3) has two chiefs during the project time. Normally, each person in this group is responding to the normal organization concerning technical problems and personal questions and to the project organization concerning progress in the project.

This organization can function only if good relations between the project leader and the technical managers are established.

A basic condition for controlling large projects is the use of EDP-network planning. This is the only way, during the total project time, to be sure that the planning is ahead of the work done, and the only way in which to get immediate warning in case of deviation from budgets and plans, and the only way to communicate enough detailed information for control.

Another important use of EDP in project management is for the preliminary evaluation of the technical solutions and their impact on the future economy of the company. For this purpose IKO has developed another EDP-program, a kind of budget simulation model. This is not more than one year old, but has already proved valid in approximately 15 companies.

If D.V. wishes to get any more information about the method recommended by IKO, I shall certainly be happy to supply you with such.

9th September, 1975 IKO/GF

Attachment 3

METHODS FOR EVALUATION

OF

OPTIMUM SPARE PART STOCK

Basis for the Inventory Control Technique

The techniques which nowadays are applied to managing the maintenance parts are based on:

1. Thorough recording of the material usage to make a statistical forecasting.

2. Knowledge of the usage or the lifetime of the components for calculations.

One of the largest, single expenditures is precisely for components for which

- there is no statistical material (the usage is too low)

  or

- usage or lifetime is unknown.

Nevertheless, one may feel these components are necessary in the production and maintenance functions because it is impossible to know which problems may arise.

These components could be named "unrecorded spare parts" and ought to be considered as insurance against unforeseen events.

Determination of the Size of the Stock

Normally, the calculation of the safety stock can be based on demand and time of delivery in conjunction with a policy regarding the probability for a shortage of spare parts (service level).

The decision of storing "unrecorded spare parts" (which is often a decision of buying or not) requires, however, that more economic aspects be taken into consideration.

The calculation method which is here presented for "unrecorded spare parts" is based on the following assumptions:

1. The possibility of calculating component failure.

2. Advance calculation of the economic consequences of a stop.

3. A purchased spare part will maintain the full value during storage period.

4. If inapplicability or normal consumption occurs the whole investment is used.

If those assumptions are fulfilled the following principal statements can be made.

A spare part is to be kept in stock if and only if:

> the possible cost of breakdown during the remaining lifetime for the machine exceeds the possible costs of inventory and the possible costs of inapplicability.

If this statement is to be converted into mathematical terms the following parameters must be known:

- the frequency of failures with the component
- the function of the failure distribution for the component
- the price or alternative cost of the component
- the costs of breakdown
- the remaining lifetime of the equipment
- the internal interest rate.

However, all the above parameters cannot be known, and therefore the next part of the course includes other available practical methods.

Cost Analysis of Shortage of Spare Parts

In the first place our analysis concerns those components for which purchase or non-purchase may have great economic consequences, both positive and negative.

Our interest is in the economic decision whether or not the spare parts should be stored.

Breakdown causes a certain cost whether or not the spare part needed is in stock. But the magnitude of the costs is directly dependent upon the time used for repairs.

On this basis the following term is used for cost of shortage of spare parts in connection with breakdown in production. The cost of shortage is:

> Difference in total costs until the production item is repaired, which depends on whether or not the spare parts are in stock.

The cost of shortage thus is a function of time, based both on lost production hours and on the period required for purchasing spare parts.

Service Requirements and Economy

For components with high volume usage, ordering and inventory turnover (the quantity expected to be consumed before resupplying) is determined by demand and purchasing.

The safety stock (for components with low volume usage this is generally denoted as stockpile) is determined by the service level requirements. This influences the costs of inventory which will increase in conjunction with increasing safety stock.

The level of service need not be the highest possible, but it must be balanced with the demand in order to give an optimal economic result. This brings about the question of costs with regard to shortage of spare parts.

Figure 1 shows

> a simplified principal model of variable costs as a function of the size of the spare part stock. Costs of purchasing and keeping spare parts in stock increase, whereas costs caused by shortage of spare parts in stock decrease, when spare part stock increases. A certain area is obtained which represents an economic maximum.

Service Level

Service levels may be defined in many different ways, but here the following term is used:

$$\text{Service level} = \frac{\text{Demand that can be satisfied from the stock}}{\text{Total demand}} \times 100$$

We shall use this definition in the following.

A description of total variable costs as a function of the service level can be found in Figure 2.

> Theoretically the service level can be between 0% (no stock) and 100% ("maximum" stock which precludes any shortages). These extremes are to be avoided for components with high volume usage when optimal economic results are desired.

A further discussion of costs of shortages as well as for stockpile will come later.

Fig 1.

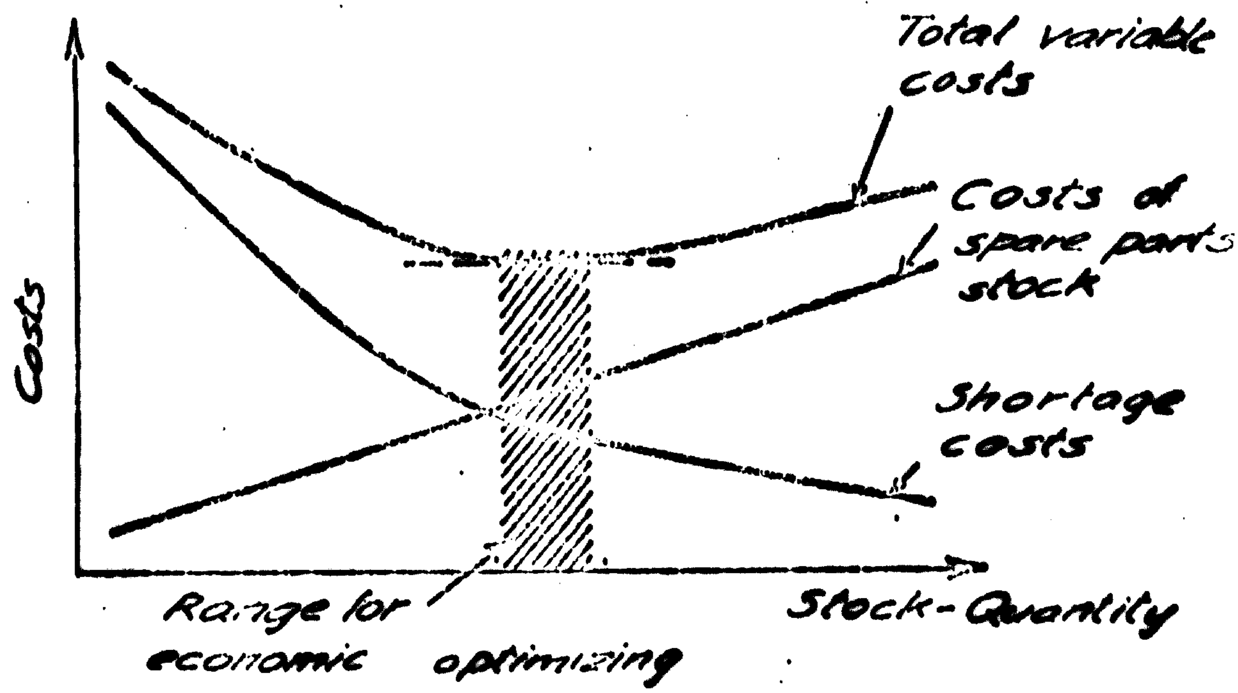
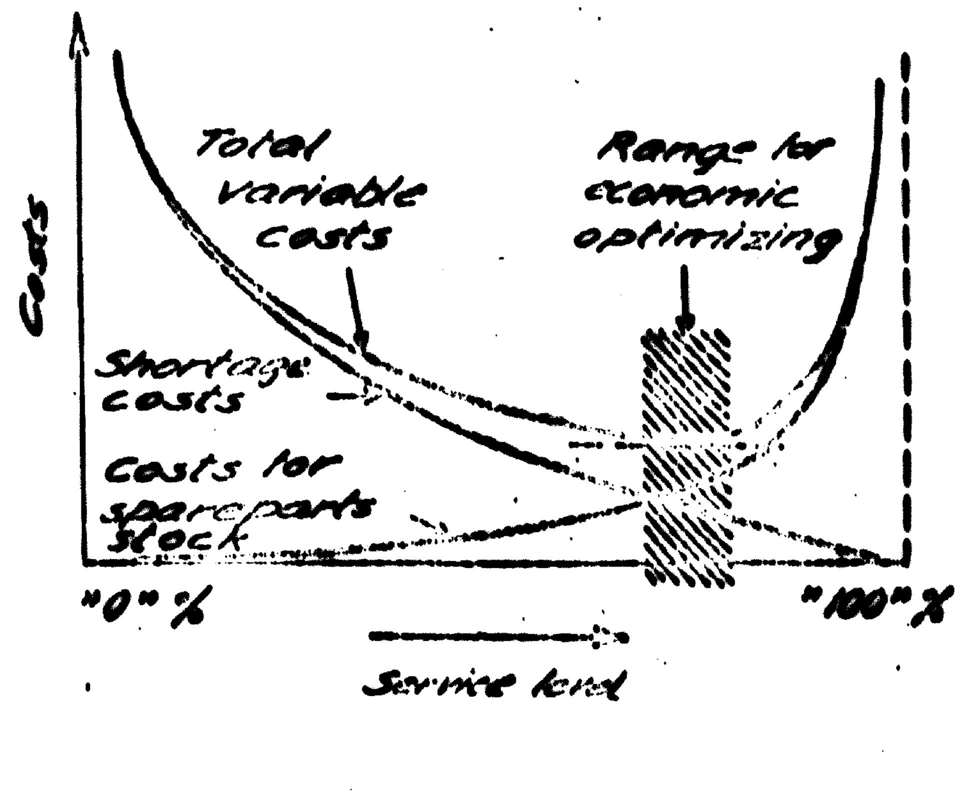

Total variable costs
Costs of spare parts stock
Shortage costs
Costs
Range for economic optimizing
Stock-Quantity

Fig. 2


Total variable costs
Range for economic optimizing
Costs
Shortage costs
Costs for spareparts stock
"0" %
"100" %
Service level

In order to estimate relevant probability models for the components of interest, some general models are presented based upon the periodical frequency of demand.

Probability Models

We shall show how materials used in the past three different components, A, B and C, can indicate their very different distributions of demand. The examples are greatly simplified. Figure 3 shows how the demand per component is recorded per period when the length of period is the purchasing time of component (= administrative time in connection with ordering + time of supply + time for receipt).

Examples :

Component A - Period 1: 3 pieces, Period 2: 10 pieces, etc.

Component B - Period 1: 1 piece, Period 2: 2 pieces, etc.

Component C has a greater use and represents several periods.

In Figure 4, all periods with equal demand have been added up separately and the result is shown on the right side of the figure in the histogram.

Component A

The mean demand is $\bar{x} = 4.25$ units, whereas a demand of three units prevails during most periods.

The distribution may be a typical Poisson distribution (the curve has been expanded in the figure). It is a simplified test to examine whether the standard deviation (σ) is equal to the square root of the mean ($\sqrt{\bar{x}}$).

$$\sqrt{\bar{x}} \approx \sqrt{\frac{(x_i - \bar{x})^2}{n}}$$

(The right side of the equation presents the formula for the empirical standard deviation).

Empirically the Poisson distribution agrees with the real distribution in the case of relatively low demand.

The Poisson distribution with the parameter λt can be expressed in the following way:

$$P(X = x) = \frac{(\lambda t)^x}{x!} e^{-\lambda t}$$

Attachment 3

FIG 3

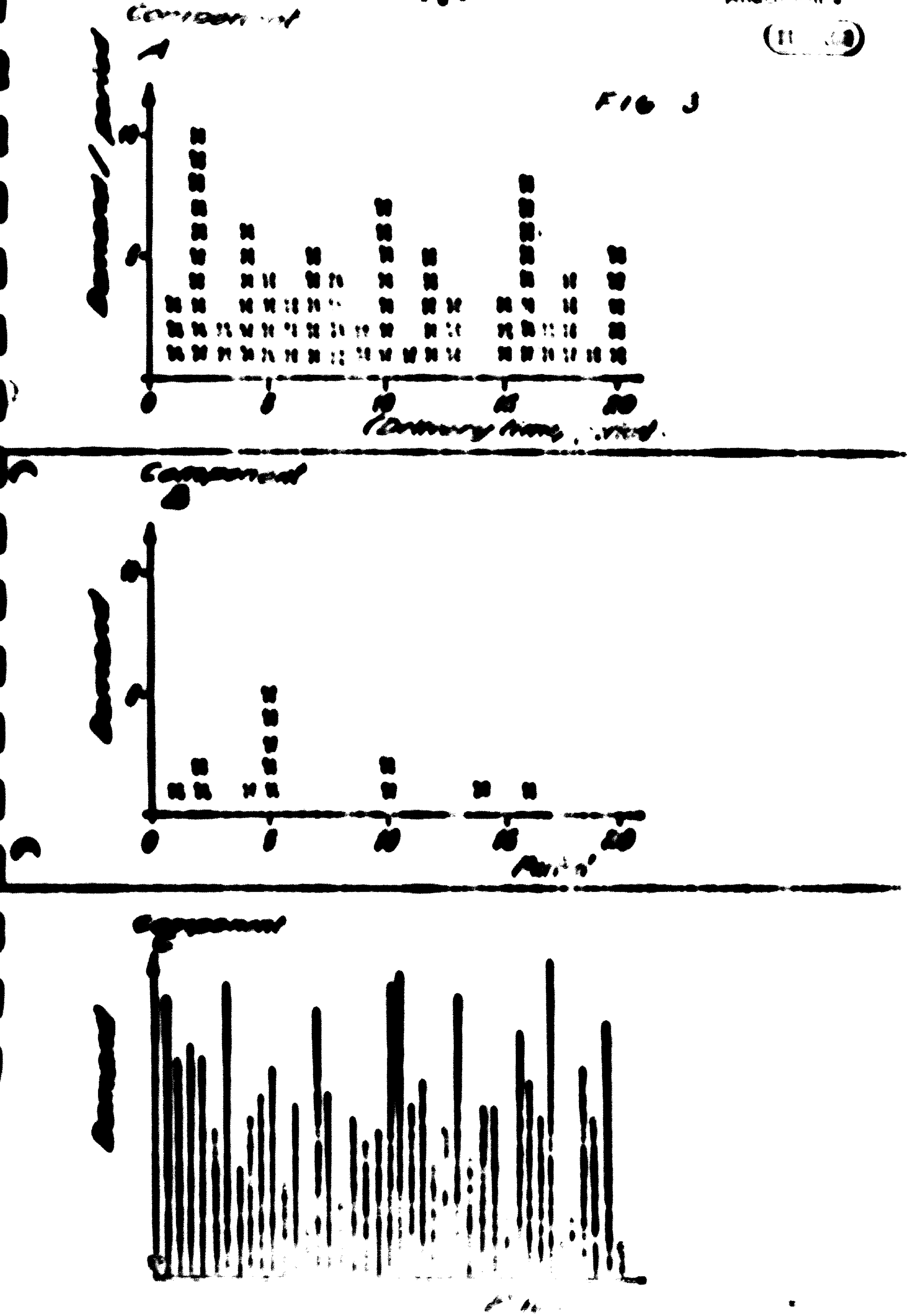
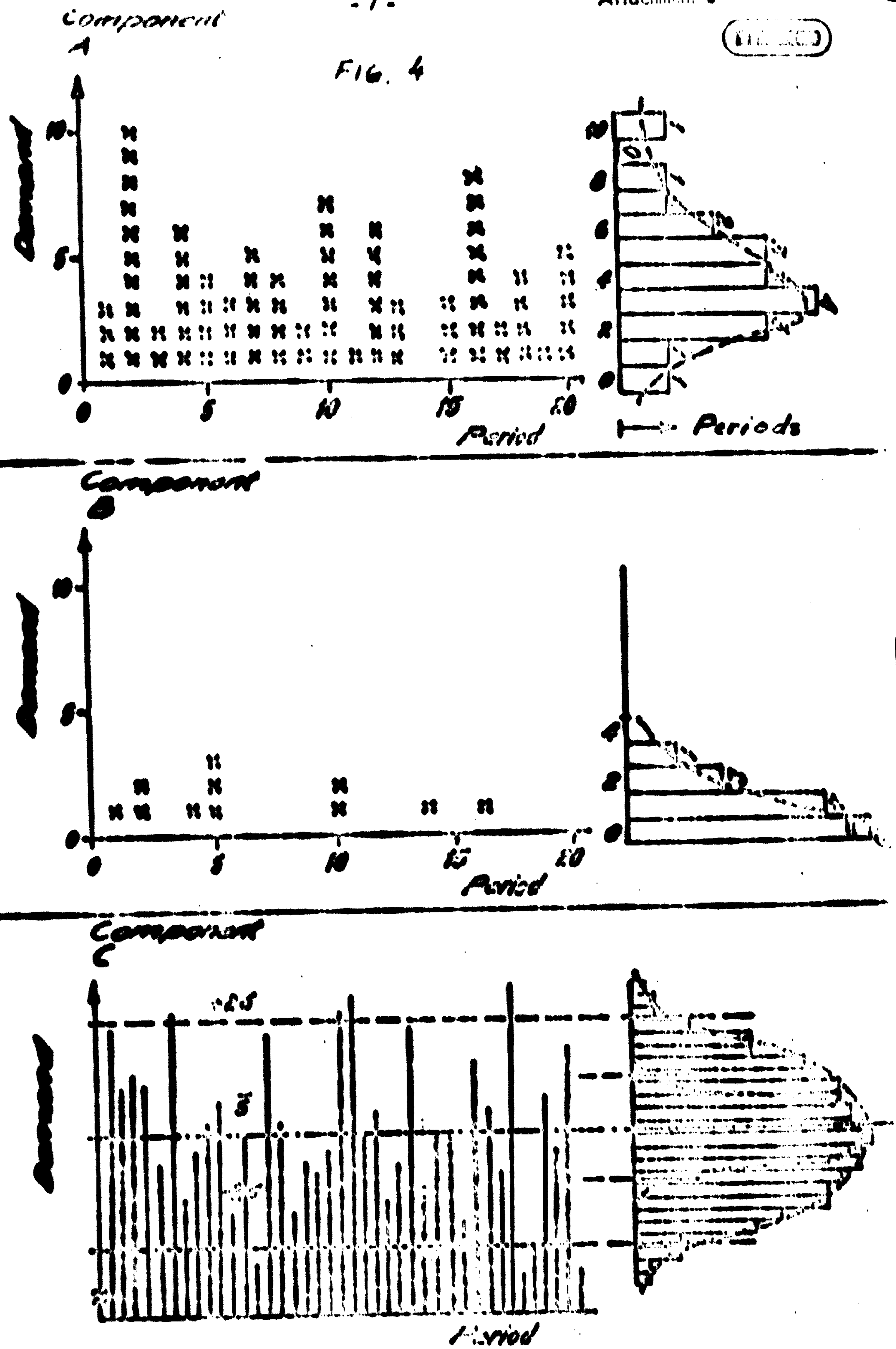


FIG. 4


Component A
Demand
Period
Periods
Component B
Demand
Period
Component C
Demand
Period

where λ t is the frequency of events in the period of time (O,t) and P (X = x) is the probability for exact x events in the same interval.

Component B

There has been demand for this component only for about a third of the period. We are interested in the probability for the first event at the time T within the period (O,t).

The probability distribution for T will be:

$$F(t) = P(T \leq t) = 1 - P(T > t)$$

P (T > t) is the probability for the fact that there will be no events within the period, i.e. x = o in the former equation which gives

$$P(X = 0) = \frac{(\lambda t)^0}{0!} e^{-\lambda t} = e^{-\lambda t}$$

Expressed in our current terms:

The probability for lack of components within the period (O,t)

$$\underline{F(t) = 1 - e^{-\lambda t}} \quad (t > o)$$

This distribution is called the exponential distribution.

Component C

Relatively great demand generally gives a normal distribution. In the figure the demand is distributed around a mean, C. Based on the service level 95.5%, the limits 2б and -2б are depicted on the figure. Between those limits 95.5% of the demand is found. (An example of a smaller distribution around the same mean value is shown too).

Mathematically the normal distribution can be expressed as follows:

$$Y = \frac{1}{\sigma\sqrt{2\pi}} \cdot e^{-\frac{1}{2}\left(\frac{X-\mu}{\sigma}\right)^2}$$

μ = the mean value

σ = the standard deviation

The normal distribution is not very interesting in this connection and will not be further discussed.

In accordance with the former reasoning, our interest is directed towards components with high purchasing and storage costs and correspondingly high costs of losses in accordance with shortages where the probability of shortages during a certain period is difficult to estimate.

The components in question have a very low frequency of usage and often the problem is whether or not to buy a unit.

On the basis of the probability distribution introduced, we are using with good approximation, the exponential distribution as a basis for a model development. The model, which results in a "nomogram for analysis of spare parts", makes a practical application of the total reasoning of shortage costs.

In the following we shall explain the concept "Shortage costs" and the construction of the model.

Cost of Shortages for Spare Parts

The basis is two different situations in connection with breakdown of machinery:

1. Special spare part is in stock
2. Special spare part is not in stock

In both cases loss arises as a consequence of stop time necessary for the repair of machinery. This loss (cost per time unit as a consequence of lack of production) often varies with the time used, which is to be considered when fixing the shortage costs.

The variety may be caused by the possibility that a buffer inventory, for instance, has been "consumed", which increases production costs because of production on another machine, extra time, etc.

In accordance with the previous description the evaluation of the following parameters is needed in order to decide the shortage costs.

K	Cost per time unit (N.B. function of time) until the machine has been repaired.
$T_{\text{without stock}}$	Number of time units which represents the loss of production until the machine has been repaired when no spare parts are in stock.
$T_{\text{with stock}}$	Number of time units which represents the loss of production until the machine has been repaired when spare parts are in stock.

$$\boxed{K_B = K\left(T_{without} - T_{stock}\right) + \text{special costs}}$$

The above formula applies to the shortage costs.

Taking into consideration K's function of the time, the following term can be used:

$$K_B\ (t) = K_1\ (t_1 - t_o) + K_2\ (t_2 - t_1) + K_3\ (t_3 - t_2) + \ldots.$$

where

K_1, K_2 .... are current costs for corresponding intervals of time within the period ($T_{without\ stock}$ $-T_{with\ stock}$).

Figure 5 shows an example of shorage costs with varying K.

Figure When spare parts are not available the repair should be planned and prepared during the purchasing period. This often reduces necessary time of repair compared with immediate repair after breakdown.

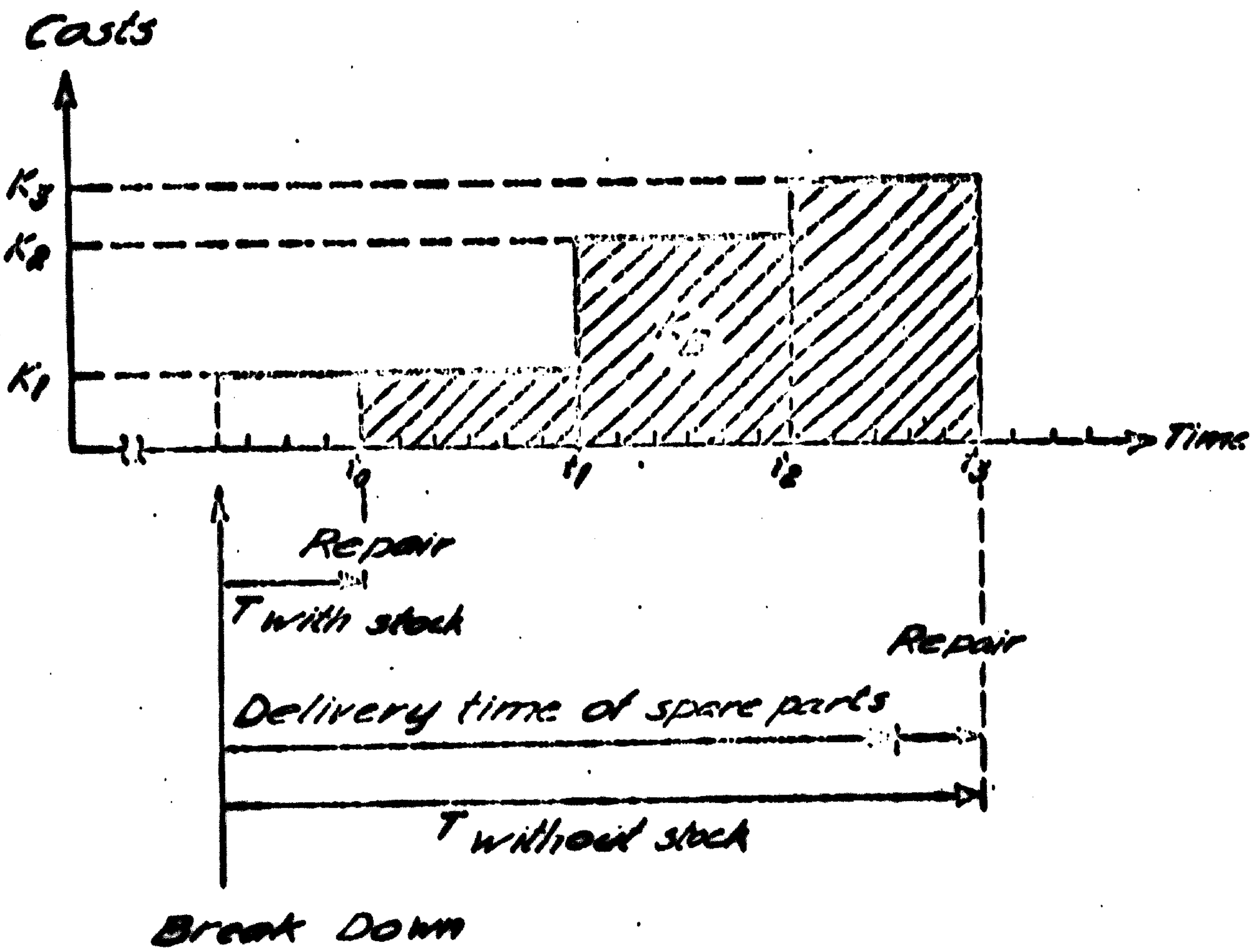
The example implies step-wise variety in the cost. A description in accordance with the enclosure gives a good idea of the calculation.

Comments concerning repairs:

K, cost per time unit	All probable alternatives which can contribute to reduced losses should be taken into consideration, e.g. - possibilities of production substitution within own company - borrowing of machinery - production by another company - purchasing of (semi-) products.
$T_{without}$ stock respective of $T_{with\ stock}$ time until machinery has been repaired	Attention should be paid to all circumstances that can bring about the shortest possible time of repair, e.g.: - possibility of forwarding spare parts by express - loan from elsewhere - possibilities for manufacturing or repairing spare parts in own or another workshop - access to necessary drawings for manufacturing/repairing/assembling - readiness and know-how within own organisation

FIG. 5

Calculation of shortage costs



$$K_E = K_1(t_1 - t_0) + K_2(t_2 - t_1) + K_3(t_3 - t_2)$$

- purchasing of know-how from outside the company.

K_B shortage costs — At the final evaluation, special costs should be added, e.g. extra workshop costs, etc.

Analysis of Spare Parts

Maintenance costs include among other things costs of material. The material administration ought to be regarded as an integral part of maintenance, and its objective ought to be:

> To minimise under given conditions the costs of capital investment and capital consumption.

The phrase "given conditions" refers to many considerations, among which are fixed service level and production plans and requirement of production availability. For the stock administration of spare parts, the "minimising of costs" implies a weighing between the following types of costs:

1. Probable costs for lack of production and repair of failures when special spare parts are not available.

2. Probable costs for having special spare parts in stock (costs of storage and spare part inapplicability).

Our reasoning is based on a reliability technique which calculates:

- The probability of need for a special spare part during the economic life of the machine.
- Probable cost for lack of production caused by shortage of a special spare part.
- Probable cost of capital investment for a special spare part.
- Probability that special spare parts become inapplicable (e.g. the machine for which they should be used has gone out of production), and costs of spare parts.

A spare part ought to be in stock only if the calculated shortage costs exceed those of inventory and the inapplicability of spare parts.

Model Description

The requirements for storing a spare part:

Calculated shortage cost	>	Calculated cost of inventory	+	Calculated cost of inapplicability of spare parts

The probability of failure, i.e. the need for spare parts during the remaining economic life of a machine's T years is

$$F\ (T) = i - e^{-\lambda T}$$

The probability that no defect occur will then be

$$F\ (T) = e^{-\lambda T}$$

From this the following term can be tabulated

Calculated shortage costs	$K_B\ (i - e^{-\lambda T})$
Calculated costs of inventory	$A \cdot r_i \cdot \frac{i}{\lambda}\ (i - e^{-\lambda T})$
Calculated costs of inapplicability of spare parts	$A \cdot e^{-\lambda T}$

Symbols:

Frequency of failures (frequency of events) = $\frac{1}{Z}$, where Z expresses the mean time between failures (MTBF).

Often information of the current spare part's lifetime is available, and a probable value of Z may be estimated on the basis of former experience. It can be practical to divide up the spare part assortment in "MTBF groups" where the placing of spare parts is made by professional experts within the company.

T Remaining economic life of a current machine or maintenance item. (Estimate of the length of the machine's productive function in the future).

A <u>Price of Spare Part</u>

Often the price is known and can be utilised as a parameter in order to find out which calculated shortage cost is necessary to motivate the purchase of the spare part.

Even the total price may be used as a basis for calculation of costs of inapplicability of spare parts because full price must be paid when buying unavailable spare parts.

r_i Interest rate, as an expression for total costs of stock and as a basis for investment decisions. It is realistic to include the following general types of cost in "r":

- Costs of capital	(8-15%)
- Wages and social benefits	(3- 8%)
- Storing facilities	(2- 5%)
- Costs of stock (tools and transport etc.)	(2- 5%)
- Administration costs (control, administration, recording)	(1- 3%)
Total approx.	(15-35%)

The figures vary very much from one company to the other (and from one country to the other).

For the relationship between shortage costs and "maximum acceptable" price of spare parts the following equation can be set up:

$$\boxed{\frac{K_B}{A} > r_i \cdot \frac{1}{\lambda} + \frac{e^{-\lambda T}}{1 - e^{-\lambda T}}}$$

This equation is directly transformed into a nomogram with the following logarithmic scales (Figure 6).

% years or hours — MTBF, the scale covers 0, 1-20 years or 500 - 150,000 hours. The transformation from years into hours is based on three shifts with one year representing about 8300 hours.

T years — Remaining economic life of the maintenance item. The scale covers 1-20 years.

r_i% — Interest rate for costs of stock. The scale covers 10-50%.

A kr. — Shortage costs. The scale covers 500 - 1,000,000 kr. (or $ etc.)

a and b — Scales for the purpose of finding c.

c — The ratio between shortage costs and maximum acceptable price of spare parts.

An example has been described in the nomogram. Coloured scales have been used in order to preclude misunderstandings. Corresponding scales have the same colour.

Figure 6 shows an example of the application with uncertainty in the parameters:

Encl. 8 Example of utilisation of the nomogram. MTBF has been fixed at 3 years. T is uncertain and has been fixed at 5-10 years. r_i is difficult to calculate, but the area 25-35% has been estimated. Price of spare parts: 3000 kr.

1. Place a ruler between Z = 3 years and T = 5 years respective of 10 years.

   The value of "a" is approximately 0.03 - 0.2.

2. Place a ruler between Z = 3 years and r_i = 0.25 respective of 0.35.

   The value of "b" is approximately 0.75 - 1.05.

3. Maximum variation for a + b = c is approximately 0.78 - 1.25.

4. Find the area 0.78 - 1.25 on the c scale. Draw lines from these ends through A = 3000 kr. and find the corresponding ends in the K_B scale, which gives as result: K_B approximately 2300 - 3700 kr.

If the shortage costs are estimated to be within this area, special discussion is advised.

If K_B is > 3700 kr. the spare part should be bought.

If K_B is < 2300 kr. the spare part should <u>not</u> be bought.

Administration of Stock

Presentation of Problems

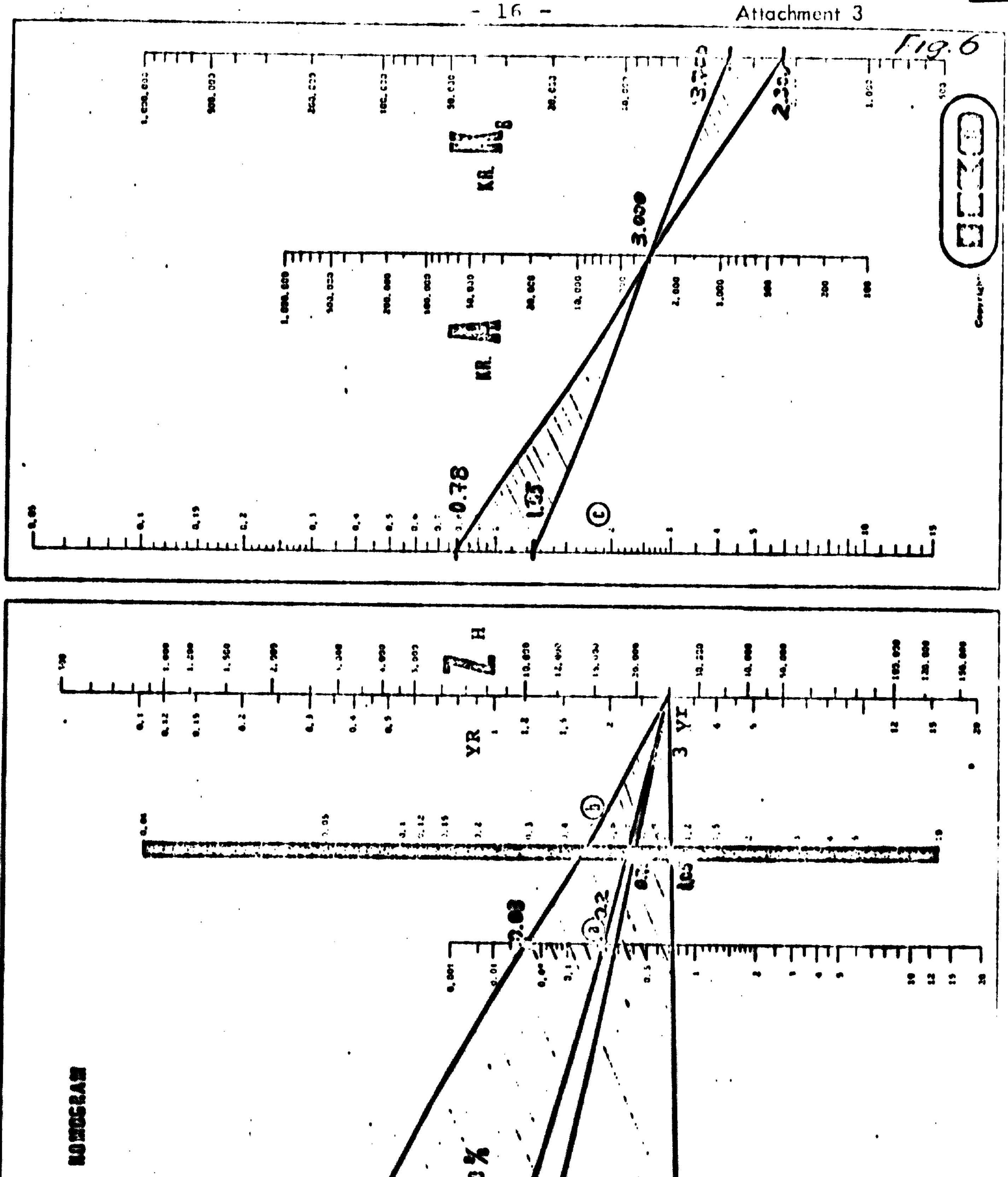
In the literature many descriptions of systems for administration of stock can be found. These descriptions tend then to elucidate general problems of stock and special problems concerning spare parts and consumption material.

A stock system is an administrative system for control and administration of stocked material. If possible, the system should establish a high service level and a low capital investment and low administration costs. Therefore, in this area great conflicts arise when an optimal weighing is difficult to procure and, for that reason, a general system solution can not be presented.

Whether the system is treated completely manually or is based on EDP, there are two questions that ought to be answered in the first place.

- How much has to be ordered?
- When must it be ordered?

Fig.6



Prognosis

The purpose is to estimate the future demand in a satisfactory manner.

The traditional method for such estimates is to extrapolate future demand from the past. To achieve good results two important conditions are required:

- There must have been over a period of certain systematisation in the demand, so that mathematical formulas can be used.
- The proposals must be based on sufficient historical data.

In EDP systems four prognosis models are often used:

- Horizontal
- Trend
- Seasonal/cyclical
- Trend-seasonal/cyclical

The horizontal demand has irregular deviations around a constant average, whereas the course of trend increases or decreases during a long period. For the seasonal demand it is required that the deviations occur regularly in the same period, e.g. the same year, and that they substantially exceed the average need. Trend-seasonal/cyclical is a combination of the two latter courses.

Exponential Smoothing

For the forecasting of demand different methods can be used, e.g. slighting averages, least squares, etc. A method often used in the EDP system is exponential smoothing which requires very limited data storage and calculation time. It can be of first degree, second degree, etc., and thereby be different for various curves of demand.

However, the most utilised method for horizontal demand is the first degree, that is simple exponential smoothing.

The expected requirement in the period to come (B_{i+1}) is the past period's expected requirement (B_i) plus a fraction (α) of the difference between real demand (E_i) and (B_i), that is

$$B_{i+1} = B_i + \alpha (E_i - B_i)$$

The smoothing factor may vary from 0 to 1. Normally, a value of the magnitude 0.1 - 0.3 is used in order to prevent fluctuations that are too great.

Economic Quantity of Orders

When calculating the so-called economic quantity of orders, the well-known simple square root formula is often used.

$$Q = \sqrt{\frac{2N \cdot S}{A \cdot r}}$$

The symbols are:

- Q Economic quantity of orders
- N Demand per period (e.g. years)
- S Order cost
- A Price per unit
- r Storage factor

The formula gives a cost minimum for costs of orders and stock on condition that:

- these costs are essential
- no quantity discount can be obtained
- the marginal costs of orders with regard to those in stock of another unit are constant
- the total quantity is delivered at the same time
- the packing does not influence the quality

These conditions may, if necessary, be considered through, for instance, variable values or conditions in the calculation.

As far as spare parts are concerned, it is in many cases easier to reorder up to a maximum level.

Reordering Point

In order to administer the stock, reordering point (-level) is often used. This should be of such a magnitude that the quantity generally covers the expected requirement prior to expected time of delivery. If control in relation to reordering point is made only periodically, the requirement under the corresponding time should also be considered. Since the requirement and the purchasing time include uncertainty, a safety stock is an important measure.

That is the reordering point:

$$P = B_i (t_a + t_p) + S$$

The symbols are:

B_1 Expected requirement per time unit
t_a Purchasing time
t_p Time between two controls of reordering point
S Safety stock

Purchasing Time

The purchasing time is a very important factor for the reordering point. If the uncertainty is great, the safety stock must reflect this.

The purchasing time is the time from which the reordering impulse has been given to when the material is available for usage. It includes delivery time and administrative time for reordering, receipt, control, etc., and transport time which does not influence the delivery time.

Geographical location, agreement with suppliers, etc. influence the purchasing time from one company to another depending upon the system. Moreover, the trade conditions may influence the suppliers' service level and thereby cause greater uncertainty. However, with flexible systems and agreements with suppliers, consumption material and consumption spare parts usually can be procured on short notice.

Requirements During Purchasing Time

A projection method by means of exponential smoothing has been described. If there is a "high and smooth" demand during a long time it is possible by this method to obtain an acceptable average of the requirements during the purchasing time. Moreover, the demand often can be normally distributed.

Normally, most spare parts do not meet this requirement. They have a low frequency, even when taking a long purchasing time into consideration.

Often consumption components have a greater demand but usually a short purchasing time, which often implies a Poisson-distributed demand

If, moreover, free available local stock is frequently used for cheap components whose consumption is recorded only when there is normal distribution, the recorded practical demand will be very low.

Using the Poisson-distributed demand with a majority of zero values, it is not acceptable to use exponential smoothing with fixed smoothing factor. Another method is to use a variable with a low value, in case of zero values and a high one in other cases. Naturally, there is a risk that large withdrawal from the stock for a planned work will strongly increase the average demand and thus the reorder point. Perhaps the material ought to be re-ordered externally for this piece of work.

Safety Stock

First and foremost the safety stock should pick up the uncertainty in

- demand during the purchasing time
- purchasing time
- stock balance

The safety stock for a certain material gives a certain service level which is here the percentage of the total demand that can be satisfied from the stock.

The service level is rising with increasing safety stock, but the costs of the latter increase and grow abnormally high if 100% service is the ultimate aim.

If the distribution of the demand, for instance, is normal, the degree of deviation can be found by calculating the Mean Absolute Deviation (MAD)

$$MAD = \frac{1}{n} \sum_{i=1}^{n} |x_i - \bar{x}|$$

where x_i is the demand in period "i" and $\bar{x}$ is the arithmetic mean value of the demand.

Between the standard deviation σ and MAD there is the following connection:

$$\sigma = 1.25 \times MAD$$

By using this formula a connection can be obtained between safety stock and service level

$$S = k \times 1.25 \times MAD$$

In this formula "k" is the safety factor or amount of standard deviation from the mean value, e.g.

Service level	"k"
50 %	0
84 %	1
98 %	2
99.86	3

(In statistical tables more accurate statements are made).

Since the service level should first and foremost reflect the costs of shortages, it can in many cases be troublesome to work only with one value in a company. Normally, the costs of shortages vary a great deal between different types of components.

The rules described give only an indication of the methods and problems which are present within this area. Practical and theoretical details can greatly change this simplified picture of reality.

Attachment 4

MICROFILM TECHNIQUE

MEMO CONCERNING MICROFILM

1. Introduction

This paper is a resume of IKO's experience in the field of microfilming. Below is described the state of the art, technique and the economy of this method. However, before introducing microfilm techniques at the Danube Iron and Steel Works, certain Hungarian conditions should be considered, especially who the suppliers are, which services they can rent and what price relations are.

2. State of the Art

The term microfilm refers to the reduction of original documents onto photographic film using one of the various microfilms such as microfilm or microfiche. The micro image appearing on the film can be from one-fifth to 1/22,500th of the size of the original document. And that is where the bulk of the saving comes from. It is estimated that by converting paper files onto microfilm, a company can save up to 90% of the space used to file its documents, thus realising impressive rental space savings.

In addition, there is often greater security by having the information stored on microfilm, and reference to information can be more efficient and quicker.

Basically there are two types of microforms. One is microfilm of 35 mm or 16 mm. Since the information is in sequence, this form is better for archival records. The film roll needs to be wound through a reader either manually or mechanically; these readers are expensive.

The second form is microfiche (French for a file index card) which is more flexible and thus accounts for about 70% of the market. The most common microfiche is a durable sheet of film, 6 inches by 4 inches, and contains 98 pages of information at a reduction ratio of 24, or 208 pages at a reduction of 42.

The equipment needed to run a microfilm system in the office includes a camera to film the documents, film, facilities for film processing, storage cabinets, microfilm readers, printers, duplicators and enlarger printers. It is not essential to have all this equipment as some of the processing can be contracted out. UDT, Britain's largest private financial institution, bought a camera, processor cabinets, readers and duplicators for about £25,000. The company reckons that it is saving about £32,000 a year, against the alternative of extending its paper filing system for customer records.

By 1975, UDT estimates that it would have needed to file some 10 m papers in 1 m customer accounts, requiring some 9000 sq.ft of space. But its customer file library at Holbrook House, Cockfosters, was already occupying 8800 sq.ft. The stimated £32,000 a year savings comes from 70% on space and the rest on staff savings - since an increase of 50% in staff would have been needed to service the larger library. The savings are net on annual consumables like microfiche jackets amounting to some £11,000 a year.

Microfilm market leader in the U.K. is Kodak and the company also claims to have the largest microfilm micropublishing bureau in Europe at its Fulham, South London plant. Because the market was first developed in the U.S., the U.K. market is dominated by the international groups. Bell and Howell, for instance, states the company's 1973 annual report, "is placing prime emphasis on development and sales of micro-imagery equipment, systems and supplies. In terms of sales it is the company's largest and fastest growing business - 46% domestic sales increase in 1973".

That growth for the domestic U.S. market compares with a growth in the same period of 73% for Europe.

Market shares are difficult to come by and the different sectors of the market are shared in different ratios by the participants. Some of the U.K. firms, like Microfilm Reprographics, enjoy substantial business in their fields. Agfa-Gavaert, a newcomer to the market, is hoping to make an impression by forming a rental base.

Broadly, a breakdown of the market by consultants G. Baker and Associates shows that about 40% is business systems and records, 30% engineering documentation, 26% micropublishing and 4% government. Within that breakdown a growing sector of the market is computer output microfilm - a system which provides a method of converting computer-produced magnetic tapes directly into human readable data, but on microfilm instead of on a paper printout.

1. General List of Terminology

1.1 Technical Microfilm Techniques

Normally used for microfilm processing of drawings.

1.2 Administrative Microfilm Techniques

Normally used for microfilm processing of documents, files, etc.

1.3 Aperture Cards

A punch card containing a photo of a 35-mm microfilm.

1.4 Cine Mode/Comic Mode

The orientation of the picture of the film Vertical/Horizontal.

3.5 COM, Computer Output Microfilm

An electronic machine which can convert magnetic tape from the EDP equipment directly for microfilm at a much higher speed (15 - 50 x) than normal printers.

3.6 Diazo-Vesikular

Two different methods for copying microfilm. Developed by Ammo/nium/heating.

3.7 Eye Ball

Large letters, enabling direct reading of the microfilm.

3.8 Jacket

Card for filing parts of film rolls.

3.9 Readers

Equipment necessary for transformation of microfilm to readable material. Normally supplied with copying equipment and then called Reader-Printers.

3.10 Magasin

Casette for film for special readers.

3.11 Micropublishing

The microfilm used directly for communication.

3.12 Microfiche

Film card, normally 105-148 mm covering a number of pictures between 60 and 244.

3.13 Microfilm

Normally in rolls of 16.35 and 105 mm.

3.14 Reduction

The reduction ratio, for instance 48 times reduced, is written as 48X. For the COM system are 24X, 42X and 48X standards.

3.15 Roll Film

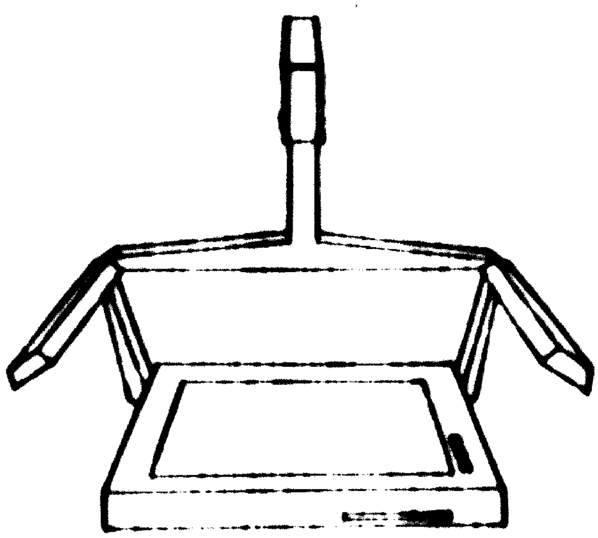
16 or 35 mm film rolls by a standard length of 100 feet.

4. The Microfilm Technique

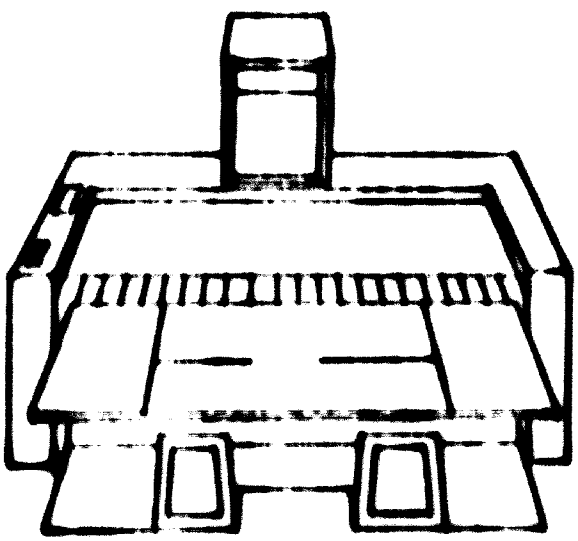
4.1 Microfilming

The conversion of documents to microfilm takes place in a special apparatus using roll film. An exception is the processing of aperture cards, for which exist special cameras for filming, development and mounting of the picture in one process.

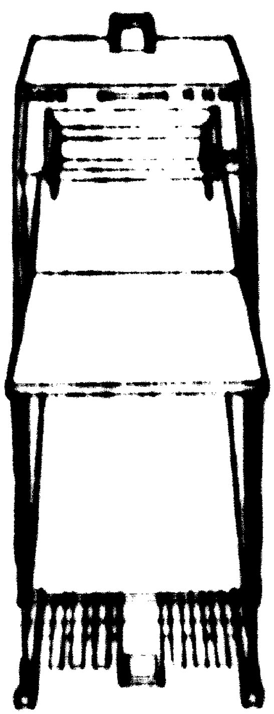
Some typical equipment developed for specific purposes is shown below.



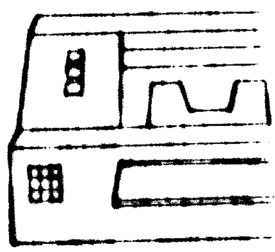
1. Single document, small number, decentralised.



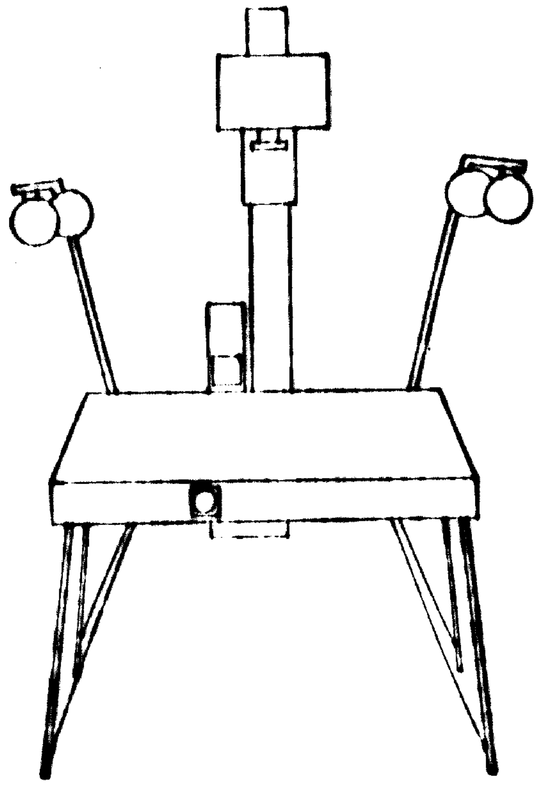
2. Rotation, larger number, decentralised.



3. Automatic loading, coding, both sides, automatic development, centralised.



4. Endless paper, controlled.

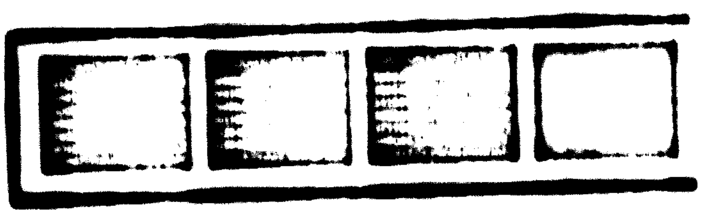


5. Precision-photos, controlled.

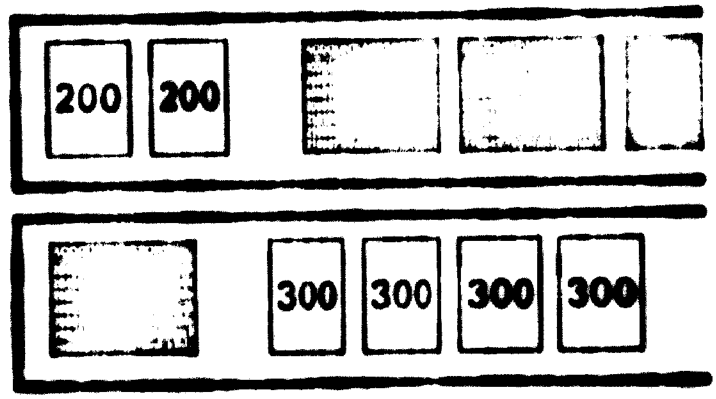
4.2 Recovering

The following is not instructions but a summary.

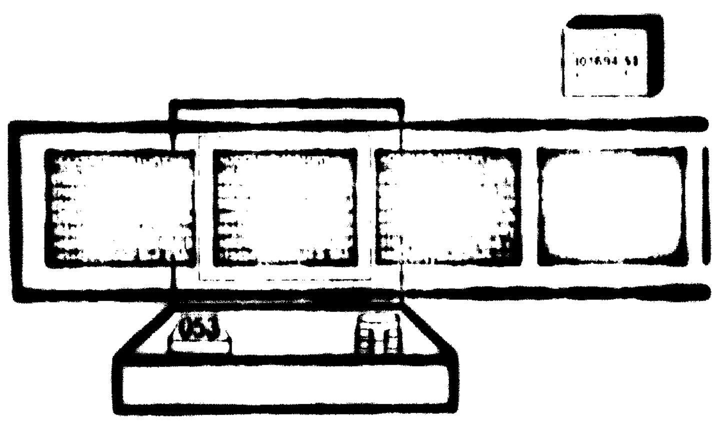
1. With few documents per area, it is enough to mark the roll film, for instance chronologically. The single data can be selected by a flash technique.



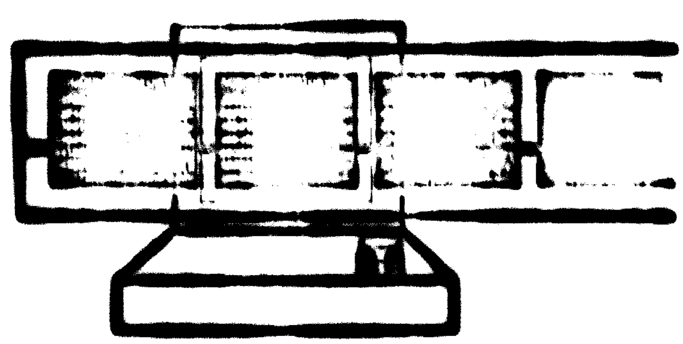
2. With larger amounts, both date and alphabetic sorting and flash techniques can be used. However, then a pre-sorting is necessary.



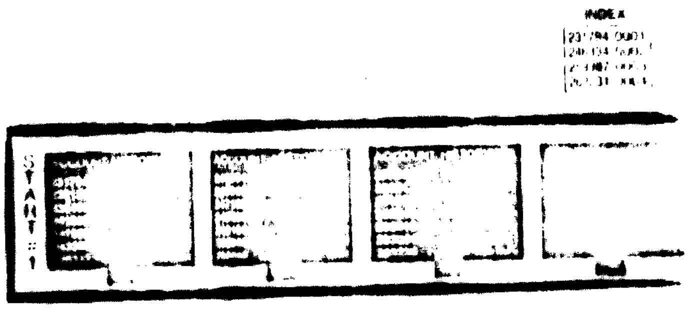
3. Next step is a counter registration, the same technique as used on tape recorders.



4. Code lines - An automatic camera equipped with code-line equipment putting code lines into fixed positions between the pictures. A code-line registrator mounted at the reader gives the possibility of reading a three-digit number.

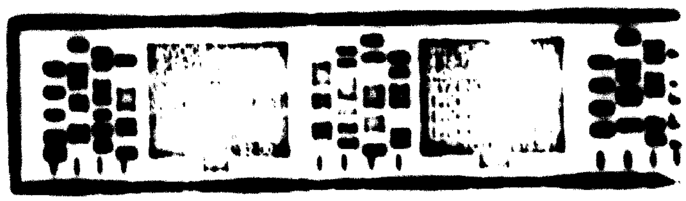


5. **Image control** - This method is advantageous when operating large amounts with a high frequency of looking up. Each picture is equipped with a square, readable by an electronic unit at the reader, which then can identify a special number, and be called by tipping it into the keyboard. The single document can be coded visually by the camera. By EDP processing of the documents, this code can form a part of the identification. By manual processing it is necessary to establish a journal.

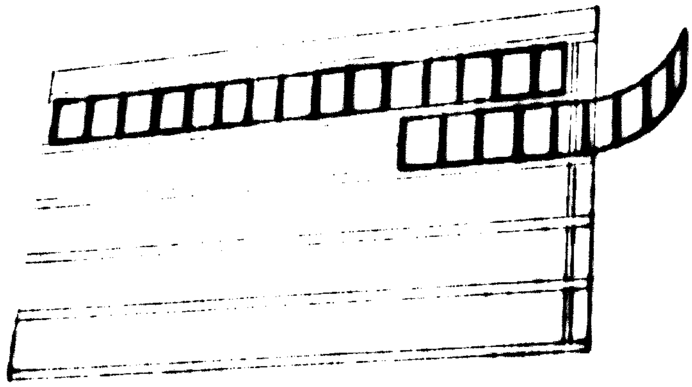


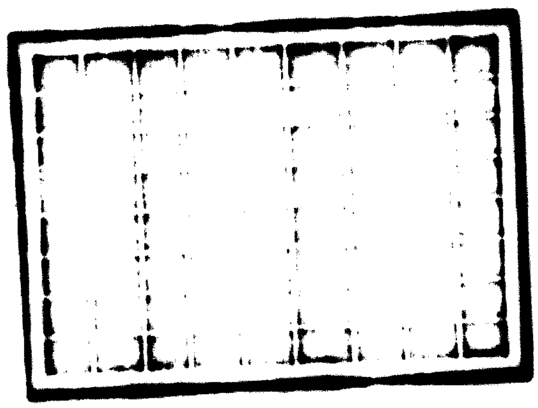
6. **Miracode (Copyrighted Kodak terminology)** - This method is today the most advanced method on the market. It is based on a binary coding system placed on the film before every photo. This makes it possible to call every document from a keyboard when the code is known. The code can include as many digits as desirable, for example machine no., supply no., date, etc. By manual exposure the coding accordingly will be manual. By EDP and COM the coding can be made automatically.

This method is unsurpassed when there is a demand for many calls in large files.



7. Microfiche - This can be produced in two ways. By use of jackets which by copying can be transformed to microfiche. Or by use of the so-called step and repeat camera. The camera films only on a small part of the 105-mm roll film at a time. The exposures can be controlled in horizontal and vertical direction so that the pictures can be placed in a predetermined coordinate system. The latter method is rather expensive and complicated and will show sufficient rentability only in special situations.





4.3 Economy

The economic elements which form the basis for the decision for using the microfilm technique are very different and very difficult to state exactly without knowing in detail the cash structure in Hungary. However, the general experience of all companies which have implemented the microfilm technique is one of cheaper documentation or quicker communications and a better survey of their information.

Below are mentioned some of the most important economic elements to consider.

1. Production of Film

1.1 Manual systems
central/decentral exposure
automatic single shut exposure

1.2 COM system
number of photos per year
type of output roll film 16/35mm/fiche

1.3 Copying system
number of copies
type of film

2. Use of Microfilm

2.1 Finish
information flow
maintenance of files, etc.

3. Readers

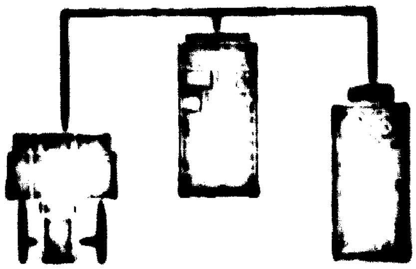
3.1 Demands
frequency
price

The next page shows some economic relations and figures of the present Danish market.

COMPARATIVE STOCK CAPACITY

Millions characters per unit

WRITING SPEEDS



1-2000 pages per hour

50-100.000 pages per hour

50 times faster

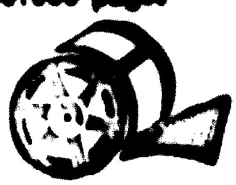
HANDLING- AND PACKING COST COMPARISON

Problem: 6000 pages report in 4 copies.

FILM	PAPER
12 min. to duplicate 4 copies and pack in cardboards.	6 hours to split and bind
Price appr. 250kr.	Price appr. 225,-kr.

FILM/PAPER COST COMPARISON

50.000 pages



100 feet

105mm FILM

200 MIKROFICHE

50.000 pages

FILM	127kr.
CHEMICALS	15kr.
	142kr.

STANDARD PAPER 1850kr.

OFFPRINT. PAPER 5550kr.

PAPER COST

STANDARD LEPORELLO

SPECIAL PRINT

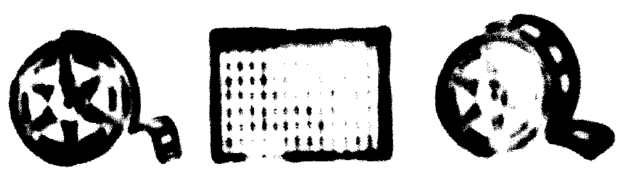
35-37 kr. per 1000 pages

70 kr. and up per 1000 pages

COPYING COSTS AND SPEED

	FILM	PAPER
1. Copy	2,36 kr./per 1000	37 kr./per 1000
2. Copy	0,97 kr./per 1000	34 kr./per 1000
3.-5. Copy	0,97 kr./per 1000	Falling price
Over 6. Copy	0,97 kr./per 1000	New run
Speed	2.000,000 pages per hour	10000/per hour

FILM COSTS



	Number of pages	Price	Price 100 pages
16mm FILM	6000	73,00	3,06
35mm FILM	16000	42,00	7,66
105x150mm FICHE	270	0,72	7,46

[illegible] [illegible] [illegible] [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] 1 2 3

1 Con. wire 4 2 2

2 Contact 2 4 1 2

3 Assembly 1 - 1

1 Case 7 1 5

2 Wh[illegible] 8 8 - 7 B.O.I.

3 Assembly 3 1 2 Spec. [illegible]

[illegible] the parts are accordingly identified as 1-1, 1-2, etc.

It is understood that the cost for 1-1 Contact Assembly has been found by adding 2-1, 2-2 and assembly and multiplying by 1.(4 + 5 + 1) x 2 = 20.

The cost model is very useful in the teamwork to speed the understanding of where the cost goes and how it is built up.

Notes may also be added to the blocks about procedures, etc.

The cost model may also be used to present the overall picture of the product or system and thus for selection of area or project. Percentages can be calculated and added to each block.

Logarithmic Model

When looking into a complex system to locate VE projects, a logarithmic model may be of use.

The model gives the opportunity to identify main and detail cost areas of the system (a ship - the total expenditure of a company, etc.).

Also, magnitudes of cost throughout the system may be easily compared.

The model may also be useful for the team when studying a single product.

The model will be presented as follows

The reason for logarithmic scale is to get the blocks spread throughout the scale.

Calculations of Families

When the parts approach has been chosen for a project, the decision about which parts - assembly operations of sub-assemblies - will be chosen, must also be based on the total number per year of produced parts.

A practical way of presenting this information is:

Value of Families

[illegible]

The value of the clutch itself is 1000 x 60 = 60,000.

The value of all the parts and assembly operations throughout the family amounts to [illegible].

3. PROGRAMMES FOR IMPROVING THE PRODUCTS

3.1 History

Value analysis originated in the United States.

Changes in engineering products were brought about during the Second World War due to a shortage of previously available materials and skills. As these became available again after the war, designs were examined with a view to reverting to the original specifications. In many instances it was found that the changes were not only lower in cost, but were more satisfactory from the customer's point of view.

As a result, efforts were made to produce procedures which would make improvements of this type happen by intention and not as a result of extreme circumstances. It was realised that to do so the function required of the product had to be considered as well as its cost. Value was defined as:

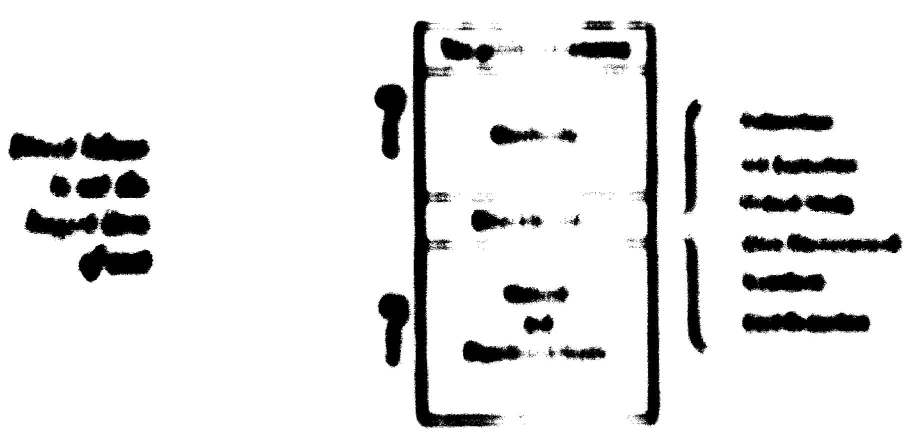
$$\text{Value} = \frac{\text{Function}}{\text{Cost}}$$

These procedures, first developed by the General Electric Company of America, were subsequently employed by the American Department of Defense, and used on the shipbuilding programmes of the 1950s and subsequently on the aerospace programmes.

Today, the technique is used extensively in the U.S.A. as well as in Western Europe. The technique has been further developed in Scandinavia and used as a routine problem-solving tool.

3.2 What is VA?

Examination of the management techniques which are used in engineering for profit improvement indicates that the principal target has long been the cost of direct labour which now constitutes approximately [illegible] of the cost.



Thus it is apparent that a greater overall improvement could be achieved if the basic design of each scheme or product was studied before released for production.

Just as it is realised that method study should precede work measurement, so ideally a design study should precede method study. It is this role which is played by value analysis.

VA may be defined as:

> an analytical technique designed to examine all the cost components and functions of a product or system in order to determine whether any cost item can be reduced or eliminated while retaining all necessary functional and quality requirements.

VA gives:

- Better products
- Lower costs
- Improved communications
- Cost consciousness
- Management development
- Organisation development

3.3 Who is Involved?

3.3.1 Teamwork

The teamwork [illegible] approach is not intended as a substitute for individual skills. However, there are clearly many occasions when the requirements and knowledge of a number of different disciplines need to be used together.

The effectiveness of the teamwork results from using the people who are normally concerned with the product and concentrating their collective abilities and experience in a free but orderly attack on the selected problem.

The composition of each team will differ according to the nature of the project under study. The members should be of sufficient seniority to be able to speak with authority for their respective departments, and see that any action agreed to is carried out.

They will not be engaged full time on the project, but will combine the work with their normal duties, [illegible] they are responsible for [illegible] implementation of any changes affecting their specialised fields.

2.3.2 Organisation

Value analysis does not necessarily involve the setting up of a large department, but it is probable that most organisations will appoint a coordinator or a small group to manage and coordinate the various value activities. The coordinator is responsible for guiding and organising the work of the team, for collecting and analysing information, running team meetings, progressing the work allocated to team members and maintaining proper controls and records.

2.4 Philosophy

2.4.1 Value

By defining value = $\frac{\text{Function}}{\text{Cost}}$ one forces the involved persons to combine what a product does with what it costs. Often one equals value to cost.

2.4.2 The Functional Approach

Value analysis is concerned with FUNCTIONS and the way these functions can be performed at the lowest cost. Consequently, a product or system is studied in such a way that the functions are identified and alternative ways of performing them generated. As a result, the initial design or specification is changed [illegible] totally or in part to provide a technically equal or [illegible] system or item at lower cost. Similarly, in the study of [illegible] and administration, the functions are [illegible], [illegible] and [illegible] in concept before details of the manufacturing or operating methods required to meet the specifications are established.

Basically then, value analysis questions the concept + the means by which the necessary functions are performed.

In different ways it asks these basic questions:

What is it?
What does it do?
What does it cost?
How else could it be done?
What will that cost?

2.4.3 [illegible]

[illegible] people understand that unnecessary cost is present in any product due to a number of reasons, e.g.:

Lack of information about customers' needs, [illegible] [illegible], [illegible] [illegible] etc.

Lack of time when the design was first set forth

Honest wrong beliefs

Changed circumstances (requirements, specifications etc.)

Fear of failure by change to new ideas. Fear of loss in status or ridicule when putting forward new ideas.

They understand and believe that it is possible to improve products. They also start to accept proposals as a help and not criticism.

2.5 Elements of Value Analysis

2.5.1 Selection

Value analysis should not be applied to everything. The systems, products and items of overhead and administration selected for study should result from careful analysis. The areas selected are those which should yield the greatest results for the least time and effort and with the minimum of risk.

2.5.2 Information

For any selected item, time must be allowed for the relevant costs, specifications and requirements to be collected, analysed and prepared for the use of the designer or team. This is usually the task of a coordinator, who is frequently the only full-time person involved.

2.5.3 Analysis

There are three types of analysis:

a) Cost Analysis is the most usual preliminary of a study. The [illegible] costs of the component parts or elements of the subject are tabulated to an appropriate degree of detail. From such an analysis those which appear to be of disproportionate cost and offer potential for study and improvement can be selected.

b) Functional Analysis requires an accurate definition to be [illegible] of the function performed by the subject under investigation. To understand properly the subject, the definition of function must be brief and precise. For this reason it is recommended that the definition be expressed by two words, a verb and a noun. For example, a pencil 'makes marks' or a screw may 'join parts'.

e) **Function/Cost Analysis** is particularly valuable in the study of complex schemes, as an aid to the designer in construction and quite separately as a means of locating areas of poor value in the overhead sector and in some administrative procedures.

3.6 The Procedure

The procedure concentrates the team's skills and knowledge effectively, thus preventing one-sided or time-wasting meetings.

On each selected project the team follows six basic steps:

1. Information - What is it? What does it do? What does it cost?
2. Speculation - How else could it be done?
3. Evaluation - What would that cost?
4. Investigation and Planning
5. Implementation
6. Summary

3.6.1 Information

The scope of the study is established and the necessary costs and other information are collected, analysed and prepared by the co-ordinator. The functions are described and the areas of high cost or poor value identified by cost analysis and function/cost analysis techniques.

3.6.2 Speculation

At this point the team seeks to reach agreement on the scope to be studied and the approach to be used. All must speculate freely and use their creative ability to generate alternative ideas which will perform the required function(s).

Judgement is suspended, ridicule, criticism or evaluation are not permitted until the supply of creative ideas is exhausted.

3.6.3 Evaluation

When all ideas have been recorded, each is reviewed in turn and briefly explained. An assessment of the relative cost of each is made on the assumption, at this stage, that each is practicable. Other factors, such as safety and reliability may be included in the first part of the evaluation.

The team makes a systematic assessment of the overall advantages and disadvantages of each selected idea, [illegible] and function into consideration, the lower cost solutions, which are best from all points of view, are selected for further development.

2.6.4 Planning

After the meeting, the selected idea or ideas will be thoroughly investigated by the team members and the coordinator, using the existing resources of their departments. A plan will then be developed for the implementation of the change.

2.6.5 Implementation

This step will depend on the nature of the proposal. In the case of an existing scheme or product, the coordinator will progress the introduction of the idea through normal channels and, if necessary, arrange for further team meetings to deal with any problems which may arise.

2.6.6 Report

The outcome will be prepared and circulated. Information collected during the study will be examined with a view to extracting useful cost and other data for future reference.

2.7 Applications

2.7.1 Products

In a product sense almost every form of manufactured item is suitable for value analysis study : ships, aircraft, electronics, furniture, food, chemicals, rubber and plastics, buildings, general engineering products, footwear and so on. Products of a 'one off' nature are just as likely to yield savings as mass-produced items.

2.7.2 Overheads

Many successful studies have been carried out in maintenance and other items of overhead cost. Some examples are:

Packaging

Protective clothing

Services - steam, electricity, gas etc.

Handling

Containers and pallets

Office and factory cleaning

Fire precautions

2.7.3 Management, Work and Service Functions

Administration studies present their own particular problems, since unlike the study of "things" there is often no detailed design or specification of activity in existence. In consequence, the team may be led by an organisation and methods specialist who will collect and provide the necessary technical information in much the same way that a designer would do for a manufactured product.

2.8 The Main Requirements

Whichever way a programme is introduced and whichever product or overhead cost areas are tackled initially, there are common requirements.

1. All of the senior levels of direction and management should understand the broad purpose and procedures of value analysis.

2. They should carefully examine the ways it can best help their business and if they decide to go ahead they should determine a basic plan of objectives and the ways in which the results are to be measured.

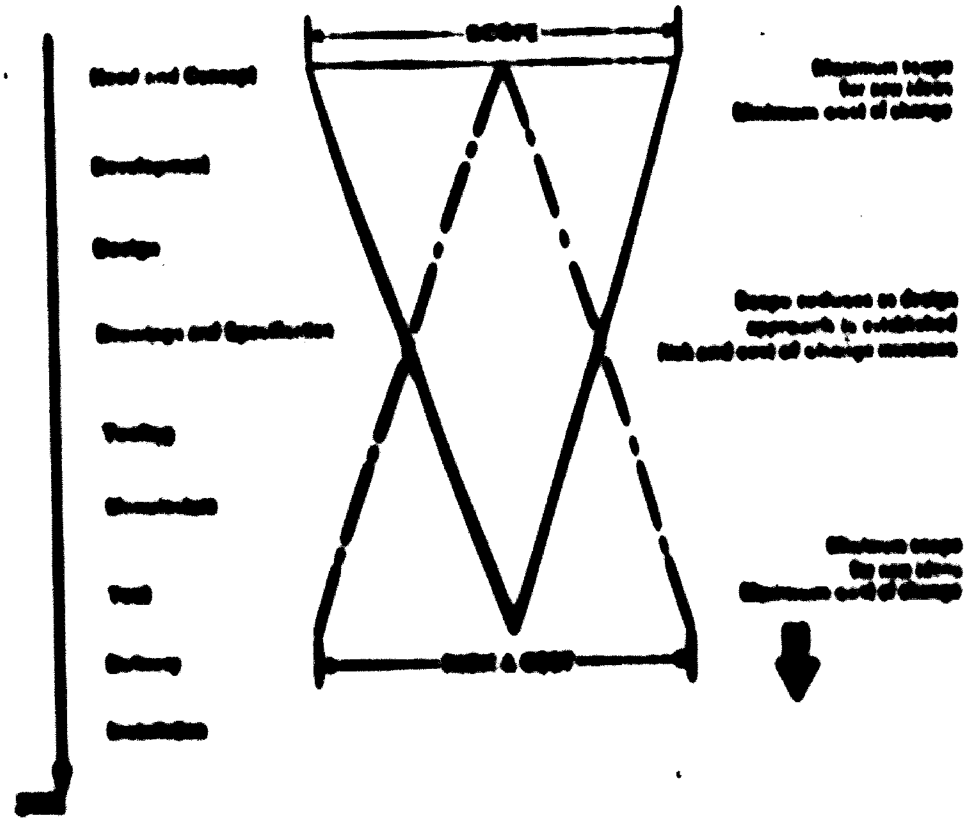
3. The product range and other expenses should be carefully analysed to select the most suitable areas for study in both the short and the long term.

4. A suitable experienced coordinator (or coordinating group) should be appointed to manage and coordinate the work. A full-time coordinator is preferable, although in small companies he may only be justified on a part-time basis.

5. Staff from all levels, who will be involved with the studies directly or indirectly, should receive formal training or appreciation courses.

6. In time, if not initially, the programme should be aimed more at avoiding unnecessary costs in new products than in reducing costs in existing ones. (Investigations of existing products are restricted because of the need to accept basic design approaches and the cost and risk of change and re-qualification, which is influenced by existing stock levels, tooling, spares requirements, interchangeability, existing catalogues and similar arrangements.)

7. Progress and results should be reviewed regularly and a report made to and acted upon by the management.



The relationship of time to cost of change.

8. If value analysis is promoted as part of corporate profit improvement effort, it should be combined with certain other schemes and practices which have similar objectives. For example, many of the ideas expressed in Company Suggestion Schemes can be channelled more successfully through a value analysis team - which includes the originator - than is possible through some of the usual channels.

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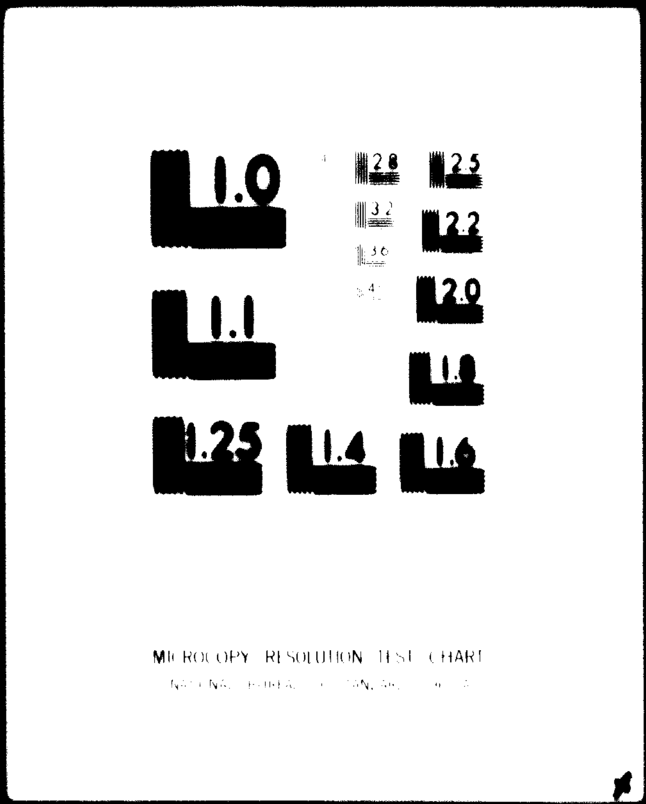
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7. <u>Labour Reporting</u>

Examine current methods of reporting labour usage of maintenance personnel. Design changes compatible with system requirement outlined in 6. above.

8. <u>Material Usage</u>

Examine present system of material cost distribution to ensure its adequacy for historical information reporting. It is suggested that the introduction of PMO's and STO's will require a change in the method of allocating material costs.

9. <u>Inventory Control</u>

Examine the current methods of Inventory Control as related Spare Parts. Develop methods as appropriate to ensure adequate inventories of spare parts, minimum inventory levels, identification and deletion of obsolete inventories, etc. Analyze current identification coding system including location codes and redesign as appropriate to the requirements of the "Managed Maintenance System".

10. <u>Microfilm and Reproduction Equipment</u>

Examine and report on the adequacy of current facilities to cope with demands of an integrated "Managed Maintenance System" and identify equipment requirements which would assist in the modernization of the System, particularly in areas of maintenance scheduling and Spare Parts manufacture.

11. <u>Computer Facilities</u>

Develop full output requirements such as PMO's; Analytical, Historical, Cost and Special Request Reports; Equipment and Parts Catalogues, etc.

Assist in defining of input data requirements such as equipment data, PMO data, labour and material usage, etc.

12. <u>Spare Parts Manufacture</u>

Evaluate current methods of determining what spare parts are to be manufactured, which are to be purchased, etc. As appropriate, set up Decision Rules for spare parts manufacture, taking into account such things as manufacturing facilities, storage facilities and costs, quantity and frequency requirements, etc.

ii). Counterpart fellowship training

Report on the fellowship training programme which would be desirable for certain members of the Dunai Iron and Steel Plant personnel. Identify the number of persons, the type of training for each individual, together with suggestions on the location and duration of the necessary training.

4. Specific Tasks to be implemented by the contractor

The contractor will be expected to work with the Hungarian Iron and Steel Association and the Dunai Iron and Steel Works management personnel to provide the necessary technical assistance and counselling for the development and installation of a "Managed Maintenance System" on a four phase basis as described below.

Phase I. Introduction to Managed Maintenance

This first stage of the suggested project is minimal. It requires the preparation of Seminar or Lecture sessions covering the principles of "Managed Maintenance". It would include such things as benefits, processing methods, output report samples, etc. This training session should be given to Plant and Maintenance Management in reasonably small groups.

The training material would be prepared by the Consultant responsible for the Project. This must then be converted to Hungarian (Slides - sample forms - lecture notes, etc.), by the counterpart organisation. The actual Seminars or Lectures should be given by a forceful and competent Hungarian lecturer who is also technically qualified, also to be provided by the counterpart organisation.

Phase II. System Development

Due to the degree of development which has been reached by Maintenance Engineering, the approach to the design and installation of "Managed Maintenance" will be somewhat different than starting with no information on which to build.

Each of the basic or fundamental data vital to a modern system has already been developed. Therefore, the System Development Stage of the Project will be greatly enhanced and can be documented almost in its entirety at an early stage.

Responsibility for designing and documenting this system is basically the Consultant's. It must be borne in mind, however, that considerable input is required from the Counterpart Chief Engineer (Maintenance) and his staff. In addition, approval by management of the overall plan is vital, particularly in regard to Maintenance organizational changes.

This must not be misconstrued as meaning there is only one plan and no deviation is permitted. When a Plan is submitted to the Counterpart Organization for approval, there is always flexibility in it. The Consultant in conjunction with Works Management will be expected to arrive at an agreed Plan that will greatly enhance the potential of a well designed "Management Maintenance System" for the Bunai Iron and Steel Works.

Phase III. Work Plan Preparation

Once the System has been developed, the next Stage is the development of the Work Plan. This is the responsibility of the Consultant but it must also be prepared in close co-operation with the Counterpart Chief Engineer (Maintenance) and such staff as he may deem appropriate.

The Work Plan will, in effect, consist of a series of detailed activities. Each activity will be defined in sufficient detail as to act as a set of instructions.

Each activity will be assigned responsibility, time sequence in terms of lapsed time and anticipated man days to accomplish.

Phase IV. Implementation Counselling

The level of competence in the Maintenance Engineering Staff is such that subsequent to the Managed Maintenance Indoctrination - System Development - Work Plan Preparation - Stages, the Consultant will not be required on a full time basis for implementation purposes.

His role will be of a Counselling nature, providing guidance, counselling and quality review services.

Further to this he would be prepared to meet with Management on specific occasions to report on progress to date and to discuss the Project generally.

It is anticipated that the management staff of Maintenance Engineering will be capable of assuming full responsibility for completion of the Project within nine months of initiating this Project.

5. <u>Other substantive requirements</u>

The consultants will be expected to prepare the following reports:

a) <u>Introduction to Managed Maintenance Report</u>

This report should cover Phase I and describe, as far as practical, the lectures and summaries of discussions. It shall be written in English and received by UNIDO in ten (10) copies and within four weeks of completion of the necessary field work for that Phase. UNIDO shall supply written comments on this report within six (6) weeks of its receipt.

b) <u>System Development Report</u>

This report covering Phase II shall be submitted in English and in ten (10) copies and should be received by UNIDO within four (4) weeks of the completion of the necessary field work for that Phase. This report should contain a clear definition of the Managed Maintenance System developed with the Danube Iron and Steel Works. UNIDO shall supply written comments on this report within six (6) weeks of its receipt.

c) <u>Work Plan Preparation Report</u>

This report shall be submitted in English and in ten (10) copies and should be received by UNIDO not later than four (4) weeks after the completion of the necessary field work for Phase III. This report shall include a detailed description of the activities, responsibilities and time required to implement the

Managed Maintenance System. The requirements for microfilm and reproduction equipment and counterpart training should also be included in this report. UNIDO shall supply written comments on this report within six (6) weeks of its receipt.

d) Final Stages of Implementation Counselling Report (During the implementation of the Managed Maintenance System)
Final work and results on the installation of the Managed Maintenance System will be described in a report which shall be in English and in ten (10) copies and shall be received by UNIDO not later than four (4) weeks after the completion of the necessary field work for Phase IV. UNIDO shall supply written comments on this report within six (6) weeks of its receipt.

e) Draft Final Report
In English and in ten (10) copies which shall be received by UNIDO not later than four (4) weeks after completion of all services in the Project Area. UNIDO shall provide written comments to the Contractor concerning the Draft Final Report within six (6) weeks after UNIDO's receipt of such report in Vienna. Such comments shall receive due consideration in the preparation of the Final Report.

f) Final Report
In English and in twenty-five (25) copies which shall be received by UNIDO not later than two (2) months after the Contractor's receipt of UNIDO's comments on the Draft Final Report.

The implementation time for the project from commencement of work by the contractor to delivery of the Final Report should not be longer than fourteen months.

OFFER:

DEVELOPMENT OF A MANAGED MAINTENANCE SYSTEM OF THE

DANUBE IRON AND STEEL WORKS

UNITED NATIONS NATIONS UNIES

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION

DEVELOPMENT OF A MANAGED MAINTENANCE SYSTEM FOR THE DANUBE IRON AND STEEL WORKS

December 1974

Norconsult A.S.
Consulting Engineers, Architects & Economists
P.O. Box
Høvik, Norway
Telegrams: Norconsult Oslo, Tel.: Oslo [illegible]
Telex: [illegible]

United Nations Industrial
Development Organisation (UNIDO)
Chief. Purchasing and Contracting Services
P.O. Box 707

A-1011 VIENNA
Austria

Your ref. IS/MUN/72/804
Our ref. IKO/MF/ik

2 December 1974

Dear Sirs,

Project Title: Development of a Managed Maintenance System
<u>for the Danube Iron and Steel Works.</u>

1. INTRODUCTION

We have received your invitation to offer our services in undertaking this project.

It is hereby our pleasure to present our proposal for the services called for and in accordance with the invitation Norconsult A.S. has subcontracted the whole project to IKO-Consulting Group, a company with which we have collaborated on a number of projects and whom we trust to be very well suited for this project since

- IKO-Consulting Group has 20 years of experience as maintenance consultants. They have carried out a large number of major assignments in this field in Scandinavia as well as internationally. They hold a leading position in Scandinavia in the area of training and education of maintenance managers, and have carried out more than 100 seminars, courses and conferences.

- IKO-Consulting Group is for this project presenting a highly qualified team, consisting of consultants with solid experience in iron and steel works as well as in the establishment of advanced maintenance management and information systems.

- IKO-Consulting Group will support the project with a well documented software/know-how in this field such as coding systems, joborder systems, EDP-report systems,etc.

IKO-Consulting Group has by our judgement the relevant experience, the right personnel, and the systems know-how both necessary and sufficient to fulfil the requirements stated in the "Substantive Terms of Reference".

2. PRESENTATION OF NORCONSULT A.S.

Norconsult A.S. is a Norwegian-based private company offering international consulting services in engineering, architecture, economics and associated fields. Its permanent staff numbers about 1250, of which about 800 hold professional degrees. The multi-disciplinary professional forum adopts a project-oriented approach to its tasks, forming integrated teams for their execution as necessary. The working methods assure the placing of any project in its appropriate socio-economic setting, and emphasize the importance of planned operation of complex projects under varying local conditions. A general brochure about Norconsult A.S. will be found as Enclosure 1.

Norconsult A.S. has for many years served the Norwegian industry and participated in the development of it. This particularly applies to traditional Norwegian industries such as aluminium, iron and steel, ferroalloys, as well as mining. The experience and know-how thus obtained has been applied on a number of projects carried out abroad. Below is a list of such notable assignments.

Client	Services rendered	Year
UAR Atomic Energy Establishment Cairo	Design of an atomic laboratory in Cairo	1961-62
Elkem A/S Oslo, Norway	Design and construction supervision of the civil engineering work at a ferro-manganese smelting plant in Sinai, AR Egypt	1962-64
Ministry of Defence West Germany	Research regarding nuclear blast-proof underground facilities in Germany	1962-70
Eurochemik	Design and construction for atomic high-level waste plants in Belgium	1962-63 1965-66

Client	Services rendered	Year
Broken Hill Pty Co. Australia/Elkem Norway	Design and construction supervision of the Broken Hill Ferro-Manganese Plant, Tasmania.	1960-61
	Design of extensions	1965
Etibank Turkey	Feasibility study and design evaluation for an integrated aluminium products' industry in Turkey.	1966-67
	Design review and evaluation of final project	1968
UNIDO, Vienna/ COPEDESMEL Argentina	Feasibility study for a 150,000 ton aluminium reduction plant in Argentina	1970
State Electric Power Board Norway	Preliminary project for a pre-tensioned concrete nuclear reactor tank in rock in Norway	1970
Government of Kuwait	Feasibility study for an optimum-sized aluminium smelter in Kuwait, including technical, social and economic evaluations	1970
Ministry of Industry Norway	Feasibility study for a petrochemical complex, refinery and chlorine plant in Norway	1971
Asian Development Bank	Appraisal mission to Taiwan Integrated Aluminium Industry (TALCO)	1971
Government of Tanzania/Norwegian Agency for International Development	Terms of Reference for Stiegler's Gorge Hydropower Utilisation, covering: - Electric Hydropower Generation - Iron and Steel Production - Aluminium Production - Ferroalloy Production - Magnesium Production	1970
Government of Surinam/IBRD	Utilisation of hydroelectric potential for aluminium smelting in West Surinam..	1973

3. PRESENTATION OF IKO CONSULTING GROUP

IKO-Consulting Group was founded in 1945.

The Group is presently employing a permanent staff of more than 200 professionals, the major part holding a university degree.

The Group consists of consulting companies established in Denmark, Norway, and Sweden with interlocking ownership and operating in close cooperation. For projects outside Scandinavia these companies operate under the name of IKO-Consulting Group.

IKO-Consulting Group is through membership of national organizations associated with international consulting organizations such as Federation Europeenne des Associations de Conseilles en Organization (FEACO) and Federation Internationale des Ingenieurs Conseills (FIDIC).

Approximately 2/3 of IKO's revenue comes from private clients. Since 1955 consultancy on maintenance problems has been one of our basic services. During this time we have been following and influencing the development of maintenance management systems. Initially the development focused on the surrounding repair costs reduction, later preventive maintenance, planning and scheduling, spare part administration, organization and education became more important. In the last 5 years statistical and "in operation" control methods combined with intensive use of EDP have become more and more relevant.

Our assignments in this field can be roughly devided into two parts, however, with heavy interaction:

a.

Training and education of the maintenance staff. More than 2500 maintenance managers have been trained in our open or individual company-organised seminars.

b.

Comprehensive projects in large private industries, such as:

Iron & Steel Works
Papermills
Cement Factories
Glass Works, etc.

Maintenance Management Projects consisting of:

Organization
Management Education
Planning and Scheduling
Administrative Systems (EDP-based)
Statistical Control (EDP-based)
Technology

IKO has undertaken a number of assignments outside the company's home countries.

To support the project with the highest technological knowledge the technical development director of Norsk Jernverk A.S., Mo i Rana, Norway, is joining the project team as associated consultant.

A general brochure about IKO Consulting Group will be found as enclosure 2.

A general brochure about Norsk Jernverk A.S. will be found as enclosure 3.

A list of assignments carried out by IKO concerning maintenance in heavy industry will be found as enclosure 4.

4. PLANS FOR EXECUTION OF THE PROJECT.

4.1 Scope of work

The Scope of Work as described in the Substantive Terms of Reference is the basis for our proposal.

Ad. point 1:

Bagground information:

Gives a clear presentation of the present situation and we have no comments.

Ad. point 2:

Aims of the project:

We agree to this.

Ad point 3:

Main objectives of the work:

Gives a very clear picture of the problems in question and the required improvements.

Ad point 4:

Special tasks to be implemented by the contractor:

Phase 1:
Introduction to managed maintenance:

We recommend that consideration be given which level in the organisation is expected to attend these seminars. It is not possible to make general material covering all functions and all organisational levels.

We suggest that the lecturer selected, also be qualified to adjust material and seminars for a number of different and small groups inside as well as outside the maintenance organisation.

As this educational function is essential for the success of the total project, we would like to give some assistance in organising this.

Phase II:
System Development:

Rather early in the project the organisational frame work in which the maintenance function is to work, must be decided since this will give the basis for the systems and information flow, necessary to establish a managed maintenance system.

Phase III:
Work Plan Preparation:

The size and complexity of the total project calls for a very careful and professional planning of all activities.

We recommend that a network plan is established based on detailed description of each activity.

The activity plans must describe purpose, working program, necessary information, expected result, responsible manager, and expected time consumption.

The network must describe the time sequence, the time period and the duration of all activities and the total project. Please find an example of a network and an activity description in enclosure 5.

Phase IV:
Implementation Counselling:

No comments.

Ad. point 5:

Other substantive requirements:

Please find in enclosure 6 a proposal for the time schedule for the reports mentioned in the Substantive Terms of Reference, article 5 point a), b), c), d), e), and f).

4.2 Organization of work/personnel involved.

Since this work must be carried out in close cooperation between the counterpart and the contractor, we suggest a Steering Committee be established for the total project.

The Steering Committee should be responsible for reports to UNIDO and to the general manager of the counterpart, for further organization and planning of the project, and for all necessary information pertaining to the project.

The Steering Committee should consist of:

The director of production
The manager of maintenance
The manager of EDP
The contractors projectleader
(+ a S.C. Secretary).

It is foreseen that the project should be devided into a number of subprojects such as:

1)
Overall planning of all efforts to improve the managed maintenance system.

2)
Organization and development of personnel.

3)
Development of data bases and coding systems.

4)
Development of policies, standard instructions, procedures. This project covers subjects such as Buy/Make Spare Parts, Max/min Inventory, Repair/Discard Equipment, etc.

5)
Development of administrative systems for

- Central planning
- Departmental planning
- Detail planning & work preparation
- Material control
- Manpower control
- Equipment control
- Cost control.

This project covers subjects as budgetting, Preventive maintenance, Historical Equipment Files, Time Estimation, Work Preparation, etc.

6)
Development of information systems necessary to cover users output requests.

7)
Report of technical means to modernize the different operations/ systems, such as microfilm, special EDP-programmes, etc.

8)
Development of a Counterpart/Fellowship Training Programme.

Each of these projects should be allocated a competent engineer/economist from the counterpart. These people shall in the analysing phase of the project be responsible, together with the contractor, for each project and later assume the total responsibility.

As the different subprojects calls for a very broad expertise, we suggest that our projectleader is responsible for all projects, and that he is given the possibility of drawing on a rather broad group of consultants especially suited, problem for problem.

The active consultants in this projects are suggested to be:

Gunnar Frydensberg, team leader
Finn Gjedebo
Jon Birkeli
Gert Hansen
Jørgen Karaa Rasmussen
Flemming Madsen

Please find curriculum vitae for these persons in enclosure 7.

4.3 Plan of work

Our plan of work calls for 1) Activities in Hungary, 2) Activities at the home office.

The total project is calculated to a consultant effort of 13 man months.

Since it is necessary to draw heavily on IKO's database on maintenance in order to execute the work as quickly as required, we propose 3 1/2 man months of the consultants effort to be carried out at our home office. We recommend that, in some shorter periods, members of the counterparts' staff to stay with us.

The rest of the contractor efforts (9 1/2 m/m) is expected to take place in Hungary.

Our plan of work is divided into the following phases (I to IV is corresponding to the phases mentioned in the Substantive Terms of Reference article 4).

Phase 0: Fact finding.

Examination of the present level of the systems, data and personnel.
Organization of the total project.
Preparation of practical framework for total project (See point 4.2.1 to 4.2.8)

Phase I: Preparation of Seminar covering the basic principles of Managed Maintenance System.

Phase II: Carrying out the project mentioned in 4.2.1 to 4.2.8.

Phase III: Establishment of a work plan for the further implementation and development of the maintenance management system.

Phase IV: Follow up.

Please find in enclosure 6 a proposal for the time schedule for these phases.

5. COST

Our cost proposal is based on:

Work 5 days a week with a total of 40 working hours per week.

A man-month is calculated to include 4.3 weeks.

We charge an average fee of Norwegian kr. 30.000 per man-month for the consultants on this project. According to the present rate of exchange, 1 US dollar equal to 5,50 Norwegian kr, this is equivalent to US dollar 5.450 per man-month. The same rate applies to work in Hungary and at the home office.

Air tickets are calculated at present prices. A price increase will in all probability occur in the near future, and this increase will have to be added to the total costs given below.

The details of the cost calculations are given in Enclosure 8.

The total contract price will be US $ 87,854.

5. SUPPORT IN HUNGARY

An English-speaking and writing secretary must be placed at the team's disposal for the duration of the work in Hungary, furthermore the team should be provided with a passenger car, and with adequate office facilities.

Yours faithfully,
p.p. NORCONSULT A.S.

Kjell Grinde
Managing Director

LIST OF ENCLOSURES

Enclosure 4

List of Assignments Carried out by IKO-Consulting Group

Representing relevant experience for the actual project.

1. Norsk Jernverk A.S., Mo i Rana, Norway
   (Norway's largest steel work industry)

   a) Organization of the maintenance organization
   b) General efficiency programme
   c) Plant lay-out for all maintenance facilities

2. Norrbottans Jernverk A.B., Luleå, Sweden.
   (Swedens largest steel work industry)

   a) Study of the spare part system.
   b) General efficiency programme.

3. Ribe Jernstøberi A/S Ribe, Denmark
   (Largest radiator steel panel industry)

   a) Preventive maintenance systems
   b) Time estimation
   c) General efficiency programme.
   d) Cost control programme

4. Zelezarna Ravne, Yugoslavia
   (Large steel work industry)

   a) Organization of the maintenance functions.
   b) General efficiency work in the maintenance functions.

5. Norsk Koksværk A/S, Mo i Rana, Norway
   (Large coke factory)

   a) Planning of the maintenance work shops.
   b) General efficiency programme.

6. Sandviken Jernverk A.B., Sandviken Sweden
   (Large steel mill)

   a) Organization
   b) Time estimation system

7. Aalborg Portland Cement Fabrik, Aalborg, Denmark
   (Denmark's largest Cement Factory)

   a) Total analysis of present situation and planning of the improvement of the maintenance function during the next five years.
   b) Stand by specialist in above mentioned project.

8. Uljanik Shipyard, Pula, Jugoslavis
(Large Yugoslavian Shipyard).

a) Organization
b) Preventive maintenance systems
c) Cost control programme

9. Borregaard A/S, Oslo, Norway
(Norway's largest Paper Industry)

a) Administrative systems
b) Re-organization of some functions
c) Man power administration

10. Gulhögens Bruk, Skövde, Sweden.
(Swedens largest Cement Factory)

a) Establishment of the administrative maintenance systems.
b) Organization of the maintenance functions.
c. Information systems.
d) Spare part and store organization.

11. Nordiske Kabel & Traad Fabriker, Copenhagen, Denmark,
(Denmark's largest cable work industry)

a) Preventive maintenance system
b) Man power administrative systems
c) Cost control system

12. Korsør Glasværk A/S, Korsør, Denmark
(Denmark's largest glass work industry)

a) Organization of the maintenance functions
b) Establishment of administrative systems
c) Education of personnel.

Subproject No. 7

MAIN PLANNING

PURPOSE

- To structure the planning system according to the future organization so that the separate detail planning functions are provided with the best possible data for developing plans.
- To evaluate follow-up procedures to make certain that at all times the progress of all productive functions is efficiently registered. Those registrations should form the basis for decision-making, when there are deviations from the plans.

PROGRAM

010 Principal sketches for future Planning System.

020 Segregrate into Technical and/or Organizational Units.

030 Network Model for the Future Planning System

110 Define input and output for the activities.

120 Establish processing rules for activities.

130 Select methods and tools for activities.

140 Select persons responsible and others

150 Work out forms and routines for activities.

160 Implement the system for all activities.

170 Follow-up

T51 Finish

INFORMATION:

The handbook of organization

The information system

The present main planning system

The fact finding report on planning.

RESULT

- Main planning and control system documented by final forms and rules for:

  - Major Repair Jobs
  - Planned Repair
  - Preventive Maintenance
  - Spare Parts
  - Statistic
  - Economy
  - Etc.

DURATION

- The first phase of this work should be carried out by an engineer with experience from the company and well-educated in the use of modern techniques (for example, EDP and net-work models), assisted by one or two management consultants.

- The later phases of the work should be carried out by personnel from the company exclusively. Two persons will be needed nearly full time and some others will be needed for shorter periods. The persons from the company will work under the leadership of the persons executing Phase I.

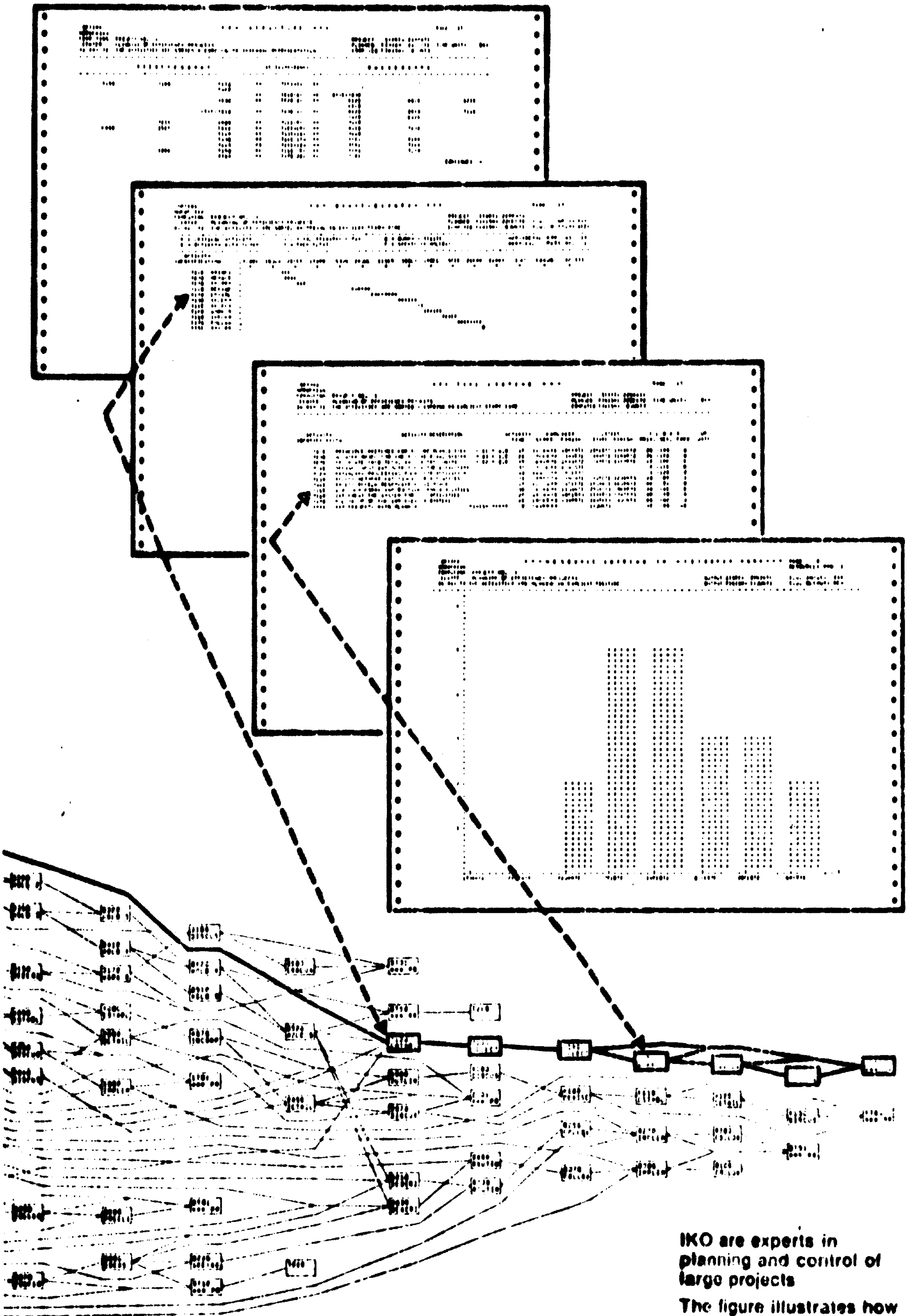
- The project can start shortly after the completion of Stage I of the reorganization. In addition, it must be carried out and realized in conjunction with Stage II.

- Consultant time: Approximately 14 weeks.

RESPONSIBILITY

The manager of the main planning department.

PLANNING OF EFFICIENCY PROJECTS

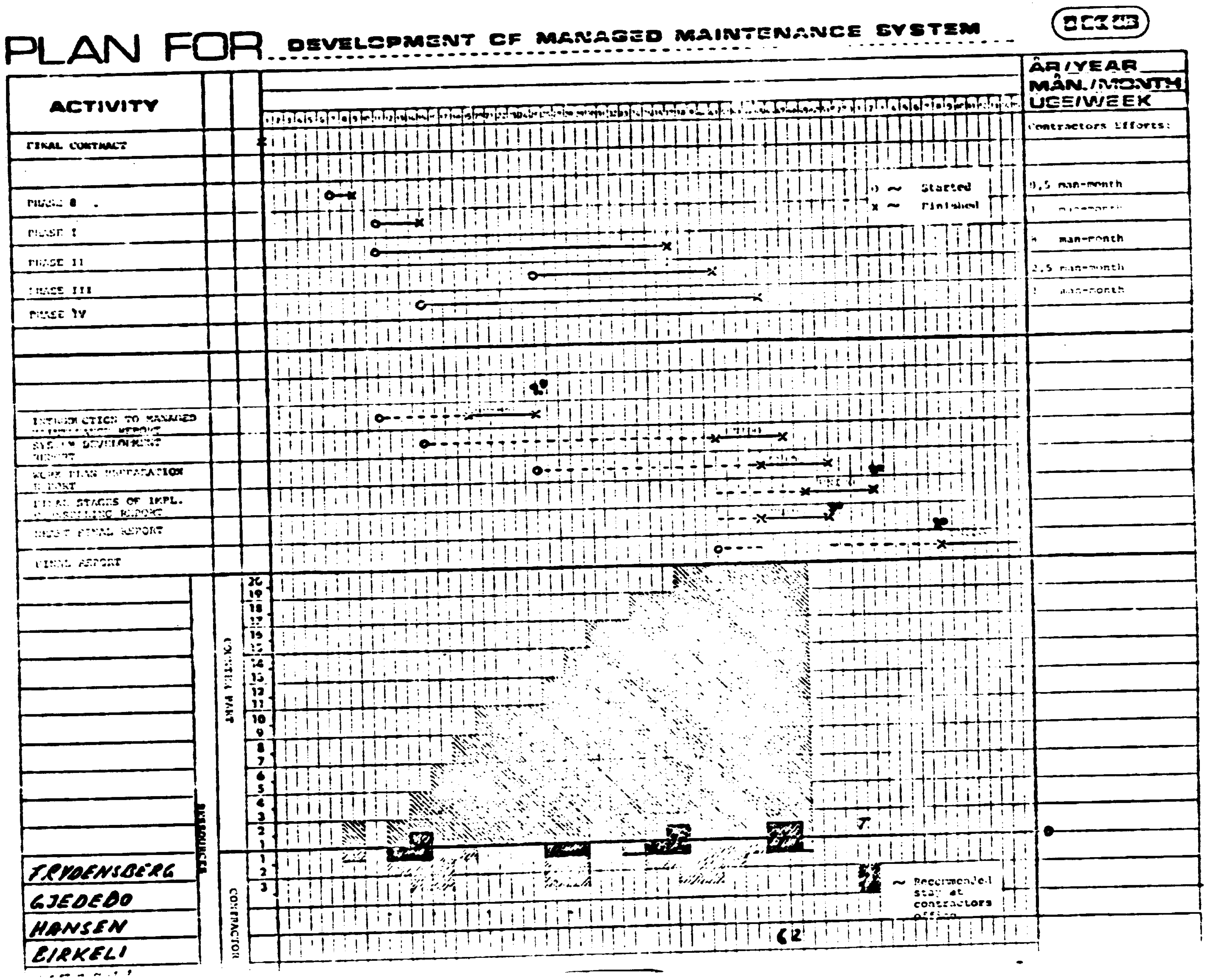


IKO are experts in planning and control of large projects

The figure illustrates how subproject no. 7 (Main planning) is controlled and related to other subprojects.

Enclosure 6.

PLAN FOR DEVELOPMENT OF MANAGED MAINTENANCE SYSTEM



CURRICULUM VITAE

1. Gunnar Frydensberg
2. Finn Gjedebo
3. Gert Hansen
4. Jon Birkeli
5. Jørgen Kæraa Rasmussen
6. Flemming Madsen

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UNITED NATIONS

PERSONAL HISTORY STATEMENT (PROJECT PERSONNEL)

(TANS 2)

THIS INFORMATION MAY BE SUBMITTED TO MEMBER GOVERNMENTS

DATE: December 1, 1987 SIGNATURE: [signature]

1. NAME: Erik Gunnar Frydensborg
2. NATIONALITY: Danish
3. PRESENT ADDRESS: Bolbrovej 1, 2960 Rungsted Denmark
4. DATE OF BIRTH: January 6, 1932
5. MARITAL STATUS: Married

KNOWLEDGE OF LANGUAGES: Mother Tongue: Danish

OTHER LANGUAGES	READ		WRITE		SPEAK		UNDERSTAND	
	EASILY	NOT EASILY	EASILY	NOT EASILY	FLUENTLY	NOT FLUENTLY	EASILY	NOT EASILY
English	x		x		x		x	
German	x		x		x		x	

EDUCATION: (see Instruction 5)

DATES ATTENDED From	To	NAME and LOCATION of INSTITUTION of LEARNING	ACADEMIC DEGREES and CERTIFICATES or DIPLOMAS OBTAINED	MAIN FIELD of STUDY
1951	1957	The Copenhagen Institute of mechanical engineering, Denmark	B.Sc.	Industrial engineer
1970		Carnegie-Mellon University, Pittsburg, USA	PFE	Business Administra

LIST ANY PUBLICATIONS OR PAPERS: (see instruction 6)

A number of articles in Danish and Swedish periodicals and newspapers.

A number of manuals and monographs for company use.

Experienced lecturer on Organization, Efficiency, Improvement, Maintenance, Production Planning, Strategic Planning, Value Analysis, etc.

9. LIST SPECIAL QUALIFICATIONS AND SKILLS CONFIRMED BY LICENSES HELD AND MEMBERSHIP IN PROFESSIONAL, CIVIC, PUBLIC OR INTERNATIONAL SOCIETIES OR INSTITUTIONS RELEVANT TO YOUR APPLICATION; INDICATE THE CLASS OF MEMBERSHIP WHEN APPROPRIATE:

The Society of Engineers of Denmark, general member.

Danish Management Society, board member.

Danish Management Consultants' Society, board member.

10. **PROFESSIONAL EXPERIENCE** (see Instruction 7)

A.

From: 1961 To most recent date of employment:

EMPLOYER (Name and Address) AND TYPE OF BUSINESS: IKO-Konsulent A/S, Copenhagen, Denmark
Consulting firm in the IKO Consulting Group, international management consultants.

TITLE OF POST AND NATURE OF DUTIES:

Managing director, board member, partner.
Responsible project manager on major projects.
Responsible for the group's world-wide contact to large private industries.
Member of the board's committee on strategic planning

NUMBER AND KIND OF EMPLOYEES SUPERVISED: Directly 50, mainly consultants holding a university degree. Indirectly 500, mainly consultants holding a university degree and staff-personnel from clients.

B.

From: 1958 To: 1961

EMPLOYER (Name and Address) AND TYPE OF BUSINESS:
Det Danske Staalvalseverk A/S, Frederiksvark, Denmark.
Major Steel Work (2.500 employees).

TITLE OF POST AND NATURE OF DUTIES:

Industrial engineer.

Participant in a large expansion programme.

NUMBER AND KIND OF EMPLOYEES SUPERVISED:

C.

From: 1957 To: 1958

EMPLOYER (Name and Address) AND TYPE OF BUSINESS:

Firma Sach G.m.b.H., Düsseldorf, Germany

TITLE OF POST AND NATURE OF DUTIES:

Engineer at the drawing office.

Design and calculating steel mills.

NUMBER AND KIND OF EMPLOYEES SUPERVISED:

PROFESSIONAL EXPERIENCE (Continued)

D.

From: 1950 To: 1957

EMPLOYER (Name and Address) AND TYPE OF BUSINESS:

Det Danske Staalvalseværk A/S, Frederiksværk, Denmark
Major Steel Work (2.500 employees)

TITLE OF POST AND NATURE OF DUTIES:

In the period 1950 - 1953 and in all adjourns in my basic study time (53-57) I was working as technician in the maintenance department.

NUMBER AND KIND OF EMPLOYEES SUPERVISED: 0-5 other technicians.

E.

From: To:

EMPLOYER (Name and Address) AND TYPE OF BUSINESS:

TITLE OF POST AND NATURE OF DUTIES:

NUMBER AND KIND OF EMPLOYEES SUPERVISED:

F.

From: To:

EMPLOYER (Name and Address) AND TYPE OF BUSINESS:

TITLE OF POST AND NATURE OF DUTIES:

NUMBER AND KIND OF EMPLOYEES SUPERVISED:

G.

From: To:

EMPLOYER (Name and Address) AND TYPE OF BUSINESS:

TITLE OF POST AND NATURE OF DUTIES:

NUMBER AND KIND OF EMPLOYEES SUPERVISED:

Use additional sheet if you have held more posts.

UNITED NATIONS

PERSONAL HISTORY STATEMENT *(PROJECT PERSONNEL)*

(TARS 3)

THIS INFORMATION MAY BE SUBMITTED TO MEMBER GOVERNMENTS

(see instruction 8)

ANALYSIS OF RELEVANT EXPERIENCE: *Use this space to analyze your experience in relation to your statement concerning your specialization. Additionally, if you are applying for a specific post, please indicate the number of the Job Description of this post and analyze your experience in relation to the duties and requirements set out in the Job Description.*

MAJOR ASSIGNMENTS:

For more than 13 years as a management consultant I have carried out and supervised a wide variety of assignments in Norway, Sweden, Denmark, England, Germany, Spain and Yugoslavia. Described below are some major assignments where I have been in charge of the total project:

1961 - Norsk Hydro A/S, Norway
Chemical Industry (10.000 employees)

Establishing maintenance systems
Project size: 12 man months.

1962 - Nordiske Kabel- og Traadfabrikker A/S
NKT, Copenhagen, Denmark
Cable Work (5.000 employees)

Establishing production planning and control systems
Project size: 38 man months.

1964 - Aalborg Skipyard A/S, Aalborg, Denmark
Shipyard (3.000 employees).

Investigation of efficiency in production and administration.
Project size: 36 man months.

1964 - Frederikshavn Skipyard A/S, Frederikshavn, Denmark
Shipyard (1.500 employees).

Organization of ship repair shop
Project size: 12 man months.

1965 - Ribe Jernstøberi A/S, Ribe, Denmark
Foundry (1.000 employees).

Product development, production planning, market survey, organizational development, general efficiency improvement
Project size: 48 man months.

1966 - Nakskov Shipyard A/S, Nakskov, Denmark
Shipyard (2.500 employees).

Product development, production planning, organizational development, general efficiency improvement. Project size: 80 man months.

1967 - Aalborg Portland-Cement Fabrik A/S, Aalborg, Denmark
Cement industry (3.000 employees).

Analyses of spare-part demand, planning of a 5-year programme for systematic maintenance.
Project size: 36 man months.

1968 - Elsinore Shipyard A/S, Elsinor, Denmark
Shipyard (3.000 employees).

General efficiency improvement, production methods, design, systems, organizational development, and management systems.
Project size: 72 man months.

1969 - F.L. Smidth & Co. A/S, Copenhagen, Denmark
Cement manufacturing company (20.000 employees).

Organizational development, administrative systems, general efficiency.
Project size: 100 man months.

1970 - Uljanik Shipyard, Pula, Yugoslavia
Shipyard (6.000 employees).

Assisting in all modifications and additions necessary to change from the building of different types of medium sized ships (up to 80.000 dwt) to oil/ore tankers of 265.000 dwt.
Project size: 220 man months.

1971 - Split Shipyard, Split, Yugoslavia
Shipyard (6.500 employees).

Organization and systems rationalization concerning the yard's total administrative commercial, and production systems.
Project size: 80 man months.

- DFDS A/S, Copenhagen, Denmark
Shipping company (3.000 employees).

Organizational development and rationalization of administrative systems.
Project size: 50 man months.

1972	-	Burmeister & Wain A/S, Copenhagen, Denmark Shipyard (3.000 employees). Establishing new production planning system and a time distribution analysis of the production departments. Project size: 12 man months.
	-	Bremer Vulkan G.m.b.H., Bremen, Germany Shipyard (5.000 employees). Establishing new steel-production line Project size: 8 man months.
1973	-	The Ministry of Defence, Denmark (24.000 employees) General efficiency improvement programme for army, airforce and navy (inclusive of the navy shipyard). Project size: 150 man months.
1974	-	A.P. Møller, Copenhagen, Denmark Shipowners and trading company (approx. 26.000 employees). Organizational development, cost reduction programmes, and technical surveys. Project size: 100 man months.
	-	Major projects in large companies and public organizations.

Over the last several years I have served in an intermittent advisory capacity to a number of Denmark's largest firms:

F.L. Smidth & Co. A/S	Producers of cement production facilities. (App. 10.000 employees).
Danværft A/S	Group of Danish shipyards (app. 5.000 employees).
A.P. Møller	Shipowners and trading company (app. 26.000 employees).

In addition to assignments for clients I have also been in charge of a number of internal development projects such as:

- a system for systematic plant lay-out
- a system for corporate strategy development
- a technological data-base for shipbuilding
- a systematic maintenance programme
- a production planning system for shipyards and light and heavy metal industries.
- a data base for cost/time distribution in shipbuilding.

Furthermore my position has required a constant up-to-date knowledge of modern management and forced me to attend a large number of seminars and courses in this field as well as an intensive reading of litterature.

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UNITED NATIONS

PERSONAL HISTORY STATEMENT (PROJECT PERSONNEL)

(TARS 2)

THIS INFORMATION MAY BE SUBMITTED TO MEMBER GOVERNMENTS

E: ____________ SIGNATURE: ____________

1. NAME: Gjedebo, Finn
2. NATIONALITY: Norwegian
3. PRESENT ADDRESS: Prestegårdveien 5, 1320 Stabekk, Norway
4. DATE OF BIRTH: Jan 5, 1912
5. MARITAL STATUS: Married

6. KNOWLEDGE OF LANGUAGES: Mother Tongue: Norwegian

OTHER LANGUAGES	READ		WRITE		SPEAK		UNDERSTAND	
	EASILY	NOT EASILY	EASILY	NOT EASILY	FLUENTLY	NOT FLUENTLY	EASILY	NOT EASILY
English	x		x		x		x	
German	x		x		x		x	

EDUCATION: (see instruction 5)

DATES ATTENDED From	To	NAME and LOCATION of INSTITUTION of LEARNING	ACADEMIC DEGREES and CERTIFICATES or DIPLOMAS OBTAINED	MAIN FIELD of STUDY
1933	1937	Technirche Hochschule Aachen	Diplomingenieur	Anorganic Chemistry

LIST ANY PUBLICATIONS OR PAPERS: (see instruction 6)

9. LIST SPECIAL QUALIFICATIONS AND SKILLS CONFIRMED BY LICENSES HELD AND MEMBERSHIP IN PROFESSIONAL, CIVIC, PUBLIC OR INTERNATIONAL SOCIETIES OR INSTITUTIONS RELEVANT TO YOUR APPLICATION; INDICATE THE CLASS OF MEMBERSHIP WHEN APPROPRIATE:

Member Norwegian Engineering Society
Member Norwegian Foundry Association
Member Norwegian Metallurgical Society
Member Verein Deutsche Eisenhütter Leute, Germany
Member Iron and Steel Society, Great Brittain
Member The Metallurgical Society of AIME, USA

30. **PROFESSIONAL EXPERIENCE** (see Instruction 7)

A.

From: 1969 To post recent date of employment:

EMPLOYER (Name and Address) AND TYPE OF BUSINESS:

A/S Norsk Jernverk, Oslo, Iron and Steel Work
Special consultant to Norconsult and IKO Consulting Group

TITLE OF POST AND NATURE OF DUTIES:

Director of technical development projects.

NUMBER AND KIND OF EMPLOYEES SUPERVISED: Supervision of major projects, planning and implementation work a total workforce of 200 - 400 people

B.

From: 1967 To: 1969

EMPLOYER (Name and Address) AND TYPE OF BUSINESS:

A/S Norsk Blikkvalseverk, Tinplate and Electro-technical Material producer

TITLE OF POST AND NATURE OF DUTIES:

Director of A/S Nrosk Blikkvalseverk, a subsidiary of A/S Norsk Jernverk

NUMBER AND KIND OF EMPLOYEES SUPERVISED: 400 employees including technical personell, sales department, purchasing, laboratories,

C.

From: 1964 To: 1969

EMPLOYER (Name and Address) AND TYPE OF BUSINESS:

S/S Norsk Jernverk

TITLE OF POST AND NATURE OF DUTIES:

Director of production coordination among the different plants and coordination purchasing, production and sales.

NUMBER AND KIND OF EMPLOYEES SUPERVISED: 20 administration assistants.

PROFESSIONAL EXPERIENCE (Continued)

D.

From: 1950 To: 1964

EMPLOYER (Name and Address) AND TYPE OF BUSINESS:
Stavanger Electro Staalverk A/S, Stavanger. Alloyed Steel Work and foundry

TITLE OF POST AND NATURE OF DUTIES:
Technical director

NUMBER AND KIND OF EMPLOYEES SUPERVISED: 1150 engineers, administrative personnel and workers.

E.

From: 1947 To: 1950

EMPLOYER (Name and Address) AND TYPE OF BUSINESS:
Stavanger Electro Staalverk, Stavanger

TITLE OF POST AND NATURE OF DUTIES:
Production manager

NUMBER AND KIND OF EMPLOYEES SUPERVISED: 800 engineers and workers covering all technical departments

F.

From: 1939 To: 1947

EMPLOYER (Name and Address) AND TYPE OF BUSINESS:
Stavanger Electro Staalverk, Stavanger

TITLE OF POST AND NATURE OF DUTIES:
Chief of laboratories

NUMBER AND KIND OF EMPLOYEES SUPERVISED: 40 laboratory engineers and assistants

G.

From: 1937 To: 1939

EMPLOYER (Name and Address) AND TYPE OF BUSINESS:
Stavanger Electro Staalverk, Stavanger

TITLE OF POST AND NATURE OF DUTIES:
Steel works engineer

NUMBER AND KIND OF EMPLOYEES SUPERVISED: 35 foremen and workers

Use additional sheet if you have held more posts.

UNITED NATIONS

PERSONAL HISTORY STATEMENT *(PROJECT PERSONNEL)*

(TARS 3)

THIS INFORMATION MAY BE SUBMITTED TO MEMBER GOVERNMENTS

(see instruction 8)

ANALYSIS OF RELEVANT EXPERIENCE: *Use this space to analyse your experience in relation to your statement concerning your specialization. Additionally, if you are applying for a specific post, please indicate the number of the Job Description of the post and analyse your experience in relation to the duties and requirements set out in the Job Description.*

Norsk Jernverk has the following plants:

Rana Gruper (ore mining) producing 1 mill. tons of hematite and magetite ore.

Iron and Steel Work, Mo in Rana, producing 600.000 tons of pig iron, and 700.000 tons of steel.

Blikkvalseverket A/S producing 80.000 tons of tinned material and 30.000 tons electrotechnical material.

A/S Norsk Staaltaufabrikk, Trondheim, producing 7.000 tons of wire rope, with a 70% ownership of A/S Norsk Staaltrådtrekkeri, producing 9000 tons of drawn wire.

During my years in production, I have been in charge of the maintenance operations.

As part of my work on development projects I have handled maintenance projects in relation to new equipment and to maintenance organization.

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UNITED NATIONS

PERSONAL HISTORY STATEMENT *(PROJECT PERSONNEL)*

(TARS 2)

THIS INFORMATION MAY BE SUBMITTED TO MEMBER GOVERNMENTS

DATE: ______ SIGNATURE: ______

1. NAME: Hansen, Gert
PRESENT ADDRESS: Stenløkken 70, 3460 Birkerød

2. NATIONALITY: Danish
4. DATE OF BIRTH: 1941 - 07 - 18
5. MARITAL STATUS: Married

6. KNOWLEDGE OF LANGUAGES: Mother Tongue: Danish

OTHER LANGUAGES	READ		WRITE		SPEAK		UNDERSTAND	
	EASILY	NOT EASILY	EASILY	NOT EASILY	FLUENTLY	NOT FLUENTLY	EASILY	NOT EASILY
English	x		x		x		x	
German	x			x	x		x	
French	x			x	x		x	

7. EDUCATION: (see Instruction 5)

DATES ATTENDED From	To	NAME and LOCATION of INSTITUTION of LEARNING	ACADEMIC DEGREES and CERTIFICATES or DIPLOMAS OBTAINED	MAIN FIELD of STUDY
1963	1969	Technical University of Denmark, Copenhagen (Danmarks Ingeniør-akademi)	B.Sc.	Mechanical and industrial engineer.

8. LIST ANY PUBLICATIONS OR PAPERS: (see instruction 6)

A number of articles in Danish periodicals

A number of papers for conferences in Quantitative Methods

Experiences lecturer in Operations Research, Quantitative Methods, Statistics, Maintenance, Network Planning etc.

9. LIST SPECIAL QUALIFICATIONS AND SKILLS CONFIRMED BY LICENSES HELD AND MEMBERSHIP IN PROFESSIONAL, CIVIC, PUBLIC OR INTERNATIONAL SOCIETIES OR INSTITUTIONS RELEVANT TO YOUR APPLICATION; INDICATE THE CLASS OF MEMBERSHIP WHEN APPROPRIATE:

Member of: Danish Management Association
Danish Society of Engineers.

10. **PROFESSIONAL EXPERIENCE** (see Instruction 7)

A.

From: 1969 To most recent date of employment:

EMPLOYER (Name and Address) AND TYPE OF BUSINESS: IKO-Konsulent A/S, Copenhagen, Denmark Consulting firm in the IKO Consulting Group, International management consultants.

TITLE OF POST AND NATURE OF DUTIES:

Chief Consultant

Projectleader on major projects in the field of planning and scheduling with emphasis on the steel industry and the functionsmain planning, maintenance, material administration.

NUMBER AND KIND OF EMPLOYEES SUPERVISED: 0 - 30 Consultant with staff members from the client.

B.

From: To:

EMPLOYER (Name and Address) AND TYPE OF BUSINESS:

TITLE OF POST AND NATURE OF DUTIES:

NUMBER AND KIND OF EMPLOYEES SUPERVISED:

C.

From: To:

EMPLOYER (Name and Address) AND TYPE OF BUSINESS:

TITLE OF POST AND NATURE OF DUTIES:

NUMBER AND KIND OF EMPLOYEES SUPERVISED:

UNITED NATIONS

PERSONAL HISTORY STATEMENT *(PROJECT PERSONNEL)*

(TARS 3)

THIS INFORMATION MAY BE SUBMITTED TO MEMBER GOVERNMENTS

(see instruction 8)

...ALYSIS OF RELEVANT EXPERIENCE: Use this space to analyze your experience in relation to your statement concerning ... of specialization. Additionally, if you are applying for a specific post, please indicate the number of the Job Description o... ...is post and analyze your experience in relation to the duties and requirements set out in the Job Description.

RELEVANT PROJECT EXPERIENCE:

Scandinavian:

Heavy Machinery Manufacturer: (1200 employees)	Planning system for production and maintenance.
Cable Works: (4000 employees)	Detail planning for maintenance department.
Process Industry:	Project management for planning and construction of a new plant.

Internationally:

Major Steel Industry: (6000 employees)	Main and detail planning systems for hull construction, outfitting and maintenance.
Special knowledge:	Utilization of network planning principles for a large number of different purposes. Establishment of computer-based coding systems for various purposes.

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UNITED NATIONS

PERSONAL HISTORY STATEMENT *(PROJECT PERSONNEL)*

(TARS 2)

THIS INFORMATION MAY BE SUBMITTED TO MEMBER GOVERNMENTS

DATE: [handwritten date, 1981] SIGNATURE: [signature]

1. NAME: Birkeli, Jon
PRESENT ADDRESS: IKO-Konsulent A/S
Blovstrød Center
3450 Allerød

2. NATIONALITY: Norwegian
4. DATE OF BIRTH: March 22, 1941
5. MARITAL STATUS: Married

KNOWLEDGE OF LANGUAGES: Mother Tongue: Norwegian

OTHER LANGUAGES	READ EASILY	READ NOT EASILY	WRITE EASILY	WRITE NOT EASILY	SPEAK FLUENTLY	SPEAK NOT FLUENTLY	UNDERSTAND EASILY	UNDERSTAND NOT EASILY
English	x		x		x		x	
German		x		x		x		x

EDUCATION: (see instruction 5)

DATES ATTENDED From	To	NAME and LOCATION of INSTITUTION of LEARNING	ACADEMIC DEGREES and CERTIFICATES or DIPLOMAS OBTAINED	MAIN FIELD of STUDY
1958	1959	Newton-Conover High-school, Newton, NC-USA	Highschool Diploma	General
1960	1964	Lenoil-Phyne College Hickory, N.C USA	B.A.	Economics
1967	1971	U. of South Carolina Columbia, S.C. USA	Ph.D.	Economics

LIST ANY PUBLICATIONS OR PAPERS: (see instruction 6)

7. LIST SPECIAL QUALIFICATIONS AND SKILLS CONFIRMED BY LICENSES HELD AND MEMBERSHIP IN PROFESSIONAL, CIVIC, PUBLIC OR INTERNATIONAL SOCIETIES OR INSTITUTIONS RELEVANT TO YOUR APPLICATION; INDICATE THE CLASS OF MEMBERSHIP WHEN APPROPRIATE:

Danish Management Association
American Economics Association
American Institute for Decision Sciences.

10. PROFESSIONAL EXPERIENCE (see instruction 7)

A.

From 1971 To most recent date of employment:

EMPLOYER (Name and Address) AND TYPE OF BUSINESS: IKO-Konsulent A/S, Copenhagen, Denmark
Consulting firm in the IKO Consulting Group, international management consultants.

TITLE OF POST AND NATURE OF DUTIES:

Management Consultant	1971 - 1972	Nature of duties is described in "Analysis of Relevant experience"
Senior Consultant	1972 - 1974	
Chief Consultant	1974 -	

NUMBER AND KIND OF EMPLOYEES SUPERVISED:

B.

From 1967 To: 1971

EMPLOYER (Name and Address) AND TYPE OF BUSINESS:
University of South Carolina, Columbia, S.C. USA
Institution of learning

TITLE OF POST AND NATURE OF DUTIES:

1967 - 1970 EDP application advisor at university computer center

1967 - 1970 Teaching assistant in: Statistics, Economics, Operation Research and Capital Budgetting.

1970 - 1971 Lecturer in Capital Budgeting.

NUMBER AND KIND OF EMPLOYEES SUPERVISED:

C.

From 1965 To: 1967

EMPLOYER (Name and Address) AND TYPE OF BUSINESS:
First National Bank, Hickory, N.C. USA
Retail Banking

TITLE OF POST AND NATURE OF DUTIES:

Management trainee 1965

Assist. EDP-manager 1966 - 67

NUMBER AND KIND OF EMPLOYEES SUPERVISED: Computer personnel 4-6

UNITED NATIONS

PERSONAL HISTORY STATEMENT *(PROJECT PERSONNEL)*

(TARS 3)

THIS INFORMATION MAY BE SUBMITTED TO MEMBER GOVERNMENTS

(see instruction 8)

ANALYSIS OF RELEVANT EXPERIENCE: *Use this space to analyze your experience in relation to your statement concerning your specialization. Additionally, if you are applying for a specific post, please indicate the number of the Job Description of this post and analyse your experience in relation to the duties and requirements set out in the Job Description.*

SCANDINAVIAN:

Banking: (4000 empl)

Management Information Demand Analysis on all levels of the organization.

Prioritizing of data-base development and peripheral computer and management systems

Heavy Industry: (2000 empl)

Modelling of computer based planning and control system for calculation of alternative consequences of short and long term activities.

INTERNATIONALLY:

Major Steel Industry: (6000 empl)

Building and implementing a coordinated and comprehensive coding system used as communication medium in data collection and retrieval systems.

Constructing and implementing a material management system.

Major Steel Industry: (5000 empl)

Establishing computer oriented budgetting and calculation systems.

Building and implementing a material standardization system.

Establishing priority schedule for computer application

Re-organization of various supportive and productive functions, including maintenance coding system (see details above).

Special knowledge:

Project management, management systems and especially strategic planning.

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UNITED NATIONS

PERSONAL HISTORY STATEMENT (PROJECT PERSONNEL)

(TARS 2)

THIS INFORMATION MAY BE SUBMITTED TO MEMBER GOVERNMENTS

DATE: _______________ SIGNATURE: _______________

1. NAME: Rasmussen, Jørgen Karran
PRESENT ADDRESS: Højgårdstoften 91
2630 Tåstrup

2. NATIONALITY: Danish
4. DATE OF BIRTH: 1941-05-14
5. MARITAL STATUS: Married

7. KNOWLEDGE OF LANGUAGES: Mother Tongue: Danish

OTHER LANGUAGES	READ: EASILY	READ: NOT EASILY	WRITE: EASILY	WRITE: NOT EASILY	SPEAK: FLUENTLY	SPEAK: NOT FLUENTLY	UNDERSTAND: EASILY	UNDERSTAND: NOT EASILY
English	x		x		x		x	
German	x			x	x		x	

EDUCATION: (see Instruction 5)

DATES ATTENDED From	To	NAME and LOCATION of INSTITUTION of LEARNING	ACADEMIC DEGREES and CERTIFICATES or DIPLOMAS OBTAINED	MAIN FIELD of STUDY
1960	1968	University of Aarhus, Denmark	M.Sc.	Mathematical Statistics and Operations Research

. LIST ANY PUBLICATIONS OR PAPERS: (see instruction 6)

A number of articles in Danish periodicals.

A number of papers for conferences in Quantitative Methods

Experiences lecturer in Operations Research, Quantitative Methods, Statistics, Maintenance, Network Planning etc.

9. LIST SPECIAL QUALIFICATIONS AND SKILLS CONFIRMED BY LICENSES HELD AND MEMBERSHIP IN PROFESSIONAL, CIVIC, PUBLIC OR INTERNATIONAL SOCIETIES OR INSTITUTIONS RELEVANT TO YOUR APPLICATION; INDICATE THE CLASS OF MEMBERSHIP WHEN APPROPRIATE:

Member of: Danish Management Association
Danish Federation of Business Economists

10. PROFESSIONAL EXPERIENCE (see Instruction 7)

A.

From: 1969 To most recent date of employment:

EMPLOYER (Name and Address) AND TYPE OF BUSINESS: IKO-Konsulent A/S, Copenhagen, Denmark
Consulting firm in the IKO Consulting Group, international management consultants.

TITLE OF POST AND NATURE OF DUTIES:

Chief Consultant.

Project leader on projects in the field of maintenance, network planning, manpower administration with emphasis in statistical methods.

NUMBER AND KIND OF EMPLOYEES SUPERVISED: 0 - 20 Consultants and staff members from the clients.

B.

From: 1968 To: 1969

EMPLOYER (Name and Address) AND TYPE OF BUSINESS:
The Computer Centre of Danish Agriculture

TITLE OF POST AND NATURE OF DUTIES:

Operations Research Consultant

NUMBER AND KIND OF EMPLOYEES SUPERVISED:

C.

From: To:

EMPLOYER (Name and Address) AND TYPE OF BUSINESS:

TITLE OF POST AND NATURE OF DUTIES:

NUMBER AND KIND OF EMPLOYEES SUPERVISED:

UNITED NATIONS

PERSONAL HISTORY STATEMENT (PROJECT PERSONNEL)

(TARS 3)

THIS INFORMATION MAY BE SUBMITTED TO MEMBER GOVERNMENTS

(see Instruction 8)

ANALYSIS OF RELEVANT EXPERIENCE: Use this space to analyze your experience in relation to your statement concerning your specialization. Additionally, if you are applying for a specific post, please indicate the number of the Job Description of this post and analyze your experience in relation to the duties and requirements set out in the Job Description.

RELEVANT PROJECT EXPERIENCE:

Scandinavian:

Heavy Machinery Manufacturer: (2500 employees)	Rationalization of design and drawing offices
Cable Works: (4000 employees)	Statistical control system for maintenance
Glass Works: (1100 employees)	Maintenance organization and planning. Spare parts inventory control.
Public Sercice organization: (10.000 employees)	Maintenance organization and statistical efficiency follow-up.

Internationally:

Major Steel Industry: (6000 employees)	Rationalization of design and drawing offices. Modification and implementation of IKO's EDP programme for ratio-delay studies on local computer.

Special Knowledge:

Utilization of EDP and statistical methods for solving management problems.

Has been responsible for a number of IKO development projects, such as:

- A management information system for consulting firms.
- A system for dimensioning work units in a shipyard.

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UNITED NATIONS

PERSONAL HISTORY STATEMENT (PROJECT PERSONNEL)

(TARS 2)

THIS INFORMATION MAY BE SUBMITTED TO MEMBER GOVERNMENTS

DATE: 1974-11-25 SIGNATURE: [illegible]

1. NAME: Madsen, Flemming John

PRESENT ADDRESS: Rudersdalsvej 110
2840 Holte

2. NATIONALITY: Danish

4. DATE OF BIRTH: 1944 - 12 - 06

5. MARITAL STATUS: Unmarried

KNOWLEDGE OF LANGUAGES: Mother Tongue: Danish

OTHER LANGUAGES	READ		WRITE		SPEAK		UNDERSTAND	
	EASILY	NOT EASILY	EASILY	NOT EASILY	FLUENTLY	NOT FLUENTLY	EASILY	NOT EASILY
English	X		X		X		X	
German	X			X	X		X	
French	X			X	X		X	

EDUCATION: (see instruction 5)

DATES ATTENDED From	To	NAME and LOCATION of INSTITUTION of LEARNING	ACADEMIC DEGREES and CERTIFICATES or DIPLOMAS OBTAINED	MAIN FIELD of STUDY
1965	1972	Danmarks Tekniske Højskole (technical University of Denmark Copenhagen	M.Sc.	Mechanical and Industrial engineering

LIST ANY PUBLICATIONS OR PAPERS: (see instruction 6)

LIST SPECIAL QUALIFICATIONS AND SKILLS CONFIRMED BY LICENSES HELD AND MEMBERSHIP IN PROFESSIONAL, CIVIC, PUBLIC OR INTERNATIONAL SOCIETIES OR INSTITUTIONS RELEVANT TO YOUR APPLICATION; INDICATE THE CLASS OF MEMBERSHIP WHEN APPROPRIATE:

Member of: Danish Management Association
Danish Society of Engineers
Danish Federation of Business Economists.

PROFESSIONAL EXPERIENCE (see Instruction 7)

A.

From 1973 To most recent date of employment

EMPLOYER (Name and Address) AND TYPE OF BUSINESS:

IKO Consulting Group, Management Consulting

TITLE OF POST AND NATURE OF DUTIES:

Management Consultant
Specialist in planning systems

NUMBER AND KIND OF EMPLOYEES SUPERVISED:

B.

From To:

EMPLOYER (Name and Address) AND TYPE OF BUSINESS:

TITLE OF POST AND NATURE OF DUTIES:

NUMBER AND KIND OF EMPLOYEES SUPERVISED:

C.

From To:

EMPLOYER (Name and Address) AND TYPE OF BUSINESS:

TITLE OF POST AND NATURE OF DUTIES:

NUMBER AND KIND OF EMPLOYEES SUPERVISED:

UNITED NATIONS

PERSONAL HISTORY STATEMENT *(PROJECT PERSONNEL)*

(TARS 3)

THIS INFORMATION MAY BE SUBMITTED TO MEMBER GOVERNMENTS

(see Instruction 8)

ANALYSIS OF RELEVANT EXPERIENCE: *Use this space to analyse your experience in relation to your statement concerning your specialisation. Additionally, if you are applying for a specific post, please indicate the number of the Job Description of the post and analyse your experience in relation to the duties and requirements set out in the Job Description.*

Relevant Project Experience:

Light machinery manufacturer:

EDP based system for production planning and inventory control.

APPENDIX 8

INVITEE'S ANALYSIS OF COST PROPOSAL

PART I

TOTAL COST

1. **PROFESSIONAL SERVICES**

A. Project Area

Position Title	Man Months	Cost per Man Month	Total Cost
Project leader	2 1/2	5,450	$ 13,625
Consultants	7	5,450	$ 38,150
			$
			$
		TOTAL PROJECT AREA	$ 51,775

B. Home Office

Position Title	Man Months	Cost per Man Month	Total Cost
Project leader	1	5,450	$ 5,450
Consultants	2 1/2	5,450	$ 13,625
		TOTAL HOME OFFICE	$ 19,075

2. **SUBSISTENCE**

A. Project Area

285 man/days at $ 32 per day. — $ 9,120

B. Briefing and De-briefing

5 man/days at $ 36 per day. — $ 180

C. Other (specify) inside Scandinavia

5 man/days at $ 32 per day. — $ 160

TOTAL SUBSISTENCE — $ 9,352

3. **TRAVEL AND TRANSPORTATION** (specify in PART II B below) — $ 5,394

4. **REPORTS** — $ 950

5. **OTHER DIRECT COSTS (specify)**

Telecommunication Hungary/Scandinavia	$ 200
Insurance	$ 1,000
	$
TOTAL OTHER DIRECT COSTS	$ 200

	TOTAL COST
6. EQUIPMENT, MATERIALS AND SUPPLIES	
Equipment	$..................
Materials and Supplies	$..................
TOTAL EQUIPMENT, MATERIALS AND SUPPLIES	$ -
7. SUBCONTRACTS (specify)	
....	$..................
....	$..................
TOTAL SUBCONTRACTS	$ -
8. GRAND TOTAL ITEMS 1 - 7 CONTRACT PRICE:	$ 87,854

PART II

A. CURRENCY REQUIREMENTS

a) Contractor's Currency $..79,734.........

b) Local Currency $...9,120.........

c) Other Currency $................

B. TRAVEL AND TRANSPORTATION EXPENSES (List - See Instructions, para. 3)

2 air tickets, Oslo-Budapest-Oslo, each 467	$ 934
12 air tickets, Copenhagen - Budapest - Copengagen each 340	$ 4,080
2 air tickets, Oslo - Copenhagen - Oslo, each 140	$ 280
Taxis	$ 100
	$ 5,394

CONTRACT

UNIDO Contract No. 75/2
Project No. IS/HUN/72/804
Activity Code 2

CONTRACT

between

THE UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

and

Norconsult A.S.

for the provision of services relating to the Managed Maintenance System of the Danube Iron and Steel Works

in

Hungary

This Contract entered into between the UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION (hereinafter referred to as the "UNIDO"), having its headquarters located at Lerchenfelderstrasse 1, Vienna, Austria, and Norconsult A.S. (hereinafter referred to as the "Contractor") havings its principal office located at Maries vei 20, P.O. Box 9, 1322 Høvik, Oslo, Norway;

W I T N E S S E T H

WHEREAS, UNIDO has agreed to provide assistance to the Government of Hungary (hereinafter referred to as the "Government") in carrying out a project relating to the Managed Maintenance System of the Danube Iron and Steel Works (hereinafter referred to as the "Project") in Hungary (hereinafter referred to as the "Project Area");

WHEREAS, in this connexion, the UNIDO desires to engage the services of the Contractor to perform the work hereinafter set forth;

and,

WHEREAS, the Contractor represents that he is ready, willing and able to provide such services.

NOW, THEREFORE, the parties hereto mutually agree as follows:

1.00 <u>AIM OF THE PROJECT</u>

1.01 The aim of the Project is to advise and assist the management of the Danube Iron and Steel Works to develop and introduce a managed maintenance system for the Danube Iron and Steel plant.

2.00 <u>RESPONSIBILITIES OF THE CONTRACTOR</u>

2. <u>Statement of Work</u>

The Contractor shall render, on the terms hereinafter set forth, the services and facilities necessary to accomplish the aforementioned aim of the Project and in particular he shall carry out all work and services necessary to reach the objectives outlined in the substantive terms of reference upon which his proposal was based and which form a part of this Contract, being attached hereto as Appendix 1.

Further, the Contractor shall carry out these duties in the manner outlined in his formal proposal, forwarded to UNIDO by his letter of 2 December 1974.

2.0 <u>Contractor Services</u>

For the performance of his obligations under this Contract, the Contractor shall make available a total of thirteen (13) man-months of service, as follows:

a) <u>Project Area Services</u>

Nine and one half (9½) man-months of service shall be carried out in the Project Area by a team comprising the Team Leader and other personnel as named in paragraph 2.03 hereinafter. Time spent in briefing and de-briefing of Contractor's personnel at UNIDO, Vienna (see paragraph 2.04 hereinafter) and travel time to and from the Project Area or UNIDO, Vienna, is not included in the number of man-months stated above. A man-month of service in the Project Area is defined as a period equivalent to a calendar month, consisting of five (5) working days per week and eight (8) working hours per day.

b) Home Office Services

Three and one half (3½) man-months of service shall be carried out at the Contractor's Home Office by personnel as named in paragraph 2.03 hereinafter. For purposes of this Contract, a man-month of service in the Home Office is defined as a period equivalent to a calendar month, consisting of five (5) working days per week and eight (8) working hours per day.

c) In addition to the services referred to in sub-paragraphs a) and b) of this paragraph, the Contractor shall provide the services of such other Home Office personnel and technical facilities to provide the necessary back-stopping support to the staff members serving in the Project Area.

2.03 Contractor's Personnel

The personnel to be provided by the Contractor and their length of time in the Project Area and/or Home Office shall be as follows:

Name	Field of Activity	Duration of Assignment (months) Project Area	Home Office
Gunnar Freydensberg (Team Leader)	Management Specialist	2½	1
Finn Gjedebo	Systems Development Specialist	1½	-
Gert Hansen	Planning/EDP Specialist	2½	1
Leif Norking	Systems Development/EDP Specialist	1	1
J. E. Haugvik	Systems Development/EDP Specialist	1	½
K. Andreasen	Cost Control Specialist	1	-
	TOTAL:	9½	3½

The personnel set forth hereinbefore are considered essential for the work to be performed under this Contract, accordingly:

a) prior to replacing any of the named personnel, the Contractor shall notify UNIDO reasonably in advance and shall submit detailed justifications together with the curriculum vitae of the proposed replacement personnel to permit evaluation by UNIDO of the impact which such personnel replacement would have on the work programme;

b) no personnel replacement shall be made by the Contractor without the prior written consent of UNIDO in accordance with Clause 4 of the General Conditions.

2.04 <u>UNIDO Briefing and De-briefing</u>

In addition to the time period stated in paragraph 2.03, the Contractor's Team Leader shall be available for one (1) days' briefing and exchange of views at UNIDO Headquarters in Vienna no later than 17 February 1975. He shall also return to UNIDO Headquarters in Vienna for two (2) days' de-briefing upon completion of his assignment in the Project Area. All costs incurred by the Contractor in connexion with such briefing and de-briefing are included in the Contract price referred to in paragraph 4.01 hereinafter.

2.05 <u>Project Area Assignment</u>

The Contractor's team shall be in the Project Area and commence performance no later than one (1) day from the date of the completion of the Team Leader's briefing in Vienna and shall complete the work in the Project Area no later than 15 January 1976.

2.06 <u>Team Leader's Responsibilities</u>

The Team Leader shall be responsible for ensuring that the work in the Project Area is performed in accordance with the terms of this Contract and for supervising, directing and coordinating the Contractor's personnel in the performance of their duties.

2.07 Contractor - UN Relationship

The Contractor's Team Leader shall maintain close contact as necessary with UNIDO, Purchasing and Contracting Services, for any out-of-the-ordinary problems which may arise and for which guidance is in order. UNIDO representatives shall have the right to observe, at any time, the progress of the work carried out under this Contract and to consult with the Contractor's Team Leader and personnel concerning their work performance.

2.08 Contractor - Other Facilities and Services

Except as set forth in paragraph 3.01 hereinafter, the Contractor shall provide all the facilities and services required by the Contractor's personnel for the execution of the Contract. Expenses of every kind incurred in connexion with such personnel shall be solely for the account of the Contractor. Such expenses shall include, but shall not be limited to, the cost of wages, housing, food, travel, medical attention and insurance.

2.09 Reports

The Contractor shall submit to UNIDO the reports which are listed below. Such reports shall be written in accordance with Annex D entitled "Basic Principles of Scientific Report Writing" and dispatched in accordance with Annex C entitled "Instructions to Contractor for the Dispatch of Reports" which are attached hereto and made a part hereof.

a) Introduction to Managed Maintenance Report

This report should cover Phase I and describe, as far as practical, the lectures and summaries of discussions with local authorities. It shall be written in English and must be received by UNIDO in ten (10) copies and within four (4) weeks of completion of the necessary field work for that Phase. UNIDO shall supply written comments on this report within six (6) weeks of its receipt.

b) System Development Report

This report covering Phase II shall be submitted in English and in ten (10) copies and should be received by UNIDO within four (4) weeks of the completion of the necessary field work for that Phase. This report should contain a clear definition of the Managed Maintenance System developed with the Danube Iron and Steel Works. UNIDO shall supply written comments on this report within six (6) weeks of its receipt.

c) Work Plan Preparation Report

This report shall be submitted in English and in ten (10) copies and should be received by UNIDO not later than four (4) weeks after the completion of the necessary field work for Phase III. This report shall include a detailed description of the activities, responsibilities and time required to implement the Managed Maintenance System. The requirements for microfilm and reproduction equipment and counterpart training should also be included in this report. UNIDO shall supply written comments on this report within six (6) weeks of its receipt.

d) Final Stages of Implementation Counselling Report (During the implementation of the Managed Maintenance System)

Final work and results of the installation of the Managed Maintenance System will be described in a report which shall be submitted in English and in ten (10) copies and shall be received by UNIDO not later than four (4) weeks after the completion of the necessary field work for Phase IV. UNIDO shall supply written comments on this report within six (6) weeks of its receipt.

e) Draft Final Report

In English and in ten (10) copies covering the work carried out by the Contractor in accordance with his proposal and the attached Terms of Reference, which shall be received by UNIDO not later than four (4) weeks after completion of all services in the Project Area. UNIDO shall provide written comments to the Contractor concerning the Draft Final Report within six (6) weeks after UNIDO's receipt of such report in Vienna. Such comments shall receive due consideration in the preparation of the Final Report.

f) Final Report

In English and in twenty-five (25) copies which shall be received by UNIDO not later than two (2) months after the Contractor's receipt of UNIDO's comments on the Draft Final Report.

2.10 Standards of Work

The Contractor agrees that the performance of work and services pursuant to the requirements of this Contract, shall conform to high professional standards.

3.00 RESPONSIBILITIES OF UNIDO

3.01 UNIDO - Facilities and Services

To assist the Contractor and his Project Area personnel in the performance of the work, UNIDO shall provide, or cause the Government to provide, at no cost to the Contractor, the following facilities and services as UNIDO may determine to be necessary for the execution of the Project: such office space, essential office furniture and equipment and local transportation for official purposes, as may be available.

4.00 PAYMENT

4.01 Contract Price

UNIDO shall pay the Contractor for the full and proper performance of his obligations under this Contract, including briefing and de-briefing as provided for in paragraph 2.04 hereinbefore, the sum of United States Dollars eighty-seven thousand eight hundred fifty-four (US $ 87,854). This sum shall cover all expenses incurred by the Contractor, including but not limited to: salaries, indemnities, social charges, overheads, technical assistance and supervision costs, as well as costs in connexion with the travel of the Contractor's personnel from their country of residence to the Project Area and return, from the Project Area to other countries, if such journeys are considered necessary for the execution of the Contract and travel within the Project Area for which the Project transportation facilities referred to in paragraph 3.01 hereinbefore are unavailable.

4.02 Contract Ceiling

The Contractor shall not do any work, provide material or perform any other services which may result in any charges to UNIDO over and above the said United States Dollars eighty-seven thousand eight hundred fifty-four (US $ 87,854) without the prior written consent of UNIDO and a formal amendment to this Contract.

4.03 Currency of Payment

a) Of the total Contract price of United States Dollars eighty-seven thousand eight hundred fifty-four (US $ 87,854), an amount equivalent to United States Dollars nine thousand one hundred twenty (US $ 9,120), to cover local expenses, shall be paid in Hungarian Forints.

b) The remainder of United States Dollars seventy-eight thousand seven hundred thirty-four (US $ 78,734) shall be paid in Norwegian Kroner or in United States Dollars, at the option of UNIDO.

c) All payments shall be made at the UN operational rates of exchange in effect on the date of payment.

4.04 Progress Payments

Progress payments on account of the Contract price shall be made as follows:

a) The Contractor shall be paid an amount equivalent to United States Dollars nine thousand one hundred twenty (US $ 9,120) to cover local expenses. This amount shall be processed for payment at the beginning of the Project.

b) The balance of the Contractor's total fee, United States Dollars seventy-eight thousand seven hundred thirty-four (US $ 78,734) shall be paid as follows:

i) United States Dollars twelve thousand eight hundred fifty-four (US $ 12,854) upon UNIDO approval of the Introduction to Managed Maintenance Report, submitted in compliance with paragraph 2.09 a) above;

ii) United States Dollars twenty-five thousand (US $ 25,000) upon UNIDO approval of the Final Stages of Implementation Counselling Report, submitted in compliance with paragraph 2.09 d) above;

iii) United States Dollars twenty thousand (US $ 20,000) upon UNIDO approval of the Contractor's Draft Final Report, submitted in compliance with paragraph 2.09 e) above;

iv) United States Dollars twenty thousand (US $ 20,000) upon UNIDO approval of the Contractor's Final Report, submitted in compliance with paragraph 2.09 f) above.

4.05 Withholding or Withdrawal of Payments

UNIDO may withhold any payment to the Contractor, or on account of subsequently discovered evidence, nullify the whole or part of any payment approval theretofore given, to such an extent as may be necessary to protect UNIDO (or UNDP) from loss under this Contract on account of:

a) the Contractor's failure to carry out the work or to make adequate progress on the work;

b) the Contractor's defective work, not remedied;

c) the Contractor's failure to make timely submittal of the reports provided for under paragraph 2.09 hereinbefore;

d) the Contractor's failure to make payments properly for material or labour;

e) the existence of damage claims or reasonable evidence indicating the probable making of damage claims.

The withholding of any interim payment shall not effect the Contractor's obligation to continue performance under this Contract.

The making of any payment hereunder by UNIDO shall not be construed as an unconditional acceptance of the work accomplished by the Contractor up to the time of such payment.

4.06 <u>Submission of Invoices</u>

All invoices and supporting documents shall be submitted in one (1) original and four (4) copies in accordance with paragraph 5.04 hereinafter.

4.07 <u>Place of Payment</u>

All payments by UNIDO under this Contract shall be made to accounts to be designated by the Contractor.

5.00 <u>GENERAL PROVISIONS</u>

5.01 This Contract shall be deemed to be effective from the twenty-eighth day of January 1975, the date of the Contractor's cabled acceptance of the Contract award.

5.02 <u>General Conditions</u>

The parties hereto agree to be bound by all of the "General Conditions" attached hereto as Annex A and made a part hereof.

5.03 <u>Notices</u>

Any notice given by either of the parties hereunder shall be sent in writing.

5.04 <u>Transmission of Reports, Invoices and Notices</u>

All reports as in paragraph 2.09, all invoices and supporting documents as in paragraph 4.06 and all notices as in paragraph 5.03 hereinbefore shall be addressed as shown under the signatures of the parties hereto.

IN WITNESS WHEREOF, the parties hereto have executed this Contract.

Norconsult A. S.

By ....

Title ....

Maries vei 20, P.O. Box 9,
1322 Høvik, Oslo,
Norway.

Date..............................

United Nations Industrial
Development Organization (UNIDO)

By ....

D. F. Mant, Chief,
Purchasing and Contracting Services
P. O. Box 707,
A-1011 Vienna,
Austria.

Date 11 MAR 1975

PROJECT PLANS

(This attachment has been prepared by the counterpart staff)

CONTENTS:

2. TOTAL WORKING PROJECT

I Objective

To introduce a centrally directed and integrated maintenance system it is required to elaborate a suitable organization structure and systems necessary, where duties and obligations are given separately. After this introduction the maintenance parameters have to improve. Projects elaborated for four areas (education, central office, hot steel mill, plant maintenance) has to be suitable for general introduction to Dunai Vasmü. The systems have to be suitable for computer preparation too. The project should be adaptable to the organization, dispositions and production relations of the enterprise.

II Activities

1. Information

Considering that the put down and the evaluation are the objectives of the first part of the project, it is important to enter into relations with all competent managers to notify about the objectives and information. Hereby everyone, who is interested in it, will give and receive all information necessary.

2. Registration of present situation

Works are on 4 main areas in progress:

1)	Education	2.1
2)	Hot Steel Mill	2.2
3)	Maintenance Departments	2.3
4)	Central Office	2.4

These subprojects which are also divided into further parts include the programs of measures with full particulars.

3. Analysis

of organizations, systems and data of subprojects have to be made more detailed. All analyses should be directed to:

- reduce costs,
- improve organization of work,
- increase efficiency of managing,
- develop reserves optimally,
- utilize more efficiently the labour,
- modernizing of managing and information systems,
- improve of time consumption of process equipment.

2/...

4. Proposals must be elaborated for themes which are given detailed in subproject, then summarize them to a uniform system and report it for decision.

5. It is required after decision to elaborate the definite project in the same way as detailed in subproject. The ready projects must be summarized.

III Information Resources

IKO consultants,

2.1, 2.2, 2.3, 2.4,

orders,

statistics,

discussions of management.

IV Results

A centrally managed, integrated maintenance system shall be worked out based on a computer.

- improvement of relative costs,
- improvement of organization of work,
- increase of management's efficiency,
- development of optimal reserves,
- improvement of labour efficiency,
- improvement of utilization of equipments,
- possibility to introduce a uniform code system,
- general improvement of working and managing conditions.

V Time Consumption

Draw up of the summarized projects: 30th November, 1975.

VI Responsible

Gábor Csinády.

2.1 EDUCATION

I Objective

The aim of the project is to establish a planning system for large repair jobs, overhauls and investments. The system shall include all normal project planning tools.

II Activities

1. Information

To all managers and participants competent on education shall be reported about the objects and necessity of education.

2. Duties

1)	Preparation of the English education material	2.1.1
2)	Preparation of the Hungarian education material	2.1.2
3)	Education program	2.1.3

III Information Resources

IKO consultants

Dunai Vasmü's experiences,

IKO materials.

IV Results

All groups of leaders need the course, the projecting, which helps to achieve a certain level of special knowledge within the next years.

V Time Consumption

According to 2.1.1, 2.1.2, 2.1.3.

Latest finishing: 1st August.

VI Responsible

Gábor Csinády.

2.1.1 The Material of the Course in English

I Object

The material of the course has to include fundamental principles of modern controlled maintenance, with tables, diagrams and figures to demonstrate advantages and methods of it.

The material shall be the handbook of the teachers from which they can choose the important parts of each group.

II Activities

Draw up of the English subject matter of instruction. (About 300 pages).

III Information Resources

IKO library and instructions's matter.

IV Results

Plant maintenance course handbook (about 300 pages).

V Time Consumption

Earliest beginning: 1st February, 1976

Latest ending: 1st April, 1976

VI Responsible

Finn Gjedebo.

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2.1.2 The Material of the Course in Hungarian

I Objective

Translation of the instruction matter into Hungarian language.

II Activities

1) Translation

2) Typewriting

3) Preparation of figures, tables and diagrams

4) The education responsible consults at IKO

5) Definitive draw up of the instruction matter.

III Information Resources

IKO Consultants,

English instructions matter.

IV Results

Translation of the total English material into Hungarian, copy of all tables, diagrams and figures to be projected.

V Time Consumption

Earliest beginning: 15th April

Latest ending: 10th April

Dunai Vasmű hours: 300.

VI Responsible

Izabella Laczkóry 1-150 pages.
István Kovács 150-300 pages.

2.1.3 Education programme

I Objective

The aim of this project is to plan and carry out a broad maintenance management education in Dunai VasmÜ.

The plan must show the education structure, the size and types of groups to be educated, the objective to be reached for each group, the duration of the cources and the time schedule for the total education programme.

II. Activities

1. Information

All managers and participants shall be reported about the objects and the necessity of education.

2. Duties

1) Draw up of education programmes,

2) Draw up of the list of participants. First class.

3) Preparing the time-table of the course. For the first class.

4) Insurance of technical means and rooms for education.

5) Delivery of lectures for the first class.

III Information Resources

IKO consultants

Instruction matter.

IV Results

For each group of leaders shall exist a course programme, which in accordance with the time schedule during the coming years, shall bring them up to the defined level of knowledge.

V Time Consumption

Earliest beginning: 1st April

Latest ending: 1st August

Dunai VasmÜ hours: 410

VI Responsibles:

Gábor Csinády, Dezsö Tóth, Ferenc Páli, Gyula Kovács.

7/...

2.2. Hot Rolling Mill

I Objective

The aim of the project is to develop organization and all necessary systems for managing the maintenance of the hot rolling mill in the furure.

The systems shall be operative as soon as possible, i.e. they shall be operative without preparation of EDP programmes, however, a later conversion to EDP must be taken into consideration when elaborating the systems.

The systems for the hot rolling mill shall be the platform for extension of managed maintenance systems for all machinery and equipment at Dunai VasmU.

II Activities

1. Information

It is to be ensured, that all the necessary information on the project will be provided for all those, who are concerned with or are influencing the project.

2. Registration of present situation

The registration of present situation shall be performed in the following areas:

2.1	Organization	project	2.2.1
2.2	Preventive Maintenance	-	2.2.2
2.3	Planning System (small repairs)	-	2.2.3
2.4	Project Planning System	-	2.2.4
2.5	Work Order System	-	2.2.5
2.6	Material Administration System	-	2.2.6
2.7	Cost Control System	-	2.2.7
2.8	Coding System	-	2.2.8

The above listed will be elaborated as separate subprojects.

3. Analyses

The details of analyses are contained in the subprojects. Care should be taken for coordination of subprojects - avoiding parallelities and omission on important points.

4. Proposals

The proposals elaborated in subprojects have to be summarized for simultaneous submittal to the management.

5. Implementation

After decision a preliminary and a final plan is to be elaborated, according to subprojects. When they are ready, they have to be summarised.

III Information Resources

IKO consultants.

Project 2.3, 2.4 and their subprojects.

Effective rules, descriptions.

Records.

Leaders.

IV Results

The conditions in Hot Rolling Mill will be generally improved, breakdowns reduced, and, depending on possibilities, the maintenance total costs will also be reduced.

V Time Consumption

DV: 200 hours

Schedule: Latest finish on the base of subprojects is on 31st october

VI Responsible:

Bende József

2.2.1 Organization

I Objective

The aim of this project is to evaluate and reorganize the division of duties and responsibilities of all managers (from maintenance factory manager to group leaders) in two maintenance shops.

Proposed organizational changes must respect the overall organization of the maintenance function of Dunai VasmU.

II Activities

1. Information

It is to be ensured, that all the necessary information on the project will be provided for all those, who are concerned with or are influencing the project.

2. Registration of Present Situation.

2.1 Present organization and structure of the two workshops beginning from top leader.

2.2 Actual duty of each leader on the base of organization scheme, and deviation from job descriptions.

2.3 Distribution of duties and responsibilities, scope of authority and competency of each leader.

2.4 Way, degree and regularity of communication between leaders.

2.5 Present system of information flow, with the aim of an efficient management.

2.6 The weak and strong points, their causes, the controlled and not controlled tendencies.

2.7 Opinions and proposals from workers and leaders.

3. Analyses

3.1 Evaluation of the present organization scheme and structure.

3.2 Proper definition and scope of duties on the base of organization scheme, finding out of defects.

3.3 Perfection of scopes of authorities and competencies, showing on the possible overlappings.

3.4 Way, degree and regularity of communication between leaders.

3.5 Present system of information flow to and from, with the aim of an efficient management.

3.6 The weak and strong points, their causes, the controlled and not controlled tendencies.

3.7 Opinions and proposals from workers and leaders.

4. Proposals

4.1 Improvement of present organization and structure.

4.2 Elaboration of proper definition and scope of duties.

4.3 Improved perfection of scopes of authorities and competencies, showing no overlappings.

4.4 Improved way, degree and regularity of communication between leaders.

4.5 Improvement of information flow and feed back.

4.6 Improvement of weak points.

4.7 Utilization of useful proposals from workers and leaders.

5. Implementation (planning)

The total plan for implementation of proposals is to be elaborated in two steps:

a) A preliminary plan on the base of decisions on proposals.

b) Elaboration of final plans. They should meet the following requirements:

- economic calculations,
- time scheduling,
- resource requirements,
- results expected,
- conditions of implementation,
- distribution of responsibilities.

III Information Resources

IKO consultants

Present organization scheme

Job descriptions

Authority descriptions

Discussions

Project leader

IV Results

An improved organization scheme.

Properly defined scope of duties of each leader.

Defined authorities.

Realization of information feed-back.

Improved communication between leaders.

V Time Consumption

IKO: 40 hours

DV: 500 hours

VI Responsible

Bende Jozsef

2.2.2 Preventive Maintenance

I Objective

The aim of this project is to elaborate a complete system for preventive maintenance of the hot rolling mill, including systems for:

- cleaning
- lubrication
- inspection
- condition checking
- adjustments, exchange of parts and small repair jobs.

II Activities

1. Information

It is to be ensured, that all the necessary information on the project will be provided for all those, who are concerned with or are influencing the project.

2. Registration of Present Situation

The following are to be registered:

2.1 Kinds and technics of PM.

2.2 Present content and performance of function checking.

2.3 Present method of adjustments and exchange of small parts.

2.4 Recording and administration routines of point 2.1, 2.2, and 2.3.

2.5 State of fitting out of PM workers with tools and instruments.

2.6 The weak and strong points, their causes, the controlled and not controlled tendencies.

2.7 Opinions and proposals from workers and leaders.

3. Analyses

3.1 Analysis of kinds and technics of PM.

3.2 Analysis of present content and performance of function checking.

3.3 Analysis of present method of adjustments and exchange of small parts.

3.4 Analysis of recording and administration routines of point 2.1, 2.2, and 2.3.

3.5 Analysis of state of fitting out of PM workers with tools and instruments.

3.6 Analysis of the weak and strong points, their causes, the controlled and not controlled tendencies.

3.7 Analysis of opinions and proposals from workers and leaders.

4. Proposals

On the base of the above analyses a series of several preliminary proposals will be elaborated. These have to be simulated and analysed. Factors needing special attention are the following:

4.1 Improvement and unification of kinds and technics of PM.

4.2 Improvement of present content and performance of function checking.

4.3 Improvement of present method of adjustments and exchange of small parts.

4.4 Improvement and unification of recording and administration routines of point 2.1, 2.2, and 2.3

4.5 Improvement of state of fitting out of PM workers with tools and instruments.

4.6 Improvement of contact between workers and leaders.

4.7 The elaboration and simulation of proposals have to be consulted continuously with the leaders.

5. Implementation (plans)

The total plan for implementation of proposals is to be elaborated in two steps:

a) A preliminary plan on the base of decisions on proposals.

b) Elaboration of final plans. They should meet the following requirements:

- economic calculations,
- time scheduling,
- resource requirements,
- results expected,
- conditions of implementation,
- distribution of responsibilities.

III Information Resources

IKO consultants

Project 2.2.1, 2.2.3, 2.2.4, 2.2.5, 2.2.6, 2.2.7, and 2.2.8.

Inspection diaries

Reports

Notes

Records

Discussions

Project leader

IV Results

1. Methods for kinds and functions of PM.
2. Methods for content and performance of function checking.
3. Methods for adjustments and exchange or small parts.
4. Rules for administration routines of point 1, 2 and 3.
5. Proposal for improvement of fitting out of PM workers with tools and instruments.
6. Methods for an improved contact (communication) between subordinates and leaders.

V Time Consumption

IKO: 40 hours
DV: 660 hours

VI Responsible

Páll Ferenc

2.2.3 Planning System (small repairs)

I Objective

The aim of the project is to establish a planning system for planned and accute repairs including:

- information files
- coordination rules
- analysis
- direction
- scheduling

II Activities

1. Information

It is to be ensured, that all the necessary information on the project will be provided for all those, who are concerned with or are influencing the project.

2. Registration of present situation

The following is to be registered:

1) Flow routes of information and basic data necessary for planning of small planned and acute repairs.

2) Planning process of planned and acute repairs.

3) Performance instructions of small planned and acute repairs.

4) Performance process of small and acute repairs.

5) Technical control system and evaluation of small and acute repairs.

6) The weak and strong points, their causes, the controlled and not controlled tendencies.

7) Collection of opinions and proposals from workers and leaders.

3. Analyse

of present system registered, covering:

1) Flow routes of information and basic data necessary for planning of small planned and acute repairs. Finding out the difference between actual and necessary information.

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2) Planning process of planned and acute repairs, finding out the defects of the system.

3) Performance instructions of small planned and acute repairs, finding out the defects.

4) Performance process of small and acute repairs, finding out the hindrances.

5) Technical control system and evaluation of small planned and acute repair performance.

6) The weak and strong points, their causes, the controlled and not controlled tendencies.

7) Opinions and proposals from workers and leaders.

4. Proposals

On the base of the above analyses a series of several preliminary proposals will be elaborated. These have to be simulated and analysed. Factors needing special attention are the following:

1) Proposal for improvement of small planned and acute repair planning, and of flow of information and basic data. Implementation of a uniform system.

2) Proposal for improvement of planning process of small planned and acute repairs.

3) Improvement of small planned and acute repairs.

4) Improvement of small planned and acute repairs performance system.

5) Improvement of technical control system and evaluation of small planned and acute repair performance.

6) Improvement of communication between subordinates and leaders.

The elaboration and simulation of proposals shall be continuously discussed with leaders.

5. Implementation (planning)

The total plan for implementation of proposals is to be elaborated in two steps:

a) A preliminary plan on the base of decisions on proposals.

b) Elaboration of final plans. They should meet the following requirements:

- economic calculations,
- time scheduling,
- resource requirements,
- results expected,
- conditions of implementation,
- distribution of responsibilities.

III Information Resources

IKO consultants

Project 2.2.1, 2.2.3, 2.2.4, 2.2.5, 2.2.6, 2.2.7, and 2.2.8.

Network plans, repair evaluations.

Repair protocols.

Records.

Work orders.

Discussions.

Project leader.

IV Results

1. Rules for flow of information and basic data necessary for planning of small planned and acute repairs.
2. Methods for planning process of small planned and acute repairs.
3. Rules for the instructions system of small planned and acute repairs.
4. Methods for the performance system of small planned and acute repairs.
5. Methods for the control system and evaluation of performance of small planned and acute repairs.
6. Methods for an imrpoved communication between subordinates and leaders.

V Time Consumption

IKO: 20 hours

DV: 420 hours

VI Responsible:

Páll Ferenc

2.2.4 Project Planning System

I Objective

The aim of the project is to establish a planning system for large repair jobs, overhauls and investments. The system shall include all normal project planning tools.

II Activities

1. Information

It is to be ensured, that all the necessary information on the project will be provided for all those, who are concerned with or are influencing the project.

2. Registration of Present Situation

The following are to be registered:

1) Flow routes of information and basic data necessary for planning of project planning.

2) Planning process of project planning.

3) Performance instructions of project planning.

4) Performance process of project planning.

5) Technical control system and evaluation of project planning.

6) The weak and strong points, their causes, the controlled and not controlled tendencies.

7) Opinions and proposals from workers and leaders.

3. Analyse

of present system registered, covering:

1) Flow routes of information and basic data necessary for planning of project planning. Finding out the difference between actual and necessary information.

2) Planning process of project planning, finding out the defects of the system.

3) Performance instructions of project planning, finding out the defects.

4) Performance process of project planning, finding out the hindrances.

5) Technical control system and evaluation of project planning performance.

6) The weak and strong points, their causes, the controlled and not controlled tendencies.

7) Opinions and proposals from workers and leaders.

4. Proposals

On the base of the above analyses a series of several preliminary proposals will be elaborated. These have to be simulated and analysed. Factors needing special attention are the following:

1) Proposal for improvement of project planning, and of flow of information and basic data. Implementation of a uniform system.

2) Proposal for improvement of planning process of project planning.

3) Improvement of project planning instruction system.

4) Improvement of project planning performance system.

5) Improvement of technical control system and evaluation of project planning performance.

6) Improvement of communication between subordinates and leaders.

The elaboration and simulation of proposals shall be continuously discussed with leaders.

5. Implementation (planning)

The total plan for implementation of proposals is to be elaborated in two steps:

a) A preliminary plan on the base of decisions on proposals.

b) Elaboration of final plans. They should meet the following requirements:

- economic calculations,
- time scheduling,
- resource requirements,
- results expected,
- conditions of implementation,
- distribution of responsibilities.

III Information Resources

IKO consultants

Project 2.2.2, 2.2.3, 2.2.4, 2.2.5, 2.2.6, 2.2.7, and 2.2.8

Network plans, repair evaluations.

Repair protocols.

Records.

Work Orders.

Discussions.

Project Leader.

IV Results

1. Rules for flow of information and basic data necessary for planning of project planning.
2. Methods for planning process of project planning.
3. Rules for the instruction system of project planning.
4. Methods for the control system and evaluation of performance of project planning.
5. Methods for an improved communication between subordinates and leaders.

V Time Consumption

IKO: 20 hours

DV: 400 hours

VI Responsible

Páll Ferenc

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2.2.5 Work Order System

I Objective

The aim of this project is to establish a work order system for planned and acute repair jobs. The system shall include information files, data bank, and all necessary forms and permanent rules.

II Activities

1. Information

It is to be ensured, that all the necessary information on the project will be provided for all those, who are concerned with or are influencing the project.

2. Registration of Present Situation

The following is to be registered:

2.1 The work order system for planned and acute repairs as

- orders from inside the mill,
- orders from Central Maintenance
- orders from outside companies.

2.2 Technics of time estimation for jobs.

2.3 Flow of information and basic data necessary for processing of work orders, statistics, machine data files.

2.4 Storing, recording and obtaining of drawings, documentations necessary for processing of work orders, coding system of machines and spare parts.

2.5 Division of job numbers and cost-holders necessary for processing of work orders.

2.6 Process of supply with materials and spare parts necessary for work orders.

2.7 The weak and strong points, their causes, the controlled and not controlled tendencies.

2.8 Opinions and proposals from workers and leaders.

3. Analysis

3.1 Finding out the deficiencies of 2.1.

3.2 Satisfactory profoundness and precisity of 2.2.

3.3 Finding out the defects of 2.3.

3.4 Finding out the defects of 2.4.

3.5 Suitability of 2.5 for the future.

3.6 Deficiencies of 2.6.

3.7 Analysis of the weak and strong points, their causes, the controlled and not controlled tendencies.

3.8 Analysis of opinions and proposals from workers and leaders.

4. Proposals

On the basis of the above analyses a series of several preliminary proposals will be elaborated. These have to be simulated and analysed. Factors needing special attention are the following:

4.1 Improvement of the work order system for planned and acute repair jobs.

4.2 Improvement of technics of time estimation for jobs.

4.3 Improvement of flow of information and basic data necessary for processing of work orders, statistics, machine data files.

4.4 Improvement of storing recording and obtaining of drawings, documentations necessary for processing of work orders, coding system of machines and spare parts.

4.5 Improvement of division of job numbers and cost-holders necessary for processing of work orders.

4.6 Improvement of process of supply with materials and spare parts necessary for work orders.

4.7 Improvement of contact between workers and leaders.

4.8 The elaboration and simulation of proposals have to be consulted continuously with the leaders.

5. Implementation (plans)

The total plan for implementation of proposals is to be elaborated in two steps:

a) A preliminary plan on the basis of decisions on proposals.

b) Elaboration of final plans. They should meet the following requirements:

- economic calculations,
- time scheduling,
- resource requirements,
- results expected,
- conditions of implementation,
- distribution of responsibilities.

III Information Resources

IKO consultants

Project 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.2.6, 2.2.7, and 2.2.8.

Orders.

Drawing and documentation repository.

Statistics.

Handbook of job numbers and cost holders.

Records.

Discussions.

Project leader.

IV Results

1. Rules for work ordering of planned and acute repair jobs.
2. Methods for time estimation.
3. Rules for flow of information and basic data necessary for processing of work orders, statistics, machine data files.
4. Rules for storing, recording and obtaining of drawings, documentations necessary for processing of work orders, coding system of machines and spare parts.
5. Methods for division of job numbers and cost-holders necessary for processing of work orders.
6. Rules for supply of materials and spare parts.
7. Methods for an improved communication between subordinates and leaders.
8. Application of a uniform coding system.

V Time Consumption

IKO: 40 hours

DV: 560 hours

VI Responsible

Zelenka László

2.2.6 Material Administration System

I Objective

The aim of this project is to:

- Examine the present way of material handling and storing in order to improve this.
- Examine the present quantity of material and spare parts in order to propose reduction, extension of stock and deletion of obsolete inventories.
- Examine the present policy for buy/make spare parts in order to reduce costs.
- Establish a material planning system connected to the maintenance planning system.

II Activities

1. Information

It is to be ensured, that all the necessary information on the project will be provided for all those, who are concerned with or are influencing the project.

2. Registration of Present Situation

The following is to be registered:

2.1 Material storage and handling, layout of stores, paper routines.

2.2 Quantity of material and spare parts, deletion of obsolete inventories, stock level in the Hot Rolling Mill.

2.3 Buying process of spare parts (in conjunction with project 2.4.4).

2.4 Process of spare parts' renewal.

2.5 Material planning system in connection with the maintenance planning system.

2.6 Transportation, transport routes, flow of transportation information, paper routines.

2.7 The weak and strong points, their causes, the controlled and not controlled tendencies.

2.8 Opinions and proposals from workers and leaders.

3. Analyses

of present systems registered, with the aid of descriptions, flow diagrams.

3.1 Analysis of material storage and handling, layout of stores, paper routines.

3.2 Analysis of quantity of material and spare parts, deletion of obsolete inventories, stock level in the Hot Rolling Mill. Detection of shortages and increased stocks.

3.3 Analysis of buying process of spare parts (in conjunction with project 2.4.4). Finding out the ways of simplification.

3.4 Analysis of process of spare parts' renewal, improvement of recording.

3.5 Analysis of material planning system in connection with maintenance planning system.

3.6 Analysis of transportation, transport routes, flow of transportation information, paper routines.

3.7 Analysis of the weak and strong points, their causes, the controlled and not controlled tendencies.

3.8 Analysis of opinions and proposals from workers and leaders.

4. Proposals

On the basis of the above analyses a series of several preliminary proposals will be elaborated. These have to be simulated and analysed. Factors needing special attention are the following:

4.1 Improvement of material storage and handling, layout of stores, paper routines simplification.

4.2 Optimal stock level, deletion, regulation of stock level.

4.3 Improvement of buying process of spare parts (in conjunction with project 2.4.4).

4.4 Improvement of process of spare parts' renewal.

4.5 Improvement of material planning system in connection with the maintenance planning system.

4.6 Improvement of transportation, transport routes, flow of transportation information, paper routines simplification.

4.7 Improvement of contact between workers and leaders.

4.8 The elaboration and simulation of proposals have to be consulted continuously with the leaders.

5. Implementation (plans)

The total plan for implementation of proposals is to be elaborated in two steps:

a) A preliminary plan on the basis of decisions on proposals.

b) Elaboration of final plans. They should meet the following requirements:

- economic calculations,
- time scheduling,
- resource requirements,
- results expected,
- conditions of implementation,
- distribution of responsibilities.

III Information Resources

IKO consultants

Project 2.2.1, 2.2.2, 2.2.3, 2.2.4 2.2.5, 2.2.7, 2.2.8, 2.3.7, 2.4.4.

Material and spare part stock sheets EBP).

Statistics

Orders

Requisition copies

Stores

Records

Notes

Discussions

Project leader.

IV Results

1. Improved methods for material storage and handling, layout of stores, paper routines.

2. Improved methods for reaching the optimal stock level, deletion, regulation of stock level.

3. Improved rules for buying spare parts.

4. Improved rules for spare parts' renewal.

5. Rules for material planning system.

6. Rules for transportation, transport routes, flow of transportation information, paper routines.

7. Methods for an improved communication between subordinates and leaders.

V Time Consumption

IKO: 40 hours

DV: 610 hours

VI Responsible:

Vidék Ferenc

2.2.7 Cost Control System

I Objective

The aim of this project is to establish a cost control system for the maintenance costs, in order to be able to analyse and evaluate the cost-carriers.

The system shall include costs originated by labour, spare parts, materials, etc., and compile this cost on defined units and functions.

II Activities

1. Information

It is to be ensured, that all the necessary information on the project will be provided for all those, who are concerned with or are influencing the project.

2. Registration of Present Situation

The following is to be registered:

2.1 Cost planning system, and information, statistics, reports, bills necessary for planning.

2.2 Cost accountance and control, flow of information, reports, bills, statistics.

2.3 The effect of cost changes on maintenance, and the effect of technological costs on maintenance costs.

2.4 The weak and strong points.

2.5 Opinions and suggestions from workers and leaders.

3. Analyses

of present systems registered with the aid of process descriptions, flow diagrams:

3.1 Analysis of cost planning system.

3.2 Analysis of cost accountance and control system.

3.3 Analysis of cost effects for determination of necessary profundity of cost break-up.

3.4 Analysis of storing, recording and obtaining of drawings, documentations necessary for processing of work orders, coding system of machines and spare parts.

3.5 Analysis of division of job numbers and cost-holders necessary for processing of work orders.

4. Proposals

On the basis of the above analyses a series of several preliminary proposals will be elaborated. These have to be simulated and analysed. Factors needing special attention are the following:

4.1 Improvement of cost planning system.

4.2 Improvement of cost accountance and control system.

4.3 Improvement of cost regulation system.

4.4 Improvement of cost communication between workers and leaders.

4.5 Elaboration and simulation of proposals shall be continuously discussed with leaders.

5. Implementation (plans)

The total plan for implementation of proposals is to be elaborated in two steps:

a) Apreliminary plan on the basis of decisions on proposals.

b) Elaboration of final plans. They should meet the following requirements:

- economic calculation,
- time scheduling
- resource requirements,
- results expected,
- conditions of implementation,
- distribution of responsibilities.

III Information

IKO consultants

Project 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.2.5, 2.2.6, 2.2.8, 2.4.8, and 2.4.5

Cost plans, material and spare part stock sheets (EDP)

Bills

Protocols

Reports

Statistics

Discussions

Project leader

IV Results

1. Methods for cost planning.

2. Methods for cost accountance and control.

3. Methods for regulation of cost changes.

4. Rules for communication between leaders and subordinates.

5. Rules for storage and requisition of information and data, for supply of EDP with basic data.

V Time Consumption

IKO: 40 hours

DV: 630 hours

VI Responsible

Vidák Ferenc

2.2.8 Coding System

I Objective

The aim of this project is - as far as possible - to elaborate an integrated system for:

- machine identification coding
- material and spare part coding
- equipment coding
- drawing coding
- work order coding

Furthermore, the coding system have to cover cost distribution and analyses, machinery break-down recording and analyses, labour qualifications etc.

II Activities

1. Information

It is to be ensured, that all the necessary information on the project will be provided for all those, who are concerned with or are influencing the project.

2. Registration of Present Situation

2.1 Coding system of machines and equipments.

2.2 Coding system of spare parts.

2.3 Coding system of erection and other materials.

2.4 Coding system of work orders.

2.5 Coding system of drawings.

2.6 It has to be studied, the coding system of

- cost brake-up and analysis,
- machinery break-downs recording and analyses,
- labour qualifications.

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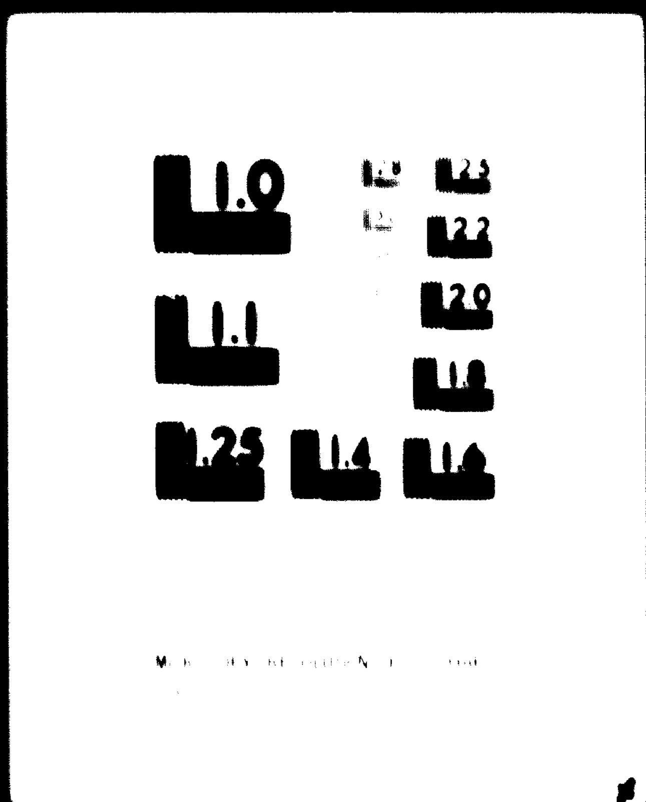

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3. Analyses

3.1 Analysis of coding system of machines and equipments, detection of deficiencies and problems.

3.2 Analysis of coding system of spare parts detection of deficiencies and problems.

3.3 Analysis of coding system of erection and other materials, detection of deficiencies and problems.

3.4 Analysis of coding system of work orders, detection of deficiencies and problems.

3.5 Analysis of coding system of drawings, detection of deficiencies and problems.

3.6 ...alysis of 2.6, detection of deficiencies and problems.

4. Proposals

It shall represent a coding (i.e. numeration) system, which is suitable for EDP and joins up to the integrated system of DV including:

- machinery
- spare parts
- erection and other materials
- drawings
- work orders

5. Implementation

The total plan for implementation of proposals is to be elaborated in two steps:

a) A preliminary plan on the basis of decisions on proposals.

b) Elaboration of final plans. They should meet the following requirements:

- economic calculation,
- time scheduling,
- resource requirements,
- results expected,
- conditions of implementation,
- distribution of responsibilities.
- to be used manually.

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III Information Resources

IKO consultants

Project 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.2.5, 2.2.6, 2.2.7, 2.3.7, 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.6.

Present system descriptions.

EDP dept.

Project leader.

IV Results

Developed complete integrated coding system and its descriptions for all of the activities concerned with managed maintenance system.

V Time consumption

IKO: 40 hours

DV: 600 hours

VI Responsible

Németh Miklós

2.3 Maintenance Unit

I Objective

The aim of this project is to develop the necessary organization and systems for production planning and maintenance jobs of the factory.

The systems shall be operated possibly before involving the EDP. They should be coordinated with the central integrated managing system.

The systems elaborated for the Machining and Erection shop shall represent the basis of future escalation of systems on other workshops of the factory.

II Activities

1. Information

It is to be ensured, that all the necessary information on the project will be provided for all those, who are concerned with or are influencing the project.

2. Registration of Present Situation

The registration of present situation shall be performed in the following areas:

2.1	Organization	project 2.3.1
2.2	Planning system (main)	project 2.3.2
2.3	Planning system (detail)	
	- for erection shop	project 2.3.3/1
	- for machining shop	project 2.3.3/2
2.4	Plant lay-out	
	- for erection shop	project 2.3.4/1
	- for machining shop	project 2.3.4/2
2.5	Technical data	
	- for erection shop	project 2.3.5/1
	- for machining shop	project 2.3.5/2
2.6	Work effectivity factors (personal)	project 2.3.6
2.7	Material administration	project 2.3.7
2.8	Cost control	project 2.3.8

3. Analyses

The details of analyses are contained in the subprojects. Care should be taken for coordination of subprojects - avoiding parallelities and omission on important points.

4. Proposals

The proposals elaborated in subprojects have to be summarized for simultaneous submittal to the management.

5. Implementation

After decision a preliminary and a final plan is to be elaborated, according to subprojects. When they are ready, they have to be summarized.

III Information Resources

IIKO consultants

Project 2.3, 2.4 and their subprojects.

Effective rules, descriptions.

Records.

Leaders.

IV Results

The conditions in Hot Rolling Mill will be generally improved, breakdowns reduced, and - depending on possibilities - the maintenance total costs will be reduced as well.

V Time Consumption

BV: 200 hours

Schedule: latest finish on the base of subprojects is on 31st October, 1975.

VI Responsible

Vencsel Ferenc

2.3.1 Organization

I Objective

The aim of this project is to evaluate and reorganize the division of duties and responsibilities of all managers (from shop leader to group leader) in two maintenance shops (Erection and Machining shop). Proposed organizational changes must respect the overall organization of the maintenance function of Dunai Vasmü.

II Activities

1. Information

It is to be ensured, that all the necessary information on the project will be provided for all those, who are concerned with or are influencing the project.

2. Registration of Present Situation

2.1 Present organization and structure of the two workshops beginning from top leader.

2.2 Actual duty of each leader on the base of organization scheme, and deviation from job descriptions.

2.3 Distribution of duties and responsibilities, scope of authority and competency of each leader.

2.4 Way, degree and regularity of communication between leaders.

2.5 Present system of information flow, with the aim of an efficient management.

2.6 The weak and strong points, their causes, the controlled and not controlled tendencies.

2.7 Opinions and proposals from workers and leaders.

3. Analyses.

Incorporating:

3.1 Evaluation of the present organization scheme and structure.

3.2 Proper definition and scope of duties on the base of organization scheme, finding out of defects.

3.3 Perfection of scopes of authorities and competencies, showing on the possible overlappings.

3.4 Way, degree and regularity of communication between leaders.

3.5 Present system of information flow to and from, with the aim of an efficient management.

3.6 The weak and strong points, their causes, the controlled and not controlled tendencies.

3.7 Opinions and proposals from workers and leaders.

4. Proposals

4.1 Improvement of present organization and structure.

4.2 Elaboration of proper definition and scope of duties.

4.3 Improved perfection of scopes of authorities and competencies, showing no overlappings.

4.4 Improved way, degree and regularity of communication between leaders.

4.5 Improvement of information flow and feed back.

4.6 Improvement of weak points.

4.7 Utilization of useful proposals from workers and leaders.

5. Implementation (planning)

The total plan for implementation of proposals is to be elaborated in two steps:

a) A preliminary plan on the basis of decisions on proposals.

b) Elaboration of final plans. They should meet the following requirements:

- economic calculations,
- time scheduling,
- resource requirements,
- results expected,
- conditions of implementation,
- distribution of responsibilities.

III Information Resources

ILO consultants

Present organization scheme

Job descriptions

Authority descriptions

Discussions

Project leader

IV Results

An improved organization scheme.

Properly defined scope of duties of each leader.

Defined authorities.

Realization of information feed-back.

Improved communications between leaders.

V. Time Consumption

NIO: 80 hours

VI Responsible

Vencsel Ferenc

2.3.2 Planning System (main)

I Objective

The aim of the project is to establish a main planning system for maintenance shops enabling the fulfillment of production tasks in due time, and ensuring a proper and efficient utilization of the resources. The system shall include:

- scheduling
- resource planning
- coordination rules
- information files
- analyses
- statistics

The proposed planning system must respect (be within the frames of) the central planning system.

II Activities

1. Information

It is to be ensured, that all the necessary information on the project will be provided for all those, who are concerned with or are influencing the project.

2. Registration of present situation

The following points shall be described and presented in a flow diagram:

2.1 Registration and flow of work orders.

2.2 Technical administration of production and maintenance work orders.

2.3 Material ordering.

2.4 Scheduling of production and maintenance works.

2.5 Detection of weak and strong points.

2.6 Coordination of maintenance work scheduling with that of the factories.

2.7 Opinions, wishes and proposals of leaders concerned.

2.8 Coding system.

3. Analyses

The present situation with flow diagram shall be analysed and evaluated.

3.1 Registration and flow of work orders (detecting possible parallelities).

3.2 Technical administration of production and maintenance work orders, ways of simplifications.

3.3 System of material ordering.

3.4 Scheduling of production and maintenance works.

3.5 Detection of causes of weak and strong points.

3.6 Detection of problems in cooperation with factories of disturbing and delaying factors.

3.7 Selection of useful suggestions.

3.8 Detection of deficiencies of coding system.

4. Proposals

based on the analyses shall be concentrated on the improvement of present planning processes and their conjunctions. They shall incorporate the necessary feed-backs, taking into account the escalation of EDP programs.

They have to be compatible with the central planning system.

4.1 Improvement of registration of work orders, perfection of forms used.

4.2 Improvement of technical administration, its simplification.

4.3 Improvement of material administration.

4.4 Improvement of scheduling.

4.5 Efficient modification of weak and strong points.

4.6 Improvement of scheduling coordination between central maintenance factory and production factories.

4.7 Utilization of useful suggestions.

5. Implementation

The total plan for implementation of proposals is to be elaborated in two steps:

a) A preliminary plan on the basis of decisions on proposals.

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b) Elaboration of final plans. They should meet the following requirements:

- economic calculations,
- time scheduling
- resource requirements,
- results expected,
- conditions of implementation,
- distribution of responsibilities.

III Information Resources

IKO consultants

Project 2.2.5, 2.2.8, 2.3.3, 2.3.5, 2.3.7, 2.3.8, 2.4.2, 2.4.3, 2.4.4, 2.4.5.

Discussions.

Records.

Project leader.

IV Results

A new flow diagram with modifications.

Proposals for improved administration routines.

Proposals for improved scheduling methods.

Proposals for improved information recording in the shops.

V Time Consumption

IKO: 40 hours

DV: 400 hours

VI Responsible

Kovács Gyula

2.3.2/I Planning System (detail) Erection Shop

2.3.2/II Planning System (detail) Machine Shop

I Objective

The aim of the project is to establish a detail planning system for the preparation of weekly operative plans on the basis of the monthly plan in the Erection shop. Through this, realization of a better, more efficient method for the operative production activity.

II Activities

1. Information

It is to be ensured, that all the necessary information on the project will be provided for all those, who are concerned with or are influencing the project.

2. Registration of present situation

1) Registration of present preparation of weekly operative plans from monthly plans.

2) Registration of provision with material, spare parts, tools, drawings, instruments.

3) Registration of present work instructions.

4) Registration of present time estimation.

5) Registration of load of resources. At two major repairs a detailed job evaluation shall be performed, determining the utilization of living labour power.

6) Find out the weak and strong points, the controlled and not controlled tendencies.

7) Recording the wishes and proposals of shop-manager, foreman, group leaders.

3 Analyses

On the basis of registrations is to be analysed:

1) The preparation method of weekly programs, the correlations of the programs with the demands of factories.

2) Provision with material, spare parts, tools, drawings, instruments (method and quality).

3. Form of work instructions.

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4) Method and precisity of time estimation.

5) Load of resources, details of job evaluation hindering factors:

To be analysed are, three subsequent months for planned time, actual time at the erection group and one month period at the wagon repairing group, on the basis of existing work sheets. Also the degree of plan-performance, the hindrances of realization, are to be analysed.

6) The weak and strong points, their causes, the controlled and not controlled tendencies.

7) Selection of realizable proposals.

4. Proposals

On the basis of analyses proposals shall be elaborated on:

1) Better method of elaboration of weekly operative plans, in this relation a possible modification of monthly planning.

2) Improvement of labour power conditions, material, tools and facilities supply.

3) Improvement of work instructions, information.

4) Improvement of time estimation.

5) Improvement of utilization of resources, modification of weak and strong points.

5 Implementation (planning)

The total plan for implementation of proposals is to be elaborated in two steps:

a) A preliminary plan on the basis of decisions on proposals.

b) Elaboration of final plans. They should meet the following requirements:

- economic calculations
- time scheduling,
- resource requirements,
- results expected,
- conditions of implementation,
- distribution of responsibilities.

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III Information Resources

IKO consultants

2.3.2, 2.3.4, 2.3.5, and 2.3.7.

Registration in the workshops

Discussions

Project leader

IV Results

A description of weekly program technics.

Improved work instructions.

Elaboration of proper information routines, information storage.

Proposal for a better utilization of working time.

Coding system development.

V Time Consumption

IKO: 30 hours

DV: 204 hours

VI Responsible

Bela Antal

2.3.4/1 Plant Layout (Erection Shop)

I Objective

The aim of this project is to analyse the present layout - including material flow, local stores, transportation system and equipment to develop optimal conditions for production.

II Activities

1. Information

It is to be ensured, that all the necessary information on the project will be provided for all those, who are concerned with or are influencing the project.

2. Registration of Present Situation

The following is to be registered:

2.1 Present layout.

2.2 P-Q diagrams and working hours consumption.

2.3 Way and time of labour's transportation to the place of job.

2.4 Transportation of tools and facilities (winch, dynamo, transformer, etc.) necessary for job.

2.5 Presently used transportation facilities and routes to several places of job.

2.6 Crane capacities.

2.7 The weak and strong points, their causes, the controlled and not controlled tendencies.

2.8 Opinions and proposals from workers and leaders.

3. Analyses

3.1 Analysis of present layout.

3.2 Analysis of items with frequent weights.

3.3 Analysis of causes of long labour transports.

3.4 Analysis of causes of long facility transports, delays.

3.5 Analysis of right routes of surplus or missing transport facilities.

3.6 Analysis of crane capacity.

3.7 Analysis of the weak and strong points, their causes the controlled and not controlled tendencies.

3.8 Analysis of opinions and proposals from workers and leaders.

4. Proposals

On the basis of the above analyses a series of several preliminary proposals will be elaborated. These have to be simulated and analysed. Factors needing special attention are the following:

4.1 Logical layout of machinery

4.2 Short transport routes.

4.3 Standard transport units.

4.4 Transportation avoiding to disturb the work on machines.

4.5 Easy and reliable way of transport ordering.

4.6 Local stores kept in good order.

4.7 Good physical conditions for workers.

4.8 Easy communication between workers and leaders.

During elaboration of proposals they should be consulted continuously with the workshop manager. If in some cases bad machinery will reduce the possibility of developing an efficient workshop then information should be given to responsible of project. 2.3.5. The proposals elaborated have to meet the requirements stated in "VI Results".

5. Implementation

The total plan for implementation of proposals is to be elaborated in two steps:

a) A preliminary plan on the basis of decisions on proposals.

b) Elaboration of final plans. They should meet the following requirements:

- economic calculations,
- time scheduling,
- resource requirements,
- results expected,
- conditions of implementation,
- distribution of responsibilities.

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III Information Resources

IKO consultants

Project 2.3, 2.3.1, 2.3.2, 2.3.5, 2.3.7.

Workshop plan elaborated in hand.

Records (cards) in the workshop.

Discussions.

Project leader.

IV Results

Layout in scale of 1:50 for the workshop.

Elaboration of a permanent transport system, involving:

Kind of goods,

Kind of transport facilities,

Items (units),

Frequency.

Administration of transport orders.

Detailed description of new machines proposed.

Economic calculation of modifications.

V Time Consumption

IKO: 10 hours

DV: 2 man-months

VI Responsible

Afra Antal

2.3.5/1 Technical Data (Fitter Workshop)

I Objective

The aim of this project is to study technological methods of the Fitter Workshop in order to measure possibilities of further developing and on this basis suggest some changes.

II Activities

1. Information

It is to be ensured that all information necessary to fulfill the duties are available. Connection has to be made with leaders of the Fitter Workshop for survey of duties and to collect information.

2. Registration of Present Situation

has to be put down as follows at the Fitter, car repair and the Welding Section.

1) Measure concisely the duties of each group.

2) What kind of tools, devices, manuls and mechanical respectively are available.

3) Which technologies are used at present by this group - which technologies are available for works made by this group.

4) Put down of parameters and condition details of the stable machines are available.

5) Who registers the technologies and from where they origin (who hands it over).

6) Put down of utilization for the time being of the machines, with enumeration per cent of the reasons of time losses, if necessary (welding machine). Data of 2.3.6 should be used.

7) Put down of weak and strong points.

8) Put down requests of works superintendent and of foreman.

3. Analyses

1) The present situation has to be analysed and estimated.

2) It should be analysed whether manual and mechanical tools available complies with the requirements of given purposes.

3) Quality, origin and scope of the technologies available has to be analysed.

4) Are the technologies employed up-to-date?

5) Quality and quantity of working machines available has to be analysed.

6) The utilizing level of the machines has to be analysed in connection with the technology.

7) Weak and strong points have to be analysed.

8) Proposals of work's superintendants and of foremen have to be analysed.

4. Proposals

On the basis of analyses, these proposals have to be made:

1 - 2) Modification or development of mechanical and manual tool supply in order to obtain the same.

3 - 4) Development of present technologies in order to amplify technological areas and to realize methods.

5) To remove quality of machines in use, to buy new machines if necessary or to remove the superfluous items.

6) To eliminate factors which hinder utilization (technological factor).

7) To modify weak and strong points.

8) Proposals etc.

5. Introduction

The plan of proposals has to be carried out if its final shape reached, corrections which occur are made and are accepted by the management.

When proposals to buy new machines are made the machines under installation should be taken into consideration.

III Resources (Information)

IKO consultants,

2.3, 2.3.1, 2.3.2, 2.3.4, 2.3.6.

Discussions.

Plant manager.

IV Results

Report of general level of technology, of possibilities of development also includes the amplified technological areas.

Exact description of new methods, if accepted.

Improvement of machine's utilization.

Decrease of labour.

Increase in mechanical work

V Time Consumption

IKO: 10 hours

DV: 300 hours

VI Responsible

Åke Antal

2.3.5/II Technological Outline (Mechanical Shop)

I Objective

The aim of this working project is to study technological methods used in Mechanical Shop in order to measure the possibilities for development and make proposals on this basis.

II Activities

1. Information

It is to be ensured that all information concerning the operative plan shall arrive to people who are competent and could influence the project.

2. Registration of Present Situation

has to be put down as follows:

1) Concise survey of possibilities of the individual production system technology.

2) What kind of devices and tools are available for the single machine groups.

3) What kind of machine tools are available for processing and what are their parameters.

4) Measure and determine per cent of wear-and-tear rate with indication of the starting year.

5) Sketch lay-out from areas, where the machines are settled.

6) What kind of new technologies were introduced in the last 1 - 2 years.

7) Weak and strong points as well as controlled and uncontrolled tendencies have to be determined.

8) What kind of new machine-tools are needed.

9) Requests and proposals of work superintendent and personnel should be recorded.

3. Analyses

1) The quality and efficiency of technologies in use should be examined.

2) It should be analysed if tools and devices are up-to-date.

3) It should be analysed whether the possibilities given by machines are used, comply with the requirements.

4) The rate of usefulness or the level of wear-and tear of the machine parc available should be analysed.

5) Examination of efficiency of the new technologies.

6) The demands towards new machine-tools have to be analysed.

7) Analysis of weak and strong points.

8) Analysis of proposals given by work's superintendant and his personnel.

4. Proposals

On the basis of the above mentioned analyses several different proposals will emerge: these have to be analysed and brought in harmony. The following factors are particularly considerable

1) Improvement and development of technologies used if necessary.

2) Search or purchase of tools are more up-to-date, reconstruction or exchange of devices.

3) Purchase of new machine-tools are more up-to-date, if necessary and reject out-of-dates.

4) Increase utility rate of the machine parc through more systematically made renovations.

5) Increasing of efficiency by searching and employing new technologies.

6) Efficient modification of weak and strong points.

7) Examination technologies proposed by the personnel. The already ordered or settled inside Dunai Vasmű have to be taken into consideration too.

5. Introduction

The proposals have to be carried out when the final shape is reached, occurring problems are eliminated and are accepted by the management.

III Information Resources

IKO consultants

2.3, 2.3.1, 2.3.2, 2.3.3, 2.3.4, 2.3.6.

Manual elaborated technological plan.

Discussions.

Project manager.

IV Results

Report of general level of technology of possibilities of development also include the prospective amplified technological areas.

V Time Consumption

IKO 20 hours

DV: 466 hours

VI Responsible

József Markovics

54/...

2.3.6 The Questions of Work Efficiency (Personnel)

I Objective

The aim of the project is to increase the efficiency of the workers by investigation and making proposals to eliminate all delaying factors such as:

Poor instruction and direction,

Lack of/waiting for:

- Drawings,
- Materials,
- Tools
- Etc.

Waiting for transport.

II Activities

1. Information

It should be ensured that all information concerning the operative plan shall arrive to all people who are competent and could influence the project.

2. Registration of Present Situation.

1) The rate of utilization should be measured of the work time and a diagram has to be made from the results. The measurement shall extend with 30% of the workers.

2) Collection and measurement of losses according to causes.

3) Measurement of time utilization of machines are settled in Mechanical and Fitter Shop.

4) (Group leader and foremen should examine). Examination leading and working methods as well as work time utilization of group leader and foremen.

5) Weak and strong points as well as controlled and uncontrolled tendencies have to be determined.

6) Requests and proposals of work's superintendent and of his personnel should be recorded.

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3. Analyses

1) Statement of factors which decrease efficiency determined by time analysis.

2) Analysis of causes of losses.

3) Analysis of causes of failures.

4) It should be examined whether directions and instructions are satisfactory and unambiguous. Interlockings and overlappings as well as their causes should be established.

5) Examination of the new technology.

6) Analysis of proposals given by work's superintendent and his personnel.

4. Proposals

The following factors are particularly considerable:

1) Elaboration of proposals for better utilization of work time.

2) Elimination of technological factors which hinder utilization.

3) Proposals in order to decrease losses emerged from waiting and failures.

4) Simplification of duties of the examined leaders, elaboration of a proposal concerning the content and the usefulness of the work.

5) Increase efficiency by searching and employing new technologies.

6) Proposals of work's superintendent and his personnel.

5. Introduction

The introduction plan of proposals accepted has to be carried out in two steps:

a) A preliminary plan should be carried out as the management accepted.

b) The final plan involves the details necessary for the introduction of the proposals accepted.

The plan has to comply with the following requirements:

economical calculations,
time table,
results expected,
distribution of responsibilities.

III Resources (Information)

IKO consultants,

2.3.1, 2.3.2, 2.3.3, 2.3.5, 2.3.7

Discussions.

Plan's manager.

IV Results

A description of the foreman's role in:

- instruction of worker,

- direction and distribution of the work

An analysed ratio-delay study pointing out the delaying factors and their influence on the efficiency.

V Time Consumption

IKO: 3 man/hours

DV: 40 hours

VI Responsible

Zoltán Szallár

2.3.7 Material Administration System

I Objective

The aim of this project is to:

- Examine the present way of materials handling and storing in order to improve this.

- Examine the present quantity (number of materials in order to propose reduction) extension of obsolete inventories.

- Establish a material planning system connected to the planning system and respecting (being within the frames of) the material administration system of the central maintenance office.

II Activities

1. Information

It is to be ensured, that all the necessary information on the project will be provided for all those who are concerned with or are influencing the project.

2. Registration of Present Situation

The following is to be registered:

2.1 Flow diagram of material movements necessary for production.

2.2 Present material handling and storage.

2.3 Present stocks.

2.4 Deletion system of overstock.

2.5 Descriptions of paper routines, order and report forms, information files, recording system, statistics.

2.6 The weak and strong points, their causes, the controlled and not controlled tendencies.

2.7 Opinions and proposals from workers and leaders.

2.8 Description of coding system.

3. Analyses

3.1 Analysis of flow diagram of material movements necessary for production.

3.2 Analysis of present material handling and storage.

3.3 Analysis of present stocks.

3.4 Analysis of deletion system of overstock.

3.5 Analysis of descriptions of paper routines, order and report forms, information files, recording system, statistics.

3.6 Analysis of the weak and strong points, their causes, the controlled and not controlled tendencies.

3.7 Analysis of opinions and proposals from workers and leaders.

3.8 Analysis of description of coding system.

4. Proposals

On the basis of the above analyses a series of several preliminary proposals will be elaborated. These have to be simulated and analysed. Factors needing special attention are the following:

4.1 Improvement of material movement (transport) e.g. by centralised parcelling up.

4.2 Elimination of deficiencies of present material handling and storage.

4.3 In order to keep the appropriate stock level (limits of stock minimum and maximum) the staying (prevailing) time of materials in stores shall also be reduced. This is a scheduling task.

4.4 Obsolete stocks have to be deleted.

4.5 Improvement of descriptions of paper routines, order and report forms, information files, recording system, statistics.

4.6 Improvement of EDP and recording of materials.

4.7 Utilization of useful suggestions - as far as possible.

4.8 A uniform coding system in the whole company (BV).

5. Implementation (plans)

The detail plan for implementation of proposals is to be elaborated in two steps:

a) A preliminary plan on the basis of decisions on proposals.

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b) Elaboration of final plans. They should meet the following requirements:

- economic calculations,
- time scheduling,
- resource requirements,
- results expected,
- conditions of implementation,
- distribution of responsibilities.

III Information Resources

HKO consultants

Projects 2.3, 2.3.1, 2.3.2, 2.3.3, 2.3.4, 2.3.6.

Material recording system elaborated in hand.

Earlier instructions and flow diagrams in effect.

Earlier store records.

Discussions.

Project leader.

IV Results.

An effective method for material handling and storage.

Proposals for min./max. inventory (stock).

Rules for deletion of overstocks.

Description of paper routines, order and report forms, information files, recording system, statistics.

V Time Consumption

HKC: 40 hours

DV: 400 hours

VI Responsible

MDV: Sander

2.3.8 Cost Control System

I Objective

The aim of this project is to establish a cost control system for the costs in the maintenance shops, in order to be able to analyse and evaluate the cost car s.

The sys shall include costs originated by labour, materials, machines, etc. and compile these costs on defined sections and functions.

II Activities

1. Information

It is to be ensured, that all the necessary information on the project will be provided for all those, who are concerned with or are influencing the project.

2. Registration of Present Situation

The following is to be registered:

2.1 Costs originated by work in Machining and Erection shop.

2.2 Present cost control and analysis technics.

2.3 Paper routines (in flow diagram) concerning cost analysis.

2.4 Present detailedness of fact finding and classification of several cost components.

2.5 How is the management helped in taking farther measures by the exhibited total costs as information.

2.6 The weak and strong points, their causes, the controlled and not controlled tendencies.

2.7 Opinions and proposals from workers and leaders.

2.8 Coding system.

3. Analyses

3.1 Analysis of cost originating factors in the two workshops.

3.2 Analysis of present cost control and analysis technics, their effectiveness.

3.3 Analysis of unnecessary motions in paper routines.

3.4 Analysis of present detailedness of fact finding and classification of several cost components.

III Information Resources

IKO

Projects 2.3, 2.3.1, 2.3.2, 2.3.3, 2.3.4, 2.3.6, 2.3.7.

Cost control system elaborated in hand.

Earlier instructions and flow diagrams in force.

Cost records made by Cost Accountancy.

Monthly reports on maintenance costs.

Discussions.

Project leader.

IV Results

Descriptions of
- methods,
- paper routines
- report forms,
- information files/data bank
- report output,
- statistics.

V Time Consumption

IKO: 40 hours

DV: 268 hours

VI Responsible

Mbtb Sänder

2.4 Central Organization

I Objective

The aim of this project is to elaborate an appropriate central organization and all the necessary systems for the integrated maintenance management of Dunai Vasmü. It should be coordinated with the activities of other management organizations of the company. It has to represent a uniform system, based on the application of EDP. It shall incorporate the systems elaborated for the Hot Rolling Mill and Maintenance Workshops. Most of the systems have to be operative before the application of EDP.

II Activities

1. Information

It is to be ensured, that all the necessary information on the project will be provided for all those, who are concerned with or are influencing the project.

2. Registration of Present Situation

The registration of present situation shall be performed in the following areas (subprojects):

2.1	Organization	project 2.4.1
2.2	Management Information System	project 2.4.2
2.3	Central Planning System	project 2:4.3
2.4	Material Administration System	project 2.4.4
2.5	Cost Control System	project 2.4.5
2.6	System Analysis System	project 2.4.6

The above listed will be elaborated as separate subprojects.

3. Analyses

The details of analyses are contained in the subprojects. Care should be taken for coordination of subprojects - avoiding parallelities and omission on important points.

4. Proposals

The proposals elaborated in subprojects have to be summarized for simultaneous submittal to the management.

5. Implementation

After decision a preliminary and a final plan are to be elaborated, according to subprojects. When they are ready, they have to be summarized.

III Information Resources.

IKO consultants

Project 2.2, 2.3 and their subprojects.

Effective rules, descriptions.

Records.

Leaders.

IV Results

Description of control organization and systems necessary for the integrated maintenance managing.

V Time Consumption

DV: 150 hours

Schedule: latest finish on the basis of subprojects is on 31st October, 1975.

VI Responsible

Csinády Gábor

64/...

2.4.1 Organization

I Objective

The aim of this project is to conduct an organizational analysis of all maintenance managers and maintenance functions and propose an integrated "Managed Maintenance" organization structure.

II Activities

1. Information

Considering that the put down and the evaluation are the objectives of the first part of the program, it is important to enter into relations with all competent managers to notify about the objectives and information. Hereby everyone, who is interested in it, will give and receive all information necessary.

2. Registration of Present Situation

1) The scheme of the actual organization structure must be prepared which also reflects the horizontal and vertical connections of central management.

2) The activities of the central management must be measured.

3) Also the job of each person, working within the central management must be measured, what is the content of their work, their duty and responsibility.

4) Determination of weak and strong points, collecting of controlled and uncontrolled processes.

5) To collect opinions of competent leaders and workers.

3. Analyses

The main stress has to be laid on analyses of the following:

1) What kind of changes are necessary of organization structure to achieve the managed maintenance.

2) All processes which are totally, partially or not managed, must be determined.

3) Are the jobs properly distributed? What are the differences between the prescriptions, the facts, and the claims?

4) Weak and strong points.

5) Which proposals are useful to introduce.

4. Proposals

1) Proposal of an organization structure which is believed to be necessary to realize the managed maintenance.

2) Proposals for elaboration of an integrated management for different processes.

3) Proposal for distribution of duties and obligations according to the objective.

4) Elimination of weak points to liquidate unequal conditions.

5) Introduction of useful proposals.

5. Introduction

The proposals must be prepared, so that, at first, it will be manual and then gradually be realized by computer into the new managed planning system.

a) The manager's decision about the new planning system.

b) Detailed plan of the new planning system, as well as:

   1) Time disposal of executing

      a) for manual planning,

      b) for computer preparing

   2) Aims concerned with resources,

   3) Results expected in different stages.

   4) Indication of persons made responsible for details.

III Information Resources

IKO consultants.

2.2, 2.2.1, 2.3, 2.3.1.

The current organization scheme.

Descriptions of working scopes.

Orders.

Discussions.

Leading engineer.

IV Results

A description of position and function of all maintenance managers and maintenance managers and maintenance functions (detailed for Hot Steel Mill and two maintenance shops), including a definition of tasks to be fulfilled, responsibility and authority and organizational placing.

V Time Consumption

IKO: 100 hours

DV 460 hours

VI Responsible

Gábor Csinády.

2.4.2 Management Information System

I Objective

The aim of this project is to analyse the present MIR in order to establish whether each of the leaders and positions are supplied with the necessary information in a proper form and in due time enabling them to fulfill the tasks and liabilities or not.

Furthermore, it is to be studied, which simplifications can be made in the system immediately and what changes are necessary for the preparation to EDP.

II Activities

1. Information

It is to be ensured, that all the necessary information concerning the project will be provided for all those who are concerned with or are influencing it.

2. Registration of present situation

1) Determination of relations of central office.

2) Determination of content of relations.

3) Typical information flow diagram, determination of content of information in management functions.

4) Determination of quantity of information materials.

5) Determination of procedure of information flow.

6) Determination of information routine's capacity.

7) Determination of weak and strong points.

8) Collection of opinions and proposals.

3 Analyses

1) Analysis and ranging of central office's relations.

2) Analysis of content of relations.

3) Analysis of typical maintenance information flow process and of information content.

4) It is to be analysed, whether it is necessary to maintaine to analyse the developed quantity and route of information or not.

5 The information flow route is to be analysed.

6) The information (recording, forwarding, storage) capacity of the three units are to be analysed.

7) The weak and strong points in information are to be analysed - for detection of causes of causes of existing tendencies.

8 Collection of opinions and proposals.

4. Proposals

Our intention is to get two or more alternative proposals for each of the analysed points. The basic principles of proposals are the following:

a) A logical layout of information collecting places at the company.

b) Short information flow lines.

c) Standard selection of information.

d) The way of communication should not disturb the operative work.

e) Determination of information necessary in different managing functions.

f) The materials of EDP machinery shall be kept in order.

g) The good physical conditions of information processing personnel should be cared for.

h) It is necessary to establish a personal communication between subordinates and leaders.

5. Implementation

The proposals are to be elaborated possibly in some alternatives. The implementation will be performed in two steps.

a) The management will decide for approval of the best variations, on the basis of the preliminary plan.

b) The detailed conditions of implementation are described in the final plan, consisting of:

1. Schedule of implementation.
2. Demand on resources.
3. Results expected.
4. Assignment of persons responsible.

III Information Resources

IKO consultants.

Project 2.4, 2.4.1, 2.4.4, 2.4.5, 2.4.6.

Information flow diagram.

Forms.

Discussions.

Project leader.

IV Results

A description of the Management Information System to be used in the future for the Managed Maintenance Network of Dunai VasmÜ. Detailed as follows:

- the information flow diagram of the three units:
- elaboration of a functional information system for the three units, which shows the following:

1. What kind of information shall be collected and how?
2. By which means are the information to be forwarded and where to?
3. In what arrangement?
4. How often?
5. By which administrative technics is the performance to be controlled?
6. Detailed description of the new information routine and demonstration of its efficiency.

V Time Consumption

IKO 40 hours

DV: 404 hours

VI Responsible

Tóth Dezsö

2.4.3 Central Planning System

I Objective

The aim of the project is to establish a central maintenance planning system ensuring the coordination of activities in all aspects of the "Managed Maintenance System", i.e. including:

- Scheduling
- Resource planning
- Coordination rules
- Information files
- Analysis
- Direction,
- Statistics for the planned and acute repair jobs, projects as overhauls and investments and for the manufacturing of spare parts and other items.

II Activities

1. Information

During the elaboration of the central maintenance planning system it is necessary to connect the following:

with all organs of the plant engineering department,

with the plant engineering plant section (production department, production section, general mechanic shop, accountancy part, part of labour relations).

Among the related departments, above all: Accountency, computing system, material and trade department.

Managing.

Union of the Hungarian Iron and Steel Industry.

3 Analyses

1) Analysis and ranging of connections.

2) An analysis of contents of connections.

3) Stress should be laid on analysing the importance of activities of these two departments in central planning.

4) What kind of efficiency could be expected from central planning.

5) Trace analysis following the way of fulfillment of the modified planning.

6) Analysis of plan preparation capacity.

7) The weak and strong points as well as the main tendencies of planning should be analysed.

8) Analysis of collected opinions and proposals.

4 Proposals

In preparation of the opinions it has to be fundamentally kept in view that the labour starts with manual methods, which must also become suitable for computer technique. Important factors are the following:

a) The central organs and duties of planning must be developed. The duties incorporate on enterprise level:

registration

planning of resources

coordination orders

information registration

analyses

instructions

statistics

b) Developing the route of communication and control.

c) Grouping of plan information according to the standard.

d) Elasticity in satisfaction of claims of the executive organs.

e) Determination of duties concerning the plan for each leading post.

f) Ensure that planning matter is always kept in store and well-arranged.

g) Ensure favourable labour conditions for people who take part in planning.

h) Ensure the easy communication between leaders and subordinates.

II. Introduction

Proposals shall be prepared to realise the new managed planning system gradually from manual to instrumental work.

a) Manager's decide about the new planning system.

b) Detailed plan of the conditions of the introduction as well as:

1) time schedule to fulfillment,

a) for manual planning,

b) for computered planning.

2) Claims concerning resources.

3) Expected results of the different degrees.

4) Selection of people made responsible for single particulars.

III Information Resources

IKO consultants

2.4, 2.4.1, 2.4.2, 2.4.3, 2.4.6.

Scheme of central planning organisation.

Printed matter.

Discussions.

Planning Manager.

IV Results

Description of:

- system and paper routines for scheduling and resource planning,
- information files,
- report forms,
- recording systems,
- statistics.

V Time Consumption

IKO: hours, DV: 780 hours.

VI Responsible: Mrs Dorsal Veenti, 2.4.3, Dept 16th.

2.4.4 Material Registration System

I Objective

The aim of this project is to:

- Examine the present way of material handling and storing in order to improve this.
- Examine the present quantity of materials and spare parts in order to propose reduction/extension of stock and detention of obsolete inventories.
- Examine the present situation for buy/make spare parts in order to reduce costs.
- Establish a centralized material administration system connected with the central planning system.

II Activities

1. Information

1) Tabulated chart of original stocks.

2) Tabulated chart of spare parts' turnover.

3) Tabulated chart of spare parts reserves for every depots.

4) Tabulated chart standard of spare parts.

5) Reports of spare parts' stocks prepared monthly by the AGO.

6) Tabulated chart No. 16 of each depot's turnover, summarized on the basis of the certificate characteristics.

7) Tabulated chart for maintenance prupases.

8) Monthly report from purchase and use of spare parts.

2. Registration of Present Situation

1) The present course of administration of spare parts' ordering and purchasing should be measured from the Maintenance Office (TMK) to the Material Trade Department.

2) Reserves and consumption of the spare parts' depot and the service magazines.

3) Terms of delivery of the essential parts.

4) Material ordering's administration course from Maintenance Office (TMK) to AGO.

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5) Use, turnover and stocks of milled goods and other items.

6) The material assignment system for the time being valid.

7) The accord between labour planning and part ordering.

8) Collection of certificates being valid at the time.

3. Analyses

The succeeding questions should be treated distinguished during analyses.

1) Superfluous stations in administration of purchases.

2) Superfluous and narrow reserves should be determined.

3) Analysis of delivery terms of spare parts.

4) Unnecessary activities and lacks in the manner of material ordering.

5) Analysis of important materials of milled goods and special magazine's reserves in connection with their purchase and use.

6) Analysis of material assignment system for the time being valid in the scope of Maintenance Department (TMK).

7) Analysis of the accord between labour planning and part ordering for a few themes being more important.

8) Analysis of certificates being valid at the time.

4. Proposals

Proposals must be made according to the analyses:

1) According to the proposals which have been accepted, the revision of the spare parts ordering and purchasing system must be carried out.

2) If proposals will be accepted the present spare parts economy system should be revised.

3) Preparing a time schedule for limiting orders.

4) If proposals are accepted a new material ordering system must be elaborated taking into consideration the earlier proved opinions.

5) If proposals are accepted, the standards of more important materials necessary for spare parts should be similarly elaborated as well.

6) If proposals are accepted, the material certification system should be revised.

7) If proposals are accepted, the shape of planning should be elaborated.

8) If proposals are accepted, the planning and transcription of certificates should also be carried out for computer employment.

III Information Resources

IKO consultants

1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8.

The yearly maintenance plan of Dunai VasmU.

Files of spare parts.

Certifications used, charts, summaries.

Discussions.

Manager of material trade department.

Managers of plant engineering section.

Manager of storage section.

Different charts, summaries and lists (stocks of existing data, turnover, storage, standards, reserves, monthly stocks of parts, summaries of each magazine, material and consumption files).

IV Results

An efficient method for material handling and storing.

Proposals for min./max. inventory.

Rules for buy/make spare parts.

Rules for deletion of inventories.

Description of:

- paper routines,
- order and report forms,
- information files,
- recording system,
- statistics.

V Time Consumption

IKO: 60 hours

DV: 400 hours

VI Responsible

István Zámbik

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2.4.5 Cost Control System

I Objective

The aim of this project is to establish a cost control system covering the costs in all aspects of "Maintenance System" in order to be able to analyse and evaluate the cost carriers. The system shall include costs originated by labour, materials and spare parts, machines etc. and compile these costs on defined sections and functions.

II Activities

1. Information

1) Dunai Vasmü's yearly maintenance plan divided among the sections.

2) File of maintenance costs constant tools (trade account).

3) File of maintenance costs of single tools.

4) Maintenance costs consumption monthly report.

5) Material chart for maintenance purposes.

6) Chart for time (hours) and wages consumption of maintenance.

7) File (book) for maintenance cost consumption.

2. Registration of Present Situation

1) Measure of the actual material, wages and equipment cost system.

2) Measure of the cost planning method.

3) Collecting of certificates used.

4) Measure of the currently used labour number system during accounting.

5) Collecting of weak and strong points.

6) Collecting of opinions and proposals of people who are taking part in this scope.

3. Analyses

1) Study and analysis of the accounting system.

2) Analysis of correctness of the cost planning.

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3) Analysis of certificates used in order to make account with the computer and for simplifications necessary.

4) Analysis of the currently used labour number system, elaboration of a new one suitable for computered accounts.

5) Analysis of the sooner collected weak and strong points.

6) Analysis of opinions and proposals of people who are taking part in this scope for application in the process..

4. Proposals

are as follows on the basis of analyses:

1) A uniform maintenance section's (TMK) accounting system should be elaborated,

a) which is used equally in each sections,
b) the system must be capable for the central computer account,
c) the system should also be capable to account and analyse independent of the maintenance costs of each costcarrier.

2) These certificates which are used for account and which are not capable for computered accounts, should be transformed or newly planned.

3) In order to speed up the information flow, shortening of the accounting process.

4) The currently used labour number system is not applicable in every respect to show costs exactly at the place of origin, therefore, the system should be revised.

5) Elimination of collected weak and strong points.

6) Proposal on the basis of analyses.

5. Introduction

1) On the basis of 1-A-B-C proposal the uniform Maintenance Section (TMK) accounting system will be elaborated.

2) If proposals are accepted, the certificates necessary for computer accounts should be planned.

3) If proposals are accepted, the process necessary should be elaborated.

4) If proposals are accepted, a new labour number system should be elaborated, which is capable of:

a) showing costs of each constant tool,

b) showing material consumption and spare part costs of constant tools,

c) computering preparation.

5) If proposals are accepted, concerning the weak and strong points, elaboration of the plan.

6) Elaboration of proposal on the basis of analysis.

III Information Resources

1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7.

Currently used labour number system,

Accountancy managers of Plant Sections.

Manager of accounting department.

Manager of the computer technical department.

Manager of plant engineering departments.

IV Results

Descriptions of:

- methods,
- paper routines,
- report forms,
- information files/data bank,
- report output,
- statistics.

V Time Consumption

IKÓ: 40 hours

DV: 440 hours

VI Responsible

István Zámbik

2.4.6 System Analyses

I Objective

The aim of the working plan is to study maintenance administration systems of Dunai Vasmü in order to find possibilities for simplification of the system. Furthermore, we should like to propose changes according to the possibilities.

II Activities

For the sake of the plan to be undisturbed fulfilled, we have to ensure that the following who took part in this scope, shall give all information necessary.

- Plant Maintenance Department.
- Plant Maintenance Section, - Mechanical shop, - Mounting Division.
- Steel Mill Section, - Maintenance unit,
- Accountancy Departments of sections

  Hot Steel Mill

  Plan Maintenance
- Material and Trade Department,
- Computer Technical Department,
- Union of the Hungarian Iron and Steel Industry.

2. Registration of Present Situation

1) The elements of the system should be determined concretely.

2) The structure of elements of the administration system have to be measured and the interdependencies have to be determined.

3) The flow diagram of the administration activities have to be elaborated.

4) The size of administration activities of the single job sites have to be measured.

5) It should be determined which of these elements are registered under materials equipment and labour subjects in the administration.

6) The technical inventory of administration employees have to be determined.

7) The weak and strong points as well as the level of managing have to be established.

8) The opinions, proposals and requests of leaders and labourers who are working there, have to be recorded.

3) Analyses

1) Study, comparison and analysis of the tested areas.

2) The most typical and most improtant activities of system elements should be examined.

3) The possibilities of simplifications should be established on the basis of flow diagrams.

4) The loading level of the administration organs have to be analysed.

5) To what extent are the requirements of the integrated file system filled by administration types of material, equipment and labour.

6) It should be examined whether technical equipment is suitable for this purpose.

7) The weak and strong points of administration system should be analysed and establish the causes of differences.

8) The opinions of the asked persons have to be analysed by taking the above mentioned directives into consideration.

The possibilities of simplifying administration activities should be analysed. Whether information routes are correct or not, no unnecessary or parallel activities are in the system.

4. Proposals

On the basis of analyses should be elaborated the proposals, taking into consideration particularly the following:

1) The administration activities should be built thoughtfully and usefully.

2) Simplification of the administration system.

3) Unambiguous determination of administration processes.

4) Equalization of loading levels.

5) Standardization of maintenance administration on Dunai VasmÜ's level.

6) Completion of technical inventories is necessary.

7) Elimination of weak and strong points (overloaded).

8) Proposals on the basis of summarized opinions of leaders and labourers.

During evaluation of proposals a permanent connection has to be maintained with the competent managers of these areas.

The elaborated proposals have to comply with the requirements of computer programs and take into consideration the last aim: the centralized maintenance in Dunai VasmÜ.

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5. Introduction program

The whole plan of the introduction of proposals should be carried out in two steps:

a) The preliminary plan of the proposals have to be fulfilled after sanction of management.

b) The plan carried out on the basis of proposals sanctioned, involves the details necessary for introduction.

The plan has to fill the following requirements:

For instance:
- economical calculations,
- time schedule,
- demands concerning resources,
- results expected,
- distribution of responsibilities

III Information Resources

IKO consultants,

2.2.6, 2.2.7, 2.3.7, 2.3.8, 2.4.2, 2.4.4, 2.4.5,

Departments, Sections, Plants, which are competent.

Discussions.

Plan Manager.

IV Results

Description of system proposed for modification in detail or totally.

V Time Consumption

IKO: 20 hours

DV: 410 hours

VI Responsible

Jbzsef Farkas

ATTACHMENT 6–7

FOR

FINAL REPORT

02342
(5 of 6)

MANAGED MAINTENANCE SYSTEM

DANUBE IRON & STEEL WORKS

APRIL 1976

Attachment 6:	**Introduction to Managed Maintenance System.**
Attachment 7:	**System Development Report.**

IKO

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INTRODUCTION TO MANAGED MAINTENANCE SYSTEM

TABLE OF CONTENTS

1. INTRODUCTION

The purpose of this report is to describe the activities performed and the actions taken in connection with phase I: "Introduction to Managed Maintenance" at the Danube Iron & Steel Works.

The subjects dealt with are:

1. Manual for "Course of Industrial Maintenance for Danube Iron & Steel Works.

2. Education program, stating education structure and time schedule.

2. INTRODUCTION TO MANAGED MAINTENANCE

The educational program aims to bring about a thorough understanding of the principles of a modern managed maintenance system among all leaders participating in maintenance activities at Dunai Vasmü.

2.1 Course-Manual

In the course-manual "Industrial Maintenance for Danube Iron & Steel Works" IKO has assembled the fundamental principles of modern managed maintenance.

The course-manual will serve as the instructor's handbook, from which he can select the most relevant material for the courses/seminars to be given to different, small groups, inside and outside the maintenance organization.

The course-manual consists of the following nine chapters (in all approximately 300 pages):

Chapter 1: Maintenance Objectives

Chapter 2: Maintenance Organization

Chapter 3: Personnel Management

Chapter 4: Maintenance Planning and Control

Chapter 5: Preventive Maintenance

Chapter 6: Time Estimation

Chapter 7: Material Control

Chapter 8: Basic Economy

Chapter 9: The System's Concept and the Application of EDP in Maintenance Systems

Below is given a short description of the contents of each chapter.

2.1.1 Chapter 1: Maintenance Objectives

After a relatively short introduction in which the need for maintenance is explained, a glossary follows, which lists and explains the most common words and terms regarding maintenance. It is important to have a basic common terminology, without which understanding and communication may be difficult.

Finally, the chapter deals with the objectives for maintenance, concluding with reliability engineering.

2.1.2 Chapter 2: The Organization of the Maintenance Function

In this chapter the different types of organizations in maintenance are described.

The advantages and the disadvantages of each type are listed.

After this, a practical example is described and the chapter ends with a description of the dynamics of the maintenance organization.

2.1.3 Chapter 3: Personnel Management

This chapter deals with the requirements for the maintenance personnel, from the manager down to the youngest apprentice.

As an illustration of this, a training program for apprentices in a Norwegian company is described.

The chapter ends with a detailed description of wage-systems especially fitted for maintenance.

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2.1.4 Chapter 4: Maintenance Planning and Control

After a general description of the philosophy of planning, there is a thorough going examination of the "Planning and Scheduling Maintenance Work". It gives a description of the different types of maintenance planning - development planning, long-range planning and short-term planning, with emphasis on short-term planning and scheduling.

In the last section, the network planning tool is described in detail, with exercises and solutions to further benefit the learning process.

2.1.5 Chapter 5: Preventive Maintenance

In this chapter preventive maintenance is examined.

The philosophy, on which preventive maintenance is based is presented and there is a very detailed description of the different techniques which are used. These techniques are illustrated by a variety of examples. The chapter is terminated by an illustrated section of test programs.

2.1.6 Chapter 6: Time Estimation

After showing the necessity of time estimation, e.g. in regard to the planning, this chapter gives a description of some of the different methods used.

One of the methods described is a special MTM-version, called UMS (Universal Maintenance Standard), and another is the IKO-method.

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The chapter concludes with a reference to time estimation in practice.

The chapter is illustrated.

2.1.7 Chapter 7: Material Handling and Control

This chapter deals with certain important aspects in the construction and management of spare part stores, such as:

- centralized/decentralized control, where the importance of different factors, influencing the degree of centralization of stock control, is discussed.

- managing the break-down costs, with a general description of the tools to reduce the break-down costs.

- cost analysis for shortage of spare parts, which describe a decision-model for purchase or not purchase a spare part. The application of the model is illustrated by several examples.

The last section gives a description of the systems normally applied to administration of stocks.

2.1.8 Chapter 8: Basic Economy

This chapter gives a survey of the most commonly used accounting and financial terms.

After a relatively short outline of the different forms of cost, investment analysis of the following types is described in detail:

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- pay-off method
- discounted cash-flow method
- rate of return model
- annuity method.

Finally, replacement policies are described.

2.1.9 Chapter 9: The System's Concept and the Application of EDP in Maintenance Systems

The first section treats both the system's concept and the general analysis and designing of systems. In particular, the impact of EDP on maintenance costs and system design is described, with a final example of an integrated maintenance information system incorporating EDP to the greatest extent practical.

2.2 Education Program

The course manual has been translated from English into Hungarian, and educational material, such as figures, tables and diagrams has been prepared.

The maintenance courses of D.V. should be seen as a series of continually developing courses.

The first series of courses/seminars consists of two parts:

2.2.1 Part I concerning approximately 200 managers and leaders at all levels, divided into 10 groups:

1.-A Managers, upper level I

This group includes managers of all units, i.e.:

- Plant Engineering Department leaders
- Managers of the Hot Rolling Mill
- Maintenance Plant Section leaders.

2.-A Managers, upper level II

This group includes managers who are involved, to some extent or another, in different aspects of maintenance, i.e.:

- Chief mechanics
- Chief department managers
- Department managers.

Those involved are:

- the chief mechanics of Metallurgy, Coking Plant, Power Station, Plate-finishing Plant & Rolling Mill.

- the chief department and department managers of Accounting, Finance, Planning, Organisation, Investment, Personnel etc.

3.-B Hot Rolling Mill, medium level managers I

This group includes maintenance and technological superintendents, chief foremen and foremen of Hot & Cold Rolling Mill.

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4.-B Hot Rolling Mill, medium level managers II

Includes the foremen TMK (PM), clerks, plant engineers and technicians working on maintenance areas of Hot Rolling Mill.

5.-B Maintenance Plant Section, medium level managers I

Superintendents and chief foremen of the Maintenance Plant Section.

6.-B Maintenance Plant Section, medium level managers II

The foremen, clerks, plant engineers and technicians of mechanical and fitting shops of the Maintenance Plant Section.

7.-C Hot Rolling Mill, Labor Leaders I

Group leaders, chief electricians and inspectors from the Hot Steel Mill's electric shop.

8.-C Hot Rolling Mill, Labor Leaders II

Group leaders, foremen and inspectors from the Hot Rolling Mill's mechanical shop.

9.-C Mechanical Shop, Labor Leaders I

Group leaders, foremen and other leaders, responsible for at least three persons from the Mechanical Shop.

10.-C Fitting Shop, Labor Leaders II

Group leaders, foremen and other leaders responsible for at least three persons from Fitting Shop.

The courses/seminars include:

a) Lectures based on the manual "Course of Industrial Maintenance for Danube Iron & Steel Works" given to the groups, marked A, B or C, in various degree of detail and intensity.

   The lectures for the groups marked A will be based on the chapters 1-9.

   The lectures for the groups marked B will be based on the chapters 1, 2, 4, 5, 6 & 7.

   The lectures for the groups marked C will be based on the chapters 1, 2, 5 & 6.

b) The project "Development of a Managed Maintenance System for the Danube Iron & Steel Works" by aims, proposals and planned implementation of the organization and system work, accomplished by IKO.

   The courses/seminars (part I) will take place in September-October, 1975. (See time schedule, appendix I).

2.2.2 Part II concerning approximately 180 maintenance workers from the Hot Steel Mill and the Fitting Shop.

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The courses include:

a) A short theoretical part (lectures), based on the manual "Course of Industrial Maintenance of Danube Iron & Steel Works".

b) Detailed review of maintenance systems, elaborated by IKO, emphasizing the duties of workers involved in the execution.

The course will be uniform for all groups, and will take place in November - December, 1975.

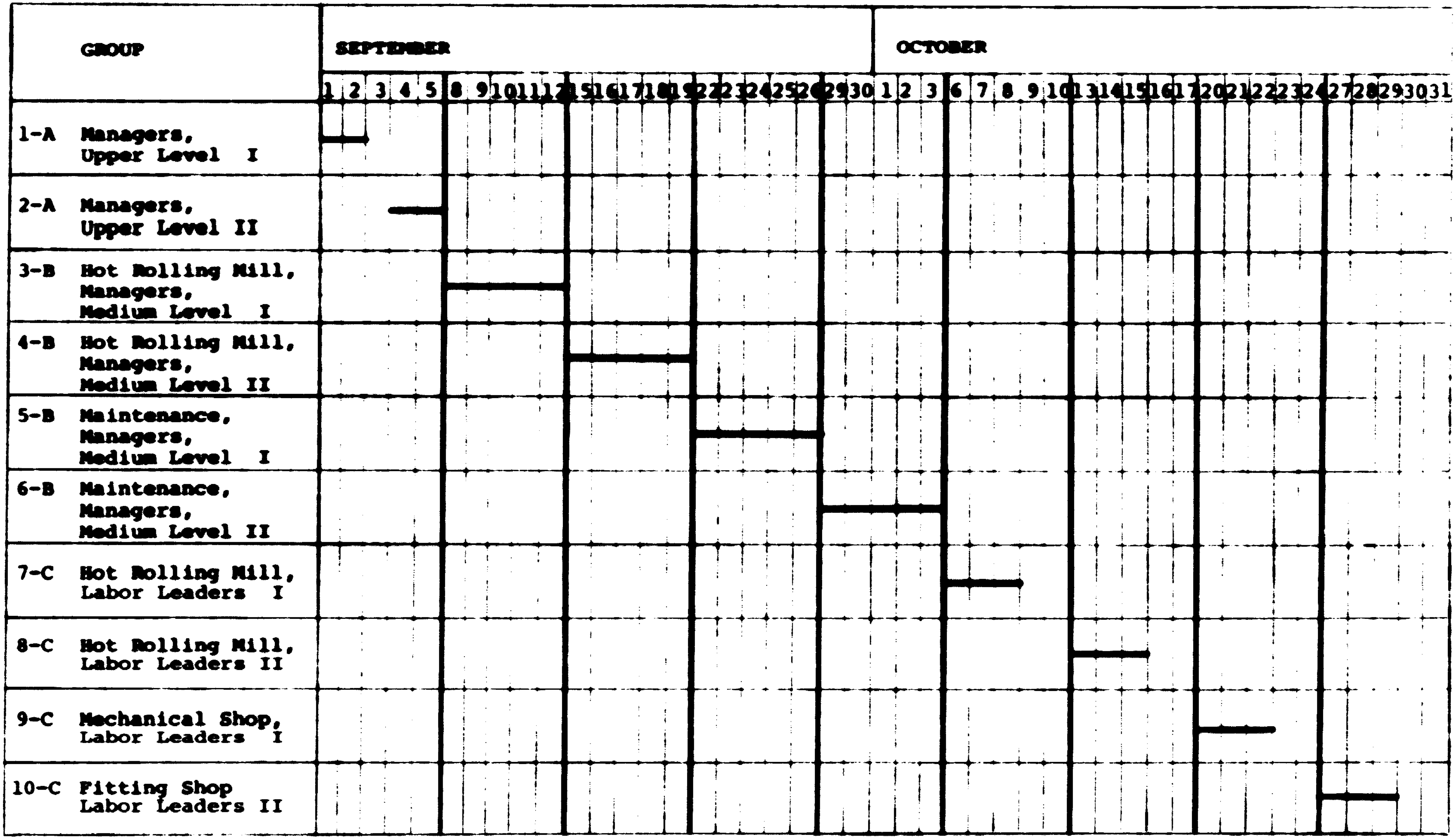
2.3. Conclusion

With this project IKO has established a foundation for the present and future education at programs in the maintenance area of Dunai Vasmű. Based on the experience of the courses Part I and Part II, corresponding courses/education programs will have to be designed to cover all factories at Dunai Vasmű, e.g. steel work, coking plant and power plant.

With this report and the delivery of the education manual, we assume that we have concluded the work required on this project (Phase I).

IKO CONSULTING GROUP

EDUCATION PROGRAM PART I:



Appendix I

SYSTEM DEVELOPMENT REPORT

SYSTEM DEVELOPMENT REPORT

FOR

DANUBE IRON & STEEL WORKS

SEPTEMBER 1975

TABLE OF CONTENTS

1. INTRODUCTION

ATTACHMENT 1.1 A section of the project-network

ATTACHMENT 1.2 Example of a subproject description

1. INTRODUCTION

The system development for the managed maintenance system of Danube Iron and Steel Work has been completed in close co-operation between the counterpart and the consultants.

It remains now for the consultants to complete implementation plan and the implementation counselling.

The method used for system development included the following steps:

a. In a 20-hours intensive course the consultants trained an analytical staff of 18 persons from the counterpart in systems analysis and job description writing.

b. The project leader from Danube Iron and Steel Work made a study trip to Scandinavian steelworks, together with the consultants' project leader, in order to study implemented managed maintenance systems.

c. 25 sub-projects were defined and scheduled in a network (attachment 1.1 presents a section of this network).

d. Each sub-project was described by objective, activities to be carried out, time requirements, and responsible manager (attachment 1.2 presents an example of a sub-project description).

e. A working group of one to five persons for each sub-project, in close cooperation with the consultants, made an inventory of the present situation and the system development.

f. The final description of the systems was elaborated in some detail by the consultants and completed by the counterpart's staff. During the total development careful attention was given to achieving step-by-step acceptance from the future users of the systems.

In order to test the systems developed, simulations are made of their use in the different types of organizational units in the maintenance function in the Hot Steel Mill, the Mechanical Shop, the Erection Shop and the Central Maintenance Office.

It should be pointed out that in the very short time of the system development phase (approximately 6 months), it has not been possible to complete all the necessary discussions which would result in acceptance of the proposed concept. However, all systems are based on this proposal and if it is not accepted, they shall be adjusted to an alternative organizational concept.

The work carried out up to now in the project has demanded a much larger effort from the consultants than calculated. It is estimated that an input of 50% more consultant hours than offered will be necessary before the conditions of the terms of reference are fullfilled. The reasons for this are several, the most important being:

g. The participation from the counterpart has not been according to the plans.

h. The condition of the counterparts present management system is much weaker than when the terms of references were written.

i. The consultants underestimated the work of inventorying the present situation, on which the system development will be based.

In addition, the consultants decided that to assure success of the projects it was necessary to go beyond the requests of the terms of reference and do the following:

j. Give 18 persons an intensive course in systems analysis and job description writing.

k. Take 2 persons on a one-week study trip to Scandinavia.

l. Demonstrate how to improve efficiency and general knowledge by organizing and EDP-processing some ratio delay studies.

However, the cooperation with the counterpart's management has been excellent. It is our opinion that problems not solved have been problems outside management control.

The degree to which the systems are detailed today demands a rather large amount of further detailing before the systems can be brought into operation. The counterpart's staff is able to do this work; however, the implementation period will be considerably shorter if they could be given consultant's aid in this work, and if minor failures can be avoided.

We recommend a staff of approximately 8 persons from the counterpart be appointed to undertake this work for a number of years. Furthermore, we recommend that this group be given consultant's aid in the first year. The objectives of the consultants should be to secure progress in the implementation by following up and by giving direct guidance to each sub-project for instance by transferring formulas, routines and methods used in other steelworks.

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*** T I M E   L I S T I N G ***

PROJECT NO. 1
MANAGED MAINTENANCE SYSTEM
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1MAY75
PLANNED FINISH:
COMPUTED FINISH: 24NOV75

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ACTIVITY IDENTIFICATION	ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
2411 01 2 ORGANIZATION	-INFORMATION	2	1MAY75	2MAY75			0	0	0	
2412 01 2 ORGANIZATION	-REGISTRATION OF PRESENT SITUATION	13	5MAY75	21MAY75			0	0	0	
2413 01 2 ORGANIZATION	-ANALYSIS	28	19MAY75	25JUN75			0	0	0	
2414 01 2 ORGANIZATION	-PROPOSALS	13	17JUN75	3JUL75			0	0	0	
2415 01 2 ORGANIZATION	-IMPLEMENTATION	6	4JUL75	11JUL75	17NOV75	24NOV75	96	0	96	

Attachment 1.1

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PROJECT NO. 1
MANAGED MAINTENANCE SYSTEM
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1MAY75
PLANNED FINISH:
COMPUTED FINISH: 24NOV75

ALPHACODE: 02
TIME UNIT: DAY

ACTIVITY IDENTIFICATION				ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
2621	02	5	M.I.S.	-INFORMATION	2	1MAY75	2MAY75	18SEP75	19SEP75	100	0	0	
2631	02	3	CENTRAL PLAN.	-INFORMATION	6	1MAY75	8MAY75	27MAY75	3JUN75	18	0	0	
2622	02	5	M.I.S.	-REGISTRATION OF PRESENT SITUATION	6	5MAY75	14MAY75	22SEP75	1OCT75	100	0	0	
2632	02	3	CENTRAL PLAN.	-REGISTRATION OF PRESENT SITUATION	7	9MAY75	19MAY75	4JUN75	12JUN75	18	0	0	
2623	02	5	M.I.S.	-ANALYSIS	20	13MAY75	9JUN75	30SEP75	27OCT75	100	0	72	
2633	02	3	CENTRAL PLAN.	-ANALYSIS	32	16MAY75	30JUN75	11JUN75	24JUL75	18	0	11	
2634	02	3	CENTRAL PLAN.	-PROPOSALS	25	4JUL75	7AUG75	15JUL75	18AUG75	7	0	0	
2635	02	3	CENTRAL PLAN.	-IMPLEMENTATION	11	9AUG75	22AUG75	10NOV75	24NOV75	66	0	66	
2626	02	5	M.I.S.	-PROPOSALS	19	22SEP75	16OCT75	21OCT75	14NOV75	21	0	0	
2625	02	5	M.I.S.	-IMPLEMENTATION	6	17OCT75	24OCT75	17NOV75	24NOV75	21	0	21	

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MANAGED MAINTENANCE SYSTEM
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ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
2221	03	2	PREVENT.MAINT.-INFORMATION	2	1MAY75	2MAY75	9SEP75	10SEP75	93	0	0	
2231	03	4	PLANN. SYSTEM -INFORMATION	3	1MAY75	5MAY75	7AUG75	11AUG75	70	0	0	
2241	03	4	PROJ.PLANNING -INFORMATION	1	1MAY75	1MAY75	3OCT75	3OCT75	111	0	0	
2242	03	4	PROJ.PLANNING -REGISTRATION OF PRESENT SITUATION	8	2MAY75	13MAY75	6OCT75	15OCT75	111	0	0	
2222	03	2	PREVENT.MAINT.-REGISTRATION OF PRESENT SITUATION	8	5MAY75	16MAY75	11SEP75	22SEP75	93	0	0	
2232	03	4	PLANN. SYSTEM -REGISTRATION OF PRESENT SITUATION	5	6MAY75	12MAY75	12AUG75	18AUG75	70	0	0	
2233	03	4	PLANN. SYSTEM -ANALYSIS	14	12MAY75	29MAY75	18AUG75	4SEP75	70	0	53	
2243	03	4	PROJ.PLANNING -ANALYSIS	16	12MAY75	2JUN75	14OCT75	4NOV75	111	0	52	
2223	03	2	PREVENT.MAINT.-ANALYSIS	23	13MAY75	12JUN75	19SEP75	21OCT75	93	0	55	
2234	03	4	PLANN. SYSTEM -PROPOSALS	10	8AUG75	21AUG75	2SEP75	15SEP75	17	0	0	
2244	03	4	PROJ.PLANNING -PROPOSALS	10	8AUG75	21AUG75	30OCT75	12NOV75	55	0	0	
2224	03	2	PREVENT.MAINT.-PROPOSALS	20	22AUG75	18SEP75	14OCT75	10NOV75	37	0	0	
2235	03	4	PLANN. SYSTEM -IMPLEMENTATION	6	22AUG75	29AUG75	17NOV75	24NOV75	61	0	61	
2245	03	4	PROJ.PLANNING -IMPLEMENTATION	8	22AUG75	2SEP75	13NOV75	24NOV75	59	0	59	
2225	03	2	PREVENT.MAINT.-IMPLEMENTATION	10	19SEP75	2OCT75	11NOV75	24NOV75	37	0	37	

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ACTIVITY IDENTIFICATION		ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
2261	04	6 MAT.ADM.SYST. -INFORMATION	2	1MAY75	2MAY75	13AUG75	14AUG75	74	0	0	
2271	04	5 COST CONTR.S. -INFORMATION	2	1MAY75	2MAY75	12JUN75	13JUN75	30	0	0	
2262	04	6 MAT.ADM.SYST. -REGISTRATION OF PRESENT SITUATUON	15	5MAY75	23MAY75	15AUG75	4SEP75	74	0	0	
2272	04	5 COST CONTR.S. -REGISTRATION OF PRESENT SITUATION	8	5MAY75	14MAY75	16JUN75	25JUN75	30	0	0	
2273	04	5 COST CONTR.S. -ANALYSIS	28	13MAY75	19JUN75	24JUN75	31JUL75	30	0	30	
2263	04	6 MAT.ADM.SYST. -ANALYSIS	35	20MAY75	7JUL75	18SEP75	17OCT75	74	0	47	
2276	04	5 COST CONTR.S. -PROPOSALS	43	23JUL75	19SEP75			0	0	0	
2264	04	6 MAT.ADM.SYST. -PROPOSALS	25	29AUG75	2OCT75	7OCT75	10NOV75	27	0	0	
2275	04	5 COST CONTR.S. -IMPLEMENTATION	18	22SEP75	15OCT75	30OCT75	24NOV75	28	0	29	
2265	04	6 MAT.ADM.SYST. -IMPLEMENTATION	10	3OCT75	16OCT75	11NOV75	24NOV75	27	0	27	

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ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
2321	DS	3	PLANNING MAIN -INFORMATION	3	1MAY75	5MAY75	14JUL75	16JUL75	52	0	0	
2322	DS	3	PLANNING MAIN -REGISTRATION OF PRESENT SITUATION	6	6MAY75	13MAY75	17JUL75	24JUL75	52	0	0	
2323	DS	3	PLANNING MAIN -ANALYSIS	24	13MAY75	13JUN75	24JUL75	26AUG75	52	0	45	
[illegible]	DS	3	PLANNING MAIN -PROPOSALS	24	[illegible]AUG75	[illegible]SEP75	[illegible]AUG75	19SEP75	7	0	0	
[illegible]	DS	3	PLANNING MAIN -IMPLEMENTATION	6	11SEP75	[illegible]SEP75	17NOV75	24NOV75	47	0	47	

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ACTIVITY IDENTIFICATION		ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
2331	06	3 PLAN.DETAIL E -INFORMATION	2	1MAY75	2MAY75	4SEP75	5SEP75	90	0	0	
2371	06	4 MAT.ADM.SYST. -INFORMATION	2	1MAY75	2MAY75	21AUG75	22AUG75	80	0	0	
2391	06	5 COST CONTR S. -INFORMATION	2	1MAY75	2MAY75	29JUL75	30JUL75	63	0	0	
2332	06	3 PLAN.DETAIL E -REGISTRATION OF PRESENT SITUATION	8	5MAY75	14MAY75	8SEP75	17SEP75	90	0	0	
2372	06	4 MAT.ADM.SYST. -REGISTRATION OF PRESENT SITUATION	8	5MAY75	14MAY75	25AUG75	3SEP75	80	0	0	
2392	06	5 COST CONTR S. -REGISTRATION OF PRESENT SITUATION	5	5MAY75	9MAY75	31JUL75	6AUG75	63	0	0	
2393	06	5 COST CONTR S. -ANALYSIS	25	9MAY75	12JUN75	6AUG75	9SEP75	63	0	[illegible]	
2333	06	3 PLAN.DETAIL E -ANALYSIS	16	13MAY75	3JUN75	16SEP75	7OCT75	90	0	75	
2373	06	4 MAT.ADM.SYST. -ANALYSIS	26	13MAY75	17JUN75	2SEP75	7OCT75	80	0	59	
2394	06	5 COST CONTR S. -PROPOSALS	14	23JUL75	11AUG75	2SEP75	19SEP75	29	0	0	
2395	06	5 COST CONTR S. -IMPLEMENTATION	6	12AUG75	19AUG75	17NOV75	24NOV75	69	0	[illegible]	
2374	06	4 MAT.ADM.SYST. -PROPOSALS	30	29AUG75	9OCT75	30SEP75	10NOV75	22	0	0	
2334	06	3 PLAN DETAIL E -PROPOSALS	25	11SEP75	15OCT75	2OCT75	5NOV75	15	0	0	
2375	06	4 MAT.ADM.SYST. -IMPLEMENTATION	10	10OCT75	23OCT75	11NOV75	24NOV75	22	0	22	
2335	06	3 PLAN.DETAIL E -IMPLEMENTATION	13	16OCT75	3NOV75	6NOV75	24NOV75	15	0	15	

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THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1MAY75
PLANNED FINISH:
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ACTIVITY IDENTIFICATION				ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
2361	07	6	PERSONNEL	-INFORMATION	3	1MAY75	5MAY75	19AUG75	21AUG75	78	0	0	
2362	07	5	PERSONNEL	-REGISTRATION OF PRESENT SITUATION	13	6MAY75	22MAY75	22AUG75	9SEP75	78	0	0	
2363	07	6	PERSONNEL	-ANALYSIS	29	30MAY75	27JUN75	5SEP75	15OCT75	75	0	27	
2364	07	5	PERSONNEL	-PROPOSALS	25	28JUL75	29AUG75	7OCT75	10NOV75	51	0	0	
2365	07	5	PERSONNEL	-IMPLEMENTATION	10	1SEP75	12SEP75	11NOV75	24NOV75	51	0	51	

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PROJECT NO. 1
MANAGED MAINTENANCE SYSTEM
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1MAY75
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ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
2461	09	4 SYSTEM ANAL.	-INFORMATION	2	1MAY75	2MAY75	16JUL75	17JUL75	54	0	0	
2462	09	4 SYSTEM ANAL.	-REGISTRATION OF PRESENT SITUATION	23	5MAY75	6JUN75	18JUL75	19AUG75	54	0	0	
2463	09	4 SYSTEM ANAL.	-ANALYSIS	40	20MAY75	22JUL75	12AUG75	6OCT75	54	0	0	
2464	09	4 SYSTEM ANAL.	-PROPOSALS	30	9JUL75	19AUG75	23SEP75	3NOV75	54	0	0	
2465	09	4 SYSTEM ANAL.	-IMPLEMENTATION	15	20AUG75	9SEP75	4NOV75	26NOV75	54	0	54	

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PROJECT NO. 1
MANAGED MAINTENANCE SYSTEM
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ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
2281	10	5 CODING SYST.	-INFORMATION	2	1MAY75	2MAY75	6AUG75	7AUG75	69	0	0	
2282	10	5 CODING SYST.	-REGISTRATION OF PRESENT SITUATION	13	5MAY75	21MAY75	8AUG75	26AUG75	69	0	0	
2283	10	5 CODING SYST.	-ANALYSIS	28	19MAY75	25JUN75	22AUG75	30SEP75	69	0	69	
2284	10	5 CODING SYST.	-PROPOSALS	33	22SEP75	5NOV75			0	0	0	
2285	10	5 CODING SYST.	-IMPLEMENTATION	13	6NOV75	24NOV75			0	0	0	

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PROJECT START: 1MAY75
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ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
2211	13	2	ORGANIZATION -INFORMATION	1	1MAY75	1MAY75	19SEP75	19SEP75	101	0	0	
2212	13	2	ORGANIZATION -REGISTRATION OF PRESENT SITUATION	8	2MAY75	13MAY75	22SEP75	10CT75	101	0	0	
2213	13	2	ORGANIZATION -ANALYSIS	23	12MAY75	11JUN75	30SEP75	30OCT75	101	0	22	
2214	13	2	ORGANIZATION -PROPOSALS	15	4JUL75	24JUL75	23OCT75	12NOV75	79	0	0	
2215	13	2	ORGANIZATION -IMPLEMENTATION	8	25JUL75	5AUG75	13NOV75	24NOV75	79	0	79	

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PROJECT NO. 1
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ACTIVITY IDENTIFICATION		ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
2251	14	4 WORK ORDER S. -INFORMATION	2	1MAY75	2MAY75	1AUG75	4AUG75	66	0	0	
2252	14	4 WORK ORDER S. -REGISTRATION OF PRESENT SITUATION	12	5MAY75	20MAY75	5AUG75	20AUG75	66	0	0	
2253	14	4 WORK ORDER S. -ANALYSIS	28	10MAY75	24JUN75	10AUG75	24SEP75	66	0	49	
2254	14	4 WORK ORDER S. -PROPOSALS	30	20AUG75	2OCT75	10SEP75	27OCT75	17	0	0	
2255	14	4 WORK ORDER S. -IMPLEMENTATION	20	3OCT75	30OCT75	28OCT75	24NOV75	17	0	17	

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ACTIVITY IDENTIFICATION				ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	DATE
2991	15	2	[illegible]ORGANIZATION	-INFORMATION	3	1NOV75	5NOV75	20AUG75	15SEP75	95			
2992	15	2	[illegible]ORGANIZATION	-REGISTRATION OF PRESENT SITUATION	6	6NOV75	13NOV75	28SEP75	8SEP75	95			
2993	15	2	[illegible]ORGANIZATION	-ANALYSIS	23	13NOV75	12JAN75	8SEP75	8OCT75	95			
2994	15	2	[illegible]ORGANIZATION	-PROPOSALS	24	4JUL75	18AUG75	20OCT75	10NOV75	64			
2995	15	2	[illegible]ORGANIZATION	-IMPLEMENTATION	10	19AUG75	26AUG75	19NOV75	26NOV75	64			

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ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
351	15	3	PLAN.DETAIL --INFORMATION	2	1MAY75	2MAY75	27AUG75	28AUG75	84	0	0	
361	16	5	PLANT LAYOUT --INFORMATION	1	1MAY75	1MAY75	1SEP75	1SEP75	87	0	0	
351	16	6	TECHN.DATA --INFORMATION	6	1MAY75	6MAY75	26AUG75	29AUG75	83	0	0	
362	15	4	PLANT LAYOUT --REGISTRATION OF PRESENT SITUATION	5	2MAY75	6MAY75	2SEP75	9SEP75	87	0	0	
352	15	3	PLAN DETAIL --REGISTRATION OF PRESENT SITUATION	8	5MAY75	14MAY75	28AUG75	9SEP75	84	0	0	
352	15	6	TECHN.DATA --REGISTRATION OF PRESENT SITUATION	13	7MAY75	23MAY75	1SEP75	17SEP75	83	0	0	
363	16	6	PLANT LAYOUT --ANALYSIS	19	9MAY75	6JUN75	9SEP75	3OCT75	97	0	0	
353	16	3	PLAN.DETAIL --ANALYSIS	20	19MAY75	9JUN75	8SEP75	3OCT75	84	0	72	
353	15	4	TECHN.DATA --ANALYSIS	25	21MAY75	26JUN75	15SEP75	17OCT75	83	0	0	
364	16	5	PLANT LAYOUT --PROPOSALS	24	29MAY75	7JUL75	29SEP75	5NOV75	87	0	0	
354	16	6	TECHN.DATA --PROPOSALS	22	17JUN75	16JUL75	10OCT75	10NOV75	83	0	0	
365	16	4	PLANT LAYOUT --IMPLEMENTATION	13	9JUL75	26JUL75	8NOV75	26NOV75	87	0	87	
355	16	6	TECHN.DATA --IMPLEMENTATION	10	17JUL75	30JUL75	11NOV75	24NOV75	83	0	83	
354	16	3	PLAN.DETAIL --PROPOSALS	33	11SEP75	27OCT75	29SEP75	12NOV75	12	0	0	
355	16	3	PLAN DETAIL --IMPLEMENTATION	9	20OCT75	6NOV75	13NOV75	26NOV75	12	0	12	

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COMPUTED FINISH: 24NOV75

TIME UNIT: DAY

ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	IP DATE
2647	17	5	MAT.ADM.SYST. -INFORMATION	1	1MAY75	1MAY75	25AUG75	25AUG75	82	0	0	
2651	17	5	COST CONTR.S. -INFORMATION	1	1MAY75	1MAY75	16JUN75	16JUN75	32	0	0	
2662	17	5	MAT.ADM.SYST. -REGISTRATION OF PRESENT SITUATION	5	2MAY75	6MAY75	26AUG75	1SEP75	82	0	0	
2652	17	5	COST CONTR.S. -REGISTRATION OF PRESENT SITUATION	6	2MAY75	9MAY75	17JUN75	24JUN75	32	0	0	
2663	17	5	MAT.ADM.SYST. -ANALYSIS	9	8MAY75	19MAY75	1SEP75	10SEP75	82	0	63	
2653	17	5	COST CONTR.S. -ANALYSIS	10	9MAY75	22MAY75	24JUN75	7JUL75	32	0	32	
2654	17	5	COST CONTR.S. -PROPOSALS	13	4JUL75	22JUL75			0	0	0	
2655	17	5	COST CONTR.S. -IMPLEMENTATION	10	23JUL75	5AUG75	11NOV75	24NOV75	76	0	79	
2664	17	5	MAT.ADM.SYST. -PROPOSALS	15	8AUG75	26AUG75	9SEP75	29SEP75	22	0	0	
2665	17	5	MAT.ADM.SYST. -IMPLEMENTATION	13	29AUG75	16SEP75	9NOV75	24NOV75	49	0	49	

*** TIME LISTING ***

OPTIMA
NORWEGIAN
COMPUTING CENTER
[illegible] JUN 75

PROJECT NO. 9
MANAGEMENT MAINTENANCE SYSTEM
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1MAY75
PLANNED FINISH:
COMPUTED FINISH: 24NOV75
TIME UNIT: DAY

ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	DATE
2341	15	4	PLANT LAYOUT I-INFORMATION	1	1MAY75	1MAY75	11JUL75	11JUL75	51	0	0	
2351	18	5	TECHN.DATA I-INFORMATION	1	1MAY75	5MAY75	29SEP75	29SEP75	105	0	0	
2342	18	5	PLANT LAYOUT R-REGISTRATION OF PRESENT SITUATION	6	2MAY75	9MAY75	14JUL75	21JUL75	51	0	0	
2352	19	4	TECHN.DATA R-REGISTRATION OF PRESENT SITUATION	6	6MAY75	13MAY75	30SEP75	8OCT75	105	0	0	
2343	19	5	PLANT LAYOUT E-ANALYSIS	25	9MAY75	12JUN75	21JUL75	22AUG75	51	0	0	
2353	19	6	TECHN.DATA E-ANALYSIS	19	14MAY75	6JUN75	8OCT75	31OCT75	105	0	0	
2354	19	7	TECHN.DATA F-PROPOSALS	15	3JUN75	23JUN75	20OCT75	17NOV75	105	0	0	
2344	16	4	PLANT LAYOUT F-PROPOSALS	37	5JUN75	25JUL75	15AUG75	4OCT75	51	0	0	
2355	16	5	TECHN.DATA G-IMPLEMENTATION	5	24JUN75	30JUN75	19NOV75	24NOV75	135	0	105	
2345	19	5	PLANT LAYOUT G-IMPLEMENTATION	14	29JUL75	19AUG75	3NOV75	24NOV75	76	0	7	

[illegible]
[illegible]
COMPUTING CENTER
06 JUN 75

*** T I M E L I S T I N G ***

PROJECT NO. 1
[illegible] SYSTEM
THE ACTIVITIES ARE SORTED ACCORDING TO TOTAL (PRIMARY) FLOAT

PROJECT START: [illegible]
PLANNED FINISH:
COMPUTED FINISH: [illegible]
TIME UNIT: DAY

ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
2611	31	2	ORGANIZATION -INFORMATION	2	[illegible]	[illegible]			0	0		
2612	31	2	ORGANIZATION -[illegible] OF PRESENT SITUATION	13	[illegible]	[illegible]			0	0	0	
2613	31	2	ORGANIZATION -ANALYSIS	29	[illegible]	[illegible]			0	0		
2614	31	2	ORGANIZATION -PROPOSALS	13	[illegible]	[illegible]			0	0	0	
2656	17	5	COST CONTROL S. -PROPOSALS	13	[illegible]	[illegible]			0	0	0	
2296	14	5	COST CONTROL S. -PROPOSALS	43	[illegible]	[illegible]			0	0	0	
2296	13	5	CODING SYST. -PROPOSALS	39	[illegible]	[illegible]			0	0	0	
2295	10	5	CODING SYST. -IMPLEMENTATION	13	[illegible]	[illegible]			0	0	0	
2656	92	5	CENTRAL PLAN. -PROPOSALS	25	[illegible]	[illegible]	[illegible]	[illegible]	7	0		
2526	85	5	[illegible] -PROPOSALS	26	[illegible]	[illegible]	[illegible]	[illegible]	7	0	0	

AN EXAMPLE OF A SUB-PROJECT DESCRIPTION.

2.3.4/2 PLAN LAYOUT (MACHINE SHOP)

I. OBJECTIVE

The aim of this project is to analyse the present layout - including material flow, local stores, transportation system and equipment - in order to develop optimal conditions for production.

II. ACTIVITIES

1. Information

It is to be ensured that all the necessary information on the project will be provided to all those who are concerned with the project.

2. Inventory of present situation

The following are to be recorded:

2.1 Present layout.

2.2 P-Q diagrams.

2.3 Material flow diagrams for typical products.

2.4 Material input and output, quantity of local stores' stock.

2.5 Transportation equipment, transport routes.

2.6 The weak and strong points, their causes, controllable and uncontrollable factors.

2.7 Opinions and proposals from workers and leaders.

3. Analyses

3.1 Analysis of present layout.

3.2 Analysis of P-Q diagrams.

3.3 Analysis of material flow diagrams for typical products.

3.4 Analysis of material input and output, quantity of local store's stock.

3.5 Analysis of transportation equipment, transport routes.

3.6 Analysis of the weak and strong points, their causes, the controllable and uncontrollable factors.

3.7 Analysis of the opinions and proposals from workers and leaders.

4. Proposals

On the basis of the above analyses, a series of several preliminary proposals will be elaborated. These have to be simulated and analysed. Factors needing special attention are the following:

4.1 Logical layout of machinery.

4.2 Short transport routes.

4.3 Standard transport units.

4.4 Means of transportation which does not disturb work on machines.

4.5 Easy and reliable way of transport ordering.

4.6 Local stores kept in good order.

4.7 Good physical conditions for workers.

4.8 Easy communication between workers and leaders.

The workshop manager should be consulted frequently during elaboration of proposals. If poor machinery will reduce the possibility of developing an efficient workshop, this information should be given to the responsible individual of project 2.3.5. The proposals elaborated have to meet the requirements stated in "IV. Results".

5. Implementation

The total plan for implementation of the proposals is to be elaborated in two steps:

a. A preliminary plan depending on which proposals are accepted.

b. Elaboration of final plans. They should include the following:

- economic calculations,
- time scheduling,
- resource requirements,
- results expected,
- conditions of implementation,
- distribution of responsibilities.

III. INFORMATION SOURCES

- IMO consultants
- Project 2.3, 2.3.1, 2.3.2, 2.3.5, 2.3.7.
- Workshop plan elaborated in hand.
- Records (cards) in the workshop.
- Discussions.
- Project-leader.

IV. RESULTS

- Layout in scale of 1:50 for the workshop.
- Elaboration of a permanent transport system, involving:

  Kind of goods,
  Kind of transport facilities,
  Items (units),
  Frequency.

- Administration of transport orders,
- Detailed description of new machines proposed,
- Economic calculation of modifications.

V. TIME CONSUMPTION

IMO: 10 hours.
BV: 504 hours.

VI. RESPONSIBLE:

Markivics József

2. SUMMARY

2. SUMMARY OF THE PROPOSALS

The managed maintenance system of Danube Iron and Steel Works is completed according to the contract between UNIDO and Norconsult/IKO. The terms of references for the project are accordingly respected.

Close cooperation between the counterpart and the consultants resulted in a complete system for managed maintenance consisting of:

a. A proposal for future organisation of the maintenance function and its relation to the other parts of the company. The proposed concept includes a centralization of the maintenance function, a clear separation of responsibilities between production and maintenance, and a division of the maintenance function into logical units according to functions.

b. A system for central planning of all maintenance activities. The proposed system consists of a yearly plan coordinating all maintenance activities by means of a network planning technique.

c. A system for planning of maintenance work to be carried out within each production unit. The proposal consists of a system for planning of projects and repair jobs based on a work order approach.

d. A system for planning of work, production of spare parts, etc. in the central work shops. The proposed system consists of a general production planning system well-suited to the actual production of spare parts.

e. A system for preventive maintenance. The proposed system includes a registration and information system, as well as necessary routines and instructions.

f. A system for administration of spare parts and material. The proposed system consists of a centralized and coordinated material administration based on central files, uniform routines and a simplified decision-making procedure.

g. A cost control system covering all maintenance activities. The proposed system is based on the proposed organizational concept and distributes responsibilities, reporting and control accordingly. Its main objective is to improve cost consciousness throughout the organization.

h. Coding system for:

   Machine numbers
   Account numbers
   Drawing numbers
   Spare parts numbers
   Materials numbers

The proposed systems are elaborated as modular systems covering the whole enterprise.

i. Proposals for contents of all necessary data bases and files.

k. Description of EDP-files, input and output request necessary for a later conversion to EDP.

l. Recommendation of a method for determining size of stocks and spare parts (see article 10).

m. Recommendation of a method for project planning by use of EDP-network (see article 10).

n. Recommendation of a method for revaluation of plant-lay-out(see article 10).

o. Recommendation of a method for modern information files, copying equipment, etc. (see article 10).

r. A complete education program in maintenance management for both production and maintenance managers. This system is described in a report delivered for UNIDO in July 1975 under the contract 75/2 - 13 (MUM/72/804).

The managed maintenance system is worked out as a manual system, which can be brought rapidly into action, but a later conversion to EDP has been taken into consideration.

3. GENERAL REMARKS

3. GENERAL REMARKS

In order to give a better understanding of the proposals in this report, we shall in this chapter describe our impressions of the present situation at the Danube Iron and Steel Works. We shall comment on such matters which during our work have been studied in connection with the system development studies. We do not intend to give a status analysis, as this is not our task and as a part of the information we have received has not been double-checked. However, we do have sufficient documentation to state the following:

There are many positive factors in the company's present situation. The technological achievements and past expansion of production show the high quality of workers and management. The continous improvement of the plant demonstrates the high technical quality of the technical staff.

The programs for further technological development and expansion of production will ensure even greater improvements in the future. The opportunities for obtaining them at reasonable cost depend mostly on how well the company solves its management problems and in which way Hungarian industry is developed.

Compared with similar plants in Western Europe, we must state that plant conditions are considerably lower and maintenance costs considerably higher than normal. The reasons for this are in our opinion:

- Production has expanded to a level much higher (+ 25% to + 75%) than foreseen when the plant was originally projected. This results in an overload on several points throughout the production line.

  As an example, the hot rolling mill during the first eight months of this year has had 28 breakdowns caused by broken rolls. This is a very high figure and indicates extremely poor quality of the rolls, and/or considerable overload, and/or poor instruction of the operators.

- The description of the present organization is old and outdated. Job descriptions and descriptions of functions are not coordinated and do not correspond to reality. The quality of the system descriptions varies greatly, and as they are made up individually, they are not well integrated as a whole.

  For example, it has been necessary to make new descriptions of all existing systems which we wanted to study. We have never seen an "in-use" description of a system.

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E

- The function of the organization for the total company is very unclear. There is a lot of overlapping between production and maintenance. Responsibilities are often impossible to place in one organizational unit. The same situation exists within the maintenance function.

  For example decisions about a major repair involve some 20 different persons and nobody has the final responsibility.

- The organization is established in such a way as to give priority to production; maintenance possibilities to influence decisions about repairtime and conditions in the plant. This is also significant in planning maintenance work and in keeping the maintenance staff efficient.

  For example, in January of this year a large repair dema[illegible] approximately 860 maintenance workers in the hot st[illegible]ill was decided and planned, in cooperation between production and maintenance staff. The workers were taken away from the normal shift and made ready to start at a certain time. The work to be performed was prepared. Then production called off the repair because the production plan had not been fulfilled.

- The amount of instruction, education, and motivation of the production workers is not sufficient. User's manuals exist for the equipment, but are not sufficiently developed. The maintenance people are instructing the production workers in proper operation even though this is the responsibility of the production foremen.

  For example blocks coming down the roll table in the hot steel mill are often not properly planned and have large burrs on them. The operator should refuse such blocks, as they harm the equipment and cause down-time and unnecessary maintenance costs.

- The demand for service from the central maintenance shops is unrealistic. The total yearly demand for spare parts amounts to approximately 250 mill. Forints; approximately 40% of this is imported, approximately 30% is bought in Hungary, and approximately 30% is produced by the counterpart.

  Any item used at the plant in principle can be ordered from the central workshops, as:

  - The delivery time for imported spare parts ranges between one and two years

  - The capacity of the Hungarian machine industry often is limited so that delivery is impossible.

- The Hungarian machine industry is not sufficiently equipped for manufacturing many of the spare parts needed by the counterpart.

- The spare parts administration is weak. This causes major difficulties, in some cases insufficient quality, and often very high costs.

As an example, rolls for the sheet straightener are to be hardened before use. This, usually is done by heating the rolls in an induction furnace, but this size furnace does not exist in Hungary. The counterpart demands such rolls. The Central Maintenance Workshop performs the hardening by heating the rolls one by one in a pit furnace. The temperature range cannot be properly controlled and the results are not good. The rolls will have a shorter life and be more expensive.

- The central maintenance shops are not efficient. They get their orders from a number of sources (about thirty) and each ordering unit can demand delivery time by giving priority. The orders often are not suitable for the existing equipment and require expensive modifications. The documentation, in general, is poor.

Drawings are not divided for each operation, and a lot of corrections are made with different coloured pencils on the blueprints. The workshops in general are not suited for efficient production, the machinery and equipment are not sufficient for production of spare parts in the wide range of technology that is needed by the counterpart, heating systems are insufficient in some factories, transport means are poor. The tools are not organized properly and their quality varies considerably.

- The administration of spare parts and materials is today decentralized, labors under very difficult conditions, and is not efficient.

Often it is impossible to get a realistic delivery time when ordering a spare part. In our samples we found deviations in delivery time from one month to one year for spare parts purchased from outside. Also, we found that some orders given to the central workshops are years old and not filled.

At present the total value of spare parts in the company amounts to approximately 400 mill. Forints. Approximately 70% of this is produced outside the company and requires delivery times from a few months to two years. Taking this into consideration, the rate of turnover for spare parts is not bad, and the total amount of spare parts in stock probably too small. This view is underscored by the fact that approximately 15% of the present spare parts have had no turnover since 1972.

- The technical staff for maintenance is too small. All technicians we talked to mentioned an overload of work. The missing documentation and the inefficient planning activities prove this.

  For example, when this UNIDO project was started, 18 technicians from the counterpart were allocated for the different sub-projects and were told by the top management to concentrate on this job. However, their normal functions were not taken over by others, because there is no spare capacity. Therefore, none of these people has been fulltime on the project and the systems developed are not as integrated as intended.

- The use of modern management tools has been started by the company, but the progress is insufficient. Three years ago the network-planning technique was introduced. Still today it is used only as a description of the logical structure in a job and not for planning control.

  The use of EDP is very low. There is sufficient computer capacity with some 40 persons working in this function.

  However, for the maintenance and materials administration no input or output proposals have been presented, and the coding systems used today are unsuitable for EDP. No plans exist for the introduction of EDP in the maintenance function, and no calculations have been made concerning the efforts required.

The present situation, partially described above, forms part of the background for our proposals concerning a new organization and a new management system for the maintenance function of the Danube Iron and Steel Works.

We are convinced that the introduction of this system will give the company major advantages. Improvements can be made in capabilities of the plant, in the quality of production, and in the volume of production, specific maintenance costs can be decreased.

However, we must stress that this is a major task for the organisation of the company and must be realised as such if remarkable results shall be obtained. The system development phase of this project has been injuriously affected by lack of capacity from the counterparts organisation. In order to get a successful implementation of the proposed systems it will be necessary to allocate qualified fulltime personnel to the project for a number of years.

Besides and above this are three important conditions:

- the top-management of the Danube Iron and Steel Works must consider the implementation of these systems as a responsibility demanding priority.

- the need for maintenance and the potential of the maintenance organisation to meet this must be realisticly analysed, and changes in capacity must be carried out accordingly.

- the advanced training of managers in modern management techniques must be accelerated at all levels.

The duration of a complete implementation is preliminary estimated to approximately 4 years. This estimation is based on the above mentioned conditions and some consultants participation.

4. ORGANISATION

ATTACHMENT 4.1	Organisation scheme Danube Iron & Steel Works
ATTACHMENT 4.2	Organisation scheme Maintenance Head Department
ATTACHMENT 4.3	Organisation scheme Rolling Mills - Maintenance Unit

4. ORGANIZATION

The present organization of the maintenance function at the Danube Iron and Steel Works is unclear and complicated.

The maintenance can be seen as consisting of 4 different units:

a. The central maintenance office which is partly without line responsibility for maintenance. However, the most efficient chief engineer advises on important maintenance decisions and holds a great deal of informal authority.

b. One part of the workshops produces spare parts and machinery. These shops, alternatively, could be located outside and independently of the company. They are a foundry, a steel casting factory, a mechanical workshop, a forging shop, etc.

c. One part of the workshops carries out maintenance work in close connection with production units (Steel Mill, etc.). Such shops are an erection shop, a wagon repair shop, etc.

Both above mentioned groups of workshops, b and c, report to the same manager and form one of eight economically independent units of the Danube Iron and Steel Works.

This unit reports to the chief engineer of maintenance. Other units (7) report to the technical director.

d. Within each production department (hot steel mill, etc.), there is a maintenance unit, responding directly to the department manager, responsible for carrying out the maintenance operation within the department, as well as pre-planning such preventive maintenance as is carried out.

This type of organizational structure is unusual in the steel industry, and while it was efficient during the very rapid establishment and expansion of the plant, it is so no longer.

The main weaknesses of the present organizational structure are:

e. The decentralized organization has caused a non-integrated development of the maintenance management systems.

f. The present administrative routines are complicated and cause both slow decision procedures and high administrative costs.

g. Since the administrative systems are complicated, demand for quick action often causes the systems to fail.

h. Central information files are difficult to maintain and do not function.

i. General conditions in the plant are totally controlled by the production managers who by nature are more qualified for production than for maintenance. Consequently, conditions are unsatisfactory.

k. The materials administration follows the decentralized organization, and therefore the possibilities for standardization and analyses of buy/make nature are difficult and do not work well. The overall control of amounts of spare parts and materials in stock is poor.

Therefore we recommend reorganizing the maintenance function of Danube Iron and Steel Works.

In appendix 4.1, 4.2 and 4.3, examples of the logical structure which is recommended are shown. The main objective of this proposal is to establish an integrated maintenance management organization. All maintenance decisions are to be controlled by a director of maintenance who answers to the technical director.

The director of maintenance is responsible for all maintenance costs and for the efficiency of the maintenance. He will divide the organization below him according to this responsibility. His first-line subordinates will be:

l. Chief of production units maintenance workshops.

m. Chief of central maintenance workshops.

n. Chief of maintenance production workshops.

o. Chief of materials administration.

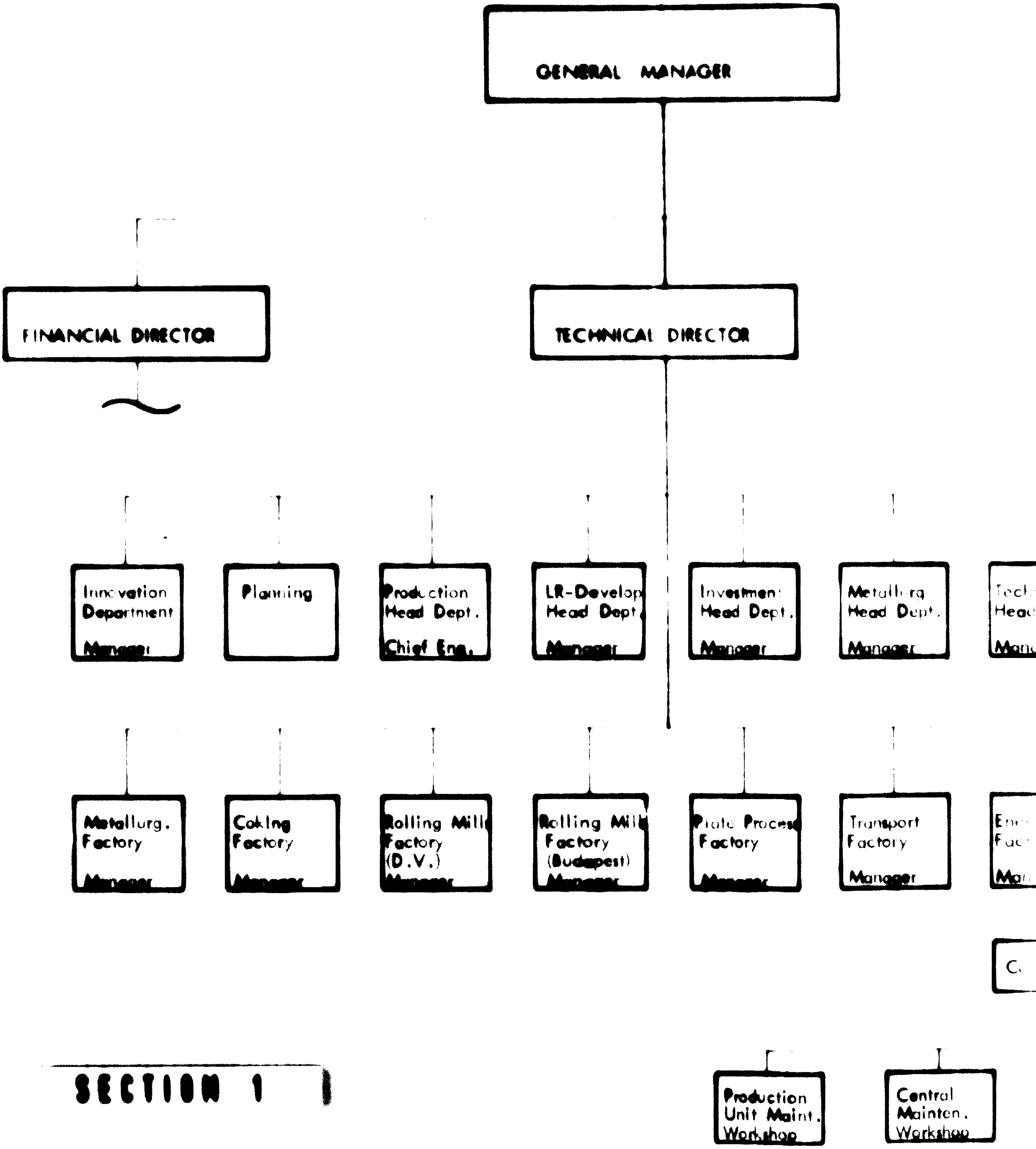
p. Chief of maintenance engineering department.

To assist the director of maintenance in making plans, comments on reports, analyses, and such continuous development of systems which might be necessary, he will have two central staffs with the following functions:

q. Central planning function.

r. Cost control function.

The function of this organisation will be more clearly understood by studying the function of the different management systems presented later in this report.

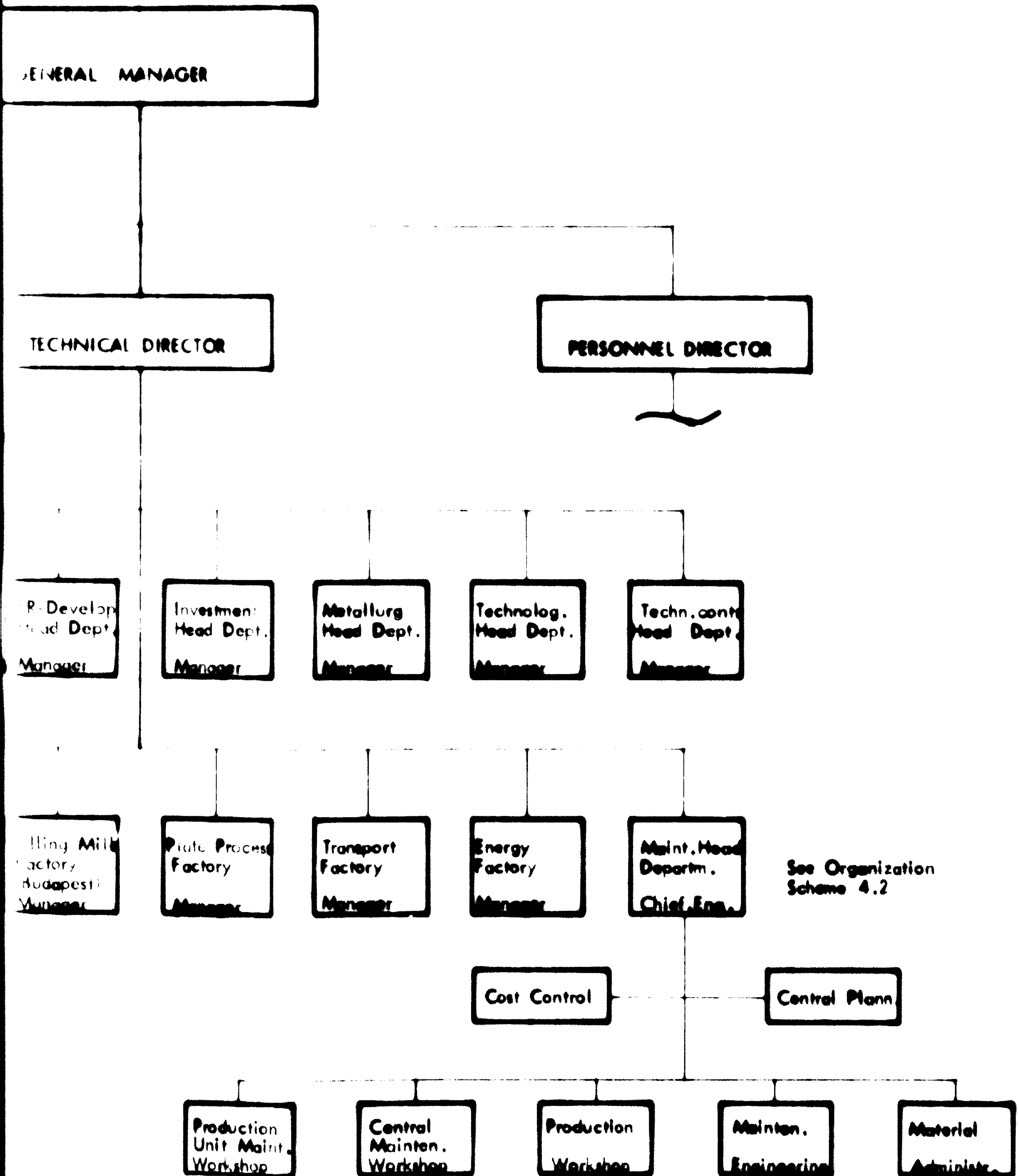


GENERAL MANAGER
FINANCIAL DIRECTOR
TECHNICAL DIRECTOR
Innovation Department Manager
Planning
Production Head Dept. Chief Eng.
LR-Develop Head Dept. Manager
Investment Head Dept. Manager
Metallurg Head Dept. Manager
Metallurg. Factory Manager
Coking Factory Manager
Rolling Mill Factory (D.V.) Manager
Rolling Mill Factory (Budapest) Manager
Plate Process Factory Manager
Transport Factory Manager
Production Unit Maint. Workshop
Central Mainten. Workshop

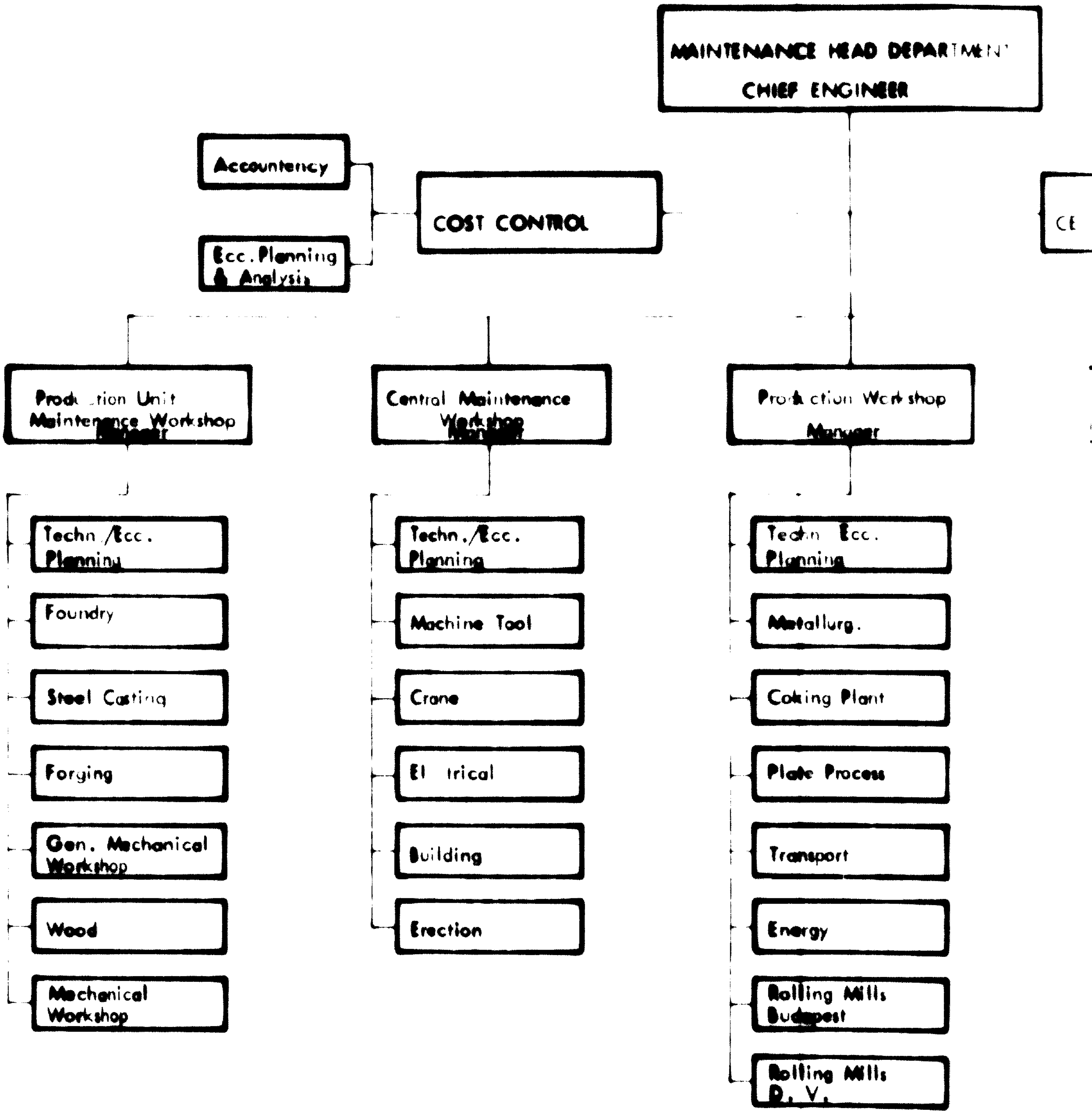
SECTION 1

ORGANIZATION SCHEME 4.1

DUNAI VASMŰ



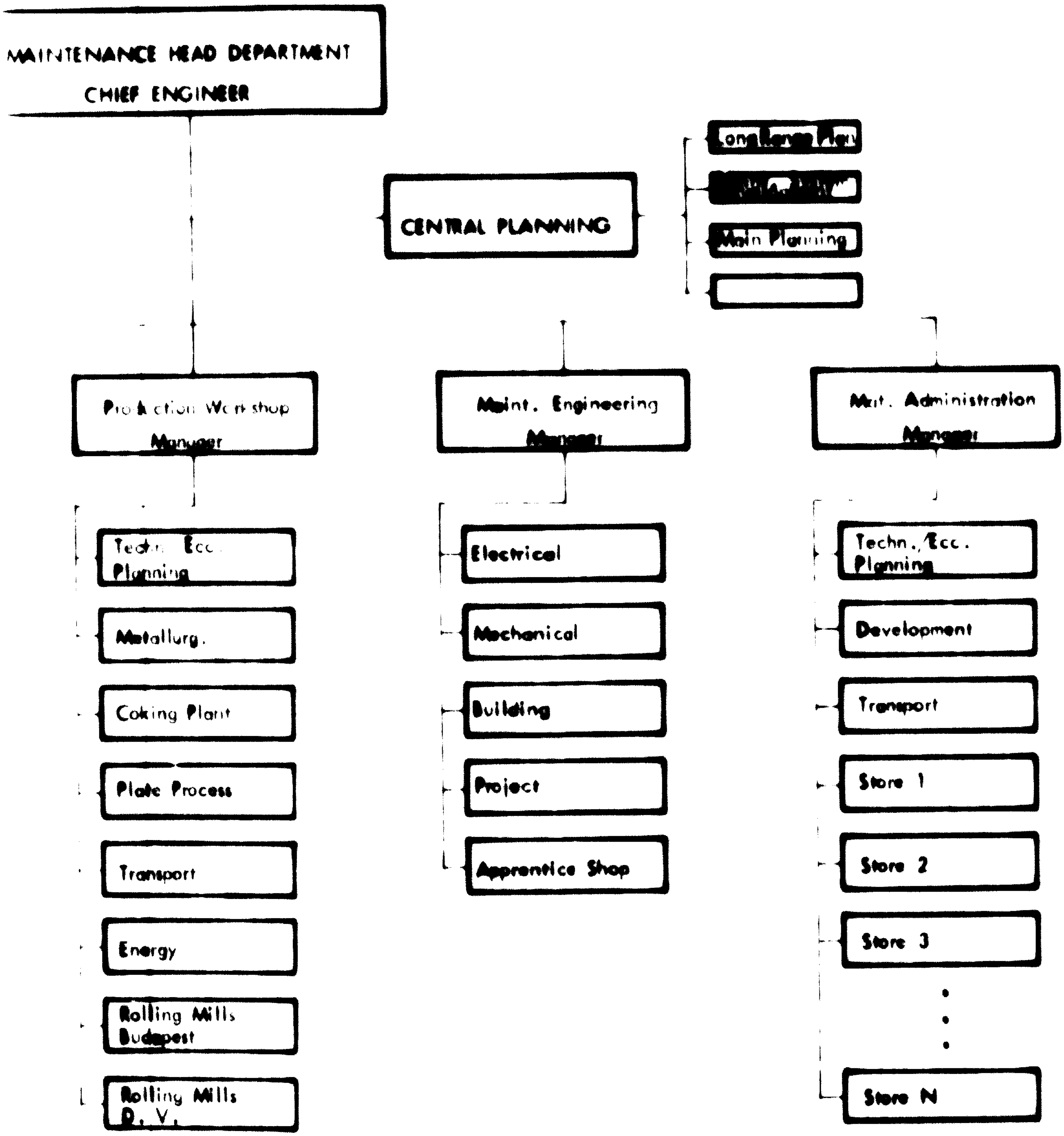
SECTION 2

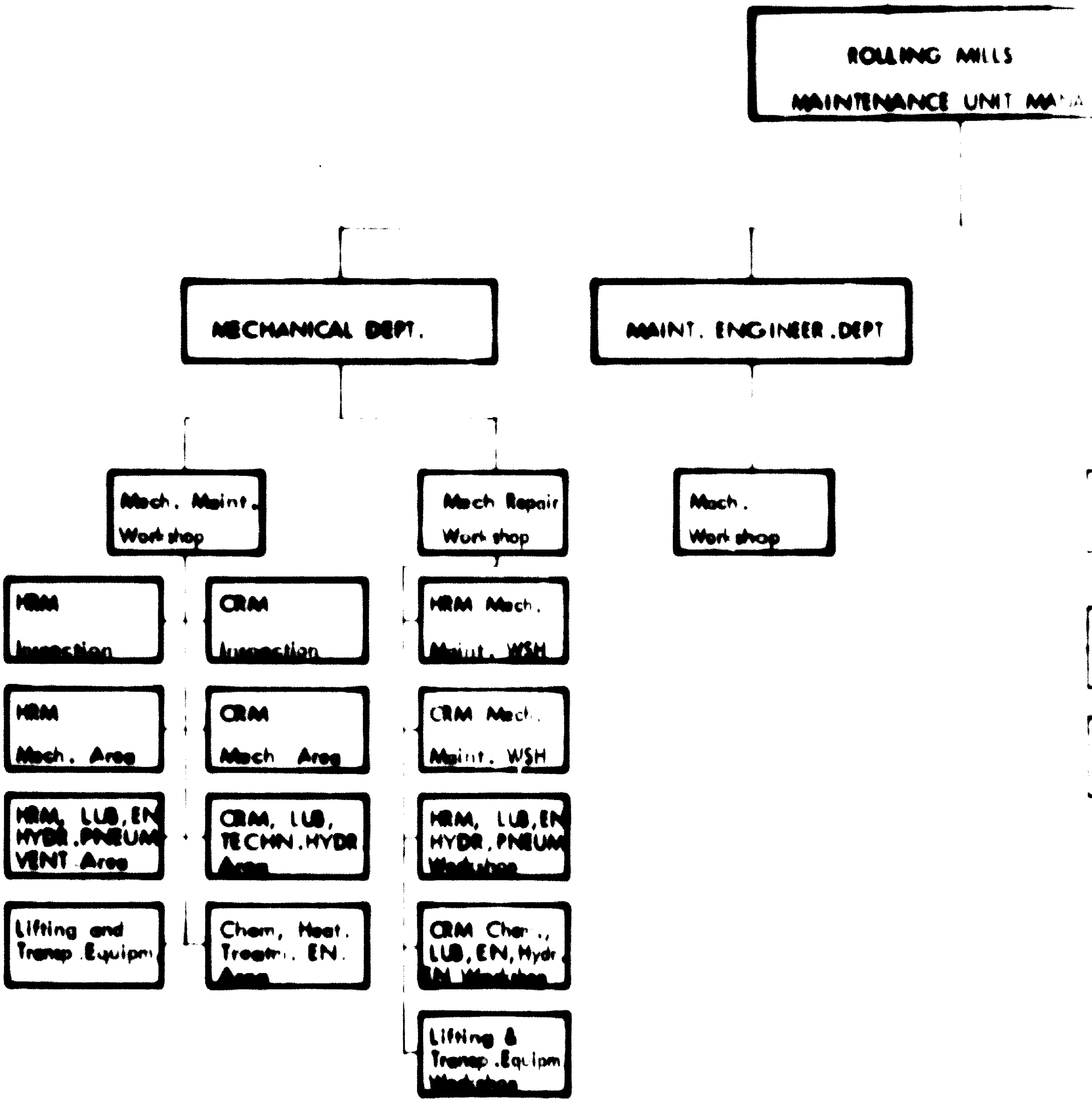

MAINTENANCE HEAD DEPARTMENT
CHIEF ENGINEER
Accountency
Ecc. Planning & Analysis
COST CONTROL
CE
Production Unit Maintenance Workshop
Central Maintenance Workshop
Production Workshop
Manager
Techn./Ecc. Planning
Foundry
Steel Casting
Forging
Gen. Mechanical Workshop
Wood
Mechanical Workshop
Techn./Ecc. Planning
Machine Tool
Crane
Electrical
Building
Erection
Techn. Ecc. Planning
Metallurg.
Coking Plant
Plate Process
Transport
Energy
Rolling Mills Budapest
Rolling Mills D. V.

SECTION 1

ORGANIZATION SCHEME 4.2

MAINTENANCE HEAD DEPARTMENT

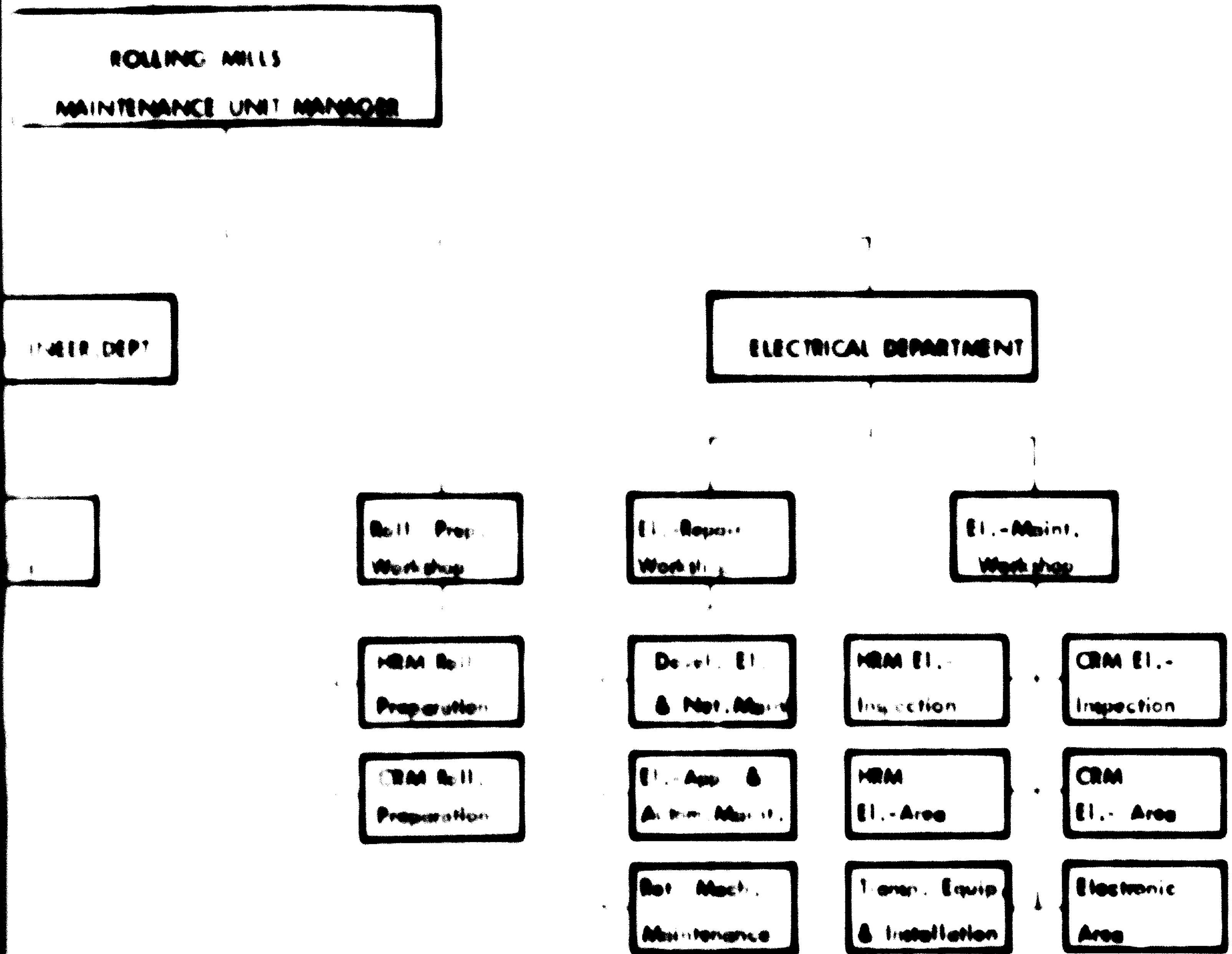



ROLLING MILLS
MAINTENANCE UNIT MA
MECHANICAL DEPT.
MAINT. ENGINEER. DEPT
Mech. Maint. Workshop
Mech Repair Workshop
Mech. Workshop
HRM Inspection
CRM Inspection
HRM Mech. Maint. WSH
HRM Mech. Area
CRM Mech Area
CRM Mech. Maint. WSH
HRM, LUB, EN HYDR. PNEUM VENT Area
CRM, LUB, TECHN. HYDR Area
HRM, LUB, EN HYDR, PNEUM Workshop
Lifting and Transp. Equipm
Chem, Heat. Treatm. EN. Area
CRM Chem., LUB, EN, Hydr EN Workshop
Lifting & Transp. Equipm Workshop

SECTION 1

ORGANIZATION SCHEME 4.3

ROLLING MILLS - MAINTENANCE UNIT

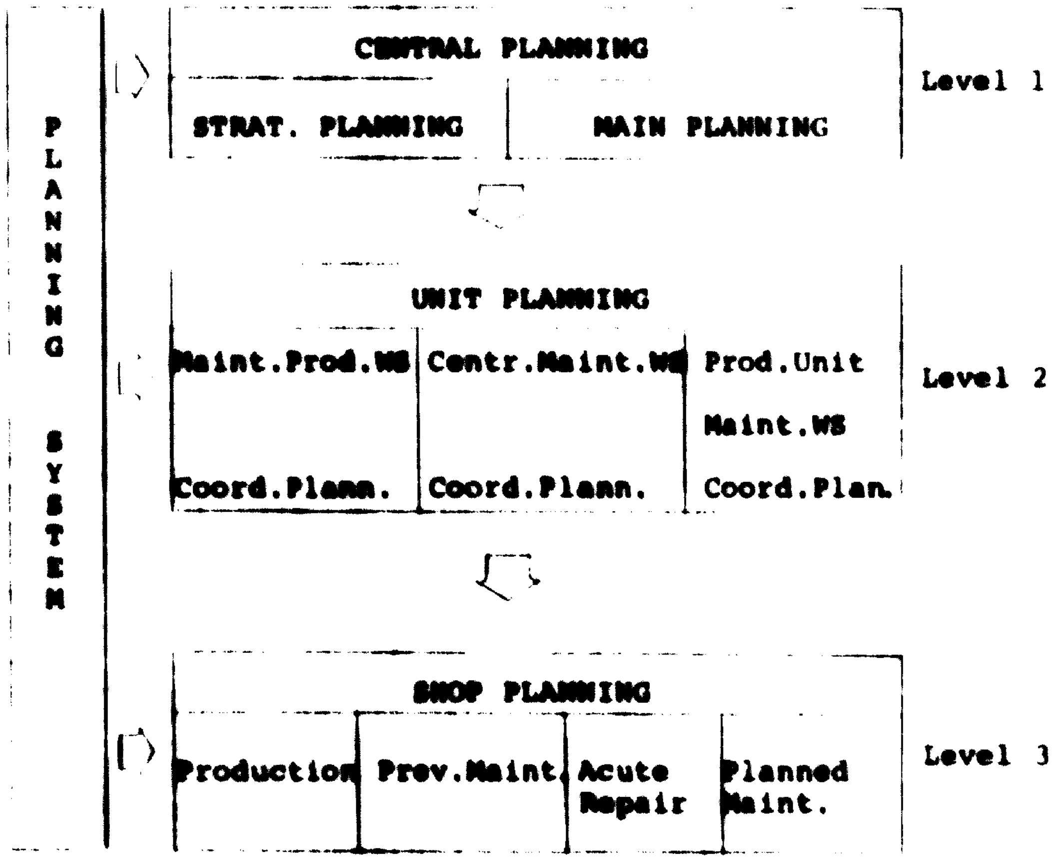


SECTION 2

5. PLANNING SYSTEM

5. PLANNING SYSTEM

The planning system as a part of the future "Managed Maintenance System" of the Danube Iron and Steel Works should be divided into three levels, corresponding to the proposed future maintenance organisation.



The basis of the planning system is the work order system and therefore we shall first present our proposal for this.

5.1 WORK ORDER SYSTEM

In order to manage and coordinate the maintenance activities it is necessary to have specific information available. The proposed work order system covers all maintenance jobs performed by

- maintenance staff
- production staff
- sub-contractors

and the system has the following tasks:

- to make clear specific wishes concerning the maintenance job in question.
- to pick up data for managing the maintenance and to form the basis of the planning and job preparation.

To understand the function of the work order system it is necessary to introduce the concepts of:

- P R I O R I T Y
- C A U S E   C O D E

5.1.1 Priority

To have a proper basis for planning the job sequence of the maintenance jobs it is necessary that jobs be assigned a priority according to their importance, i.e. all work orders for repair and maintenance jobs should have a priority code, and the priority should always be given by the work order originator.

Below a proposal for priority code and definition is given:

PRIORITY	DEFINITION
1	EMERGENCY: Maintenance requirements which have an immediate effect on production, utilities, and other services. In addition, this classification will also be used for maintenance requirements which have an immediate effect on safety. Immediate start of the requested work is mandatory.
2	URGENT: Maintenance requirements which do not have an immediate effect on production, utilities, or on the services including safety. However, if requested work is not started as soon as possible, it will become PRIORITY 1.

PRIORITY	DEFINITION
3	**NORMAL:** Maintenance requirements which do not have an immediate effect on production, utilities, or other services.
4	**ROUTINE:** This priority can be allocated only by the Maintenance Planning Department for maintenance requirements of routine nature. Included in this category are technical inspections and preventive maintenance which must be carried out according to schedule prepared by the Maintenance Function.
5	**CHANGES, ALTERATION AND OTHER NON-MAINTENANCE JOBS FOR PRODUCTION:** Includes all work orders which are not related to repair or maintenance work, i.e. changes and alterations, spare parts production and jobs normally performed by the production staff.

The following has to be taken into consideration:

- all work orders must be provided with a priority code,
- the definitions and use of respective priority codes must be carefully noted.
- priority must be assigned by the originator,
- priorities 1 and 2 must be used only in the case of absolute need. The jobs in priorities 1 and 2 cannot be pre-planned or prepared and they will, therefore, be much more expensive to perform than the jobs assigned priorities 3 - 5.

5.1.2 Cause Codes

The most efficient way to decrease

1) down-time of production and

2) at the same time, maintenance costs

is to decrease the wear and failures of production equipment.

To achieve this, the maintenance organization must take care of preventive maintenance and break-down cause analysis. It must be informed about the condition of the production equipment and know when special attention is required.

The cause codes provide an important part of this information:

CAUSE CODE	DEFINITION
1	Incorrect operation
2	Insufficient lubrication
3	Insufficient cleaning
4	Improper maintenance
5	Repair carried out too late
6	Materials failure
7	Construction failure
8	Normal wear

- All repair and maintenance jobs must be assigned a cause code after performance.

- The cause codes are given by the performing work group after the completion of the job.

- For "direct orders" (priorities 1 and 2) the work group reports the cause code to the originator, who records it on his Log Sheet.

- For jobs ordered on a work order form, the performing work group will write the cause code in the appropriate place on the sub-work order form.

5.1.3 Work Order Procedure

The work order originator must fill in all necessary information, such as account number, priority, project number, etc. on the different work order forms, as later described.

The source of work order origination should be clearly defined in order to measure and control the volume of maintenance. Work order originators must be established in compliance with the following principles:

- "Maintenance" issues work orders for major overhauls, large repairs, projects and the like. The work order must, however, be authorised by the cost center responsible.

- "Maintenance" issues work orders for all routine jobs, such as preventive maintenance, in cooperation with "Production".

- "Production departments" issue work orders for all remaining required maintenance work according to the rules.

The work order system consists of the following two main routines:

1. DIRECT ORDER(priorities 1 and 2)by means of Work Order List (Log Sheet) for issuing smaller work orders of high priority as described later on.

2. WRITTEN WORK ORDERS are to be used for all other maintenance requests, including all requests of priorities 3, 4 and 5,according to description later on. The originator forwards the original and two copies to Maintenance Planning and retains one copy for his own records.

Procedures for Processing Work Order Forms

The work order forms received by the planner will be processed prior to scheduling the requested work to the maintenance work groups. The planner determines the work sequence and, if necessary, the work groups required to complete the requested work in cooperation with the foremen. The planner estimates the time necessary for carrying out the work and prepares sub-work orders for each work group related to the work order.

Work Order List Procedure

General Rules

The WORK ORDER LISTS will be issued weekly by the maintenance planners to the authorized work order originators and may be used under the following conditions:

- the required maintenance work should be finished within the current week.

- the request must be of priority 1 or 2-type work.

- new week begins,for instance,every Sunday morning at 6 a.m.

- the used Work Order Lists (originals) will be fetched by the maintenance planners every Monday morning. After the planners have checked if any job has still not been noted as completed, and have assigned a cause code, they will go to data processing.

The copies of the used Work Order Lists will be kept by the originator for later comparison with reports.

Work Order List

The Work Order List is shown on the following page

1) The originator fills in:

- the origin number
- date of request
- description of requested work
- work group number
- account number (including priority code)

2) The originator orders the job by telephone and gives this information:

- his name and telephone number
- priority (1 or 2)
- job number
- a clear description of what he wants done.

3) When the job is completed the originator fills in:

- cause code (given by the work group)
- his signature.

WORK ORDER LIST

DUNAI VASMŰ

Ex 1: Originator Planning Data Processing

Department Ordering Work:	Control Planning						Week No.
	Date:	Name:					

Originat No.	Date of request	Description of requested work	Work group	Account No.	Cause code	Job No.	Project No.	Completed, Sign.
						422881		
						422882		
					3	422883		
						422884		

Work gr. Supervisor Originator **SHOP TICKET**

Person Ordering Work	Tel.	Date	O'clock	Priority	Job No.
Description of work					Time consumption
To be filled in after work done					
Date	O'clock	Cause 3	Work, done, name		

The Work Order Form

The Work Order Form is used for issuing larger work orders and work orders of low priority as described earlier.

DUNAI VASMŰ		WORK ORDER		JOB NO. 15306	
To Planning dep.....		Required by (date)	Ord.Work dept.	Name:	Attest sign.:
Account No	Proj. No.	Acces date	Desired completion date	Estimated costs wanted	
Goods delivered at:	Responsible goods receiver:		Person to contact in Ordering dept.:		Tel.:

Description of work:	CAUSE:	
	1. Incorr. operation	☐
	2. Lubrication	☐
	3. Cleaning	☐
	4. Inproper maint.	☐
	5. Repair too late	☐
	6. Materials failure	☐
	7. Constr. failure	☐
	8. Normal wear	☐
	9.	☐

To be filled in by the planning dept.

No.		Perform. dept.	Estim. hours	Actual hours	
- -	- - - - - - - - - - - - - - - - - - -	- - - - - -	- - -	- - - -	- - - -
- -	- - - - - - - - - - - - - - - - - - -	- - - - - -	- - -	- - - -	- - - -
- -	- - - - - - - - - - - - - - - - - - -	- - - - - -	- - -	- - - -	- - - -

Estim. date of start	Estimated date of completion	Estimated costs Ft.:	Actual date of completion:	Planner, name:
/	/		/	

Work orders, which have pre-printed job numbers, are issued to authorized work order originators and are to be used under the following conditions:

- All maintenance requests that are not given as direct orders (Work Order List), including all requests of priorities 3, 4 and 5.

- All requests of priorities 1 and 2, which cannot be carried out and completed within the current week.

- The forms are printed on special paper (NCR). The originator forwards the original (white) and two copies (two different colours) to maintenance planning, which in the future organization, will serve the maintenance group performing the job.

  The fourth copy (different colour) will be kept by the originator for later comparison with the repair report.

The preceding page shows an example of a Work Order Form, which we suggest should be discussed with the relevant persons from the counterpart, It is emphasized that it should be taken as an example which could be the basis for corrections and further development.

Issuing of Work Order Forms

The originator forwards the filled-in Work Order Form to the Maintenance Planner in the area where the job will be performed.

In filling in the form, it should be noted that:

- The Job number is pre-printed.

- If authorization of the job is required, the signature of authorizer must be filled in.

- Careful attention should be given to correct account number.

- If the originator wants a summary of the total costs for all ordered work, as for instance for major overhauls, all these Work Orders should be given the same project number. Project numbers are provided on demand by the Maintenance Planning.

- If necessary, fill in date and time available for carrying out the work.

- Always fill in requested delivery date. Maintenance Planning and the performing work group, after considering the present backlog, personnel capacity situation, materials and spare parts, etc., can tell if requested delivery date can be met.

- If space is marked by an X for estimated costs it means that the work order must be cost estimated before work has begun.

- If the originator himself has ordered spare parts or other equipment which refers to the Work Order, the delivery location, as well as the person responsible for receiving goods, must be given.

- Always record name and telephone number of the individual, who can give further information about the requested work.

- Try always to give the best possible description of the requested work.

- After completion of the job, the craftsmen (work group) must report:

  - cause code

  - date of performance

  - time consumption (total hours).

Date of performance and time consumption can be either reported via time cards or by giving an oral report to the foreman immediately after the completion of the job. If the latter alternative is chosen, the foreman registrers the given information on the work order form (priorities 3, 4 and 5) or on the shop ticket shown before (priorities 1 and 2).

<u>Work Order Flow</u> is shown on attachment 5.1. Information flow based on work order is shown on attachment 5.2.

5.2 CENTRAL PLANNING

Central planning has been assigned as a staff function of the Director of maintenance, and has the following tasks:

a) To prepare a strategic plan (STP, covering at least 5 years) whose purpose is to create the best possible basis for decisions to be made now, or following long preparation. STP: see "Course of Industrial Maintenance of the Danube Iron and Steel Works" chapter 4, point 4.3.2.

The STP is to be based both on the general policy and the objectives of the company and on the prognosis of the production units concerning foreseen expansion and planned plant lay-outs, expected purchase of new production equipment, the expected degree of utilization of the existing equipment and plants, etc.

Based on these data, an evaluation of the dimensions and form of the future organization must be made. Also the lay-out, the equipment to be purchased, the personnel (resources) needed, and the possibilities of new developments or re-education of the present personnel have to be evaluated.

b) To prepare a yearly plan (main plan) based on the wishes/demands of the production units and the maintenance strategy.

This plan is to be elaborated based on the knowledge of production planned, new installations, the condition of the production equipment, necessary complete overhauls, systematic preventive maintenance, and an evaluation of the amount of acute repairs.

The plan should act as a frame plan for each maintenance unit, i.e.:

- Maintenance production workshops

- Central Maintenance Workshops

- Production unit maintenance workshops.

The yearly plan contains the main activities to be performed, including planned projects, major overhauls, etc., and a time schedule for these activities based on an appropriate utilization of the total resources of the maintenance and possible sub-contractors. The plan is to be followed up every month, and necessary measures to prevent or remedy possible deviations, are to be taken.

c) To maintain and develop the managed maintenance system.

In this section we shall deal only with the principles of b) main planning.

5.2.1 Main Planning

All demands on maintenance work for the coming year, i.e.:

- project
- major overhauls
- planned repairs

are to be channelled through "Central Planning".

The central planning elaborates a proposal for the yearly plan (main plan), including time requirements (adaption of stop-time), priorities, and necessary resources. The plan should be accepted by production as well as by the maintenance management.

The main plan consists of three plans, one for each organisational unit:

Plan 1 - Maintenance production workshops

Plan 2 - Central maintenance workshops

Plan 3 - Production unit maintenance workshops

and acts as a frame plan for the technical/economic planning function placed within each unit.

The basic information in plan 2 and 3 should be the planned activities, scheduled time, and estimated resources needed for these activities.

The planning can be based on the network technique and be processed by means of an existing standard network EDP-program.

This will give the following advantages:

- Easy and prompt plan revisions with corresponding follow-up procedures.
- Possibilities for simulation of the consequences of alternative plans.
- Integrated resource planning.
- Sorting and selecting of output according to need/wishes.

Initially, of course, the main plan can be prepared as a Gantt-activity scheme with corresponding resource loading showing:

- resources available
- resources needed
- free capacity (lack of capacity)
- proposed to be borrowed (lent capacity).

The basic information in plan 1 should be a rough estimation of the capacity needed for each production workshop.

The estimation of needed capacity is based on:

1. Statistics on the capacity needed for store-initiated production of material, tools, equipments, and spare parts.

2. Capacity needed for performance of the planned projects, overhauls, etc.

3. Spare capacity for urgent production and special services.

5.3 UNIT PLANNING

By unit planning we understand that planning done by the techn./economic.staff, for the unit managers.

The planning will concern:

1. Maintenance Production Workshops

- To receive and evaluate the technical possibilities of producing the orders coming to the unit.
- To distribute the orders to the relevant production shops.
- To establish and maintain a survey of the resource categories and the capacities available in the unit.
- To prepare quarterly coordinated plans for the work shops based on the main plan and in-coming orders.
- To establish and maintain relevant centralized files such as, for example:
  - machinery and equipment including technical description,
  - brochures, operation manuals, etc.
- To control the total amount of work hours planned and carried out.

2. Central Maintenance Workshops

- To receive and evaluate requested maintenance work.
- To distribute the work to the relevant maintenance group.
- To establish and maintain a survey of the resource categories and capacities available in the unit.
- To prepare coordinated plans for the workshops (capacities) based on the main plan and the in-coming orders.
- To establish and maintain relevant centralised files such as
  - machinery and equipment
  - tools and aids, etc.
- To control the total number of work hours planned and carried out.

3. Production Unit Maintenance Workshop

- To establish and maintain a survey of the resource categories and capacity available.

- To manage the transference of resources from one section to another.

- To establish and maintain relevant files, such as for instance:

  - [illegible]inery and equipment
  - [illegible] and aids, etc.

The main objective for the combined technical and economic planning functions is to secure the intercommunication between the planning and the economic analysis in order to utilise the resources in an optimal way.

5.4 SHOP PLANNING

The shop planning groups are placed in the separate work shops of the units and should have the following tasks:

- job preparation
- detail planning.

Job preparation is the basis of all planning and work performance and will be described in section 5.4.1.

The detail planning system differs from unit to unit and from task to task, but always consists of:

Production planning

Maintenance planning { Preventive maintenance, Planned repairs, Projects }

These systems will be described in the following sections.

5.4.1 Job Preparation

The philosophy of job preparation is the same for the different units and shops, but here we shall distinguish between job preparation (JP) in the Maintenance Production Workshops and the Maintenance Workshops.

Maintenance Production Workshops
Job preparation has to convert the information of the work-orders, drawings, etc. and prepare the workshop documentation in such a way that it suits the work of Detail Planning and serves satisfactorily as job information in the production shops.

The responsibility of Job Preparation is to:

- evaluate the jobs and work out the job descriptions,
- work out the job-tickets and estimate the job time,
- work out material requisitions and make the material check,

In addition, "Job Preparation" intends:

To ensure the right technical documentation and the necessary human resources, materials, and tools at the right place in the right quantity and quality and at the right time necessary to perform the work (job) as planned.

The output of job preparation should be:

- Operation list
- Job tickets
- Material requisitions.

Operation List

The operation list has to be elaborated by product and it has to state all operations including operations that take place in other divisions, with sub-contractors, etc.

The job description can be written on the job tickets and the operation list is composed of the copies of the job tickets.

The operation list has to contain at least the following information:

- operation sequence
- description of the operation (as on the job tickets)
- materials per operation
- operation place (machine, group, etc.)
- time estimation
- product description (identification)
- drawing number.

Job Tickets

The job tickets are more or less prepared through the "operation lists", only general information has to be added. Next to the information on the operation list the following must be added:

- shop
- category of workers
- job number

Materials Requisitions

The materials requisitions have to contain at least the following information:

- materials identification number
- materials requisition number
- specification of materials
- corresponding job number.

Central Maintenance Workshops and Production Unit Maintenance Workshops

An appropriate utilization of resources and materials assumes that the work can be satisfactorily planned. To avoid waiting times and production loss, materials,spare parts, tools, drawings, lifting equipment, etc. have to be available when the job is going to start.

By job preparation in the maintenance shop,we understand the preparation made with the intention of providing all resources and information needed in order to perform an ordered maintenance job with a balanced use of resources and material and without unnecessary loss of time.

The output of job preparation should be:

- issued sub-work orders if necessary
- job descriptions
- material requisitions
- description of necessary tools and aids,
- time estimation of jobs.

Here we shall present a method for time estimation of different kinds of maintenance jobs.

Time Estimation

The time estimation is the basis of the capacity planning. We suggest the time estimation be based on standards obtained by a registration of real consumed time for different kind of jobs in an initial period of approximately ½ year. This method is simple and fully satisfactory.

For the sake of the construction of the standards,the jobs are divided into three groups:

1. Repetitive jobs
2. Non-repetitive jobs
3. Routine maintenance jobs.

The classification of the jobs is defined as follows:

To ensure a systematic and uniform handling of the maintenance jobs it is expedient to classify the jobs. Here we shall propose the maintenance jobs be identified by three classifications:

REPETITIVE JOBS Maintenance requests which are classified by the Maintenance Planning Department as repetitive should occur at least three times per 4-week period in order to obtain a sufficiently accurate average over a reasonable time.

For these jobs it will be easy to determine a statistical standard for each work group for each repetitive job.

NON-REPETITIVE JOBS All maintenance activities, except the ones classified as repetitive or as routine maintenance work, will be classified as non-repetitive. Job codes are assigned to non-repetitive jobs in order to indicate in which time interval they should be completed. An example is given below.

ROUTINE MAINTENANCE JOBS Maintenance activities classified as routine in general are the activities on which a fixed amount of time per week is spent, such as lubricating, routine preventive maintenance, inspection, etc.

In general these activities will be scheduled as STANDING WORK ORDERS. The work order form will be used to issue standing work orders.

The standard time for routine activities will be pre-determined by Maintenance Function in cooperation with the work group supervisors. Maintenance Planning will issue the standing work orders with priority 4 and process these as normal work orders with the exception that, in general, no report is made when these jobs are completed.

The construction method of the standards is:

__REPETITIVE JOBS (RJ)__

All standards for RJ are connected with the performing group and all RJ in a group are assigned a code.

When a certain number of jobs (minimum 20) with the same code has been completed (the dispersion in time may not be too great) an arithmetical average can be calculated:

$$\text{Standard for job } N = \frac{\Sigma \text{ hours consumed}}{\Sigma \text{ no. of jobs}} \text{ h/job}$$

If the work conditions change and the dispersion becomes too great or the definition of RJ is no longer fulfilled, the job should no longer be classified as RJ.

NON-REPETITIVE JOBS (NRJ)

All maintenance jobs, which cannot be classified as RJ and are not Routine Maintenance Jobs, have to be classified as NRJ.

The non-repetitive jobs present the major obstacle for effective workload planning. It is overcome by a statistical approach considering for each work group, all work falling within a given time interval as a job to which standards may be applied.

The time intervals and the corresponding code could be:

Time intervals (hours)	Job Code
0 - 8	1
8.1 - 16	2
16.1 - 32	3
32.1 - 64	4
64.1 - 100	5
100	9

The consumed hours registered on the work orders after performance have to be grouped according to the respective time groups (by EDP processing automatically). During an initial period of approximately ½ year a larger number of values in each group will be collected. Based on this an average time for each group can be calculated:

$$\text{Average time group } N = \frac{\sum \text{hours consumed (in group N)}}{\sum \text{No. of jobs (in group N)}} \text{ h/job}$$

An example is shown on the following page.

Work group No. N

Time intervals (hours)	Job Code	Average time of all jobs of this classification (Example)
0 - 8	1	3.4
8.1 - 16	2	12.7
16.1 - 32	3	23.5
32.1 - 64	4	46.0
64.1 - 100	5	81.0
over 100	9	for each individual job an estimated time is given.

Then the PLANNER would know that 12.7 hours is the standard for any non-repetitive work (in Work Group No. N) lasting for over 8 hours, but less than 16 hours.

His plus and minus errors would equalize each other over a week's time for the total work group.

ROUTINE MAINTENANCE JOBS (RMJ)

Maintenance jobs classified as RMJ are jobs which are going to be carried out for a longer period in time and with a fixed estimated consumption of hours per week, e.g. preventive maintenance, such as:

- cleaning
- lubrication
- inspection
- checking conditions
- small adjustments.

The following rules for RMJ have to be kept in mind:

1. RMJ have to be ordered on a work order form.
2. They should be planned in cooperation with the groups carrying out the jobs.
3. They should be approved by those responsible for costs.
4. RMJ are assigned priority 4.
5. Standards have to be based on data from the engineering department and should be expressed in hours per week.

5.4.2 Production Planning

The proposal for the planning system in the maintenance production shops is for the machinery shop.

The system is shown as a manual processed system, but the capacity loading, weekly programs, and follow-up can be processed on EDP as well.

After trial run and implementation of the system in machine shop, of course the system can be adjusted and transferred to other similar production shops.

Detail Planning

Detail Planning (DP) receives the rough loading plans (1/4-year plan) as the basis of the scheduling. Besides, DP receives from job preparation the complete work documentation, i.e.:

a) Operation list, containing the following information:

- operation sequence
- description of the operation (as on job tickets)
- material per operation
- time estimation
- operation place (machine, group, etc.)
- necessary tools
- product description (identification)
- drawing no.

b) Job tickets (work orders)

c) Materials requisitions, containing the following information:

- materials requisition no.
- specification of materials
- quantity
- corresponding job no.

The responsibility of detail planning is to:

- coordinate all activities including activities that take place in other shops or with sub-contractors by working out the "production control card".
- control the capacity of key machines or groups at the earliest possible stage.

- plan the activities according to the "production control card" (coordination plan), the material situation, and the available capacity, by working out the "weekly program" and the corresponding "load survey" per working place.
- follow the production progress by daily or weekly feed-back and conferences with the persons responsible in the production, and to analyse the consequences and adjust the plans according to the feed-back.

The work of Detail Planning is based on:

- workshop documentation
- materials situation
- data such as: capacities, workers, machines, etc.
- feed-back information from production

Attachment 5.3 shows the input, output, and routines of Job Preparation and Detail Planning.

The following areas are treated in Detail Planning:

Production Control Card

On the production control card all jobs (job tickets) for jobs using long transition time, key-(bottle-neck)machines or involving other shops/sub-contractors are listed. The transition time of the "product" is based on the estimated hour consumption per job, the time needed for transportation, and the interrelationship between the jobs.

The production control card has to contain the following information (see attachment 5.4):

- drawing no.
- product description (identification)
- card no.
- date/signature
- delivery date
- job no.
- job identification
- job transition time
- workshop no./group no.

The production control card is to be used as:

- basis of the weekly plans and the load of the workshops,
- coordination plan between the shops, other divisions, sub-contractors, etc.
- follow-up card.

Capacity Control (Key-Machines)

Before the scale of the production control card is fixed, a rough capacity control of the key-machines (bottle-necks) should be made (see attachment 5.5).

Load Survey

In order to secure the right utilization of the capacity in the shops, the load survey should be prepared. The load survey shows the cumulated loaded hours per week per machine/machine group. (See attachment 5.6). The load survey is prepared by inserting all job tickets of a product 6-7 weeks ahead.

Weekly Program

After the control of the capacity and the materials, Detail Planning prepares weekly programs (see attachment 5.7) in accordance with the load survey. Programs for 2 weeks ahead will be made each week. The weekly program should be made in 3 copies. One for Detail Planning (following up), one for the foreman, and one for the chief of shop.

Every Friday, the results from the past week and the programs for the coming weeks are discussed at a meeting between the planners and the foremen.

Filing and Dispatching of Prepared Job Tickets

By prepared job tickets are meant job tickets:

- which are dated according to the "control card",
- for which the first materials check has been done,
- which are inserted in the "load surveys"

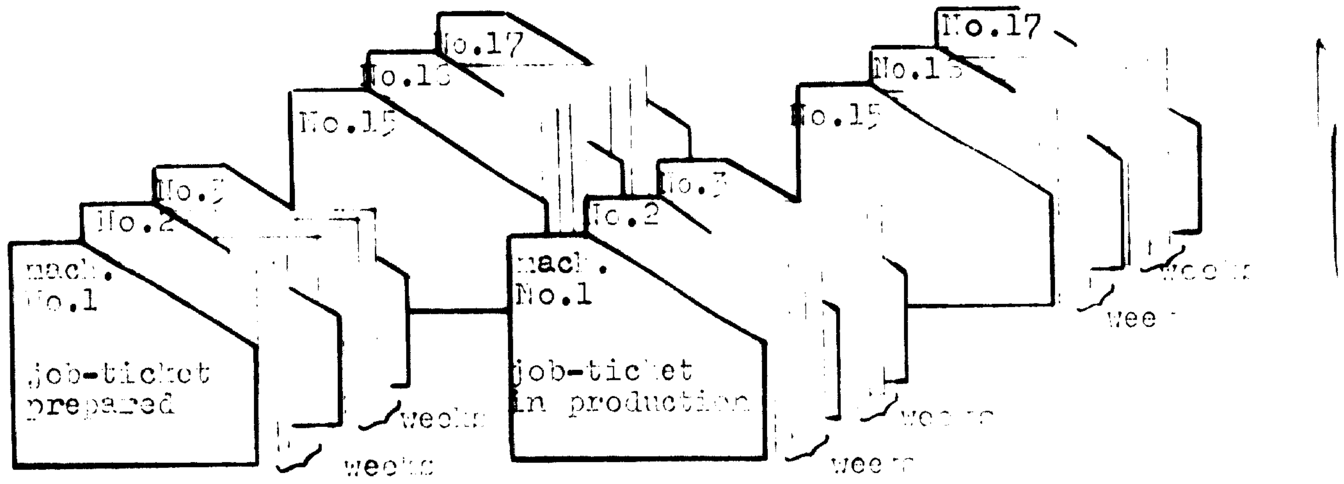
In order to manage and control the realization of the planned production, the following aids are used:

- operation list
- production control card
- job tickets
- materials requisitions
- load survey
- weekly program.

The production control card remains in Detail Planning and is filed according to the number of the control card.

The job tickets and the corresponding materials requisitions are filed according to:

Machine/group - weeks



When the jobs are ready to start, according to the weekly program decided at the Friday meetings, one copy of the job tickets is filed in the card index for job tickets in production, and two copies are sent to the shop with the weekly program.

Follow-up of the Progress in Production

The collection of information as to which jobs have been finished is one of the most important functions of the planning work. Without a correct feed-back enabling a correction of the planning factor, as well as the coming weekly programs, the planning system cannot work satisfactorily.

The time calculation must be registered in the same order as the plans are prepared, i.e. per machine/machine group (according to the weekly program).

In order to get realistic planning figures, the aim must be that the planned time should be equivalent to the actually consumed time. In order to obtain this, a factor P should be used:

estimated time x P = planned time

(planned time ~ actual time).

I.e. in order to make the system dynamic, the "actual planning factor" is to be calculated periodically as:

$$P = \frac{\text{actually consumed hours}}{\text{estimated hours}}$$

The calculation of the P factor is made on a special form (see attachment 5.8).

The number of hours (capacity) in which the machine/machine-group is supposed to work within the week has to be stated. The chief of the workshop (or foreman) should approve them, and be responsible for the realisation of the plans.

By following the development of the planning factor P, and by comparing the hours actually spent on the jobs with the approved capacity per week, one gets an idea of the efficiency and the progress in production.

The feed-back is obtained by means of weekly meetings (every Friday), "finished" job tickets, and follow-up by the planners. The status of production is registered on the production control card. The "finished" job tickets are removed from the card index for "job tickets in production".

5.4.3 Maintenance Planning

The planning system developed for the Production Unit Maintenance Workshops can be used for the Central Maintenance Workshops as well. The proposals in this section (5.4.3) are prepared for the rolling mill maintenance workshops, but after trial run and implementation of the system in these shops, of course, the system can be adjusted and transferred to other production maintenance workshops.

The job preparation and planning group in the rolling mill maintenance workshops should be placed parallel to the Maintenance Engineering group in the organisation. In fact, these groups act as staff functions to the manager.

The planning systems presented in this section are:

1. Project Planning System
2. Preventive Maintenance System
3. Maintenance Planning

5.4.3.1 Project Planning

The project planning, i.e. planning of proper projects, large repairs, main overhauls, etc., should be based on the network technique.

Today this technique is known and in some cases used in the company, but for the moment not EDP processed.

We suggest that smaller projects ($\leq$ 50 activities) be manually planned by the use of network (activity-oriented version as taught at the project leader course). Large projects (> 50 activities) should be processed on EDP by means of one of the well-known network computer programs. An activity oriented version should be preferred.

5.4.3.2 Preventive Maintenance

Preventive maintenance jobs are ordered by the work order system described in point 5.1. The jobs are assigned priority 4, and are classified as Routine Maintenance Jobs (RMJ) as described earlier.

The resource planning is included in the maintenance planning system, but some of the basic principles of PM will be mentioned here.

Basic Principles of PM

As already mentioned the prime aim of PM is to reduce wear and detect and remedy it before the machinery has to be stopped for one reason or another. The techniques involved in PM have different names and today the following are included:

1. Cleaning
2. Lubrication
3. Inspection
4. Condition checking
5. Adjustments, exchange of parts, and repair of damage observed at pre-planned stops.

PM is not a task for the maintenance function only, it is part of the daily work for all persons within an enterprise, from the managing director to the youngest office boy, from the production planning and managing man to the worker in the tool-crib.

It is really a kind of philosophy which should be introduced and kept alive in all people's minds. Wear of machinery often will result in unusual noises, smells unsafe functioning, change of colour or other unusual events. Anyone observing such changes should find it quite natural to tell the maintenance department or some other responsible party about what he or she has observed. ALL people within an enterprise should be told to do so and one should never reprimand a person for "putting his nose in other people's affairs". Sometimes it has been observed that a person does not report because he or she thinks "this is not my job", in other words the "this-is-not-my-table"-mentality prevents the PM.

A successful introduction of Preventive Maintenance principles will as a consequence also include INFORMATION about the basic principles and measures to encourage people to take an active part in the prevention of losses within the enterprise.

Besides the introduction of a philosophy or policy within the enterprise, the Preventive Maintenance System includes:

1. A control system
2. Good routines
3. Instructions
4. Trained people
5. Aids for the job

The control system consists of:

a. order forms
b. report forms
c. recording system
d. statistics

MAINTENANCE INSTRUCTIONS

Generally speaking there must always be some kind of instruction for any type of job. In some cases it is possible to state before the actual job starts

WHAT is to be done
HOW it should be done
which AIDS are to be used
TECHNICAL SPECIFICATIONS about the job.

This is of course the case in PM. Someone has to state these facts. In many cases the engineer does it, in other cases the foreman, but in too many cases it is left to the worker.

The usual attitude when PM is started is that specially trained workers, lubricators, should be used. PM makes high demand on the technical qualification. But it must also be observed, that especially in the more detailed inspections and in the condition checking operations the demand on technical qualificationsis so high that no worker is capable of doing the work correctly without some kind of information from engineers.

Verbal information about the job is the commonly used method. It is said to be quick, but in most cases the time saving means that not all information is given. In PM most operations are repetitive, sometimes of course at long intervals, and inevitably verbal instructions are quite insufficient.
It is not possible for anyone to keep in mind all the different information about PM operations.

If a verbal instruction to a worker is based on a written instruction it ensures that

- all information necessary is included
- the instruction is always the same
- nothing is forgotten
- there is always a reference and a support for the memory.

Instructions for PM have been worked on for many years and it is now possible to find 3 different techniques, each one with its advantages and disadvantages.

1. The instruction is not detailed. The job is described only with the operation definition such as "check", "listen", "inspect". No other information is included.

2. The special instruction is connected to a "methods book" where the different operations are described in more details. No technical data are included.

3. The instruction is complete with method description and technical data.

Instructions of type 2 are actually type 1 instructions combined with the Methods Book.

Of course, there is less work in writing instructions for types 1 and 2, but practical experience has shown that the work necessary to write a usable Methods Book is considerable.

The oldest of the PM instructions is the Lubrication Instruction. In most industrial countries type 3 is used. In some countries, Germany, for example, this form of lubrication instruction is stated in a generally accepted national norm, in Germany DIN 8579. This indicates, that type 3 instructions are the safest and most reliable .

Below are type 1 (or type 2) instructions from an iron and steelworks factory. They were used during an introduction period; the same type was also used in the pulp and paper industry. The reason for choosing this simple type of instructions was, that it is done quickly, is quite sufficient in the early stages of a PM programme, and in this case specially trained inspectors were used. The need for a more detailed description of the different actions was not deemed necessary at this time.

Today, these instructions to a larqe extent have been replaced by type 3 instructions, the reason being that the demand on reliability in the preventive work has been increased and the technical difficulties have increased with the introduction of more automated and more complicated machinery.

The complicated machines require better information in the instructions, and as a consequence also the Methods Book has been replaced by a Methods Record, used when building instructions of type 3.

Shown below are instructions for type 1 or 2. There are only short details about what to inspect, but not very much about the method, technical details etc.

INSPECTION INSTRUCTION

MAINTENANCE DISTRICT | DATE | ISSUED | CHECKED | DATE

Insp. at Run	Insp. at Stop	Code	Machine	Component	Method	Drawing Tool-Instruction number	Rep. at Ch.	Rep. at Ord.
x			Water pump	Packing	Look, Listen, Feel	105	x	
				Coupling	-"-	105		x
				Bearing	-"-	107		
	x		Vacuum pump	Alignment	-"-	104	x	
				Fastening to base	-"-			
				Coupling to meter	-"-	105		
				Packing	-"-	105		x
				Connections to pipe	-"-	105		
x			Water filter	Connections to pipe	-"-	143		
				Int. pressure drop	Measure	145		
				Leakage	Look, feel	105		

The disadvantages with type 1 instructions may partly be overcome by using some kind of a "Methods Book". Shown below is a page from such a book.

GENERAL INSPECTION The general inspection covers: PROTECTION AND SAFETY DEVICES ALL ACCESSIBLE MACHINE PARTS Below are listed machine parts and components known as general because they are used in many machines in the factory. When found they should be inspected as per instruction below. <u>SHAFTS:</u> Roundness, wear, straightness <u>BRAKES:</u> Function, brake bands, brake linings, adjustment screws, lock nuts, wear on other parts. <u>BEARINGS:</u> Play, temperature, undue noise. Use a stethoscope.	**GENERAL INSPECTION, contd.** The general inspection will usually be done during production and under normal conditions. Shorter stops may be requested by the production foreman. The general inspection is done by <u>Looking, Listening, Feeling</u> The general inspection will cover all accessible parts. The inspector will take off covers, plate protections, etc., take safety precautions; if possible feel the parts to check for undue play, abnormal temperature, noise and vibrations. Determine, if possible, the cause of the abnormal condition. The general inspection will also cover: 1. The general tidiness of the work place (cleaning, sweeping, etc.) 2. The general exterior condition of the machine (cleaning, painting, dust, dirt). 3. All <u>functions</u> of the machine. 4. The lubrication.

The language used in any type of instructions should be clear and must be easily understood by those for whom it is intended. An engineer usually has his own technical way of expressing himself, and it is most uncertain that the workers will understand it. It must be a precise language, especially when dealing with difficult technical things.

The writer must also try to find the knowledge level amongst the workers. The engineer must never write things he is not completely and definitely sure the workers will understand. It is not enough to state "they should know because of their former training". People forget, especially the things they do not use daily. It must not be left to the worker to make the decision about the method to be used, because he is likely to take the method he knows best and it is quite possible that method will not give the safety the engineer wanted.

MACHINE MANUFACTURERS INSTRUCTION BOOKS

Manufacturers of standard machines often deliver an instruction book. Many maintenance engineers have the opinion that they have to stick to the rules in such an instruction book.

If such a book is carefully analysed, it will often be found that time intervals between maintenance operations are too short. The most revealing example is the interval for changing oil.

In most cases it is stated that the oil should be changed once a year or after 6 months. If the quantity is small it does not mean so much economically, but modern machines very often have systems containing large quantities. The manufacturer's statement is of course based on experience, but the manufacturer must be sure his machine is always well lubricated. In order to achieve that purpose he sets a short interval just to be sure....

In reality the oil may last for more than one period. It has been found under controlled conditions that the oil in a hydraulic system remained in good working condition for more than 6 years instead of the prescribed 1 year.

This fact casts no aspersions on the manufacturer. He does not know that this particular machine will profit from good maintenance. The same applies to other parts of his instructions too.

Purchasers in industry often state that the manufacturer will provide complete instructions concerning preventive maintenance. The reason is that the purchaser believes the manufacturer has the best practical experience with the machines. But that is not true, because the manufacturer has not a single one of his machines under daily observation in his own plant. Practical experience is held by his customers, but if the customer does not keep records properly, many valuable hints will never reach the manufacturer's serviceman. This again is no fault of the manufacturer's as, again, he wanted to be on the safe side.

An instruction book for any type of machinery should be set up to suit the user. The lubrication instructions should be set up according to an accepted standard, such as DIN 8579. If not, the lubrication man does not find them, and the machine will not be properly lubricated. The same applies to other information too.

After long and detailed discussions with those concerned in Sweden, it was found, that an instruction book should be divided in 3 parts and delivered in a varying number of copies to the user.

	Installation instructions	Preventive maintenance instructions	Machine data	Spare parts catalogue	Operators instructions	Drawings	Lubrication instructions
Maintenance department	x	x	x	x	x	x	x
Plant ent.	x		x				
Work study			x		x		
Prod.eng.			x		x		
Prod.plann.			x		x		
Prod.forem.			x		x		
Operator		(x)	x	x			(x)

In this set-up the Installation instructions are those needed to install the machine and give it the initial lubrication, test it before starting production, machine test record,and such things. Also information about how to lift and transport the machine, how to assemble it,etc., is included.

The machine data consist of a general description of the machine and its functions, but also general data such as measurements, weights, cable gauge, demand on facilities,such as electric power, water, compressed air,etc.

The operator's instructions consist of information on how to adjust tools, etc. before operation, how to inspect the machine before start-up and how to watch the machine during operation.

Drawings are usually able to provide such information, if necessary. It should be remembered, that a manufacturer is more willing to do this before the order is signed than after, and also that a good instruction book costs money.

There have also been discussions in Germany about the information a manufacturer should provide when delivering a machine. The result can be read in the "Technische Ausführungsrichtlinien für Werkzeugsmaschinen und ähnliche Fertigungsmittel" (Technical Guide-lines for machine tools and similar production equipment) VDI 3227, 3228, 3229, 3230 and VDI/VDE 3231 issued by the German Association of Engineers.

These guide-lines also contain valuable information about the procedure of machinery. It is amazing to see how different people in industry act when asking for quotations, finding facts about offered machines and analysing the basic facts to find the one machine suitable for the intended purpose, not to mention how the manufacturer and the customer fail to understand each other's problem during delivery and service period. All these situations are described step-by-step in the guide-lines.

Even if the manufacturer's instruction book is set up according to accepted rules, it is not always possible to use its information directly as worker's instructions.

The reason is that in most cases the user of the machine rapidly will have access to information that the manufacturer does not have. There will also be changes in intervals for different operations because of the conditions for the machine, time and load utilization etc. But the instruction book contains much valuable information and material for building one's own instructions, such as sketches and photographs.

The manufacturer usually provides a spare parts catalogue when delivering a machine of standard design. The best method used for that is the exploded view. It is easy to see the shape and relative size of the different components and also how they are assembled. The exploded view may be used also as information for the repairmen when disassembling and assembling the machine for repair or exchange of worn or damaged parts. Lines with arrows may add to the value of the exploded view in that case.

The following is an example.

SHAFT SEAL (see figure)

Remove the coupling half with a puller. Remove key (24).
Remove all burrs from the key way and the shaft end.
Unscrew the gland nut (33) and remove all parts up to and including inner washer (20).
Install a new O-ring (16).

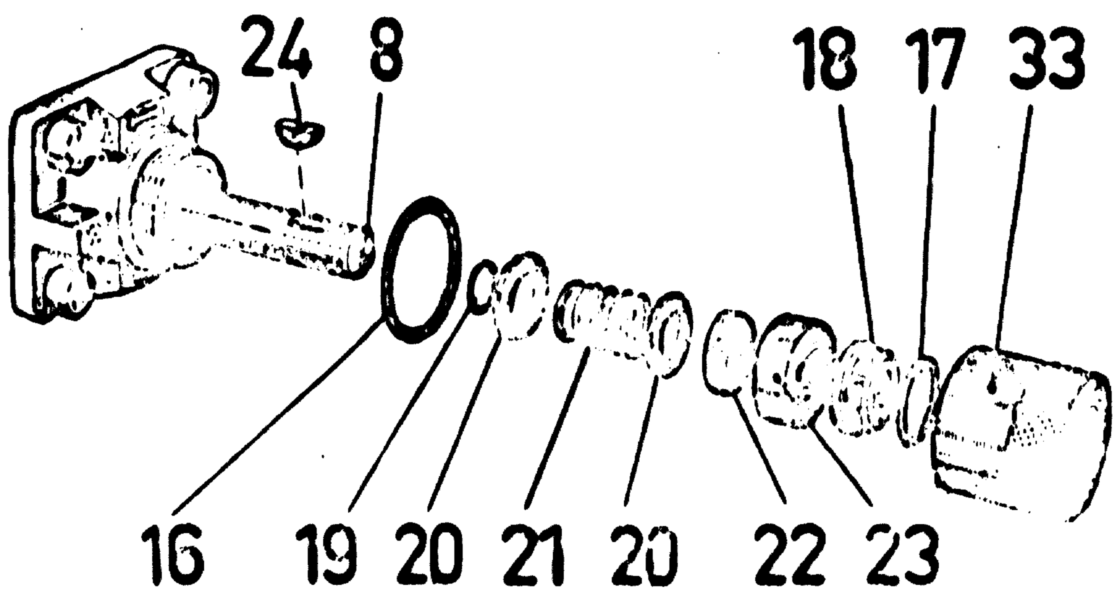
Check that the retaining ring (19) is in its place in the groove in the shaft.
Install the inner washer (20) with the chamfered side towards the ring (19).
Install the spring (21) and the second washer (20).

Install a new rubber ring (22), be careful not to damage it when passing it over the keyway. Install a new sealing disc. (23).

Install a new O-ring (17) in the gland nut (33). Insert a new sleeve (18) into the gland nut and assemble all parts on the shaft. Tighten gland nut securely.

Install the key in the keyway and push the coupling half onto the shaft with light blows of a hammer. Lock with the lock screw.

Be sure the sealing surfaces of the rotor ring (23) and the stator ring (18) are not damaged or scratched.



Exploded view with arrows indicating correct assembly.

For special machines it is too expensive to make exploded views. In such cases prepared assembly drawings should be delivered to facilitate correct repair work.

PERSONNEL FOR PREVENTIVE MAINTENANCE

As always in maintenance, skilled and trained people should be used. When first starting a preventive maintenance plan, it has been more or less a custom to use inspectors, lubricators, machine checkers and similar craftsmen, who work only in the indicated areas.

To get a certain degree of flexibility it will sooner or later become necessary to take other craftsmen into the preventive work.

When using instructions of type 3, this extension becomes fairly easy as the instructions can be used both as the basis for the initial training of new personnel and as an aid for those craftsmen who are not fully trained.

In complicated machines, especially such machines containing hydraulic, pneumatic and electric circuits, the personnel must have knowledge in more than one of these fields. The machine mechanic must know how the electric control circuit acts because he must be able to check the entire function in order to find weak components and failures. The need to train both mechanics and electricians in several new fields becomes more and more obvious. For the complex machines, methods have been developed such as

- logical fault-finding techniques
- test programmes

which have to be handled by trained craftsmen. The time savings with these methods are so great that the cost of training is negligible.

In earlier days the lubricator usually was among the less able. If a man was not capable of working as a production man he was given a job either in the tool-crib or as a lubricator.

Lubrication (and also the job in the tool-crib) is a job to be done with care and strictly according to the instructions. If a poorly trained man is used, safety and accuracy of the work may be jeopardized. The man who does lubrications may also do simple kinds of inspection when lubricating the machines. If he is a skilled craftsman, then, not only does he properly lubricate a machine but he may also contribute importantly to preventive maintenance by inspecting the machine, as well.

In Swedish industries it has been found that older mechanics who do not like to work as repairmen on incentives any longer, will do a very good job as combined lubricators, inspectors and instructors for the operators of the machines. Usually they have a very good knowledge of the machines, collected during long time as mechanics, and personality qualities that make the operators accept them as superiors.

Repair work is done in connection with the inspections, usually up to the predetermined and agreed stop time. Repair work taking more time is done later on, if the failure is not of the nature that calls for immediate action.

When the preventive programme has been in effect some time, more people are trained for the job. In some industries the preventive work is planned and scheduled as a part of the repair work, with a certain priority.

In the long run it will not be necessary to have special workers for most of the preventive maintenance work.

The internal training programme for the personnel working on preventive maintenance should be a continous process as new machines are installed and the workers trained in their use as soon as possible. This applies also to the foremen, both the PM foremen and the repair foremen (in different departments).

The preparation of instructions is usually done by maintenance engineers. They need a training course at the start of the programme, covering

- preventive maintenance techniques
- instruction language
- instruction technique
- use of methods records.

5.4.3.3 Maintenance Planning System

It is generally accepted that careful planning of an operation will improve the results. In general, however, the opinion is that maintenance work cannot be planned to any large extent.

The fact is that in a well organized maintenance department, usually more than 75 per cent of the manhours spent on maintenance jobs can be planned. Even rush jobs can be planned.

Weekly Planning Meeting

A successful maintenance planning is based on:

- a balanced order-stock enabling an equal and optimum utilization of the maintenance resources.
- greatest possible consideration of the fact that orders (jobs) have to be carried out at the right time without unnecessary delay.

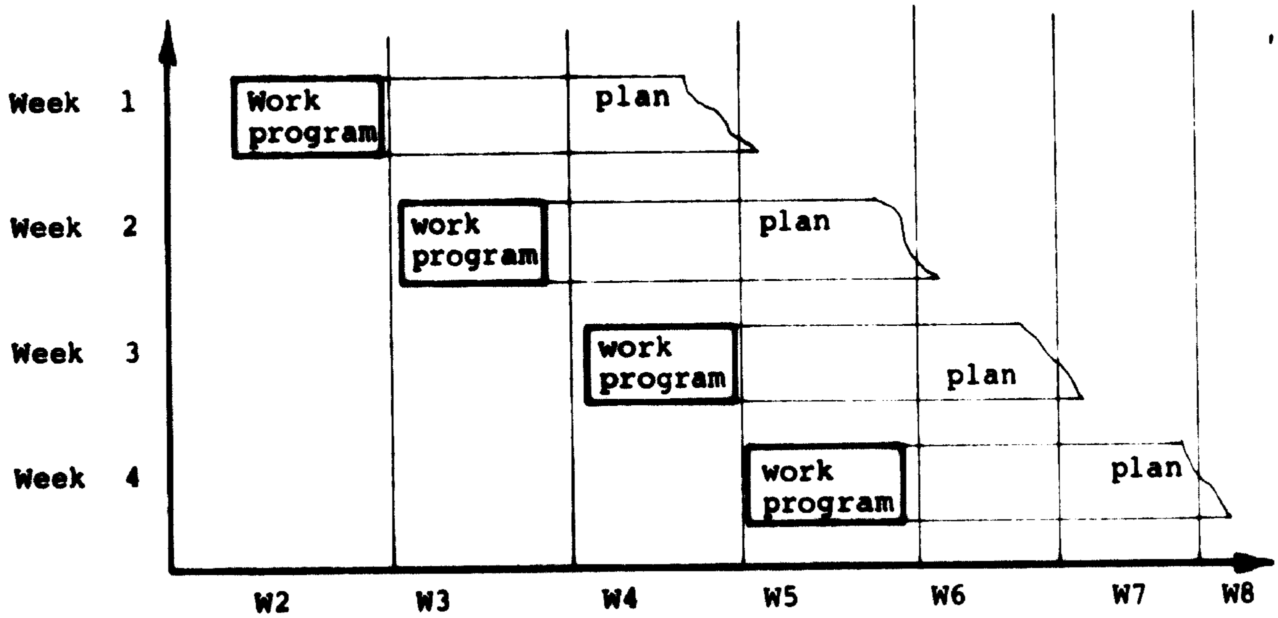
This implies well-organized team-work between the order-originators, the maintenance work-groups, maintenance engineering group, and the maintenance planners.

The introduction of weekly planning meetings between these people will result in a good ongoing relationship in questions such as preparation and priority of maintenance jobs to be carried out during the coming weeks.

The following items should be fixed on the agenda:

- report on the results of the last week's program.
- report on the orders entered last week and the total order stock.
- report on jobs under preparation.
- proposal for work-program for the coming week.
- comments on the proposed work-program. Establishment of the program for the coming week and the plans for the following weeks.
- report on the situation of the other maintenance groups and the central maintenance shops.
- miscellanous.

This means that the work program and the plan of the following weeks are prepared according to the following cyclogram:



The work-program for the next week includes only jobs prepared and ready to start. In the plan for the following weeks all jobs with a scheduled date and requiring a certain amount of resources ought to be included. The plan should serve as a prognosis base for the evaluation of the need for coordination of the various maintenance jobs and maintenance groups, and also indicate the need for extra capacity.

Capacity planning

A good maintenance- economy implies that each maintenance shop has an adequate order-stock enabling it to equalize the order variations of the order-entrance and to have the necessary time for the job-preparation.

The aim of capacity planning is to manage the time and sequence of the ordered jobs within the frame of the priority rules, in such a way that an "optimum" utilization of the available ressources will be obtained.

To understand the routine of capacity planning, it is necessary to introduce and define some basic concepts.

- Jobs ready to start and jobs not ready to start (priority group 3 and 5)

- Prescribed order stock.

The total maintenance order stock can be divided, once defined, as shown below:

Orders which are time estimated, prepared and ready to start as soon as the necessary resources are available	Orders ready to start	Total order stock
Orders which are time estimated, and prepared but not ready to start during the next two weeks, due to lack of materials, not yet fixed stop-time for production equipment, etc.	Orders not ready to start	

The standard time for orders not ready to start next week is calculated as follows:

Work group N.N.	Week			
Work standard code	Jobs not ready to start	a No. of work orders	b Statis-tical st. time	a + b
1	//// //// //// //// //	22	3.5	77.0
2	//// //// ///	13	11.6	160.8
3	//	2	22.2	44.4
4	///	3	45.3	135.9
5		-		
9	171-106-135			412.0
Hours not ready to start				820.1

Prescribed order stock

By the prescribed order stock expressed in weeks (e.i., the jobs in priority groups 3 and 5 ready to start), we shall understand the order stock ideal compared to real life.

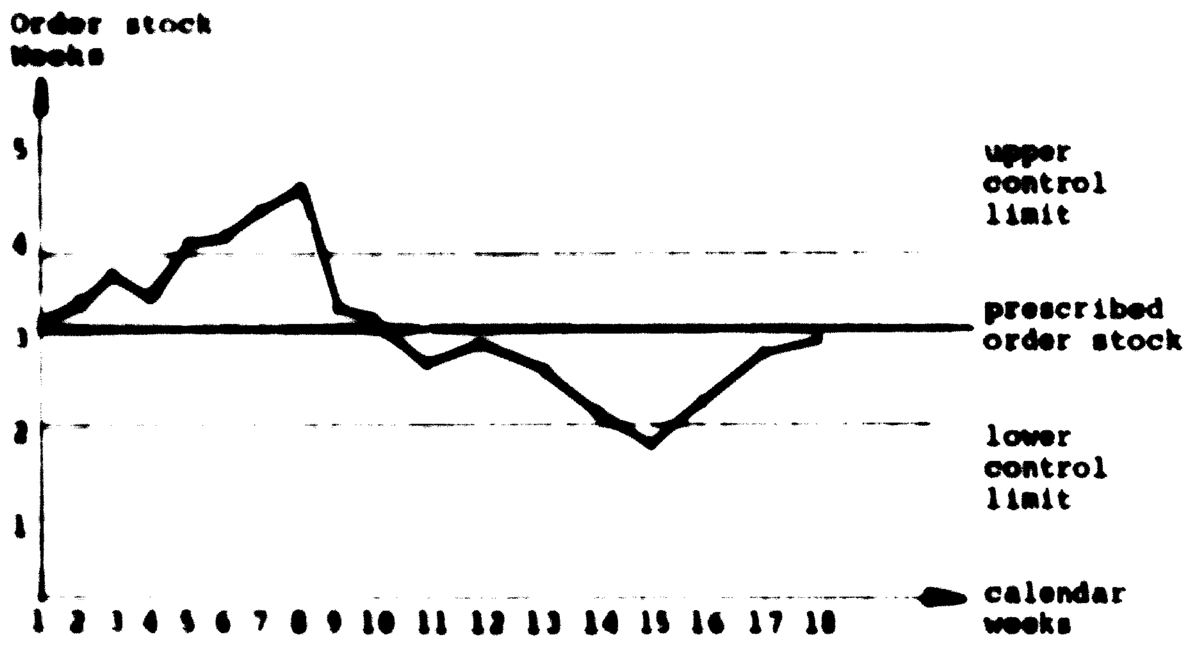
The determination of prescribed order stock for each maintenance workshop ought to be based on a study of the order entrance and the variations during the last 10 - 20 weeks.

The interplay between the order stock and the relevant maintenance capacity makes it necessary to follow up and manage the order stock. In this connection the "prescribed order stock" is important aid.

The stock of orders ready to start ought to fulfil the following requirements:

- the variation of the order entry can be filled up to the capacity limit by the cumulated jobs.
- jobs which, contrary to expectation, cannot start, due to lack of materials or spare parts, alterations in accessibility, etc., can be replaced.
- possibilities of rational combination of jobs.
- give sufficient time to job preparation.

Assuming that the "prescribed order stock" is evaluated/calculated to be 3 weeks, the following order-stock-control diagram can be made:



The difference between the control limit and the prescribed order stock can be calculated as the greatest deviation from the average of the orders entered during the last 20 weeks.

It is an essential task of the maintenance planning group to understand the order stock information, and in cooperation with respective managers take the necessary measures based on this information.

By fixed control limits and an order trend exceeding the upper limit, the maintenance workshop in question is supposed to be shorthanded. If the order trend exceeds the lower limit, the maintenance workshop in question is supposed to be overmanned. In both cases adjusting measures are necessary.

Capacity calculation

Maintenance jobs in the category routine maintenance jobs (standing work orders priority 4) are planned, and in priorities 1 and 2 jobs are not planned, but draw on the resources.

All other maintenance jobs have to be planned according to the resources available.

To make proper utilisation of the resources available for maintenance jobs, it is necessary of course to know the number of resources at one's disposal.

The available resources have to be calculated per period corresponding to planning periods, e.g., per week or 2 weeks.

An example of a capacity calculation is shown below:

WORK GROUP	PERIOD: WEEK 15		
	PLAN	REAL	DEVIATION
Norm capacity	2350	2350	
Calculated absence	-100	- 25	- 75
Lend capacity	- 50	- 25	- 25
Borrowed capacity maintenance	+ 10	+ 10	
Borrowed capacity sub-contractor	+200	+250	- 50
Planned overtime			
Real Capacity A:	2410	2560	-150
For priority 1	225	275	- 50
For priority 2	365	355	+ 10
For priority 4	410	405	+ 5
(1 + 2 + 4) B:	1000	1525	- 35
CAPACITY AVAILABLE (A - B) for priority 3 + 5	1410	1525	-115

Order Stock (week 13)	Weeks	Hours
C: Prescribed order stock	5	6750
D: Order stock ready to start	4.4	5940
Difference (C - D)	0.6	810
Kvot. $\frac{D}{C} = \frac{4.4}{5} = 0.88$		

This capacity plan is set up at the weekly planning meetings.

Explanation of the plan.

(a) Norm capacity: Own resources in hours.

(b) Calculated absence: In advance known absence due to holidays, illness, education, etc.

(c) Lend capacity: Known lending of resources to other services.

(d+e) Borrowed capacity: Known resources borrowed from other maintenance shops, " the production" or other.

(f) Planned over-time: Planned and accepted over-time.

Real capacity A: a + b + c + d + e + f

(g) For priority 1: Calculated as a 5-week running average of priority 1 jobs earlier carried out.

(h) For priority 2: Calculated as priority 1.

(j) For priority 4: Total standard for all priority 4 jobs (standing work orders).

1 + 2 + 4: Total statistical probable hours to be reserved for acute repair of priorities 1 and 2, and the standard work orders priority 4.

Capacity available: Hours which can be used for planned priority 3 and 5 jobs.

In this example the capacity-plan is prepared in week 14, is valid for week 15, and the calculations are based on data information from the situation at the end of week 13.

C	Prescribed order stock:	As described earlier in weeks h = weeks x running average of the last lo weeks real available capacity in hours/weeks. In this example 5 x 1350 = 6750 hours.
D	Order stock ready to start:	Total order stock minus orders not ready to start (as earlier described) divided by running average of the last 10 weeks real available capacity in hours/weeks. In this example: 6750 - 820 = 5930 hours or $\frac{5930}{1350}$ = 4.4 weeks.

Based on the calculated capacity and the stock of orders ready to start, the work program can now be set up.

<u>CONCLUSION:</u>

All the items described in article 5,together with the material administration system and the cost control and budgeting system, form the vital part of the "Managed maintenance system". Of course a number of records and files are needed as a data base. These and the EDP-input and output will be described in a later article.

DESCRIPTION

WORK - ORI

1. The planners/order-receivers immediately make a cost- and work evaluation on the received work order.

   The work orders are checked, signed and dispatched for further preparation.

2. Work with priorities 3 and 5 and project, requiring no construction work and no external ordering of spare parts and materials, are prepared by the performing group (shop).

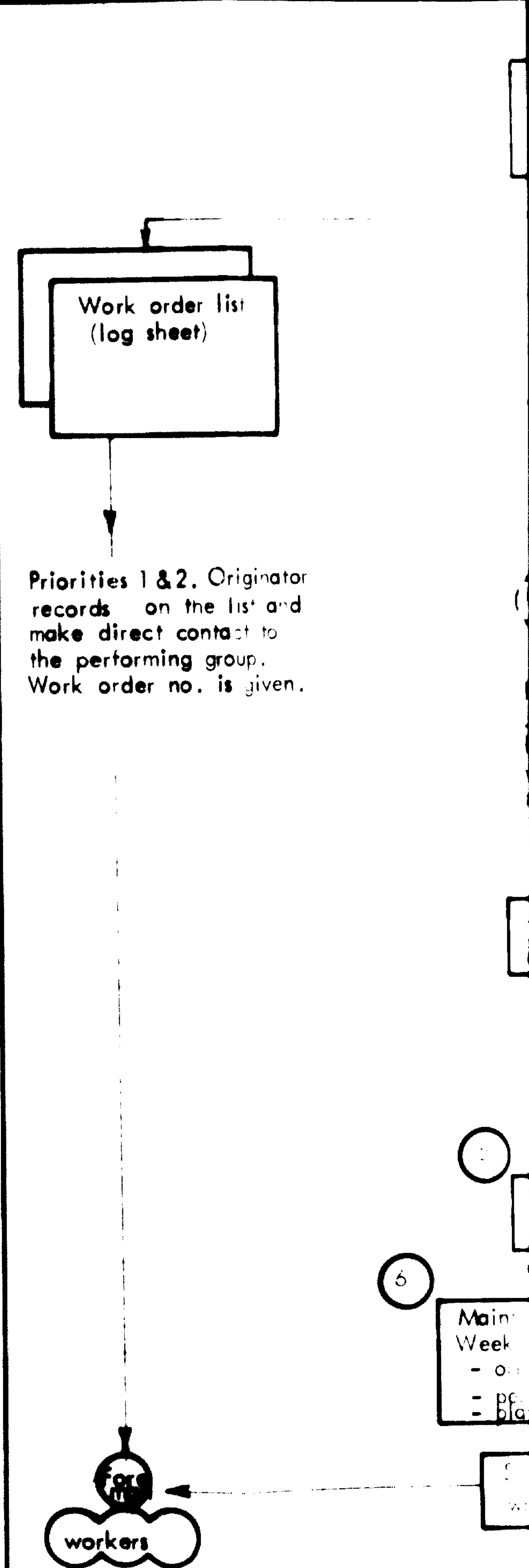
3. Planning group arranges the work orders according to the rules and hand over the work-orders to detail planning (5) or asks for external resources (4)

4. The arranged work orders can, considering the load situation in the performing groups (shops), or for other reasons if suitable, be given to external resources, e.g., central maintenance shops.

5. The prepared work orders are registered on the respective performing groups, and scheduled according to the planning rules. The planners issue Subwork-orders if necessary to the respective performing groups. The prepared work-orders planned for coming week are set up on the weekly program of the respective performing groups.

6. The work program for the coming week is fixed at the weekly planning meeting.

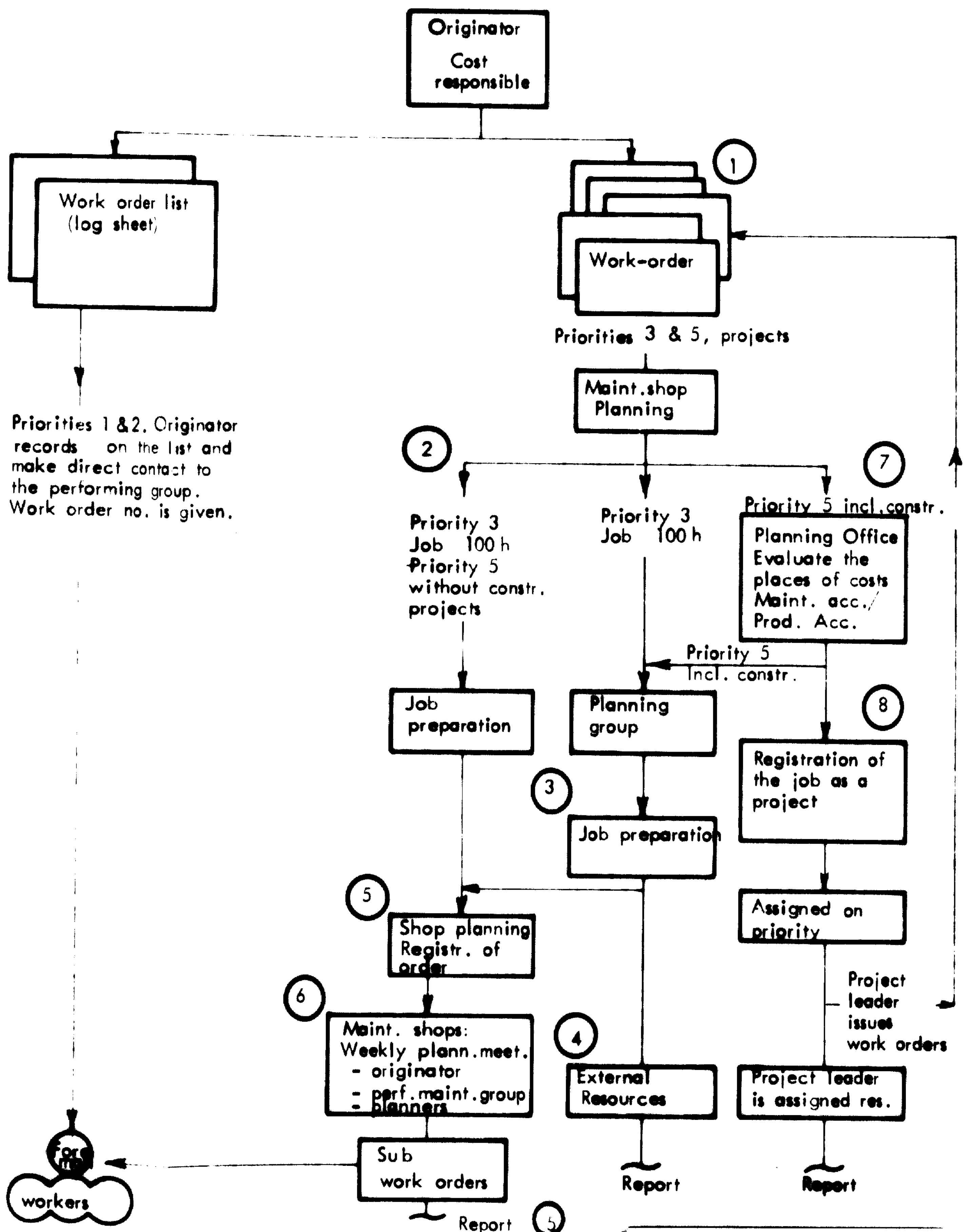
7. The work orders priority 5 which are to be considered as a project, are registered (8) and handed over to the project group. The originator is informed that the order is going to be performed by the project group.

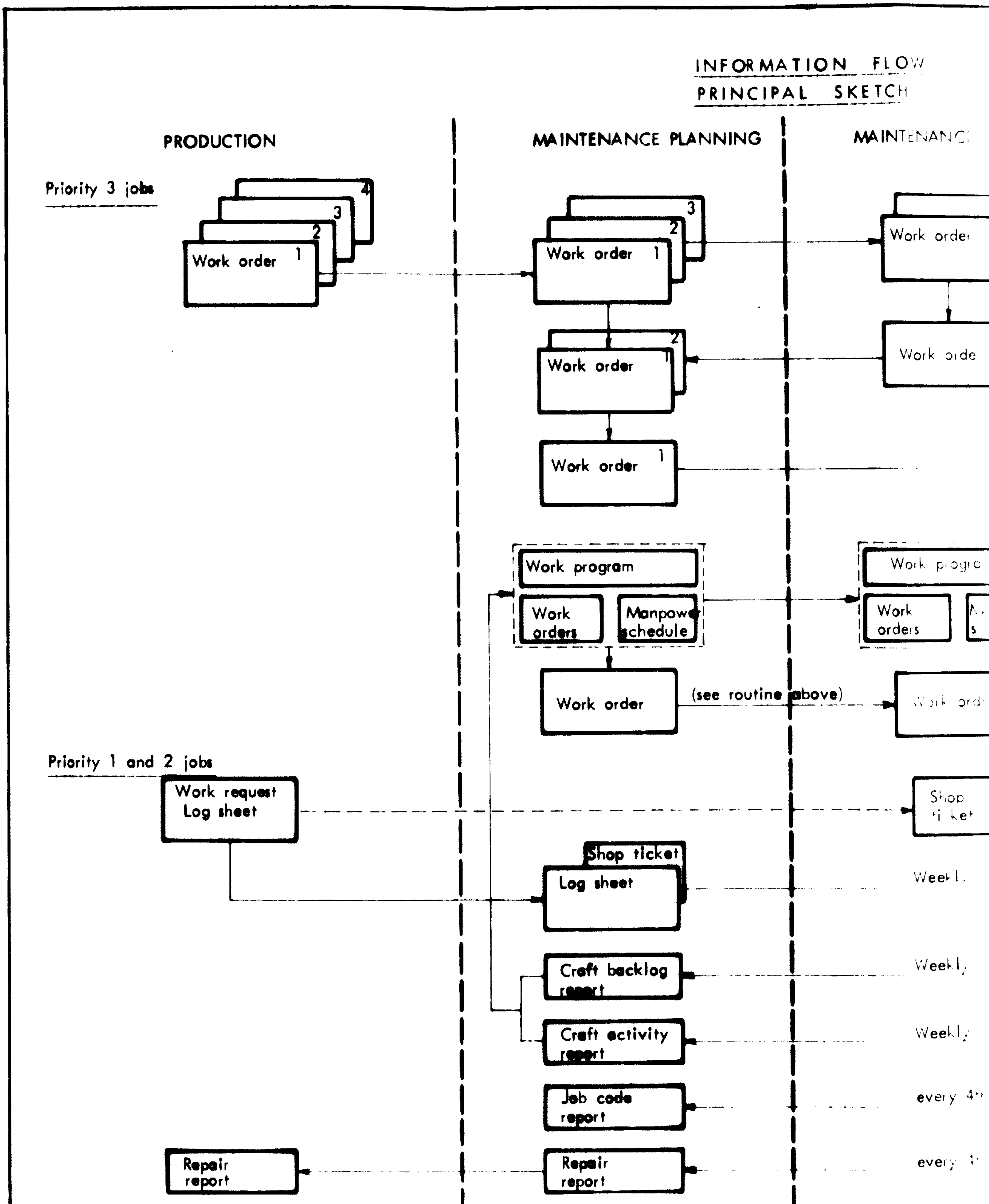


SECTION 1

ATTACHMENT 5.1

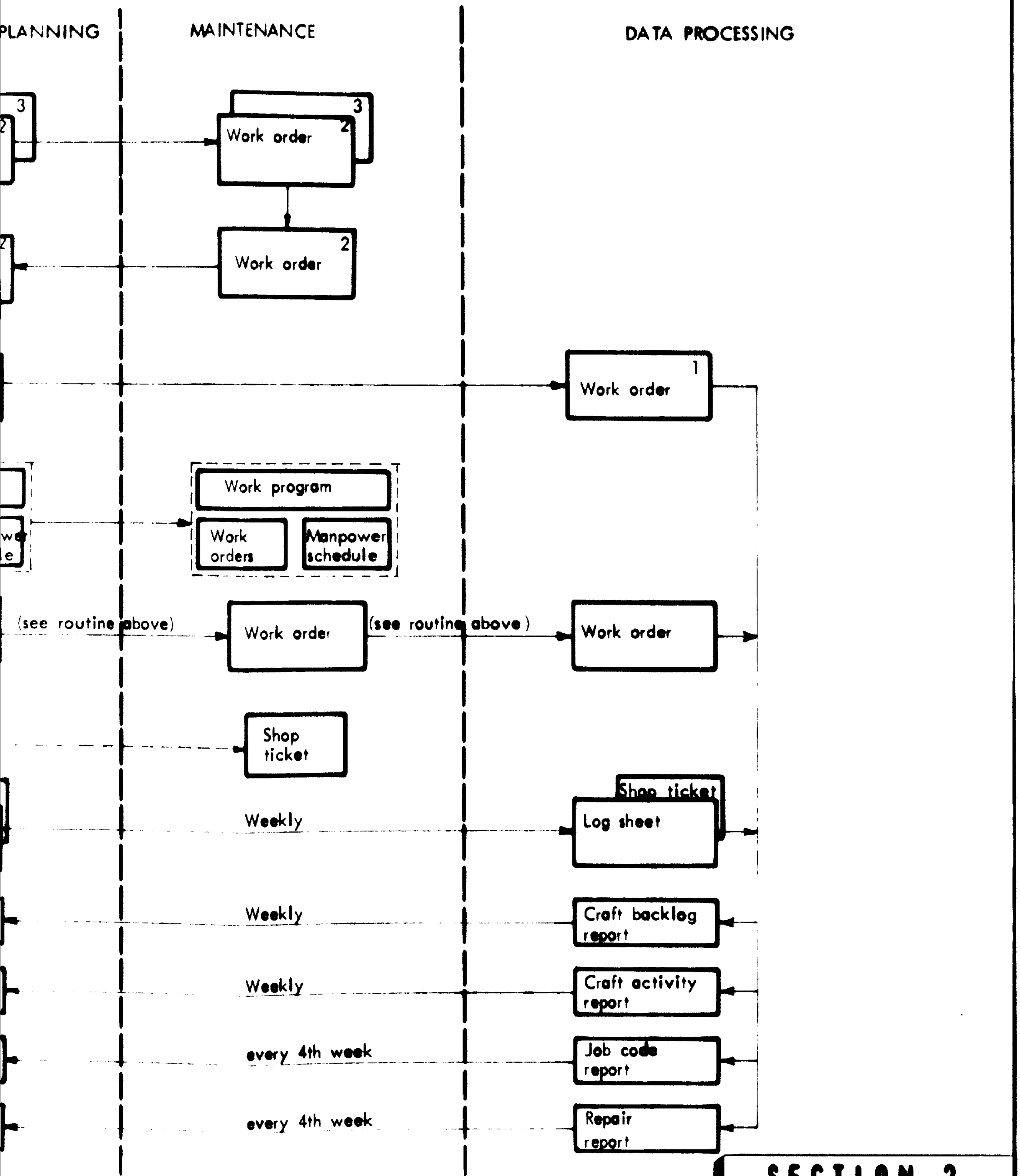
WORK - ORDER - FLOW



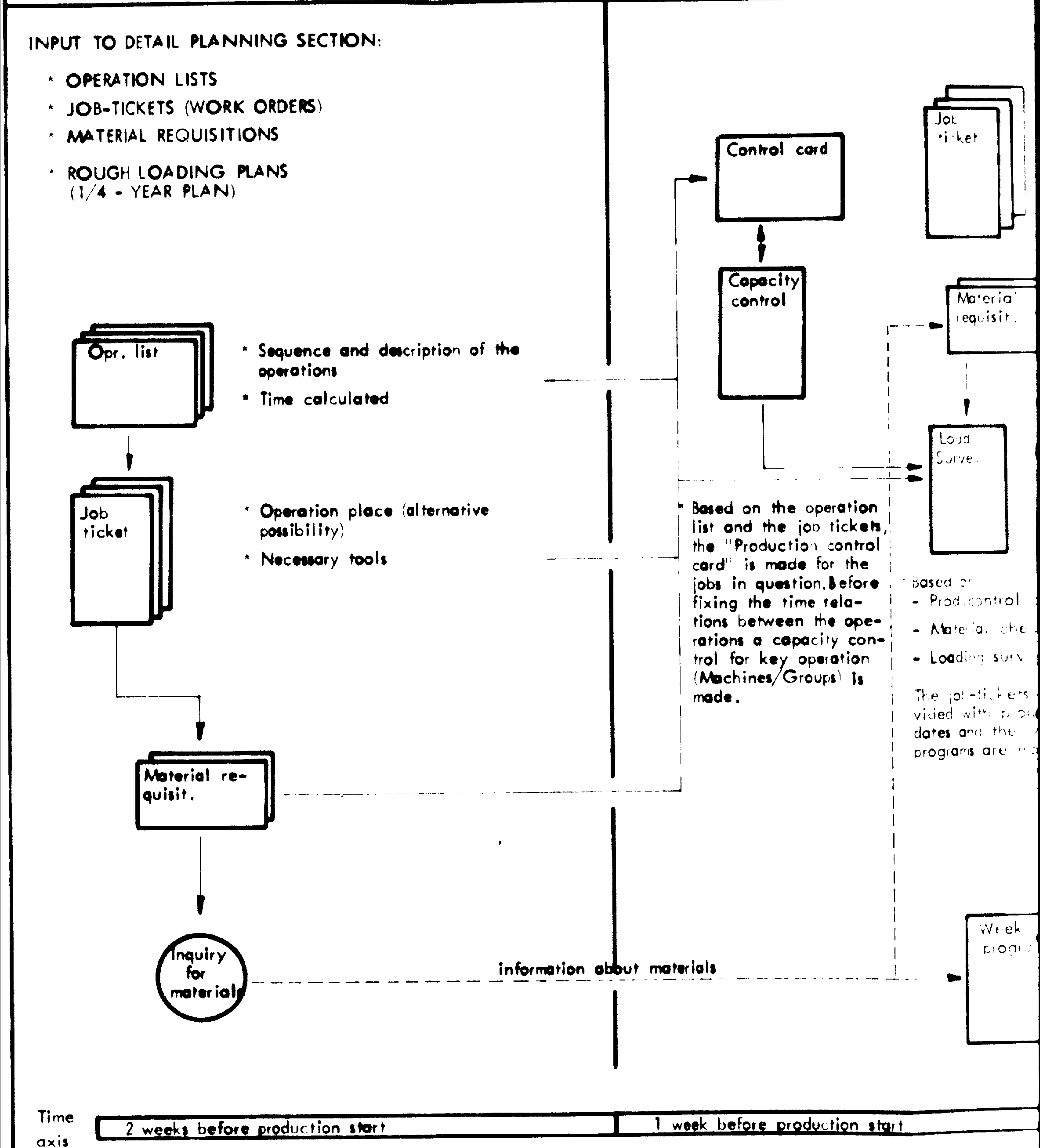

INFORMATION FLOW
PRINCIPAL SKETCH
PRODUCTION
MAINTENANCE PLANNING
Priority 3 jobs
Work order 1
2
3
4
Work order 1
Work order
Work order 1
Work program
Work orders
Manpower schedule
Work order
(see routine above)
Priority 1 and 2 jobs
Work request Log sheet
Shop ticket
Log sheet
Craft backlog report
Craft activity report
Job code report
Repair report
Repair report
Work orders
Shop

SECTION 1

INFORMATION FLOW
PRINCIPAL SKETCH



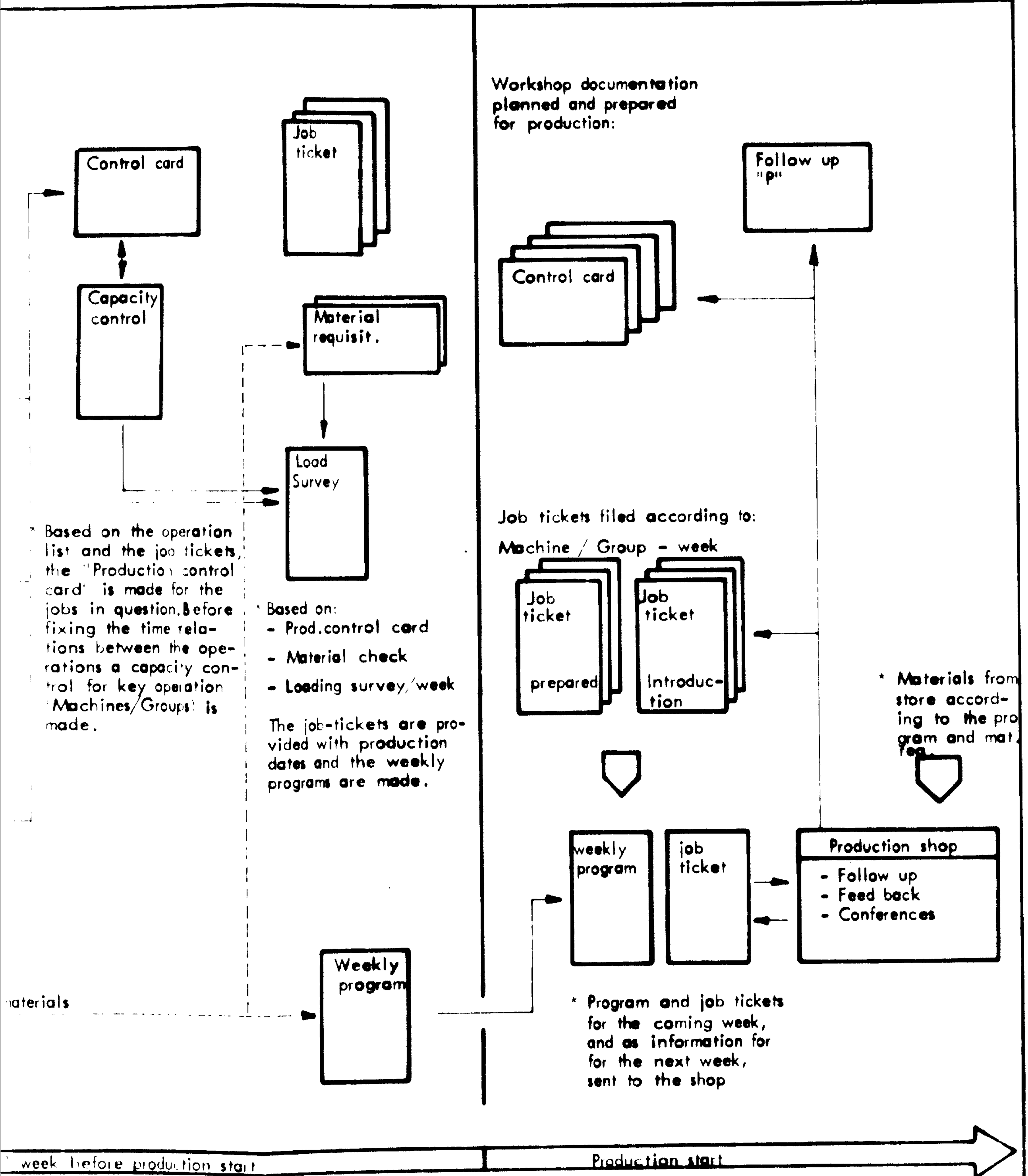
ROUGH SKETCH OF PROPOSAL FOR DETAIL PLANNING



SECTION 1

ATTACHMENT 5.3

...OPOSAL FOR DETAIL PLANNING IN MECHANICAL SHOPS



SECTION 2

Attachment 5.4

PRODUCTION CONTROL CARD

card no:

date/sign:

pos	job ticket	IDENTIFICATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
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REMARKS:

Attachment 5.5

	CAPACITY CONTROL	Planner:

Attachment 5.6

Page 1

LOADING SURVEY

PAGE: ____ OF ____

DATE: ____________

PLANNER: ____________

SHOP: ____________ FOREMAN: ____________________

WEEK No.												
TEORETICAL CAPACITY IN HOURS	H											
ACTUAL CAP.	I											
ACTUAL HOURS	J											
JOB N°	P	C	P	C	P	C	P	C	P	C	P	C
	K	L										

P: PLANNED HOURS PER JOB. C: CUMULATED HOURS FOR THE PERIOD

Load Survey Form

H = Theoretical capacity in hours: Total capacity in man-hours including shifts and planned overtime, but excluding workers on holidays.

I = Actual capacity: The actual capacity is the theoretical capacity corrected by a factor for illness, other absence, and minor breakdowns. The figures of illness and other absence will be found by statistics of the capacity utilisation.

We propose the figures of minor breakdowns to be 10% at the beginning. This factor must be discussed with the shop leaders and the foremen. The aim is to reduce these factors in order to get better utilisation of the manpower.

J = Actual hours: Actual hour consumption in connection with jobs. The actual hour consumption of the "follow-up week" (the past week) must be calculated and inserted in this space. Deviations, if any, must be discussed with the foremen at the planning meetings in order to decide, for instance, in case of a delay, whether this delay can be eliminated through overtime. If necessary, the "planned weeks" must be adjusted.

K = Planned hours per job: The planned hours are the expected actual hours.

In order to get these planned hours, the estimated hours are multiplied by a factor

$$P = \frac{\text{actual hours}}{\text{estimated hours}}$$

This factor is found through the feedback of job tickets and calculated as described in point 5.4.2.

L = Cumulated hours per week: Cumulated hours of the planned jobs must fill up the actual capacity (I).

In order to have a clear survey, the plans must be kept in files for each foreman.

Attachment 5.7

	WEEKLY PROG [illegible]	Date: Page 1 Planner: Page ____ of ____
Job nº:	SHOP:	Foreman
	GROUP:	

Pos. No.	Job No.	DESCRIPTION	PLANNED		ACTUAL		MATERIAL	
			Hr.	Min.	Hr.	Min.	From	To
A	B	C	D		E		F	

WEEKLY PROGRAM/FOLLOWING-UP

A. Pos. No.

B. No. of job.

C. The same description as that of the job ticket.

D. The planned start and finish date of the job.

E. The actual date on which the job was started and finished.

F. Information concerning origin of the materials and their destination point after completion of the job.

Attachment 5.8

Page 1

FOLLOW-UP PLANNING FACTOR P

PLANNER

QUARTER No :

GROUP	WEEK No / HOURS					P					P						P
A	ACTUAL	B				D											
	ESTIMATED	C															
	ACTUAL																
	ESTIMATED																
	ACTUAL																
	ESTIMATED																
	ACTUAL																
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FOLLOW-UP THE PLANNING FACTOR P

The planning factor P is: $\frac{\text{Actual hours}}{\text{Estimated hours}}$

This P must be calculated per foreman continuously based on the job tickets of the finished jobs. The form is shown below:

Explanation:

A = Group: Normally a group consists of the workers and 1 foreman. If some foremen have only a few men it might be expedient to form larger groups by putting together several foremen groups.

B = Actual hours: The actual hours registered on the job tickets of finished jobs within the stated week.

C = Estimated hours: The estimated hours registered on the job tickets of finished jobs within the stated week.

D = Planning factor P: $\frac{\text{Actual hours}}{\text{Estimated hours}}$ of the past 4 or 5 weeks. One form covers one quarter of a year.

Besides using P for the conversion of estimated hours into planned hours, the factor tells something about the efficiency. If the estimated hours are constant and P decreases, it means that the actual hours have been reduced. The reason for higher efficiency can be better methods, better organization of the transportation, correct manning, etc. It should be the foreman's object to raise the efficiency and keep P on a level corresponding to good efficiency.

6. MATERIAL ADMINISTRATION

ATTACHMENT 6.1	Flow-chart	
	Spare Parts Value	25.000
ATTACHMENT 6.2	Flow-chart	
	Designated Spare Parts	
ATTACHMENT 6.3	Flow-chart	
	Spare Parts in Stock	

6. MATERIALS ADMINISTRATION

The present situation in the materials and spare parts administration of the company calls for close attention.

In this chapter is presented a proposal for future materials management. However, the system as such cannot solve all of the problems. Proper coding systems, efficient procedures, efficient utilization of EDP, and a clear organization are basic elements in efficient materials management. But if we do not know what is on stock today, if we do not know the costs/value of this, if we do not know what is ordered and which delivery times will be met, if we do not know the need for spare parts, and if we do not have a description for materials administration, then this must be changed before a system can function efficiently.

Today the materials administration function of the company controls a value of approximately 400 mill. Forints and at the same time spare parts are often lacking.

We recommend a special survey to be carried out in this area. The objective of such a survey should be:

a. To identify and code all existing materials and spare parts, including such ordered and not yet delivered.

b. To register both weak points in the present situation and demands for changes.

c. To examine possibilities for deletion and propose a policy to the top management.

d. To examine the method for decision-making before ordering and propose similar rules for the whole company. This concerns both number to be ordered and where (buy/make).

e. To elaborate an efficiency improvement program for the materials administration inside the frame of the system presented below.

PROPOSED SYSTEM

The materials administration function in the maintenance organisation will be headed by a unit manager responding to the director of maintenance.

The unit manager of materials administration will be responsible for efficient utilisation of the capital kept in stocks and for minimising the direct and indirect costs caused by materials and spare parts. His responsibility is described in more detail in the system descriptions.

Decisions as to what and how much will be kept in stock, what will be manufactured inside the company, and what will be purchased will be made on the basis of the principles set forth at the maintenance courses and presented in the course manual.

Decisions as to deletions of spare parts will be made on the basis of an economical/technical/political decision by the top management. The present method shall be used increasingly until the EDP-materials administration system is functioning. Then no special method is necessary, but for some years a special person will be assigned this responsibility.

The material planning system will ensure that the results of the analyses mentioned above are brought into action and that requirements for materials and spare parts are fulfilled without unnecessary delays.

The basic principles for the material planning system (MPS) are:

- all materials and all spare parts located in the company will be filled in MPS.

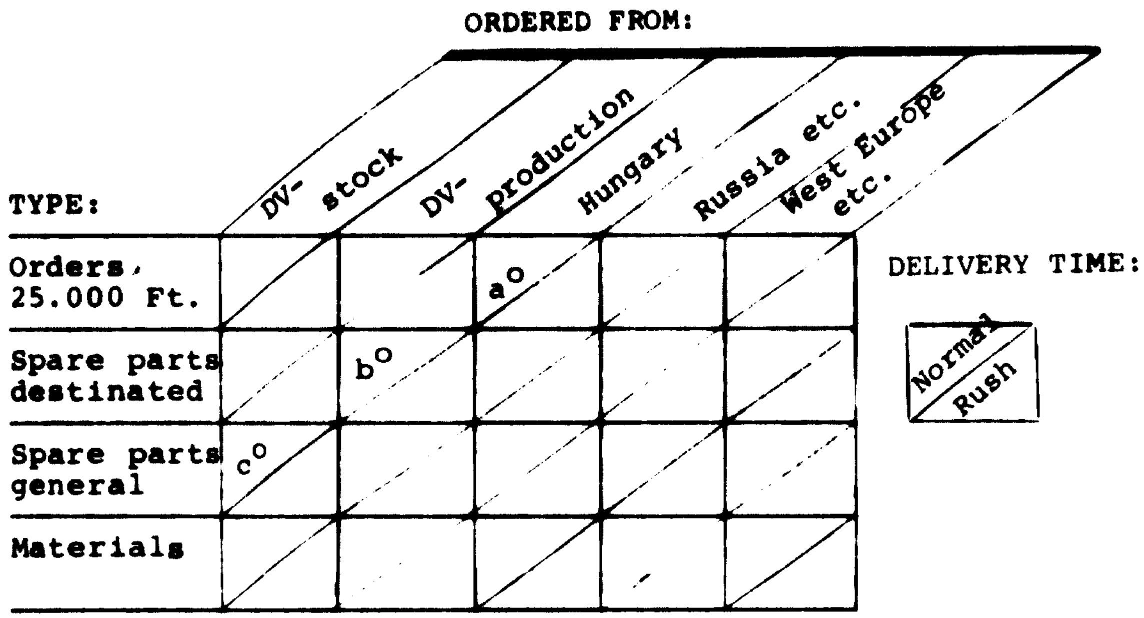
- all utilization of materials and spare parts will be requisitioned from MPS. If there is not time to complete the paper work before a part is used, it must be done immediately thereafter.

- requisitions sent to MPS may be evaluated by MPS, but the user (requestor) decides what he must have.

- MPS acts as an internal purchasing office for the maintenance production workshops and no other department can, normally, order a job to be carried out here.

The MPS routines differ depending on the type of requisitions and materials/spare parts. They are not different for goods placed in central stocks or in production units.

The following scheme shows the 20/40 main variants of routines.

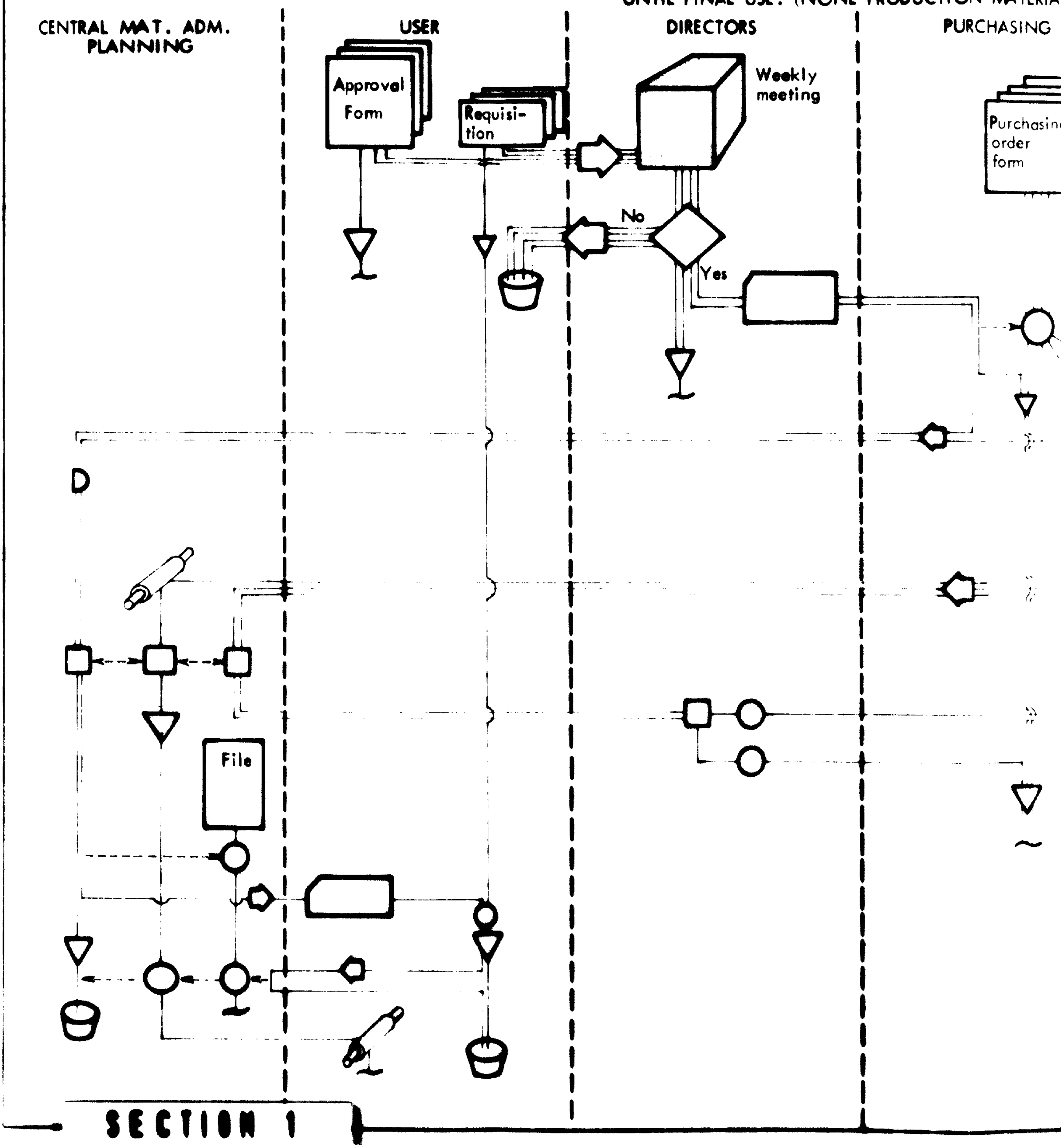


In attachment 6.1 the routine for orders amounting to more than 25.000 Forints and ordered in Hungary with a normal delivery time (a°) is described. In attachment 6.2 the routine for orders of designated spare parts ordered in a workshop within the company with a normal delivery time (b°) is described.

In attachment 6.3 the routine for orders of general spare parts ordered in a stock within the company with a normal delivery time (c°) is described. Routines for rush orders will be the same as for orders with normal delivery time, only ordering and material handling is carried out before the routines are performed

FLOW - CHART

ROUTINE FOR ADMINISTRATION
OF ITEMS > 25000 Ft. FROM INITIATIVE
UNTIL FINAL USE. (NONE PRODUCTION MATERIAL



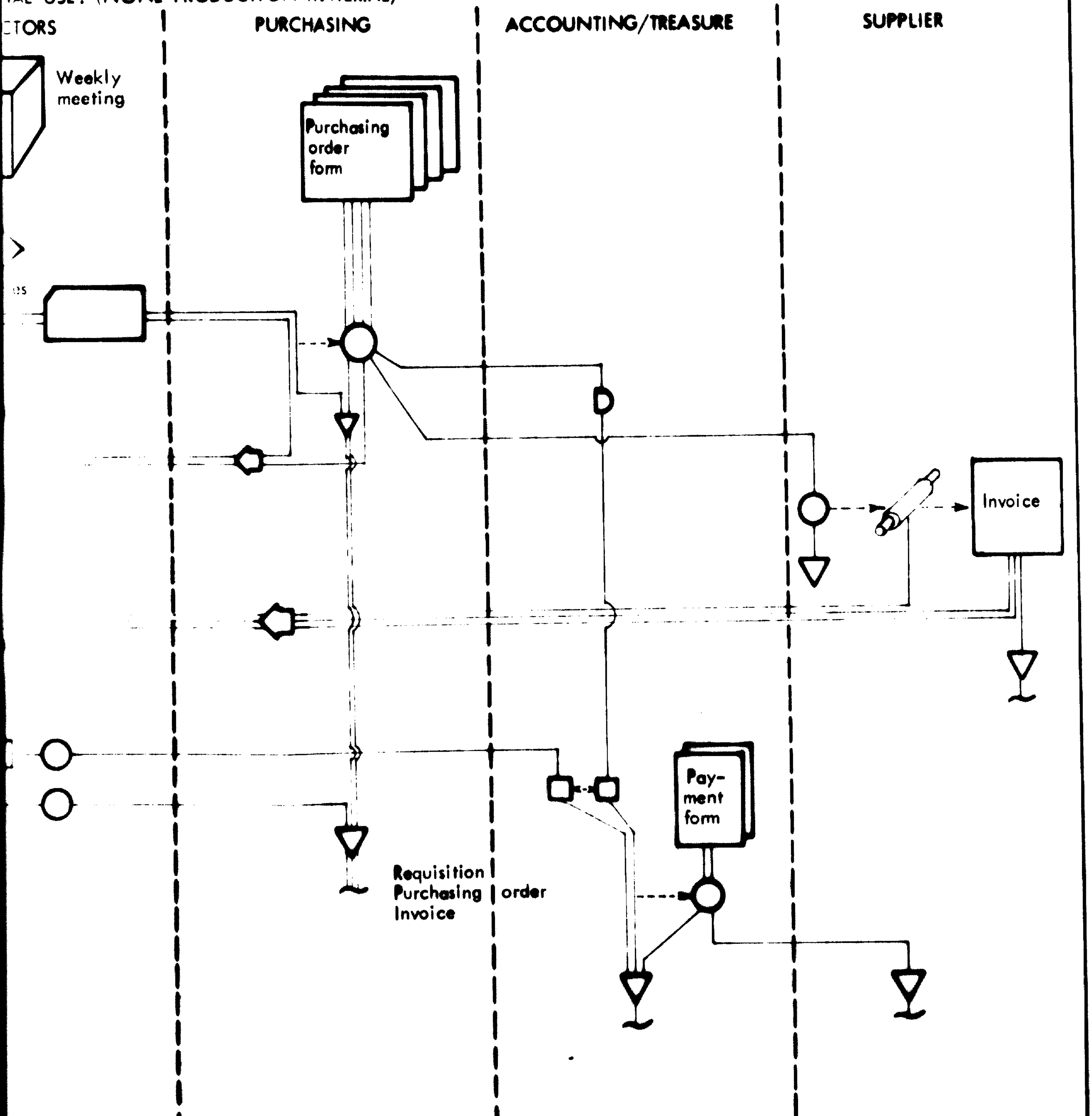
SECTION 1

FLOW - CHART

ATTACHMENT 6.1

MAT. ADM. SYSTEM

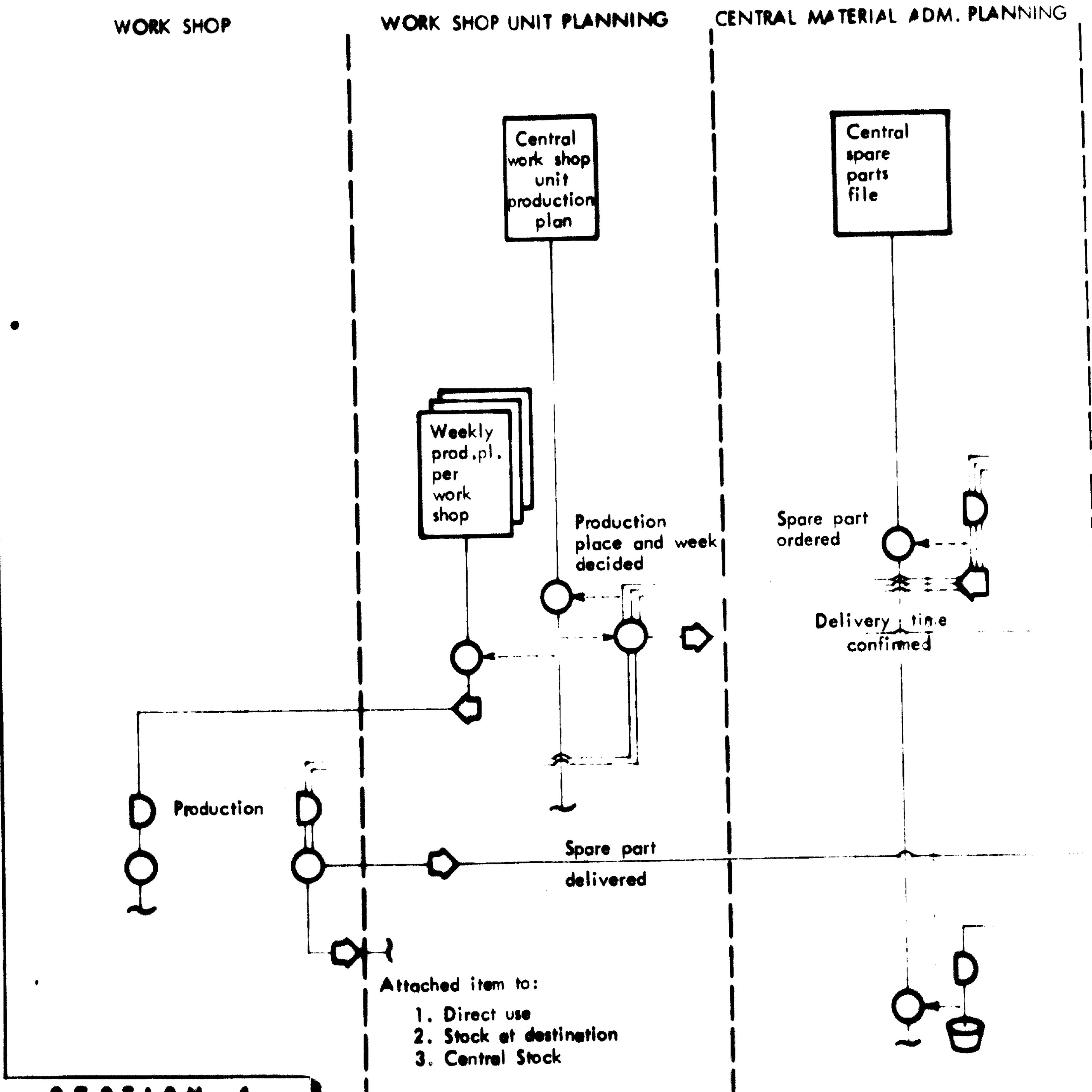
)UTINE FOR ADMINISTRATION
TEMS > 25000 Ft. FROM INITIATIVE
IAL USE. (NONE PRODUCTION MATERIAL)



SECTION 2

FLOW - CHART

ROUTINE FOR ADMINISTRATION
OF DESIGNATED SPARE PARTS PRODUCED
AT DV. FROM INITIATIVE UNTIL FINAL



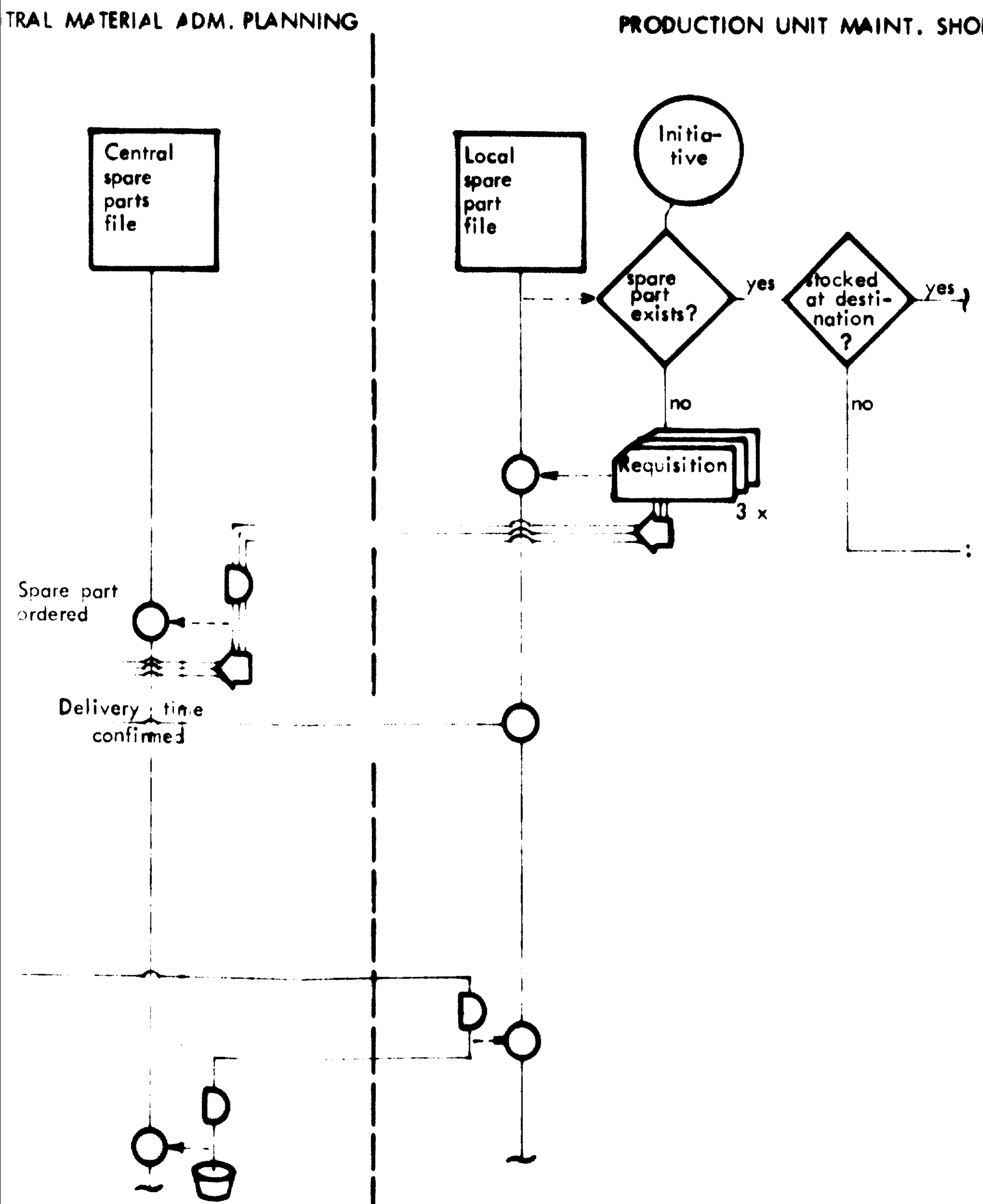
SECTION 1

ATTACHMENT 6.2

MAT. ADM. SYSTEM

FLOW - CHART

ROUTINE FOR ADMINISTRATION
DESIGNATED SPARE PARTS PRODUCED
V. FROM INITIATIVE UNTIL FINAL USE.



: Find location in local spare parts file. Mount spare part, send the attached requisition for registration to central and local spare parts file.

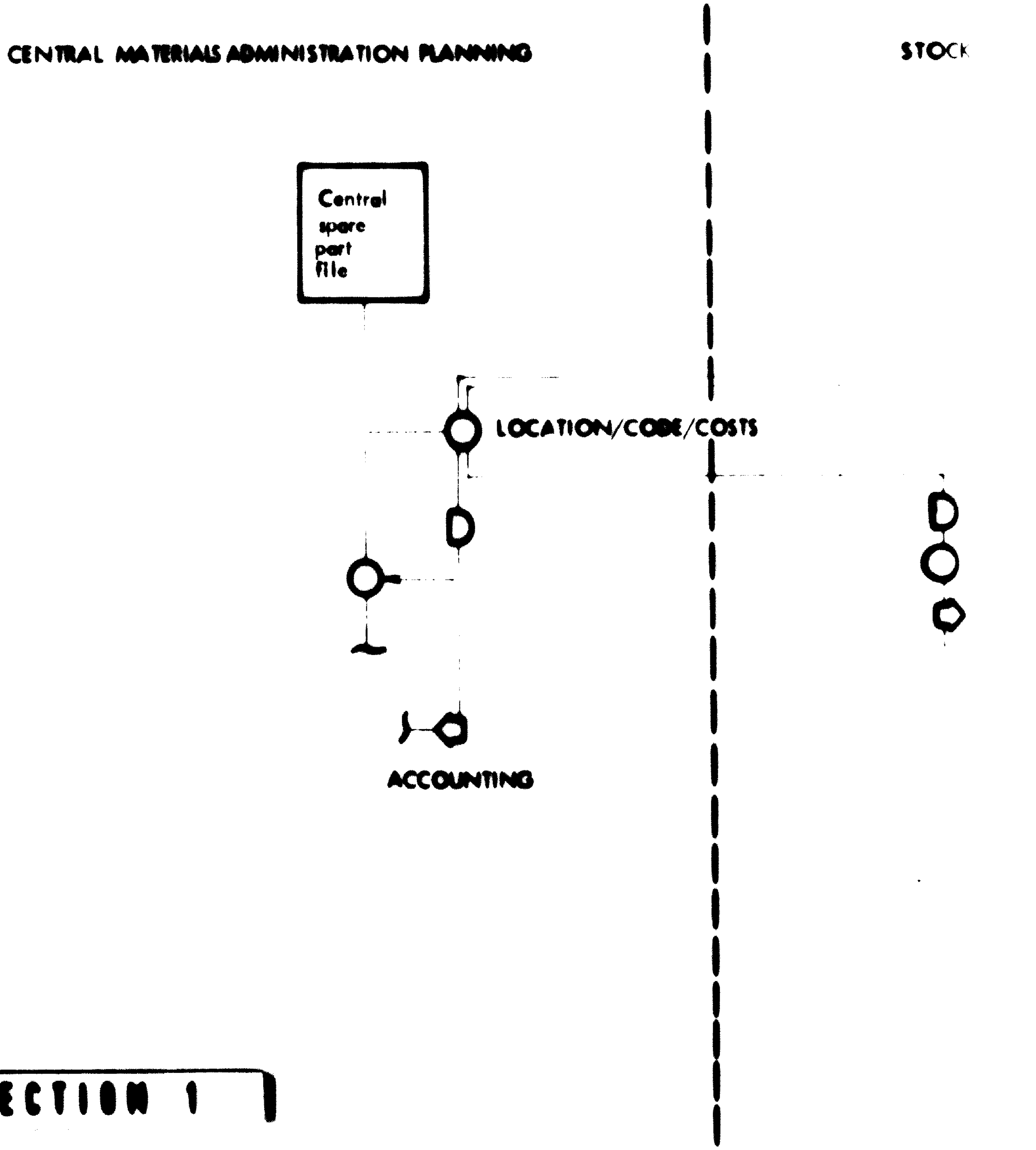
: Find copy of requisition in local spare part file, send it to CMA-Planning as call.

When spare part is mounted copies of requisition will be disposed of. (Not kept in file)

SECTION 2

FLOW - CHART

ROUTINE FOR ADMINISTRATION OF GENERAL SPARE PARTS PLACED IN STOCK IN D.V. FROM INITIATIVE UNTIL FINAL USE.

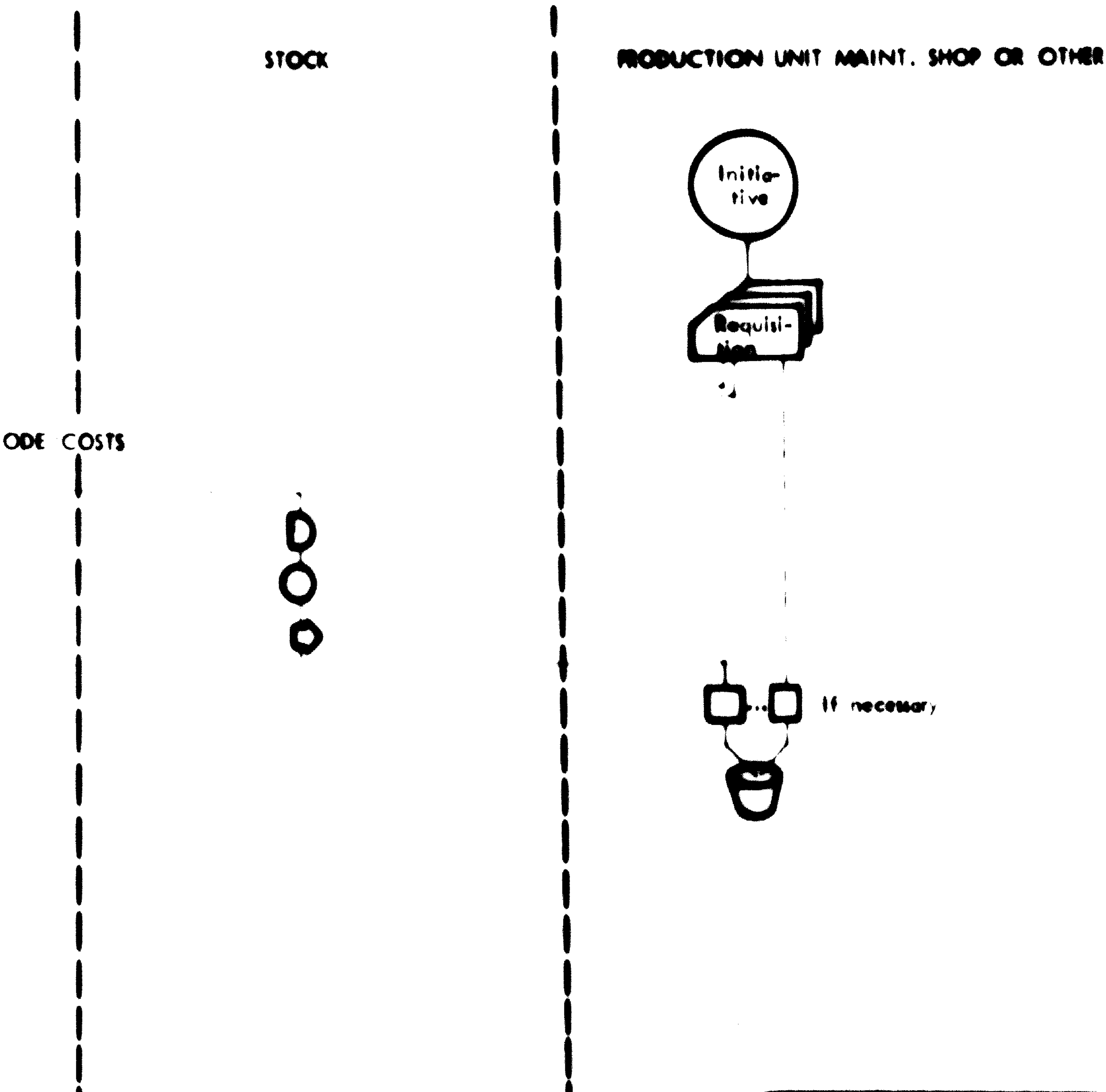


SECTION 1

ATTACHMENT 6.3

FLOW - CHART

ROUTINE FOR ADMINISTRATION
OF GENERAL SPARE PARTS PLACED
IN STOCK IN D.V. FROM INITIATIVE
UNTIL FINAL USE.



SECTION 2

7. GENERAL DESCRIPTION OF THE COST CONTROL SYSTEM FOR MAINTENANCE

7. GENERAL DESCRIPTION OF THE COST CONTROL SYSTEM FOR MAINTENANCE

The present cost control system has more weaknesses or inadequacies and the below-mentioned are the most important ones:

1. The paper process concerning the accounting system is long and complex. The introduction of EDP gives further possibilities for simplification.
2. Overhead costs, "regi costs", in the work shops are distributed among the orders through a monthly calculation of overhead costs and direct (=productive) wages and added to the direct wages as a percent. An easier way to distribute these costs would be to divide the yearly budgeted overhead costs, divide these by the yearly planned productive hours and then multiply the resulting amount by the productive hours of the specific orders.
3. A yearly budget for overhead costs is not elaborated. In order to get an effective control of all overhead costs a budgeting system based on cost responsibility areas must be elaborated.
4. Lack of coordination between cost places, standing work orders, and machine numbers.
5. Cost reporting is incomplete.
6. No detailed cost planning and cost distribution on the maintenance functions are made at present.
7. Subcontractors for maintenance jobs are not always ordered or controlled by the maintenance organization.
8. The accounting groups in the various factories and the Central Maintenance Office are working unintegrated following different routines, and not using the same routines as used in the Central Accounting Group.
9. The data processing today is performed partly manual and partly by EDP, and the development of the processing procedure is not coordinated at the various places.
10. The maintenance account numbers are used without authorization, this giving possibilities for misuse.

7.1 PURPOSE OF THE COST CONTROL SYSTEM

The purpose of the cost control system is to enable both the management and other colleagues to control the economy of their areas of responsibility, i.e.

- to report the costs of each maintenance function,
- to evaluate effectiveness by using own labour force versus co-operation/purchase,
- to evaluate the total maintenance costs distributed according to responsibility areas, functions and jobs, incl. maintenance pricing,

- to give a basis for elaboration of budgets for the total company,
- to evaluate deviations between planned and actual costs as well as causes thereof,
- to evaluate the value of equipment/machines,
- to evaluate the optimum time for replacement of an investment,
- to evaluate costs in down-time for the single works,
- to elaborate key-figures for comparative analysis.

7.2 DEFINITION OF COST CONTROL

Cost control is generally a method enabling the enterprise effectively to control actual and future costs by comparing planned and actual costs. To make the control effective, a precise and careful system for calculation, budgeting (economic planning), registration, and reporting is necessary.

7.3 BUDGETING SYSTEM

7.3.1 Introduction

The purpose of the budgeting system is - in connection with precalculations - to form the planning part of the cost control system for maintenance of the company.

In the budget, the physical plans for maintenance are expressed mainly in financial terms (Forints).

The value of decentralised budgeting, which we are recommending, lies as much in the process as in the resulting documents. Therefore, in order to make cost control function it is absolutely essential that directors and executives at all levels of the organization with maintenance cost or production responsibility be engaged in the development of the budget. The purpose of this multi-level participation is to increase the motivational impact of the resulting budget, as the executives will accept the budget more readily and they will feel a greater responsibility for its fulfilment.

Also the cost consciousness of the executives at all levels will be increased by this participation.

Consequently, the proposed budgeting system is not only a forecasting technique. It is a highly creative process which means vertical and horizontal communication within the management, until the budget has been evaluated, adjusted and readjusted into a set of integrated and realizable objectives consistent with the policies of the company.

7.3.2 General assumptions

The budgeting system must be coordinated with the maintenance planning system, the calculation system, the control reporting system and the registration (book-keeping) system.

The basis for the budget is formed by the maintenance planning system and the precalculations of major projects: materials and work-hour consumption, schedule dates etc., as well as reports from past periods, statistics, price-prognoses etc.

7.3.3 Length of the budget period.

Within the lines of a long range plan, e.g. a 5-year plan, the here described budget system for the first year represents the concrete work frame for the first coming year.

7.3.4 Budget organisation.

The establishment of a budget planning and control system necessitates the formation of units with active participation of top management within maintenance and production, responsible for the creation of the budgets.

The following units should be established:

1. A budgeting committee consisting of the maintenance director, production directors, finance director, key persons of maintenance planning, of maintenance in general, and finally of budget coordination staff.

   The function of this budgeting committee is to act as a reviewing and coordination unit in the budgeting procedure. This committee has the greatest responsibility for the budget.

2. A central budgeting coordination, which might consist of one or two persons with economic planning and analysis experience, should be formed. This unit should act as a central information and service center for the line management and other budgeting bodies. It prepares the procedural aspects of the budgeting process, supplies cost information, gives technical and other advice where required, and secures overall coordination.

Furthermore, it pulls together all the budgets, seeks clarification as to the accuracy and reasonableness of the figures, and checks that the budgeting procedures have been followed.

The budgeting coordination is also responsible for the formal budget control, budget analysis, and budget revision, if any, as well as the coordination activities with the investment department, and for the incorporation of additional costs for various jobs planned on maintenance budget (social, safety, etc.).

3. Furthermore, a local budgeting coordination, which might consist of a single person, should be formed within each maintenance unit for the single factory and within central maintenance workshop and maintenance production workshop.

   The tasks of this unit are:

   - to act as the connection between the central budgeting coordination and the local budgeting bodies,
   - to take care of the budgeting technical aspects of the budgeting procedure,
   - to assist the leader of the units in question.

7.3.5 Budgeting procedure.

The basic budgeting process can be divided into four phases:

1. Budget preparation.
2. Budget elaboration.
3. Budget coordination.
4. Budget approval.

The budgeting procedure is illustrated in attachment No. 7.1.

Budget preparation

Within this phase, the maintenance director, assisted by maintenance planning, draws up the framework for the budgeting of the coming year's activities. The maintenance director announces what claims are made on the activities of maintenance in order to fulfill the aims of the budget periods. This is done on the basis of an evaluation of realized or planned investments and dispositions, within the frame of the long range planning, which will influence the activities in the course of the budget year.

The "central budgeting coordination" prepares budget forms, filled in with actual or calculated figures of the past budget periods, assisted by the local budgeting.

Budget elaboration

The budget elaboration is executed by maintenance factory manager, unit managers, workshop manager and eventually foremen within their responsibility areas in order to fulfill the demands for maintenance. The elaboration for the respective production units takes place in consideration of the production leaders' wishes and points of view. This engagement goes as far down in the organisation as practical, following the principle, that each person is budgeting the activities and costs for which he is held responsible and which he can influence. The preliminary budgets of each level are approved by the highest management board on that level.

The budgeting is partly based on precalculations of major maintenance projects.

This phase is terminated by submitting the budgets to the "budgeting committee" for review and coordination.

Budget coordination

Now, the budgets are summarized and examined from three points of view:

1. Are the budgets realistic?

2. Are the budgets consistent with the physic/economic aims of the division?

3. Are the budgets feasible in light of the planned maintenance activities?

Budget approval

After approval of the budgets by the budgeting committee , necessary comments are made on the budgets.

By this budgeting procedure, budget realism is obtained by involving people with detailed knowledge.

7.3.6 Budgeting comments.

Budgeting comments should be worked out by the budget committee. The comments ought to deepen or throw light on the planned activities within each responsibility area, e.g. by dealing with:

- present situation,

- general aims,

- expected efficiency improvement.

7.3.7 **The structure of the budget system.**

The proposed budget system consists of:

1. Personnel budgets

2. Cost budgets.

Personnel budgets

The planned need for man-hours within and outside each organisation unit should be charted. For this purpose form 1.1 is used (see attachment 7.2.). This form is modelled like a loading program, charting the planned connections between maintenance units and production - or other receiving - units, expressed in man-hours.

The basis for this elaboration is the physical maintenance planning systems. Also the non-productive hours are planned in this form. In the principal form No. 1.1 in appendix 1 the need for man hours is planned per quarter of a year, but if it is prefered to plan per month, this would not imply a significant difference. Form 1.1 only includes the planning of man hours for workers with productive maintenance hours, but includes all non-productive hours as well for these workers.

Form 1.1 is included in the basis for planning the need for workers and employees throughout the budget year in the various categories of personnel within each organisation unit, form 1.2 (see attachment 7.3.).

Concerning the workers, these plans are transformed into productive and non-productive man hours in form 1.3 (see attachment 7.4.).

The budgeting implies an accurate definition of areas of cost responsibility, so that the budgeting responsibility of each manager is concentrated on personnel and costs included in his sphere of influence. Therefore, an organisation numbering system is a condition for the build-up of the system.

The budgets are built up from the bottom, starting with the budgets of the foremen (if these are to be included), then workshop managers, unit managers, and finally maintenance factory manager.

Cost budgets

Based on the personnel budget forms and the expected changes in the average wages per hour for the various categories of personnel, the budget coordination unit calculates the wages in form 2.1 (see attachment 7.5).

Both direct and indirect materials and other costs are also budgeted in form 2.1.

The budget coordination unit has to supply the cost budgeting persons with cost information, telling what account numbers/work numbers and types of costs are to be included in the respective cost budgets.

Each person is budgeting, as previous outlined, only the costs which are influenced by his decisions.

7.5 CALCULATION SYSTEM

For greater maintenance projects, such as renewals and yearly overhauls, it is suggested that precalculations of the costs be made. These precalculations are elaborated on the basis of technical specifications from the project planning system.

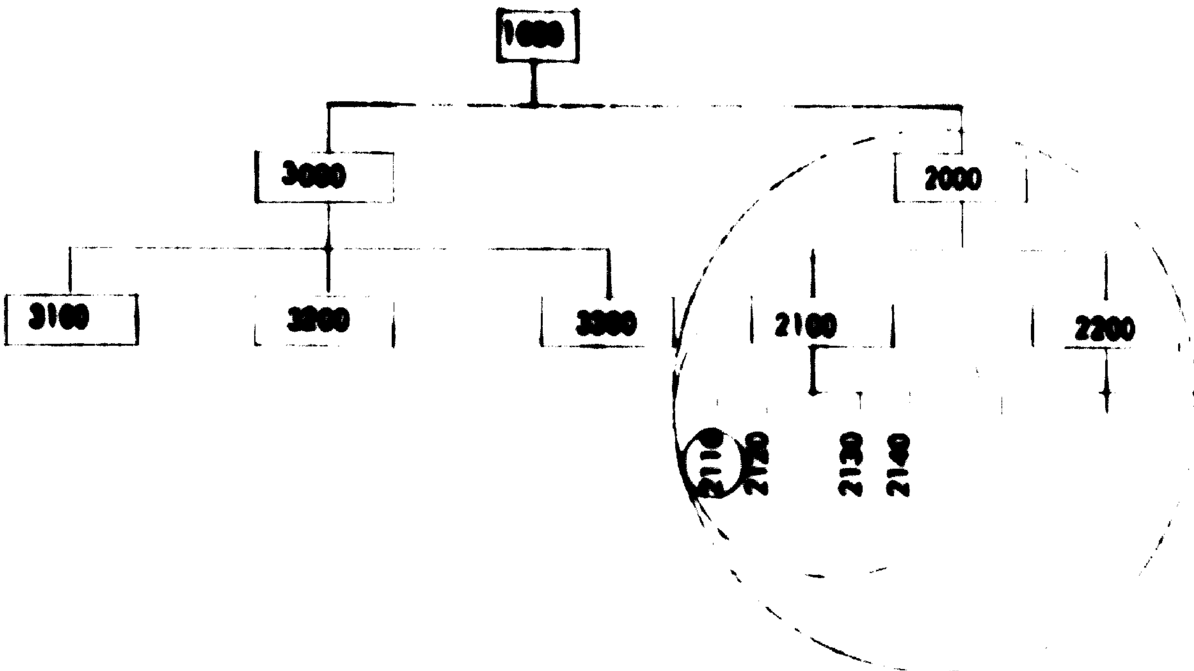
In order to follow the proposed decentralized cost responsibility principle, the person responsible for the project works out the precalculation, assisted by central planning and possibly by an economic specialist.

The precalculations contain a specification of the costs of direct materials, direct wages, direct services including cooperation, (services from other firms), and other direct costs. Indirect ("regi") costs are distributed according to the single, productive work number by multiplying the production hours of the project by a forint-factor. The forint-factor is found for a year by dividing the yearly planned indirect costs by the yearly planned productive hours (see part 5, concerning Weaknesses in the precount system).

The exact form on which the precalculations are to be registered will be worked out in cooperation with the project 2.2.4, concerning Project Planning System. The precalculation data are used as input to EDP for comparison with after-calculation data for the single project.

7.6 REGISTRATION SYSTEM

To enable follow-up with reports for each responsibility area, each organisation unit must have a number, e.g.:



O = responsibility area.

Normally, a responsibility area will be equal to an organisation unit, but if, for instance, a leader is chief of two organisation units, the responsibility area consists of these two units.

Furthermore, a number system for each machine must exist to follow up the maintenance costs per machine. This number system is dealt with in the Coding System project.

For a maintenance organisation, an organisational classification of cost-types in relation to responsibility areas (organisation unit) should be developed. These costs should include only those indirect ("regi") costs which the leader of the single organisation unit can influence, and which can be distributed according to the single organisation unit without use of distribution keys. This classification of indirect costs will show the single leader which cost-types to budget and how to make decisions, get reports, and to analyse aspects such as the cost-types for which he is held responsible.

In the computer, a file should be established containing the numbers of the maintenance organisation units and for each receiving organization unit, the work order numbers/project numbers.

The change to EDP book-keeping necessitates new paper routines now being prepared and implies changed work distribution in the effected departments.

7.6 COST REPORTING SYSTEM, GENERAL DESCRIPTION.

7.6.1 INTRODUCTION

As mentioned in the general description of the cost control system the reporting system represents the follow-up on budgets and precalculations by comparison and analysis of deviations. For larger projects the precalculations represent the basis for the follow-up, while the budgets represent the basis for the follow-up on direct and indirect costs for the maintenance departments and the maintenance costs for the receiving units, e.g.hot rolling mill.

7.6.2 PURPOSE

The purpose of the cost information system (= cost reporting system) is to provide the management with information on costs in a form and time suitable for investigating the causes of deviations and to take whatever action looks most appropriate.

7.6.3 PRINCIPLES AND STRUCTURE

The cost control reports will be distributed to the budget responsible managers with a degree of details corresponding to their budgets.

The reports are framed as periodic reports with fixed content. We have experienced that there exists a general need throughout the organization for increased cost control reporting. The volume of the periodic, current information should on the other hand be reduced to cover existing needs only.

It is found most practical to present the proposals for cost control reports in tabular form because it gives a better general view and the tabular form is more suitable as basis for future budgeting purposes. Besides, the possibilities of graphic presentation of periodic and year-to-date figures against planned figures should be considered.

In general, monthly reporting is proposed. Budget deviations can, however, be reported only on a quarterly basis.

7.6.4 Comments on the reporting forms.

The cost control reporting on personnel is executed by two forms: 11.1 and 11.2, see attachment 7.6 and 7.7.

The purpose of form 11.1 is to be a basis for evaluation of maintenance activities and their administration. The content is either hour or wage consumption in all maintenance levels and its distribution on production units or worknumbers. Furthermore, a quarterly budget comparison is made. Report form, 11.1 has connection with form 1.1.

Form 11.2 is basis for evaluation of the total man power situation, both within workshops and offices. It is only used as low in the organization as factory - department level. The form contains the number of personnel per category, increase and decrease of personnel. Budget deviations are calculated quarterly only. The column "Actual need for man-power" is filled in by the report recipient as notification towards his superiors in connextion with the proposed report meetings

At long sight, it is recommended to detail the reports further to establish better control possibilities, especially by building up of relevant experience - and norm data for the activities.

Cost control reports on costs form No. 12.1 and 12.2 (see attachment 7, 8 and 7.9) and 11.1 are intended to cover the need for cost information for the maintenance organization itself as well as for the production and other recieving units. This is obtained by accumulating the costs and reporting the costs by responsibility area.Form No. 11.1 gives a specification of the total wage costs and their application.

In form No. 12.1 the costs are specified with reference to the account numbers and types of costs which are influenced by the dispositions of the leader of each organizational unit. Thus, these cost reports contain the same types of costs as the corresponding cost budgets. The form is used for reporting both direct and indirect costs - the direct costs per recieving unit (e.g. production) and the indirect costs per maintenance unit (e.g. work shop). Furthermore, the form will give the cost specifications per sub-unit within each leader´s responsibility area.

Form No. 12.2, see attachment 7.9 is giving the monthly follow-up on the development in the maintenance efficiency, i.e. the follow-up on direct costs. For each work order (= job number) the cause for the maintenance, the actual and planned hours, and the costs are reported, while the costs are accumulated for each account number.

7.6.5 Follow-up routines.

An effective follow-up is a condition of the appropriate functioning of a cost control system.

The proposed cost control reporting system can be defined as a responsibility reporting system: The cost control is obtained by allocation of the responsibility for the deviations to the persons or organization units which are responsible for the costs, as well as by control by the management of the realization of planned activities and dispositions.

Therefore, the follow-up routines must include some pressure on the cost responsible persons in order to secure prompt action on the correct organization level.

This pressure can be obtained by:

- application of efficiency norms/standards or objectives.

- stipulation of deviation limits.

- stipulation of fixed dates for report meetings.

7.6.5.1 Standards and goals.

The cost control reporting system of the company must be integrated with the other reporting systems of the company.

Key figures, ratios and efficiency norms or standards must be elaborated by combining costs with performances. Thereby relevant factors for evaluation of the maintenance costs and indirect costs of each receiving and maintenance unit are obtained, giving help in detecting unwanted trends which require special attention.

For the above-mentioned key figures, ratios, etc., goals or objectives must be stipulated, expressing satisfactory results within a given future period, e.g., the first coming year or within five years.

7.6.5.2 Deviation and reporting limits.

The budgets cannot contain all quantified objectives. We would therefore propose the establishment of a norm data register, containing all actual standards, norms and stipulated goals. This register could also contain the stipulated limits of acceptable deviations from cost and personnel budgets, expressed as percentage limits or related to indices.

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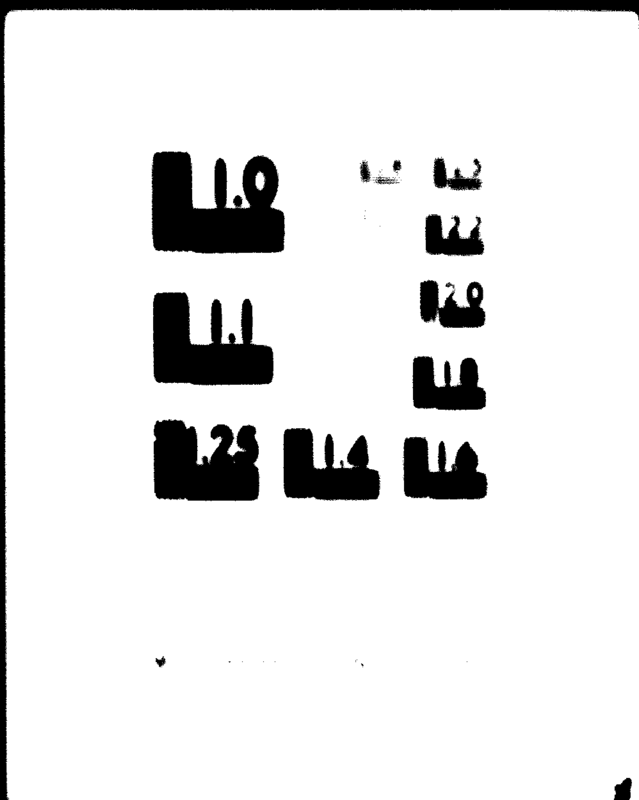

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7.7.5.3 Report meetings.

The follow-up of the cost control reports in regular report meetings can be carried out in the following order:

1. The reports for the organizational level of workshop manager/foreman and the corresponding administrative units are firstly treated by each leader for his area of responsibility. If the limits of deviation for the costs have been exceeded, the causes of the deviations are analysed and commented on, possibly in cooperation with subordinate leaders. Corrective actions on unfavorable cost development are taken or proposed. This follow-up must take place immediately after receipt of the cost control reports, and the corrective actions can be effected without further formalized procedures.

2. Three days after the receipt of the cost control reports, a meeting is held between each unit manager and his subordinate workshop managers/administrative unit leaders for discussion and commentary on unusual events and deviations from the budgets and plans.

   Furthermore, the comments should concentrate on whether favorable or unfavorable effects are expected to continue and what actions the leaders have taken or have proposed, to cope with the situation.

   The maintenance unit manager of each factory and his closest subordinates meet with the production manager and his closest subordinates 3 days after the above-mentioned meeting. This meeting is supposed to decide what actions are to be taken.

   The conclusions from the meeting are presented as minutes to the maintenance director not later than the day after the meetings have been held, indicating which persons are to be held responsible for the execution and follow-up of decided actions.

3. The maintenance director and the maintenance unit managers meet 3 days later. Cost development trends are discussed and commented on and the actions to be taken are coordinated, where necessary.

This monthly follow-up procedure, as outlined above, must be established as a regular, fixed procedure.

The daily operation and coordination problems are not to be treated by this involved follow-up procedure.

7.7.6 Final comments

In the proposed cost control reporting system, effective use of the reported information depends on the report recipiants knowing the background of the reported figures. Each leader is provided with only those figures that are clearly traceable to his operation area, without arbitrary distribution of costs.

Therefore, the introduction of the cost control system must be followed by general information about the principles and ideas of the system.

FORM NO. 11

Organization Unit No.: Chief:	Budget Year:					Date Ref.										PERSONNEL BUDGET Hour Consumption - Productive Maintenance Hours										
Maintenance Unit No.: / Receiving Unit No./Work No.		Unit No.:					Unit No					Unit No					Unit No					Unit No				
		Number of Hours					Number of Hours					Number of Hours					Number of Hours					Number of Hours				
		Total	1GT	2GT	3GT	4GT	Total	1GT	2GT	3GT	4GT	Total	1GT	2GT	3GT	4GT	Total	1GT	2GT	3GT	4GT	Total	1GT	2GT	3GT	4GT
	TOTAL:																									

Attachment 2

FORM NO. 1.2

Organization Unit No.: Chief:		Budget Year		Date Ref.						PERSONNEL BUDGET Number of Workers & Employees					
Sub-unit No.	Categories of Personnel	No. of Work. & Empl.		Planned number of Workers and of Employees in the Budget year											
		31.12 last year	Calcul. 31.12 this year	1st quarter			2nd quarter			3rd quarter			4th quarter		
				-	-	31.3	-	-	30.6	-	-	30.9	-	-	31.12
	Total														
	Total														
	Total														
Total for the Unit															
	Total														

ATTACHMENT 4 FORM NO. 1.1

Organization Unit No Chief:	Budget Year	Date Ref	PERSONNEL BUDGET Productive & Non-prod. Hours

Sub-unit No	Categories of Personnel	Planned Hours									
		Total		1st qt.		2nd qt.		3rd qt.		4th qt.	
		Prod Hours	Non-p Hours	Prod Hours	Non-p Hours	Prod Hours	Non-p Hours	Prod Hours	Non-p Hours	Prod Hours	Non-p Hours
	Total Hours										
	Overtime Hours										
	Cooperation										
	Total Hours										
	Overtime Hours										
	Cooperation										
	Total Hours										
	Overtime Hours										
	Cooperation										
	Total Hours										
	Overtime Hours										
	Cooperation										
	Total Hours										
	Overtime Hours										
	Cooperation										
Total for the Unit:											
	Total Hours										
	Overtime Hours										
	Cooperation "										

FORM NO.: 2.1

Organisation Unit No. Chief:	Budget Year	Date Ref.	COST BUDGET Direct and indirect Costs

Account No. / Unit No.	Cost Specification / Orgn. Sub-units	Actual costs last year		Calculated costs this year		Planned Costs for Budget Year										Index			
						Total		1st qr.		2nd qr.		3rd qr.		4th qr.					
		Amount	Per Hour	Amount	Per Hour	Amount	Per Hour	Amount	Per Hour	Amount	Per Hour	Amount	Per Hour	Amount	Per Hour	5 3	6 4	7 5	8 6
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Total Planned Costs																		
	Total Planned Hours																		

Attachment

Attachment 7.6

Org. Unit No.: Chief:	Period:	Date: Ref.:	Cost Control Report Personnel - Distribution of Hours/Wages in Maintenance Units.							
Maintenance Unit No. / Receiving Unit No./Work No.							Total			
							Hours/Wages	% Actual	% Budget	Index actual Budg.
Total										
Total										
Total										
Internal Operations in own Unit:										
Total Internal Oper.										
Sales-Production Orders										
Investment Order										
Total Hours/Wages								100	100	

FORM NO. 11.1

Attachment 7.

COST CONTROL REPORT

Personnel - Number of Workers & Employees

Organization Unit No.:	Period:	Ref.:
Chief:		

Sub-Unit No.	Categories of Personnel	Actual Period: Gross Personnel increase	Actual Period: Gross Personnel reduction	Actual Period: Net change	Accumulated this Year: Number 31.12	Accumulated this Year: Gross increase	Accumulated this Year: Gross reduction	Accumulated this Year: Number actual	Budget Deviation: Number	Budget Deviation: %	Actual Need for Man-Power
	Total										
	Total										
	Total										
Total for the Unit											
	Total										

FORM NO. 11.2

Attachment 7.8

Organization Unit No.: Chief:		Period:			Date: Ref.:			COST CONTROL REPORT Costs per. Org. Unit.			
		Actual Quarter			Accumulated this Year			Index: Actual Costs: Budget Costs			
								Actual Quarter		Accumulated	
Acc. No. / Unit No.	Cost Specificat. / Org. Sub-units:	Actual Costs:	Budget Deviation	Costs Per. Hour:	Actual Costs	Budget Deviation	Costs Per Hour	Total	Per Hour	Total	Per Hour
1	2	3	4	5	6	7	8	9	10	11	12
	Total:										

FORM NO. 12.1

FORM NO. 12.2

Organization Unit No. Chief:		Period:		Date: Ref.:		COST CONTROL REPORT MAINTENANCE COSTS	
				Hours		Costs	
Acc. No. / Unit No.	Cost Specification	Job No.	Cause Code	Actual	Planned	Actual this Month	Accumulated this Year
1.	2.	3.	4.	5.	6.	7.	8.

Attachment 7.9

8. CODING SYSTEM

8. CODING SYSTEM

This chapter contains the following parts:

8.1 General Paper on Coding System

8.2 Coding System. Specific Codes

8.3 Re: Numbers for Registration of Maintenance Costs,etc., the so-called Work-numbers.

8.4 Re: Materials and Spare Parts Numbers.

8.1 GENERAL PAPER ON CODING SYSTEM

The purpose of this paper is to give a general description of the construction of a coding system to be used by EDP.

8.1.1 Analysis of the Information Demand

The work group firstly should find the answers to the following questions in order to solve its task:

1. Who is responsible for bringing up to date the data, and who is using the information ?

2. For what is the information used, and in which order is it to be presented ?

3. How much information does the single user want/need (management by exeption) ?

4. How often must the information be used ?

5. Is the information sufficiently detailed ?

6. Will the information cover the future needs ?

7. How is the EDP executed ?

8.1.2 Coding System Construction

It must be stressed that it can be a large task to elaborate a coding system or to alter an existing one. Therefore, it should be investigated if existing systems can be preserved, possibly by using the old system as a part of the new one or by adding a check-digit.

8.1.3 General Rules for Coding

8.1.3.1 All numbering systems should be documented and the documentation should be filed in a central place in the organisation, e.g. in a planning function in central organisation of the maintenance or in the EDP organisation. One person should be responsible for this file and when new numbering systems are developed or old ones changed, this person should be consulted in order to avoid mistakes and to ensure coordination.

8.1.3.2 Integration of Identification and Information Should be Avoided when Possible*

A practical, economical reason must be given if integration is to be used. Integration of information and identification means:

a) Less flexibility, both in use and in development. It is more difficult to take out a new number. To change the meaning of a part of the information often is difficult or impossible because the numbering system will not be unique after the change.

b) Larger number, which is more difficult to use. There are more characters to be transferred from one document to another, more characters to be punched, etc., increasing the likelihood of errors.

c) Difficulty in development and maintenance. Different departments have to agree and the end result often is a compromise, which satisfies nobody.

8.1.3.3 Separation of Identification and Information may give the Serial Number Semi-Informative Function

The serial numbers often will be divided into groups and be used independently by different departments, functions, etc. They will provide a type of information, but should not be used systematically or be as standard references in routine procedures.

*See attachment 8.1: Serial and classification numbers.

8.1.3.4 **CHECK-DIGITS SHOULD BE USED IN NUMBERS, WHICH ARE RECORD NUMBERS IN A FILE***

The data are registrated in the file under the record number and are sent into the EDP system through the record number. If the record number is not transferred correctly, the data will be filed in the wrong place and cause inaccuracy when the file is used. When using a check-digit system, however, a record number which is incorrectly transferred may be detected and corrected in the filing process. Check-digits for record numbers for files which are derived from other files are not necessary.

8.1.3.5 **DIGITS OR LETTERS ?**

If information is included in the identification, people often want to use letters, because they find them easier to memorise. But letters only complicate the codes and make file sorting more difficult. Instead, the number can be divided into groups, so that they are easier to memorise. E.g.:

XX XX XX or | XX | XX | XX | or XX - XX - XX

If letters are preferred, not more than one position should be used to separate digit-groups.

8.1.3.6 **PROCEDURES FOR REMOVING A NUMBER FROM A NUMBERING SYSTEM SHOULD BE DOCUMENTED**

By anulment of numbers no longer used one can avoid building a file in which a larger and larger part of the file is idle. The number can be used again and through this procedure the number of characters is kept to a minimum level.

8.1.3.7 **UNIQUENESS**

It is important to avoid having one number, e.g., 1234, designate two parts/documents/persons/etc., or one part/document/person/etc. having two numbers, e.g. 1234 and 5678. This is more important within record numbers than other numbers.

*See attachment 8.2: Check-digits

8.1.3.8 STEPWISE DEVELOPMENT

When constructing a new numbering system it is often a good idea to do it step by step. For example, the first step can be an identification number and an information number of two or three characters. Additional characters should be reserved for further information. Then the system can be used in practice and later additional information can be constructed and incorporated into the system.

8.1.4. RULES FOR DOCUMENTATION

8.1.4.1 DOCUMENTATION OBJECTIVES

The documentation and the filing of this in a central place in the organization is done in order to ensure that:

- the general rules of new numbering systems are followed,
- a new system is coordinated with existing systems,
- mistakes are avoided, e.g. double numbers overlapping,
- documentation location is known and constant.

8.1.4.2 DOCUMENTATION FILE

The person in central organization of maintenance or in the EDP organization who is made responsible for the file shall ensure that changes in numbering systems and new numbering systems are documented by the department or project group changing or constructing the system. He should instruct and advise the department or project group concerning the documentation content (see point 8.1.4.3)

8.1.4.3 DOCUMENTATION CONTENT

The documentation should provide the following information:

1. The name of the numbering system.
2. The objective of the numbering system.
3. The coding structure, that is, a definition of each character or group of characters of the code.

4. If a check-digit is used, then its calculation should be defined.

5. If the code contains a serial number, then it should be mentioned how many characters are in use and the maximum number of characters possible.

6. If letters are used in the number, mention should be made if there are more than ten possibilities in any one alpha-numeric position.

7. The spacing of the number (element separation).

8. If the numbering system is coordinated with another numbering system, this coordination should be defined and the department responsible for the coordination should be mentioned.

9. The department(s) issuing new numbers should be defined. If there is more than one department, the division of the number between the departments should be indicated.

10. The procedure for taking out a new number should be described.

11. The procedure for annulment of a number (when the number is no longer used) should also be described.

12. The department in which a complete register of the content of the information number is kept should be defined. The procedure for alternatives or additions in the information content of the number should be described.

13. A short description about where the number is being used, on what documents, etc., should be made.

14. The documentation should be illustrated by different examples.

8.1. 5. MAINTENANCE RESPONSIBILITY

Responsibility for maintenance of the coding system is divided among the respective user-organization-units and the person responsible for the central file. That is, while the ultimate documentation responsibility lies with the person responsible for the central file, the user-organization-units are charged with actually providing the central file with new or updated documentation whenever additions or modifications are made to the systems.

The person in charge of the central file is responsible for:

- having in the file complete and correct documentation of the numbering systems,
- adherence to the accepted documentation rules by the respective user-organization-units or this representing project-groups,
- providing user's documentation of existing system and assist him in elaboration of modifications or additions,
- informing all users when changes or additions are made in the numbering system.

The users of the system are responsible for:

- familiarizing themselves with the "General Paper on Coding System" and the documentation of the system in question before instituting activities which will necessitate changes or additions in the existing numbering system. If so desired, the person responsible for the central file may be consulted or asked to assist in the elaboration of new documentation.
- actually working out the documentation whenever changes or additions are made in the existing system,
- providing the person responsible for the central file with copies of any changes made in the documentation of the existing system.

8.2. CODING SYSTEM. SPECIFIC CODES

8.2. 1. INTRODUCTION

Within this project the following specific codes have been prepared:

1. Machine numbers

2. Account numbers for maintenance

3. Drawing numbers

and

4. Spare parts numbers

5. Materials numbers

1: Machine numbers, and 2: Account numbers are described in a special paper on account numbers for maintenance.

Account numbers for registration of costs for:

- Production of spare parts
- Investments and other projects

are not integrated in the account numbers for maintenance. A special account numbering should be elaborated for the production of spare parts (production or order account numbers). Also a special code must be made for investments and other projects (investment or project account numbers).

3: Drawing numbers are treated in point 2.

4: Spare parts numbers and 5: Materials numbers are dealt with in a separate paper.

The connection between the codes can be illustrated as follows:

xxxx	cost place no.
xxxx - xx	machine no.
xxxx - xx - xx	account no. for maintenance costs
xxxx - xx - xxx	drawing no.
xx - xx - xxxx - x	spare part and material no.

8.2. 2. DRAWING NUMBERS

The drawing number should be constructed as follows:

XXXX - XX - XXX

the existing cost place number

machine number, i.e. the two last numbers of the existing machine number

a serial number

When the supplier of the single piece of equipment has given the drawings numbers, these codes should also be used by the company. When no numbering system has been constructed, by a third person, the company must elaborate its own, and this is then only a serial number preceded by the account and machine number.

The basis for finding a specific drawing number will hereafter be on of the following, a list of the drawing numbers with text, user's manual for the machine, main drawing, main drawing position number, and PM instructions. Descriptions of the machines must be filed by the same system.

If two or more machines have the same drawings, a reference must be made to one of them.

8.3. Re: NUMBERS FOR REGISTRATION OF COSTS ETC., THE SO-CALLED WORK NUMBERS

Firstly, it is proposed to change the terminology of these numbers because the primary function of the numbers is to record the maintenance costs. Therefore, in the following they are called account numbers. The term "work-number" (or job-number) is used for the serial number attached to the work orders made by maintenance planning for the maintenance workers describing the single job to be done.

The existing numbering system for registration of costs, planning, etc. - the account numbers - does not give sufficiently detailed information about the maintenance costs. The same is the case for the existing machine numbers. If costs are registered only for the existing machine numbers, it is not possible, for instance, to analyse unusually high costs to see what part or function of the machine is the cost creating part.

However, the machine numbers can be used as a basis for a new account numbering system, which must be formed as a further specification of the machine numbers. The persons responsible for maintenance, who must analyse break-downs, for instance, must build up the new account numbering system following the two principles:

- a part or a function of the machine with high maintenance costs must have its own independent account number,

- a vital part or function of the machine must have its own independent account number.

For instance, it is found appropriate to divide a coiler in the hot rolling mill in 5-10 parts or functions.

It is proposed that the future account numbering system be constructed as shown below:

XXXX - XX - XX - X

- XXXX → the existing cost place number
- XX → machine number, i.e. the two last serial numbers of the existing machine number
- XX → machine part number for identification of a part or function of the machine
- X → check-digit (see general description on coding system)

8.4. Re: MATERIAL AND SPARE PART NUMBERS

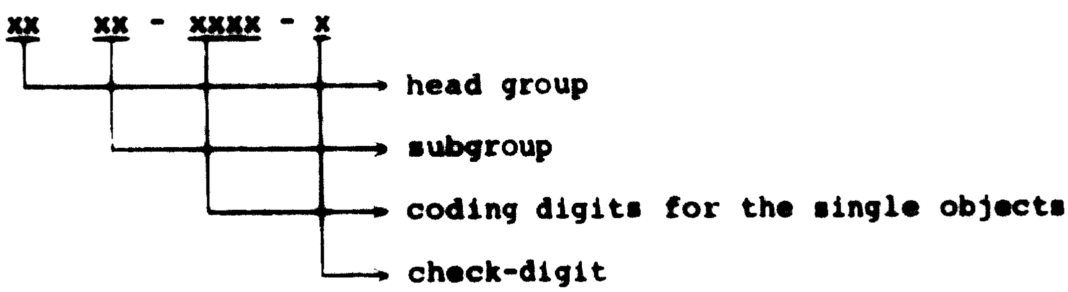
8.4. 1. THE EXISTING SYSTEM FOR NUMBERING OF MATERIALS AND SPARE PARTS

The existing system is different from store to store. This implies that it is impossible to control the size of the stocks efficiently and that control of stock by EDP is complicated substantially.

Therefore, it is recommended that a new, common numbering system be constructed.

8.4. 2. THE NEW NUMBERING SYSTEM

The new system will be developed according to the following principles:



The head groups will consist of 3 parts:

Code 00 - xx:	Spare parts
Code xx - 98:	Usual materials, including standardised spare parts
Code 99:	Fire-proof materials

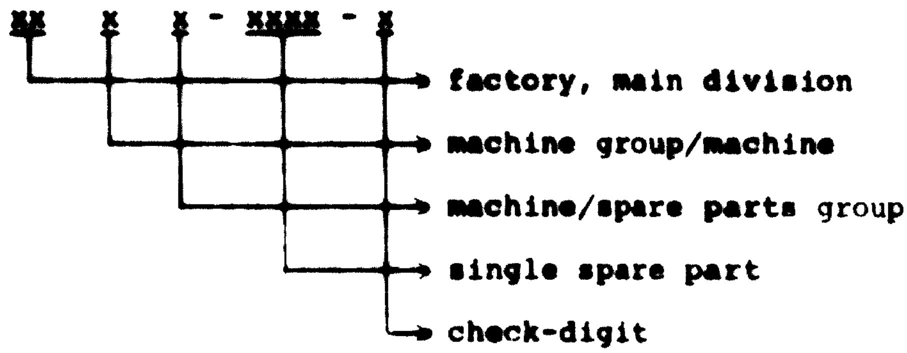
8.4. 2.1 Spare Parts

Code 00 - xx contains only:

Spare parts which are special for a single part of equipment. This means that only equipment which is found in a single factory or main division, is registered here.

Spare parts for equipment, which is found within more factories/main divisions, are defined as materials. Also standard spare parts (i.e. standard washers, bolts and nuts) included in materials.

Spare parts are given these codes:



Factory/main division (digit 1-2) can for instance be:

00 Coke Plant
01 Steel Plant
02 Hot Rolling Mill, Dunaujvaros
03 Cold Rolling Mill, Dunaujvaros
04 Rolling Mill, Budapest
05 Plate Plant
06 Energy Supply Plant
07 Transport Plant
08 Maintenance Division
09 Electrical Equipment, Hot Rolling Mill, Dunaujvaros
10 Electrical Equipment, Cold Rolling Mill, Dunaujvaros

Machine group/machine (digit 3) could for instance for Hot Rolling Mill be:

020 Mill stands and drive shafts
021 Manipulators
022 Roller table
023 Skid gears
024 Billet shear
025 Billet bank
026 Hot saws
027 Bloom furnaces inc. equipment/auxiliary equipment
028 Cold saw, straightening equipment, roller lathes
029 Miscellanous equipment for Hot Rolling Mill

<u>Machine/main spare parts (digit 4)</u> can for skid gears within the Hot Rolling Mill be:

0231 Shafts and couplings

0233 Bearings

0235 Wires

0237 Wire wheels and drums

0239 Miscellanous equipment

<u>Single spare part (digit 5-8)</u>

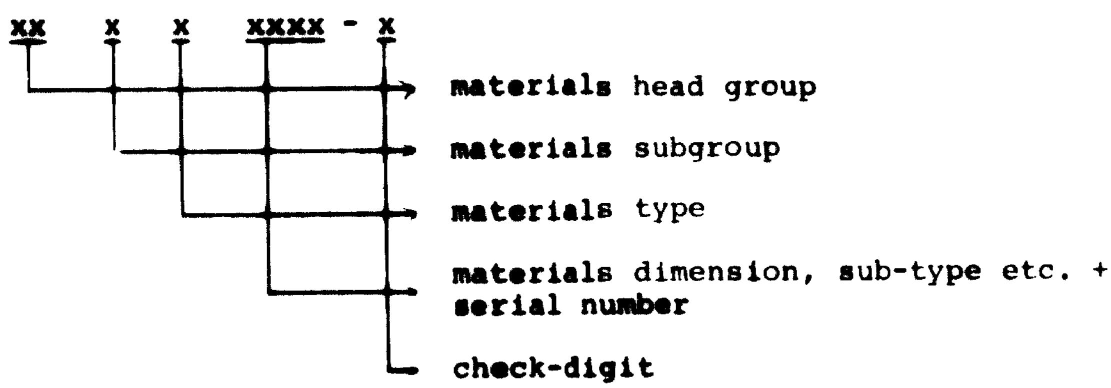
Where appropriate, the single spare part within these last 4 digits can be classified according to type, material, dimension, etc. The last digits contain a simple serial number.

Through this coding system a single spare part will be given one number only. Each spare part number must have a reference to the machine number or the drawing number in the EDP file. Thus, it is possible to get an overall view of which machines need the single spare part.

The codes for spare parts must be constructed by the maintenance people, who are responsible for the different head groups of spare parts.

8.4. 2.2 Materials

Materials are given the codes mentioned below:



<u>Materials head group (digit 1 - 2)</u> might be:

15 Building materials (not wood)

16 Building articles

17 Distribution network for CO-gas

18 Drive belts and drive belt materials

19 Electric material I

20 Electric material II

21 Gas distribution, heating and ventilation equipment

22 Instruments, measuring devices, etc. (non-electronic devices)

Materials subgroup (digit 3) can for electric material I, be:

190 Lighting, cooking, and heating equipment etc.

191 Fuses, fuse boxes

192 Sockets and plugs

193 Cable and wire material etc.

194 Insulators and accessories, lead-in insulators, insulation material

Etc.

Materials type (digit 4) can for 194: Insulators incl. accessories etc. be:

1941 High tension insulators

1943 Low tension insulators (below 2000 V)

1945 Pin insulators

1947 Lead-in insulators

1949 Insulation material

8.4. 2.3 Fire-proof Materials

Fire-proof materials are data processed in the same way as both materials and spare parts. There is a special need for planning of brick and mortar supply for the furnaces because of the interval between the building up of the furnaces; therefore a special group should be reserved for these materials.

8.4. 3. CONCLUSION

Before constructing a new coding system, it must be carefully evaluated how many head groups (how much capacity) are needed for spare parts and materials respectively. After constructing head groups, the same evaluation must be done with respect to subgroups and further classification.

Concerning the coding of usual materials, it must be investigated whether the principles contained in the national Material Code System of Hungary, constructed for statistical purposes, can advantageously be used by the company.

SERIAL AND CLASSIFICATION NUMBERS

The possible numbering divisions are the following:

Serial numbers

Classification numbers

Combined numbers

1. SERIAL NUMBERS

These numbers, which mainly give identification, can be divided into two types:

1) Pure serial numbers
2) Numbers inside certain blocks

Re. 1)

This principle is a simple numerical listing, mostly used as a subdivision in other systems.

Advantages: Control of numbers simple, numbers short, suitable for EDP

Re. 2)

Used as 1), but numbers can partly give information.

Advantage: Short numbers.

2. CLASSIFICATION OF NUMBERS

These numbers consist of a number of digits or groups of digits, each having a certain significance, i.e., the numbers give information.

Two types of these numbers are used:

1) Group-classified numbers
2) Decimal-classified numbers

Re. 1)

The single digits/digit-groups may be used alone, but a connection to the proceeding or succeeding digits/digit-groups may exist.

Advantage: Flexibility

B01..11

Every single digit has a specific significance, and a succeeding digit has a subordinate relationship to a preceding digit.

Advantage: Very detailed number may be constructed.

3. COMBINED NUMBERS

These numbers consist of a combination of serial and classification numbers and are the types most common.

CHECK-DIGITS

Check-digits are one or more digits added to the original number, making it "self-controlling".

The check-digit has a special mathematical connection with all other digits in the original number. By punching or by data input to the computer, it is then possible by a corresponding calculation to calculate the check-digit and thereby decide if the number is correct. By this method punch and writing errors are detected in 99% of the cases.

The error frequency from punching is about one per one thousand.

1. PRACTICAL ASPECTS

If the alternative to check-digits is to punch all once again to check errors, the punch work can be reduced by 30 - 40% by using check-digits. As the punch work is an expensive phase in EDP, this saving can be substantial.

The "self-controlling" activity may take place:

1) in connection with the punching, as the punching machine is equiped with an electronic circuit, which makes a control calculation on the check-digit. If an inconsistency exists, the punching machine is stopped. The great advantage of this method is that errors are detected at an early stage.

2) in connection with the data input to the computer, which is programmed to execute control calculation and list invalid numbers on a list. Discovering of error comes later than in 1) above.

3) in connection with both the punching and the data input.

2. CHECK-DIGIT SYSTEMS

Here, only two known and widespread methods are described.

These two methods are both based on a multiplication of each digit in the original number by a factor different from digit to digit. On the basis of these products a sum is caluclated and to this sum the check-digit is added. This final sum is dividable with a certain modulus.

In the following, two examples based on modulus 10 and modulus 11 are expounded.

2.1 The Modulus 10 Method

As an example of this method a materials number is used.

Original number excluding the check-digit	8	7	4	/	7
Each digit is multiplied by a factor (/ is calculated as a digit with the value of 0)	2	1	2	1	2
The products are calculated to	16	7	8	0	14
If the products are ≥ 10, the sum is calculated like this	7 +	(7) +	(8) +	(0) +	5
The total sum is	27				
27 divided by modulus 10 =	2, remainder 7				
The check-digit = modulus 10 less remainder 7 =	3				
The final number becomes	<u>874/73</u>				

The total calculation is executed by giving the check-digit the factor 1, and the calculation must, thereby, give a total sum, which - divided by modulus 10 - gives 0 as remainder.

The resulting error finding ability is expected to be approx. 98,8% of all errors by

- only one digit
- inversion of two digits
- random deviations

by use of the modulus 10 method with the factors 1, 2, 1, 2, etc.

Also other factors can be applied. E.g. 1, 3, 1, 3, etc. or 1, 3, 7, 1, 3, 7, etc. depending on the nature of the errors in the numbers.

2.2 The Modulus 11 Method

Example:

The original number	1	3	0	6	4	3 -	2	5	6
Each digit multiplied by a factor	4	3	2	7	6	5	4	3	2
The products are calculated to	4	9	0	42	24	15	8	15	12
The sum of the products is calculated to	129								
Sum 129 divided by modulus 11 =	11, remainder 8								
The check-digit = modulus 11 less remainder =	8 = 3								
The final number then becomes	13 06 43 - 2563								

The control calculation of the final number is done as described under the modulus 10 method.

The error finding ability is calculated to be approx. 99,1%.

Other factors may be applied.

2.3 Selection of Method

The modulus 11 method has a better error finding ability than the modulus 10 method, but the difference is only 0,3%. On the other hand, the modulus 11 method gives check-digits from 0 to 10, and as the check-digit 10 normally is not desired, all numbers with this check-digit have to be cancelled, which is often a great disadvantage.

As a conclusion it is recommended that modulus 11 method be chosen if 9% of all numbers can be cancelled. Where numbers cannot be cancelled, the modulus 10 method is chosen.

9. INFORMATION BASE AND FILES

9. INFORMATION BASE AND FILES

The establishment of the bases and files necessary for processing the managed maintenance system on EDP* is set forth within the description of each sub-system.

In this article the content of the bases and files is illustrated by important main data of the main bases and files, i.e., the listed data are not supposed to be exhaustive. Furthermore, the bases and files cannot be constructed until the final desired reporting system has been designed.

9.1 Files on EDP

MACHINE ACCOUNT NO. FILE

- machine account no.
- job no.
- cause code
- priority code
- actual hours, per month and quarter
- planned hours
- actual wages, per month and quarter
- costs actual month
- costs this year
- planned costs, per quarter

* As the system is foreseen to be introduced as a manual system which rapidly will be converted into EDP, we have presented this essential article as the future goal for information base and files. Some parts of it can not be executed in the manual system but have to wait for the EDP development of the counterparts organization.

PROJECT ACCOUNT NO. FILE	- project account no. - job no. - planned costs - actual direct wages - actual direct materials - actual direct cooperation - actual other direct costs
MAINTENANCE PRODUCTION ACCOUNT NO. FILE	- maintenance production account no. - planned direct hours - actual direct hours - planned direct costs - actual direct costs

MAINTENANCE ORG. UNIT ACCOUNT NO. FILE	- maintenance unit account no. - actual direct hours, per month and quarter - actual direct wages, per month and quarter - planned direct hours per quarter - planned direct wages per quarter - actual number of personnel - gross reduction of personnel, per month and cumulated this year - gross increase of personnel, per month and cumulated this year - number of personnel as of 31st December last year - planned number of personnel per quarter - number of personnel is filed by category of personnel - indirect cost account numbers - actual indirect costs per quarter, and cumulated this year. - budgeted indirect costs per quarter

MACHINE NO. FILE

- machine no.
- machine designation
- stop costs per hour
- initial year
- initial value
- calculated replacement year
- last and next overhaul year
- spare part numbers
- drawing no.
- manufacture
- type - model - manufacture no.
- supplier
- PM instruction numbers
- main dimensions:
  - height
  - length
  - breadth
  - weight
- location
- connected systems (oil, el., compressed air, etc.)
- techn. specifications, descriptions.

PM-INSTRUCTIONS FILE

- machine name
- machine no.
- machine element
- PM job code
- PM instruction
- tools
- reference to instruction manual
- PM cycle
- drawing no.

MATERIAL NO. FILE

- materials no.
- materials description
- weight in kg per unit
- materials account no.
- min. stock
- max. stock
- average price
- supplier no.
- yearly consumption
- delivery time in weeks
- storehouse location

SPARE
PART
NO.
FILE

- spare parts no.
- spare parts description
- weight in kg per unit
- spare parts account no.
- min. stock
- max. stock
- drawing no.
- model no.
- machine numbers
- repairable
- average price
- supplier no.
- yearly consumption
- delivery time in weeks
- storehouse location

9.2 Input to EDP

DELIVERY NOTE — daily >

- supplier
- material description
- quantity
- material/spare part no.
- receiving store no.

MATERIAL REQUISITION — daily >

- account no.
- job no.
- store no.
- quantity
- material/spare part no.

INVOICE — daily >

- account no.
- account
- supplier

PERSONNEL BUDGET NO. 1.1 — yearly >

- productive maintenance hours
- per maintenance unit
- per receiving unit

PERSONNEL BUDGET NO. 1.2 — yearly →

- number of workers and employees
- per maintenance unit

PERSONNEL BUDGET NO. 1.3 — yearly →

- productive and non-productive maintenance hours
- per category of personnel
- per maintenance unit

COST BUDGET NO. 2.0 — yearly →

- direct costs
- indirect costs
- per maintenance account no.
- per maintenance unit no.

WORK ORDER

daily

	-	work order no. (job no.)
	-	project no.
	-	machine account no.
JOB	-	week of request
OPENING	-	priority code
INFORM.	-	estimated job time (standard code)
	-	performing maint. group

WORK ORDER

weekly

	-	work order no.
	-	job completed week
JOB	-	actual consumed hours
CLOSING	-	cause code
INFORM.	-	stop time (if any)

WORK ORDER
LIST

weekly

- job no.
- machine account no.
- week no.
- actual consumed hours
- priority
- cause code
- stop time (if any)

9.3 Output from [illegible]

monthly	COST REPORT NO. 11.1	- hour/wage consumption - per maintenance unit - per receiving unit - budget comparison
monthly	COST REPORT NO. 11.2	- number of personnel - per category - per maintenance unit - increase and reduction - budget deviation
quarterly	COST REPORT NO. 12.1	- costs in total and per hour - budget deviations - indices - per account no. - per unit no.
monthly	COST REPORT NO. 12.2	- costs of maintenance - hours of maintenance - cause code - per job no. - per account no. - per unit no.

weekly → WORK ORDER

- performing maint. group
- work order no./job no.
- machine account no.
- priority
- requested week
- estimated time
- actual consumed hours
  - in this week
  - acc. up to this week

weekly → ORDER STOCK

- performing maint. group
- work order no./job no.
- machine account no.
- priority
- requested week
- work week (last week worked on the job)
- standard time
- consumed hours
- order volume in hours
- remark on no. of weeks from requested week

weekly → WORK ORDERS PER ACCOUNT

- machine account no.
- work order no.
- performing maint. group
- priority
- cause code
- standard time
- actual consumed hours

monthly → STANDARD CODE

- performing maint. group
- work order no.
- machine account no.
- standard code
- no. of jobs
- standard/estimated time
- actual consumed hours

In attachment 9.1 please find some examples of EDP-based reports.

EXAMPLES OF REPORTS

WORK REPORT WEEK 5071 | 14-12-71 page 16.

Perf. maint. group	Job No.	Machine account No.		Pri-ori-ty	Week ordered	Week comple-ted	Stan-dard time	Actual consumed hours	
								This w.	Total
6341	402896	560180	100	1	5071	5071		5,0	5,0
	403721	561100	074	1	5071	5071		9,0	9,0
	404503	566256	302	1	5071	5071		2,5	2,5
	404943	562600	086	1	5071	5071		8,5	8,5
				SUM PER PRIORITY				25,0	
6341	419483	563900	006	2	4971	000	82,0	17,5	50,5
	420024	561300	028	2	5071	5071		3,0	3;0
	420044	563010	125	2	5071	5071		16,0	16,0
				SUM PER PRIORITY				36,5	
6341	100361	563100	180	3	4071	000	82,0	28,0	52,5
	101197	561300	381	3	4171	5071	23,0	7,0	27,0
	101198	563700	413	3	4071	000	450,0	8,5	280,0
	102109	566583	580	3	4871	5071	23,5	24,0	24,0
	102535	561010	151	3	4371	000	12,0	4,0	4,0
	102715	563700	421	3	4371	5071	3,5	3,0	3,0
	103330	561010	306	3	4571	000	12,0	3,0	6,0
	103616	561300	011	3	4871	5071	3,5	2,5	2,5
				SUM PER PRIORITY				80,0	
6341	100056	561400	118	4	4071	000	25,0	24,0	80,0
	100057	562010	551	4	3071	000	21,0	22,0	61,0
	101149	562600	142	4	4271	000	40,0	40,0	130,0
				SUMPER PRIORITY				86,0	
6341	100026	563100	180	5	4071	000	250,0	14,5	90,5
				SUM PER PRIORITY				14,5	
6341	101789	670240	000	6	3971	000	104,0	65,5	98,5
	102948	681340	000	6	4171	000	12,0	2,0	10,5
				SUM PER PRIORITY				67,5	
6341				SUM PER PERF. MAINT. GROUP				389,5	

ORDER STOCK REPORT PER PERF. MAINT. GROUP — 3-11-71
WEEK 4471 — page 19

Perf. maint. group	Job No.	Machine account No.	Pri-ori-ty	Week ordered	Week worked on	Stan-dard time	Actual cons. hours	Order stock	Re-mark
6350	101606	561010 306	3	4071	4471	12,5	4,5	8,0	
6350									
6350	101117	561100 005	3	3771	000				
	101118	561100 010	3	3971	4171		2,5	2,5-	
	100048	561100 035	3	3971	4171	82,0	42,5	39,5	
	100050	561100 072	3	3971	4271	4,0	8,0	4,0-	
	100044	561100 225	3	3571	4371	12,0	5,0	7,0	
	101119	561100 311	3	4071	4371	48,0	86,5	38,5-	
6350				Orderstock per account				46,5	
6350	101483	561300 151	3	4471	000	23,0		23,0	
	101478	561300 354	3	4471	4471	110,0	2,5	107,5	
				Orderstock per account				130,5	
6350	101778	561400 118	3	4071	4271	48,0	73,0	25,0	
6350				Orderstock per account					
6350	102048	561500 011	3	3771	000				
	102158	561500 064	3	2871	000	13,0		13,0	4 PER
	100779	561500 152	3	4171	4171	12,0	17,0	5,0-	
	100268	561500 301	3	2871	000	4,0		4,0	
	100263	561500 351	3	3771	3871	12,0	6,5	5,5	
	100483	561500 356	3	4471	4471	82,0	17,5	64,5	
6350				Orderstock per account				87,0	
6350	102665	561700 011	3	3371	3671	24,0	9,0	15,0	
	101895	561700 034	3	971	4071	3,0	7,0	4,0-	
	101827	561700 045	3	1871	4071	82,0	10,0	72,0	
	102621	561700 047	3	3871	4471	12,0	4,0	8,0	
	101254	561700 088	3	3371	3971	3,0	6,5	3,5-	
	100420	561700 154	3	4471	000	23,0		23,0	
	100037	561700 160	3	3771	4371	23,0	3,5	19,5	
6350				Orderstock per account				137,5	
6350			Orderstock per perf. maint. group					409,5	

WORK ORDERS PER ACCOUNT WEEK 5071 14-12-71 Page 10

Mach. account No.		Job No.	Perf. maint. group	Prio- rity	Cau- se code	Standard time	Actual consumed hours
562300	062	100151	6360	3	1	completed	
	062	100176	6550	3		3,5	
	201	104101	6360	2	1	completed	3,0
	201	104103	6550	1	1	completed	10,0
	201	104206	6550	1	1	completed	5,0
	201	104305	6311	1	1	completed	4,0
	202	100101	6311	1	1	completed	
	202	100140	6360	3		12,0	5,0
	202	101239	6360	2	0	completed	14,0
	210	101782	6360	2	1	completed	7,5
	210	101790	6360	3		48,0	
	214	102409	6360	3		3,5	15,5
	223	100102	6550	2	1	completed	
	223	101409	6360	1	1	completed	
	223	101415	6360	1	3	completed	5,0
	225	100901	6360	3		10,5	
	225	100950	6360	3		3,0	
	225	100954	6550	3			
	225	101107	6360	3			
	241	100319	6550	3		3,0	
	241	100325	6360	5		48,0	
	241	100419	6360	3		3,0	
	241	100435	6550	5		48,0	27,0
	242	100666	6360	5		3,0	4,5
	242	101400	6360	3		8,0	
	242	101410	6550	3		22,0	3,0
	242	101436	6550	3	1	completed	3,0
	242	101998	6550	2	1	completed	1,0
	242	102306	6360	1	2	completed	4,5
562300	Total consumed hours per account						112,0
	work orders per account						174,0

STANDARD CODE REPORT WEEK 44 - 48 5-11-71 page 13

Perf. maint. group	Job No.	Mach. account No.		Standard code	No..	Standard time	Actual consumed time
6311	406583	563250	965	1	1	2,5	4,0
		Sum standard code			73	182,5	170,5
6311			average =			2,5	2,3
6311	400330	561100	018	2	1	9,9	8,0
	403331	562600	201	2	1	9,9	8,5
	403451	563250	951	2	1	9,9	8,5
	404101	563200	791	2	1	9,9	8,0
	404438	561500	481	2	1	9,9	9,5
	404899	563600	046	2	1	9,9	10,0
	405398	566255	110	2	1	9,9	14,0
	406233	561300	333	2	1	9,9	13,0
	406687	561400	330	2	1	9,9	8,5
	406931	566241	141	2	1	9,9	10,5
	407001	563200	934	2	1	9,9	14,5
		Sum standard code			11	108,9	112,5
6311			average =			9,9	10,2
6311	104396	563200	703	3	1	22,5	16,5
	104442	561100	051	3	1	22,5	27,5
	104839	562300	132	3	1	22,5	16,5
	105825	563600	305	3	1	22,5	21,0
	106169	561500	351	3	1	22,5	20,5
	107024	563900	006	3	1	22,5	30,5
	107422	561300	019	3	1	22,5	18,0
	107908	563700	212	3	1	22,5	27,5
		Sum standard code			8	180,0	177,5
6311			average =			22,5	22,2
6311	100197	563700	356	4	1	48,0	45,5
	100615-	561100	250	4	1	48,0	53,5
	100680	562300	301	4	1	48,0	47,0
	100692	561700	041	4	1	48,0	32,0
		Sum standard code			4	192,0	178,0
6311			average =			48,0	44,5
6311	104385	563200	712	9	1	110,0	115,0
		Sum standard code			1	110,0	115,0
6311			average =			110,0	115,0
6311	108541	561300	613	401	4	100,0	53,5
		Sum standard code			4	100,0	53,5
6311			average =			25,0	13,4
6311	100084	696189	000	403	4	104,0	85,0
		Sum standard code			4	104,0	85,0
			average =			26,0	21,3
6311	Sum per perf. maint. group					977,5	892,2

REPORT SUMMARY WEEK 12 1974

Perf. maint. group	1 Prior. 1	2 Prior. 2	3 Prior. 3	4 Prior. 4	5 Prior. 5	6 Total 6	7 Hours available P3 + P5	8 %	9 Average hours available last year	Performed by: 10 DV	Performed by: 11 Sub-contr.	12 Order entr. in the week	13 Total order stock in the week	14 Stock of orders ready to start in the week	15 Loading in weeks against average
	Working hours in the week					1-5	3,5	7/6x100							15/10
6310	368	791	648	777	10	2658	722	27	580	2443	215	2843	2789	2789	4,8
6510	165	268	134	105	-	672	134	20	220	569	103	530	767	767	3,2
6320	72	92	257	274	-	695	257	37	250	695	-	651	622	622	2,5
6520	26	101	71	78	-	316	111	35	125	316	-	279	541	541	4,3
6330	346	171	683	893	-	2221	811	36	550	1942	279	2347	3634	3346	6,1
6530	170	129	323	602	-	1349	448	33	480	1080	269	2188	4308	3944	8,2
6340	12	146	178	410	-	752	184	24	310	752	-	799	898	898	2,9
6341	44	133	689	234	80	1808	1397	77	1050	1808	-	3198	11253	10553	10,1
6342	170	212	705	127	69	1531	1022	67	1050	1468	63	971	4788	2937	2,7
6343	106	216	572	391	75	1466	753	51	510	1466	-	1825	3140	2990	5,9
6344	55	225	1627	76	105	2362	2006	85	1800	2362	-	2164	16940	16940	9,4
6345	102	416	335	178	37	1075	379	35	290	1075	-	840	3399	3312	11,4
6346	3	11	46	61	3	124	49	40	170	124	-	107	910	910	5,4
6347	7	43	330	18	8	578	510	88	490	578	-	344	1990	1650	3,4
6350	-	1	570	1	-	1436	1434	100	570	596	840	555	1709	1109	1,9
6540	113	251	440	229	59	1534	941	61	860	1391	143	1325	4029	3779	4,4
6545	57	186	256	157	8	679	279	41	220	679	-	1072	1701	1501	6,8
6260	55	71	350	8	3	580	446	77	300	453	127	225	1854	1854	6,2
6261	-	45	475	11	2	533	477	89	510	457	76	-	4130	3233	6,3
6262	-	42	306	137	17	540	361	67	500	540	-	683	2837	2837	5,7
6264	-	-	816	43	-	659	816	95	700	859	-	161	1153	1153	1,6
6266	-	35	50	943	-	1104	126	11	300	1104	-	1201	1473	1473	4,9
1510	764	165	730	761	-	2524	834	33	630	2300	224	2049	4412	4212	6,7
1530	40	62	39	150	-	291	39	13	80	291	-	372	335	335	4,2
1710	-	16	483	376	-	1174	782	67	340	839	335	1530	942	942	2,8
1810	-	-	113	33	-	209	176	84	120	209	-	354	1396	1396	11,6
6700	-	-	160	7	56	240	177	74	35	240	-	124	319	319	9,1
Maint. Tot.	1871	3585	9881	5753	476	24872	13663	55	11835	22757	2115	24308	74865	69032	5,8
Distr.	8	14	40	23	2	100				92	8				

10. FURTHER COMMENTS

10. FURTHER COMMENTS

In addition to the proposed systems presented in this report, a number of minor systems, methods and techniques have been discussed with the counterpart, and recommendations have been given orally and in special papers, these concern for example:

- systems for decision of max/min. inventory of spare parts.
- rules for deletion of outdated spare parts.
- materials and spare parts standardisation principles, including group technology.
- principles and equipment for microfilm and reproduction.
- principles and methods for project management and planning.
- method for layout analyses.
- method for analysing the work shop efficiency and conditions.
- method and philosophy of value analysis in the maintenance area.
- etc.

All together this completes the system development phase of the project.

ATTACHMENT 8–9

FOR

FINAL REPORT

02342
(6 of 6)

MANAGED MAINTENANCE SYSTEM

DANUBE IRON & STEEL WORKS

APRIL 1976

Attachment 8: Work Plan Preparation Report.

Attachment 9: Implementation Counselling Report.

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Attachment 8

WORK PLAN PREPARATION REPORT

TABLE OF CONTENTS

ATTACHMENTS

1. INTRODUCTION - OBJECTIVE

In this report the complete plan for implementation of the managed maintenance system at the Danube Iron and Steel Works is presented.

The total maintenance organisation is divided into 11 areas:

1. CO - CENTRAL ORGANISATION
2. CM - CENTRAL MAINTENANCE FACTORY
3. CS - CENTRAL SPARE PART PRODUCTION
4. MU - MAINTENANCE UNIT OF FACTORIES
5. RM - COLD AND HOT ROLLING MILLS
6. MF - METALLURGICAL FACTORY
7. TF - TRANSPORTATION FACTORY
8. SF - SHEET PROCESSING FACTORY
9. CF - COKING FACTORY
10. EF - ENERGY FACTORY
11. BF - ROLLING MILL FACTORY - BUDAPEST

For each area a number of implementation projects among the following 10 are defined:

1. ORG - ORGANISATION
2. WOS - WORK ORDER SYSTEM
3. PMS - PREVENTIVE MAINTENANCE SYSTEM
4. MPL - MAINTENANCE PLANNING SYSTEM
5. PPL - PRODUCTION PLANNING SYSTEM
6. MAT - MATERIAL ADMINISTRATION SYSTEM
7. CST - COST CONTROL SYSTEM
8. COD - CODING SYSTEM
9. INF - INFORMATION BASE AND FILES
10. SPC - SPECIAL SYSTEMS AND TECHNIQUES

A separate schedule is then elaborated for each area and a project leader is appointed.

The objective of establishing the implementation plan is to ensure coordination of the projects, that is, that a project comes in proper sequence, taking into consideration the interdependencies between the separate projects and the implementation areas.

The plan has been based on the 11 maintenance organisation units, and the project leaders are to follow projects 1-10 until these are implemented in all areas. In this way, experience from the first implementation area can be transferred to the next, etc.

During the system development phase, small parts of implementation work have been done. However, the implementation plan presented in this report is based on a general starting up of the projects on 1 December 1975.

The implementation plan has been EDP-processed and the results containing time sheets/plans and the corresponding resource demand are shown in Attachment 11.

2. RESUME OF THE SYSTEMS TO BE IMPLEMENTED

The managed maintenance system of the Danube Iron and Steel Works is completed according to the contract between UNIDO and Norconsult/IKO. The terms of reference for the project are accordingly respected.

Close cooperation between the counterpart and the consultants resulted in a complete system for managed maintenance, consisting of the following projects:

1. Organisation

   A proposal for future organisation of the maintenance function and its relation to the other parts of the company. The proposed concept includes a centralisation of the maintenance function, a clear separation of responsibilities between production and maintenance, and a division of the maintenance function into logical units according to functions.

2. Work Order System

   A proposal for future work order system covering all maintenance jobs (planned and fixed maintenance orders), giving all information and statistical data necessary for job preparation, planning and management.

3. Preventive Maintenance System

   A system for preventive maintenance. The proposed system includes a registration and information system, as well as necessary routines and instructions.

4. Maintenance Planning System

   A system for central planning of all maintenance activities. The proposed system consists of a yearly plan coordinating all maintenance activities by means of a network planning technique.

   A system for planning of maintenance work to be carried out within each production unit. The proposal consists of a system for planning projects and repair jobs based on a work order approach.

5. Production Planning System

   A system for planning work, production of spare parts, etc. in the central workshops. The proposed system consists of a general production planning system well-suited to the actual production of spare parts.

6. <u>Material Administrative System</u>

A system for administration of spare parts and material. The proposed system consists of a centralised and coordinated material administration based on central files, uniform routines, and a simplified decision-making procedure.

7. <u>Cost Control System</u>

A cost control system covering all maintenance activities. The proposed system is based on the proposed organisational concept and distributes responsibilities, reporting and control accordingly. Its main objective is to improve cost consciousness throughout the organisation.

8. <u>Coding System</u>

Coding system for:

Machine numbers
Account numbers
Drawing numbers
Spare part numbers
Materials numbers

The proposed systems are elaborated as modular systems covering the whole enterprise.

9. <u>Information Base and Files</u>

Proposals for contents of all necessary data bases and files.

Machine account number file
Project account number file
Maintenance production account number file
Maintenance organisation unit account number file
Machine number file
PM - instruction file
Material number file
Spare part number file

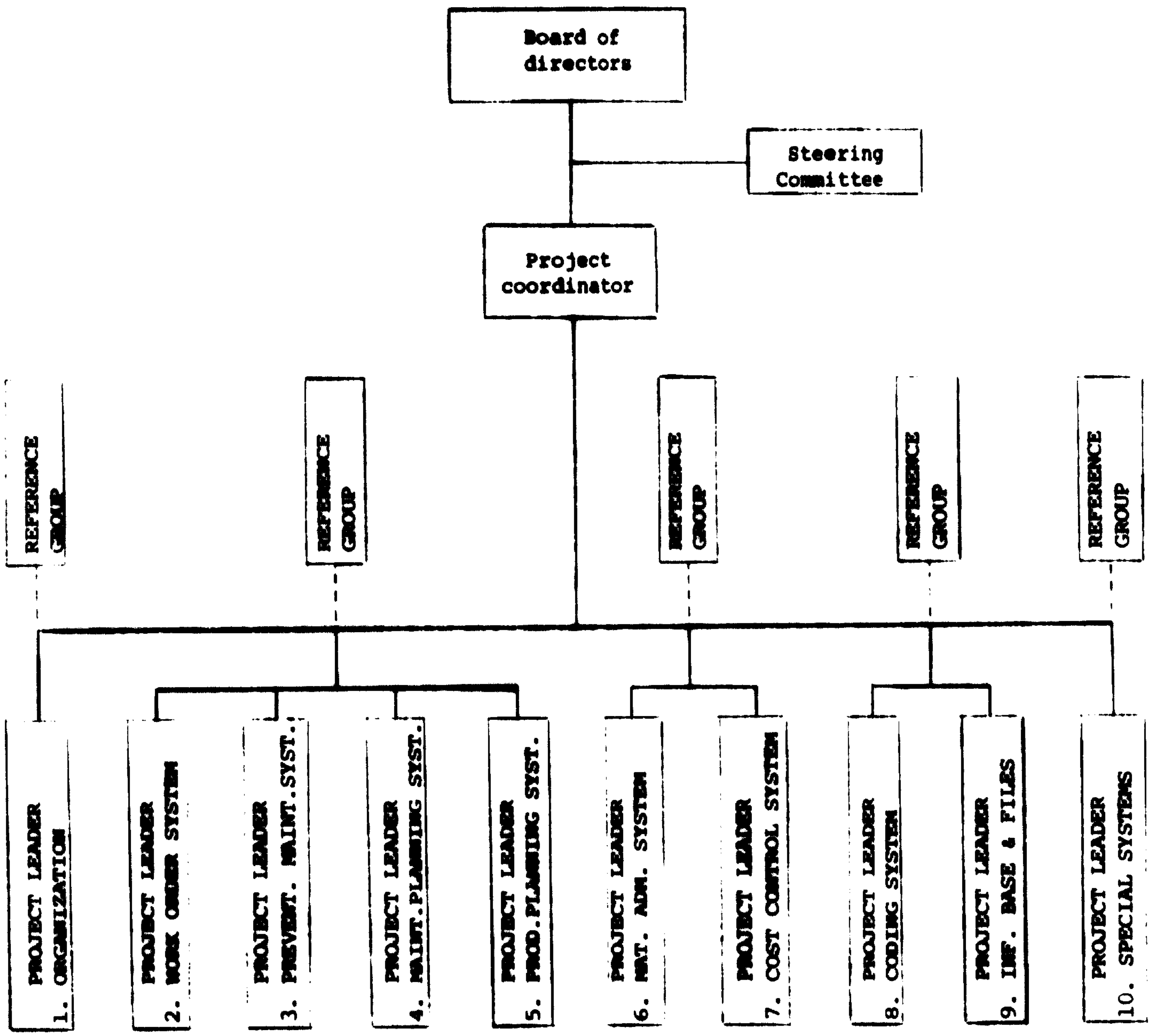
Description of EDP files, input and output request necessary for a later conversion to EDP.

10. <u>Special Systems and Techniques</u>

Method for determining size of stocks and spare parts
Method for project planning by use of EDP network
Method for re-evaluation of plant layout
Method for modern information files, copying equipment, etc.

3. PROJECT ORGANISATION

The organisation structure of the implementation of the projects is as follows:



6/...

3.1 Steering Committee

The Steering Committee is responsible for the implementation of the approved projects, and through efficient management will ensure that the Managed Maintenance System is implemented according to the accepted plans.

3.2 Project Coordinator

The project coordinator performs on the behalf of the Steering Committee the daily functions concerning the preparation, management and coordination of the projects. He also participates in the Steering Committee meetings.

The responsibility of the project coordinator is to ensure the following:

- Coordination of all projects
- Observance of the implementation plans
- Reasonable progress of the projects
- Adherence to individual project objectives
- Realisation of the expected results
- Implementation of the systems work as intended, with initiation of adjustments, if necessary.

The Project Coordinator responsible for these projects will be:

CSINÁDY GÁBOR

3.3 Reference Group

In connection with an individual project, a reference group is to be established. This group should be dynamic, that is, its members should move from area to area so that they always can instruct the users of the new systems.

The reference group and the project coordinator evaluate professionally and from the users' point of view, proposals and systems to be implemented before they are sent for approval to the Steering Committee.

The reference group can be consulted by the project group in the daily work concerning special questions.

The members of the reference group are chosen for their competence within their daily function area and their qualifications for evaluation of the proposals/systems from the project group.

3.4 Project Group

For each project to be implemented, a group of one to three persons headed by a project leader is established. The responsibility of the project leader (-group) is to elaborate in detail the proposals presented in the system development report and to implement these within the framework of the implementation plan presented in this report.

The members of the project group can be supplemented or replaced ad hoc if necessary.

4. PROJECTS TO BE IMPLEMENTED

As already mentioned, a number of projects are to be implemented in different areas. The following scheme shows the projects to be implemented in the different areas:

PROJECTS / AREAS	1. ORGANISATION	2. WORK ORDER SYSTEM	3. PREVENTIVE MAINTENANCE SYSTEM	4. MAINTENANCE PLANNING SYSTEM	5. PRODUCTION PLANNING SYTEM	6. MATERIAL ADMINISTRA-TION SYSTEM	7. COST CONTROL SYSTEM	8. CODING SYSTEM	9. INFORMATION BASE AND FILES	10. SPECIAL SYSTEMS AND TECHNIQUES
1. CENTRAL ORGANISATION	+			+	+	+	+	+	+	+
2. CENTRAL MAINTENANCE FACTORY	+			+	+	+	+	+	+	+
3. CENTRAL SPARE PART PRODUCTION	+		+		+	+	+	+	+	+
4. MAINTENANCE UNIT OF FACTORIES	+	+	+	+		+	+	+	+	
5. COLD & HOT ROLLING MILLS	+	+	+	+	+	+	+	+	+	
6. METALLURGICAL FACTORY	+	+	+	+	+	+	+	+	+	
7. TRANSPORTATION FACTORY	+	+	+	+	+	+	+	+	+	
8. SHEET PROCESSING FACTORY	+	+	+	+	+	+	+	+	+	
9. COKING FACTORY	+	+	+	+	+	+	+	+	+	
10. ENERGY FACTORY	+	+	+	+	+	+	+	+	+	
11. ROLLING MILL - BUDAPEST	+	+	+	+	+	+	+	+	+	

A standard work/activity plan is elaborated for projects 1 - 10. However, the project groups will have to make the detailing and adjustments necessary for each individual area.

The standard work plans, the project leader and the project group are presented in Attachments 1 - 10, and the EDP-processed time schedule and resource load are presented in Attachment 11.

4.1 Central Organisation

The implementation of the managed maintenance system in this area is calculated to last 65 weeks. Due to interdependencies between other areas and limitation of resources, this implementation should not start before 13 weeks after the first implementation project has been begun.

The implementation in this area consists of the following projects:

101	Organisation	(Work Plan Att. 1)
104	Maintenance Planning System	(Work Plan Att. 4)
105	Production Planning System	(Work Plan Att. 5)
106	Material Administration System	(Work Plan Att. 6)
107	Cost Control System	(Work Plan Att. 7)
108	Coding System	(Work Plan Att. 8)
109	Information Base and Files	(Work Plan Att. 9)
110	Special Systems and Techniques	(Work Plan Att. 10)

The time schedule for this area appears in Attachment 11.1.

4.2 Central Maintenance Factory

The implementation of the managed maintenance system in the central maintenance factory is calculated to last 51 weeks. Due to interdependencies between other areas and the limitation of resources, this implementation should not commence until 17 weeks after the first implementation project has been started.

The implementation in this area consists of the following projects:

201	Organisation	(Work Plan Att. 1)
204	Maintenance Planning System	(Work Plan Att. 4)
205	Production Planning System	(Work Plan Att. 5)
206	Material Administration System	(Work Plan Att. 6)

207	Cost Control System	(Work Plan Att. 7)
208	Coding System	(Work Plan Att. 8)
209	Information Base and Files	(Work Plan Att. 9)
210	Special Systems and Techniques	(Work Plant Att. 10)

The time schedule for this area appears in Attachment 11.2.

4.3 Central Spare Part Production

The implementation of the managed maintenance system in this area is calculated to last 51 weeks. Due to interdependencies between other areas and the limitation of resources, the implementation in this area should not begin before 25 weeks after the first implementation project has been started.

The implementation in this area consists of the following projects:

301	Organisation	(Work Plan Att. 1)
303	Preventive Maintenance System	(Work Plan Att. 3)
305	Production Planning System	(Work Plan Att. 5)
306	Material Administration System	(Work Plan Att. 6)
307	Cost Control System	(Work Plan Att. 7)
308	Coding System	(Work Plan Att. 8)
309	Information Base and Files	(Work Plan Att. 9)
310	Special Systems and Techniques	(Work Plan Att. 10)

The time schedule for this area appears in Attachment 11.3.

4.4 Maintenance Unit of Factories

The implementation of the managed maintenance system in this area is calculated to last 42 weeks. Due to interdependencies between other areas and the limitation of resources, the implementation in this area should not commence before 100 weeks after the first implementation project has been started.

The implementation in this area consists of the following projects:

401	Organisation	(Work Plan Att. 1)
402	Work Order System	(Work Plan Att. 2)
403	Preventive Maintenance System	(Work Plan Att. 3)
404	Maintenance Planning System	(Work Plan Att. 4)
406	Material Administration System	(Work Plan Att. 6)
407	Cost Control System	(Work Plan Att. 7)
408	Coding System	(Work Plan Att. 8)
409	Information Base and Files	(Work Plan Att. 9)

The time schedule for this area appears in Attachment 11.4.

4.5 Cold and Hot Rolling Mills

The implementation of the managed maintenance system in this area is calculated to last 74 weeks.

This project can start immediately.

The implementation in this area consists of the following projects:

501	Organisation	(Work Plan Att. 1)
502	Work Order System	(Work Plan Att. 2)
503	Preventive Maintenance System	(Work Plan Att. 3)
504	Maintenance Planning System	(Work Plan Att. 4)
505	Production Planning System	(Work Plan Att. 5)
506	Material Administration System	(Work Plan Att. 6)
507	Cost Control System	(Work Plan Att. 7)
508	Coding System	(Work Plan Att. 8)
509	Information Base and Files	(Work Plan Att. 9)

The time schedule for this area appears in Attachment 11.5.

4.6 Metallurgical Factory

The implementation of the managed maintenance system in this area is calculated to last 69 weeks. Due to interdependencies between other areas and the limitation of resources, implementation in this area should not commence until 63 weeks after the first implementation project has been started.

The implementation in this area consists of the following projects:

601	Organisation	(Work Plan Att. 1)
602	Work Order System	(Work Plan Att. 2)
603	Preventive Maintenance System	(Work Plan Att. 3)
604	Maintenance Planning System	(Work Plan Att. 4)
605	Production Planning System	(Work Plan Att. 5)
606	Material Administration System	(Work Plan Att. 6)
607	Cost Control System	(Work Plan Att. 7)
608	Coding System	(Work Plan Att. 8)
609	Information Base and Files	(Work Plan Att. 9)

The time schedule for this area appears in Attachment 11.6.

4.7 Transportation Factory

The implementation of the managed maintenance system in this area is calculated to last 69 weeks. Due to interdependencies between other areas and the limitation of resources, implementation in this area should not commence until 76 weeks after the first implementation project has been started.

The implementation in this area consists of the following projects:

701	Organisation	(Work Plan Att. 1)
702	Work Order System	(Work Plan Att. 2)
703	Preventive Maintenance System	(Work Plan Att. 3)
704	Maintenance Planning System	(Work Plan Att. 4)
705	Production Planning System	(Work Plan Att. 5)
706	Material Administration System	(Work Plan Att. 6)
707	Cost Control System	(Work Plan Att. 7)
708	Coding System	(Work Plan Att. 8)
709	Information Base and Files	(Work Plan Att. 9)

The time schedule for this area appears in Attachment 11.7.

4.8 Sheet Processing Factory

The implementation of the managed maintenance system in this area is calculated to last 69 weeks. Due to interdependencies between other areas and the limitation of resources, implementation in this area should not commence until 84 weeks after the first implementation project has been started.

The implementation in this area consists of the following projects:

801	Organisation	(Work Plan Att. 1)
802	Work Order System	(Work Plan Att. 2)
803	Preventive Maintenance System	(Work Plan Att. 3)
804	Maintenance Planning System	(Work Plan Att. 4)
805	Production Planning System	(Work Plan Att. 5)
806	Material Administration System	(Work Plan Att. 6)
807	Cost Control System	(Work Plan Att. 7)
808	Coding System	(Work Plan Att. 8)
809	Information Base and Files	(Work Plan Att. 9)

The time schedule for this area appears in Attachment 11.8.

4.9 Coking Factory

The implementation of the managed maintenance system in this area is calculated to last 69 weeks. Due to interdependencies between other areas and the limitation of resources, implementation in this area should not commence until 92 weeks after the first implementation project has been started.

The implementation in this area consists of the following projects:

901	Organisation	(Work Plan Att. 1)
902	Work Order System	(Work Plan Att. 2)
903	Preventive Maintenance System	(Work Plan Att. 3)
904	Maintenance Planning System	(Work Plan Att. 4)
905	Production Planning System	(Work Plan Att. 5)
906	Material Administration System	(Work Plan Att. 6)
907	Cost Control System	(Work Plan Att. 7)
908	Coding System	(Work Plan Att. 8)
909	Information Base and Files	(Work Plan Att. 9)

The time schedule for this area appears in Attachment 11.9.

4.10 Energy Factory

The implementation of the managed maintenance system in this area is calculated to last 69 weeks. Due to interdependencies between other areas and the limitation of resources, implementation in this area should not commence until 100 weeks after the first implementation project has been started.

The implementation in this area consists of the following projects:

1001	Organisation	(Work Plan Att. 1)
1002	Work Order System	(Work Plan Att. 2)
1003	Preventive Maintenance System	(Work Plan Att. 3)
1004	Maintenance Planning System	(Work Plan Att. 4)
1005	Production Planning System	(Work Plan Att. 5)
1006	Material Administration System	(Work Plan Att. 6)
1007	Cost Control System	(Work Plan Att. 7)
1008	Coding System	(Work Plan Att. 8)
1009	Information Base and Files	(Work Plan Att. 9)

The time schedule for this area appears in Attachment 11.10.

4.11 Rolling Mill - Budapest

The implementation of the managed maintenance system in this area is calculated to last 69 weeks. Due to interdependencies between other areas and the limitation of resources, implementation in this area should not commence until 108 weeks after the first implementation project has been started.

The implementation in this area consists of the following projects:

1101	Organisation	(Work Plan Att. 1)
1102	Work Order System	(Work Plan Att. 2)
1103	Preventive Maintenance System	(Work Plan Att. 3)
1104	Maintenance Planning System	(Work Plan Att. 4)
1105	Production Planning System	(Work Plan Att. 5)
1106	Material Administration System	(Work Plan Att. 6)

1107 Cost Control System (Work Plan Att. 7)
1108 Coding System (Work Plan Att. 8)
1109 Information Base and Files (Work Plan Att. 9)

The time schedule for this area appears in Attachment 11.11.

3. TIME SCHEDULE

The implementation planning and scheduling are processed on a standard EDP programme based on the network technique.

- The time schedule, the project leader resources and the structure (that is the interdependencies between the activities) for the implementation of all areas are presented in Attachment 11.0.

- The time schedule, shown in table form and as Gantt charts for each area, is presented in Attachments 11.1 to 11.11.

- A special time schedule listed per project leader and the necessary project leader resources for each project, shown in histogram form and table form, is presented in Attachment 11.12.

The total project time is calculated to be 177 weeks. Project start is set for 1 December 1975, which gives the calculated finishing date of the total project as 3 August 1979.

6. EXPECTED RESULTS

It is expected that the counterpart, using the proposed project organisation, work programmes, and implementation plan presented in this report, should be able to implement the proposed Managed Maintenance System within approximately four years.

This implies that the counterpart will be given consultants' aid in the first period of the implementation.

7. CONCLUSION

The implementation organisation and the implementation plan have been established in close cooperation with the management and the staff of the Danube Iron and Steel Works. It is our opinion that the implementation plan presented is realistic. However, we must emphasise that this is a major organisation task for the company, which must be realised as such if optimal results are to be obtained.

With this report we consider that Phase 3, the implementation planning phase, is completed.

STANDARD WORK/ACTIVITY PLANS

1. ORGANISATION

1.1 Objective:

To implement the proposed new concept of organisation and to carry out the necessary adjustments.

1.2 Activities:

1.2.1

The new concept will be discussed with all managers influenced by it. If any major changes in the existing principles are requested, they will be discussed with the project coordinator before being accepted.

1.2.2

The objective of the organisational unit will be described and as far as possible quantified.

1.2.3

The functions covered by the organisational unit will be described and logically divided into main functions.

1.2.4

The distribution of tasks to be performed, the authority and responsibility, coordination and information for all managers will be stated in job descriptions.

1.2.5

General rules for managers at different levels will be worked out.

1.2.6

Description of committees, fixed work groups, etc., who are acting in the organisation.

1.2.7

Establishment of an Organisation Handbook (OH), containing the above-mentioned papers and descriptions of administrative systems and other organisational rules.

1.2.8

Practical production of the OH and distribution to the most important managers.

1.2.9

Guidance for the organisational unit during the period of changes, for instance by orientation meetings etc.

1.2.10

Follow-up of the implementation, adjustments.

1.3. Resources

Project leader: Csinády Gabór

Project group:

Calculated input from project leader: 253 weeks.

2. WORK ORDER SYSTEM

2.1 Objective:

To implement the proposed new work order system in accordance with the principles presented in the "System Development Report" Part 5.1, and to follow up on the system in use and make necessary adjustments.

2.2 Activities:

2.2.1

Detailing of the proposed work order system, including re-evaluation of the necessary formulas.

2.2.2

Detailed description of necessary files.

2.2.3

Discussions with the future users to secure their final acceptance. Major changes of the principles must be discussed with the project coordinator before they are made.

2.2.4

Preliminary printing of the work order formulas and lists, purchase of necessary equipment, such as distribution envelopes, archives, etc.

2.2.5

Trial run of the new system in a secondary area parallel to the present system.

2.2.6

Training of the planning office staff in using and administering the new system. Briefing of production leaders, maintenance foremen and other persons affected by the functioning of the new system.

2.2.7

Training of the workers in using the new system ("understanding" the work order information, making the correct registrations, etc.).

2.2.8

Guidance in using the statistics required by the work order system.

2.2.9

Final printing of the necessary work order papers, total switch-over to the tested and adjusted new work order system.

2.2.10

Follow-up.

2.3 Resources:

Project leader: Páli Ferenc

Project group: Vidak Ferenc
Farkas Jozsef
Bertok Istvan

Calculated input from project leader: 123 weeks.

3. PREVENTIVE MAINTENANCE

3.1 Objective:

To implement the proposed system for preventive maintenance (PM) in accordance with the principles presented in the "System Development Report" Part 5.4.3.2 and to follow up on the system in use and make necessary adjustments.

3.2 Activities:

3.2.1

Detailing of the proposed PM system, including evaluation and design of the necessary formulas.

3.2.2

Detailed description of necessary files.

3.2.3

Discussion with the production and maintenance management to obtain their final acceptance.

3.2.4

Preliminary printing of PM formulas and lists, purchase of necessary equipment.

3.2.5

Selection of several (for instance 10) important areas of the plant in order to test the system. Describe inspections and their frequency and elaborate the PM instructions for the selected parts.

3.2.6

Selection and training of the future inspectors, who will test the proposed method in the areas selected. Inform all persons affected by the system.

3.2.7

Establish a planning system for the inspections, including reporting routines.

3.2.8

Elaborate a plan for expansion of PM, including all important machinery.

3.2.9

Final printing of the necessary PM papers, step-wise working out of the files and implementation of the PM according to the plan.

3.2.10

Guide the managers in using the statistics/information from the PM system.

3.2.11

Follow-up.

3.3 Resources:

Project leader: Páli Ferenc

Project group: Vidák Ferenc
Farkas József
Bertok István

Calculated input from project leader: 372 weeks.

4. MAINTENANCE PLANNING

4.1 Objective:

To implement the proposed new maintenance planning system in accordance with the principles presented in the "System Development Report" Part 5.4.3, and to follow up on the system in use and make necessary adjustments.

4.2 Activities:

4.2.1

Detailing of the proposed maintenance planning system.

4.2.2

Explain and define the relations between and the responsibilities of central planning, project planning, shop planning and job preparation.

4.2.3

Detailed description of necessary files.

4.2.4

Discussion with future users to secure their final acceptance. Major changes of the principles must be discussed with the project coordinator before they are made.

4.2.5

Preliminary printing of planning sheets, loading forms, time estimate forms, etc., and purchase of equipment such as tables, archives, etc. necessary to run the system.

4.2.6

Final run of the job preparation and planning system in a secondary but representative area. The trial run is to be made parallel to the system functioning at present.

4.2.7

Training of the planning office staff in using and administering the new system. Brief production leaders, maintenance foremen and other persons affected by the functioning of the new system.

4.2.8

Final printing of the necessary planning sheets and formulas, and step-wise implementation of the tested and adjusted system in all relevant areas.

4.2.9

Guidance in using the statistics/information of the maintenance planning system.

4.2.10

Follow-up.

4.3 Resources:

Project leader: Páli Ferenc

Project group: Vidák Ferenc
Farkas József
Bertok István

Calculated input from project leader: 147 weeks.

5. PRODUCTION PLANNING

5.1 Objective:

To implement the proposed new production planning system in accordance with the principles presented in the "System Development Report" Parts 5.4.1 and 5.4.2, and to follow up on the system in use and make necessary adjustments.

5.2 Activities:

5.2.1

Detailing of the proposed job preparation and production planning system, including re-evaluation of the necessary formulas.

5.2.2

Definition of the relation between and the responsibility for job preparation and production planning.

5.2.3

Detailed description of necessary files.

5.2.4

Discussions with the future users to secure their final acceptance. Major changes of the principles must be discussed with the project coordinator before being made.

5.2.5

Preliminary printing of planning sheets, loading forms, time estimate forms, etc., and purchase of equipment such as tables, archives, etc. necessary to run the system.

5.2.6

Final run of the job preparation and production planning system in a secondary but representative area. The trial run is to be made parallel to the system functioning at present.

5.2.7

Training of the planning office staff in using and administering the new system. Brief production leaders and foremen.

5.2.8

Training of the workers in using the new system ("understanding" the work order information, making the correct registrations, etc.

5.2.9

Clearing of order stock and re-evaluation of priority of the remaining orders.

5.2.10

Final printing of the necessary planning sheets and formulas, and step-wise implementation of the tested and adjusted system in all relevant areas.

5.2.11

Guidance in using the statistics/information from the production planning system.

5.2.12

Follow-up.

5.3 Resources:

Project leader: Páli Ferenc

Project group: Vidák Ferenc
Farkas József
Bertok István

Calculated input from project leader: 52 weeks.

6. MATERIAL ADMINISTRATION

6.1 Objective:

To implement the proposed new material administration system in accordance with the principles presented in the "System Development Report" Part 6, and to follow up on the system in use and make necessary adjustments.

6.2 Activities:

6.2.1

Detailing of the proposed routines and definition of the various policies to be followed for specific materials/spare parts.

6.2.2

Detailed description of necessary files.

6.2.3

Discussions with the future users to secure their final acceptance. Major changes of the principles must be discussed with the project coordinator before being made.

6.2.4

Preliminary printing of formulas and purchase of equipment necessary to run the material administration system.

6.2.5

Trial run of the material administration system parallel to the system functioning at present.

6.2.6

Training of the material administration staff in using the new system. Brief the future users and all other persons affected by the system.

6.2.7

Step-wise clearing of the existing material/spare part stock, deletion of obsolete materials/spare parts (according to principles and rules presented in a special paper) and coding of the remaining items according to the new coding system (Project 8).

<u>6.2.8</u>

Establishment of a decision model (company policy) for deletion of obsolete spare parts.

<u>6.2.9</u>

Final printing of necessary formulas and step-wise implementation of the tested and adjusted system.

<u>6.2.10</u>

Guidance in using the statistics/information from the new material administration system.

<u>6.2.11</u>

Follow-up.

<u>6.3 Resources</u>:

Project leader: Páger László

Project group: Sámbik István

Calculated input from project leader: 259 weeks.

7. COST CONTROL

7.1 Objective:

To implement the proposed budgeting and cost control system in accordance with the principles presented in the "System Development Report" Part 7 and to follow up on the system in use and make necessary adjustments.

7.2 Activities:

7.2.1

Detailing of the proposed budgeting and cost control system including re-evaluation of the necessary formulas.

7.2.2

Define the relation between and the responsibilities of the organisational units participating in the budgeting and cost control procedure.

7.2.3

Work out detailed description of necessary files.

7.2.4

Discussion with the future users to secure their final acceptance. Major changes of the principles must be discussed with the project coordinator before being made.

7.2.5

Preliminary printing of budgeting schemes and cost control report forms and purchase of equipment necessary to run the system.

7.2.6

Trial run of the system in a secondary but representative area.

7.2.7

Training of the staff in using and administering the new system. Brief managers, production leaders and all other persons affected by the system.

7.2.8

Final printing of the necessary schemes and formulas, and step-wise implementation of the tested and adjusted system.

7.2.9

Guide the managers in using the statistics/reports from the system.

7.2.10

Follow-up.

7.3 Resources:

Project leader: Páger László

Project group: Sámbik István

Calculated input from project leader: 90 weeks.

8. CODING SYSTEM

8.1 Objective:

To implement the proposed new coding system in accordance with the principles presented in the "System Development Report" Part 8 and to follow up on the system in use and make necessary adjustments.

8.2 Activities:

8.2.1

Re-evaluation of the proposed coding systems and detailed description and definition of the modules.

8.2.2

Define the relation between the various coding systems.

8.2.3

Detailed description of necessary files, catalogues, etc

8.2.4

Discussion with the future users to secure their final acceptance. Major changes of the principles must be discussed with the project coordinator before being made.

8.2.5

Simulation of coding in all functions to test the uniqueness, intelligibility and suitability of the chosen system. Make adjustments, if any.

8.2.6

Training of the staff responsible to implement and maintain the system. Brief the future users and all other persons affected by the system.

8.2.7

Elaborate a plan for step-wise implementation of the new coding systems in all relevant areas; begin the conversion to it.

8.2.8

Establish the necessary files and catalogues and the routines for maintaining them.

8.2.9

Follow-up.

8.3 Resources:

Project leader: Tóth Dezső

Project group: Asallár Zoltán

Calculated input from project leader: 05 weeks.

9. INFORMATION BASE AND FILES

9.1 Objective:

To establish the information bases and files necessary to process the managed maintenance system on EDP, in accordance with the framework set up in the "System Development Report" Part 9.

9.2 Activities:

9.2.1

Re-evaluation and detailing of the proposed

- Files on EDP
- Input to EDP
- Output from EDP (possibly report design)

9.2.2

Discussion with the future users to obtain their final comments and acceptance.

9.2.3

Elaborate a plan for establishment of the necessary files.

9.2.4

Collect data and build up the files according to the plan.

9.2.5

Develop and establish maintenance (up-dating) routines for the files.

9.2.6

Prepare the system and routines for data coding and flow in order to get necessary EDP reports.

9.2.7

Brief all persons involved, from data researchers to final report writers, on the necessity for strict data discipline and on the functioning of the system.

9.2.8

Guide the manager in using the statistics/information from the reports.

9.2.9

Follow up on the system and make necessary adjustments according to the higher degree of systems being processed by EDP.

9.3 Resources:

Project leader: Tóth Dezső

Project group: Szallar Zoltán

Calculated input from project leader: 186 weeks.

10. SPECIAL SYSTEMS AND TECHNIQUES

10.1 Objective:

To realise and implement special systems and techniques necessary to obtain a suitable and efficient processing of the proposed main systems. These special systems and techniques are presented in special papers and mentioned in the "System Development Report" Part 10.

10.2 Activities:

10.2.1

Systematise the knowledge of relevant special systems and techniques.

10.2.2

Evaluate the areas which can use theme advantageously.

10.2.3

Train the relevant persons in using these techniques and introduce the techniques in the respective areas.

10.2.4

Follow up on the use and the results of using the techniques. Propose changes if necessary.

10.3 Resources:

Project leader: Kovacs Gyula

Project group: Mate Sandor

Calculated input from project leader: 17 weeks.

Attachment 11.0

** RESULT OF TIME CALCULATION **

** PROJECT NO. 1 **

```
PLANNED    START:     0   [illegible]
COMPUTED   START:     0   [illegible]
SECONDARY  START:
PLANNED    FINISH:
COMPUTED   FINISH:  177   [illegible]
SECONDARY  FINISH:
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OPTIMA NORWEGIAN COMPUTING CENTER 03 DEC 75

*** T I M E   L I S T I N G ***

PAGE 1

PROJECT NO. 1
[illegible] IRON - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG76
TIME UNIT: WEEK

ACTIVITY IDENTIFICATION	ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
A01	****** START CENTRAL OH-AN.	0	1MAR76		6AUG76		165	C	165	
B01	CENTRAL OH-AN. FINISH ******	0	8AUG77				0	0	0	
A02	****** START CENTR.MAIN FAC.	0	5APR76				0	0	0	
B02	CENTR.MAINT.FAC. FINISH ******	0	[illegible]		25JUL77		0	0	0	
A03	****** START CENT.SPARE-.PH.	0	7JUN76				0	0	0	
B03	CENT.SPARE-.PR. FINISH ******	0	25JUL77				0	0	0	
A04	****** START MAINT.UNIT FACT.	0	10JAN76				0	0	0	
B04	MAINT.UNIT FACT. FINISH ******	0	[illegible]				0	0	0	
A05	****** START ROLLING MILLS	0	1DEC75				0	0	0	
B05	ROLLING MILLS FINISH ******	0	13JAN77				0	0	0	
A06	****** START METALL FACTORY	0	[illegible]				0	0	0	
B06	METALL FACTORY FINISH ******	0	[illegible]				0	0	0	
A07	****** START [illegible].FACTORY	0	25JUL77				0	0	0	
B07	[illegible].FACTORY FINISH ******	0	[illegible]				0	0	0	
A08	****** START SHEET PROC.FACT.	0	[illegible]				0	0	0	
B08	SHEET PROC FACT. FINISH ******	0	[illegible]				0	0	0	
A09	****** START COOKING FACTORY	0	[illegible]				0	0	0	
B09	COOKING FACTORY FINISH ******	0	[illegible]				0	0	0	
A10	****** START ENERGY FACTORY	0	10JAN76				0	0	0	
B10	ENERGY FACTORY FINISH ******	0	11JAN76				0	0	0	
A11	****** START BUDAPEST ROLLMILL	0	13MAR76				0	0	0	
B11	BUDAPEST ROLLMILL FINISH ******	0	[illegible]				0	0	0	

OPTIMA
[illegible]
COMPUTING
CENTER

*** TIME LISTING ***

PAGE 1

PROJECT NO. 1
[illegible] IRON - STEEL WORKS IMPLEMENTATION PLAN
03 DEC 75 THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79
TIME UNIT: WEEK

ACTIVITY IDENTIFICATION		ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
[illegible]	[illegible] START	ROLLING MILLS	0	1DEC75				0	0	0	
[illegible]	[illegible] START	CENTRAL ADMIN.	0	[illegible]		[illegible]		165	0	165	
[illegible]	[illegible] START	CENTR.MAINT FAC.	0	[illegible]				0	0	0	
[illegible]	[illegible] START	[illegible]	0	[illegible]				0	0	0	
[illegible]	[illegible] START	METALL FACTORY	0	[illegible]				0	0	0	
[illegible]	[illegible] START	TRANSP.FACTORY	0	[illegible]				0	0	0	
[illegible]	[illegible] START	SHEET PROC.FACT.	0	[illegible]				0	0	0	
[illegible]	[illegible] START	[illegible] FACTORY	0	[illegible]				0	0	0	
[illegible]	[illegible] START	MAINT.UNIT FACT.	0	[illegible]				0	0	0	
[illegible]	[illegible] START	ENERGY FACTORY	0	[illegible]				0	0	0	
A61	[illegible] START	BUDAPEST R.LLMILL	0	[illegible]				0	0	0	

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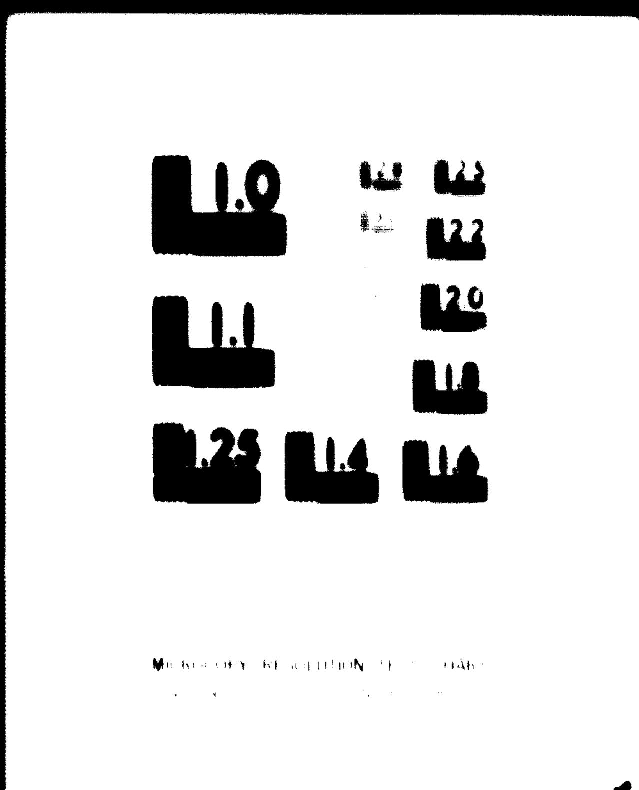
82.06.22

9 OF 10



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OPTIMA [illegible] COMPUTING CENTER   PROJECT NO. 1   *** T I M E   L I S T I N G ***   PAGE 2

[illegible] IRON + STEEL WORKS IMPLEMENTATION PLAN

03 DEC 75 THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3[illegible]
TIME UNIT: WEEK

ACTIVITY IDENTIFICATION	ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
002	CENTR.MAINT.FAC. FINISH ******	0	[illegible]77		25JUL77		0	0	0	
005	ROLLING MILLS FINISH ******	0	1[illegible]77				0	0	0	
003	CENT.[illegible] FINISH ******	0	25JUL77				0	0	0	
004	CENTRAL [illegible] FINISH ******	0	[illegible]77				0	0	0	
006	METALL FACTORY FINISH ******	0	[illegible]78				0	0	0	
[illegible]	[illegible] FACT. FINISH ******	0	[illegible]DEC78				0	0	0	
007	[illegible].FACTORY FINISH ******	0	[illegible]DEC78				0	0	0	
008	[illegible] FACT. FINISH ******	0	1[illegible]79				0	0	0	
009	[illegible] FACTORY FINISH ******	0	1[illegible]79				0	0	0	
010	[illegible] FACTORY FINISH ******	0	11[illegible]79				0	0	0	
011	BUDAPEST [illegible] FINISH ******	0	[illegible]79				0	0	0	

OPTIMA
NORWEGIAN
COMPUTING
CENTER
03 DEC 75

*** TIME LISTING ***

PAGE 1

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 30AUG78
TIME UNIT: WEEK

ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
501	CG	RM	ORGANIZATION	ROLLING MILLS	13	1DEC75	5MAR76	8MAR76	11JUN76	13	0	0	
106	TD	CO	CODING SYSTEM	CENTRAL ORGAN.	39	1DEC75	1OCT76			0	0	0	
503	PF	RM	PREVENTIVE MAINTENANCE	HOLLING MILLS	73	1DEC75	10JUN77			0	0	0	
505	PF	RM	PRODUCTION PLANNING	ROLLING MILLS	52	1DEC75	7JAN77	1NOV76	10JUN77	21	0	21	
506	PL	RM	MATERIAL ADMINISTRATION	ROLLING MILLS	52	1DEC75	7JAN77	1NOV76	10JUN77	21	0	21	
508	TD	RM	CODING SYSTEM	ROLLING MILLS	52	1DEC75	7JAN77	1NOV76	10JUN77	21	0	21	
110	MG	CO	SPECIAL SYSTEMS AND TECHNIQUES	CENTRAL ORGAN.	66	1DEC75	8APR77	8MAR76	5AUG77	13	0	13	
101	CG	CO	ORGANIZATION	CENTRAL ORGAN.	70	1DEC75	5AUG77	15MAR76	11NOV77	14	0	0	
502	PF	RM	WORK ORDER SYSTEM	ROLLING MILLS	43	27FEB76	24DEC76	2AUG76	10JUN77	22	0	22	
104	PF	CO	MAINTENANCE PLANNING	CENTRAL ORGAN.	43	27FEB76	24DEC76	6SEP76	5AUG77	27	0	27	
105	PF	CO	PRODUCTION PLANNING	CENTRAL ORGAN.	26	27FEB76	27AUG76	10JAN77	5AUG77	44	0	44	
108	PL	CO	MATERIAL ADMINISTRATION	CENTRAL ORGAN.	56	27FEB76	1APR77	17MAY76	5AUG77	14	0	14	
107	PL	CO	COST CONTROL	CENTRAL ORGAN.	43	27FEB76	24DEC76	6SEP76	5AUG77	27	0	27	
504	PF	RM	MAINTENANCE PLANNING	ROLLING MILLS	47	[illegible]	[illegible]	14JUN76	10JUN77	13	0	0	
201	CG	CM	ORGANIZATION	CENTR.MAINT.FAC	26	5APR76	29OCT76			0	0	0	
507	PL	RM	COST CONTROL	ROLLING MILLS	26	5APR76	29OCT76	29NOV76	10JUN77	30	0	30	
509	TD	RM	INFORMATION BASE AND FILES	ROLLING MILLS	43	5APR76	[illegible]	2AUG76	10JUN77	13	0	13	
301	CG	CS	ORGANIZATION	CENT.SPAREP.PR.	26	7JUN76	24DEC76			0	0	0	
206	PL	CM	MATERIAL ADMINISTRATION	CENTR.MAINT.FAC	26	7JUN76	24DEC76	30AUG76	[illegible]	9	0	0	
204	PF	CM	MAINTENANCE PLANNING	CENTR.MAINT.FAC	26	7JUN76	24DEC76	20DEC76	22JUL77	25	0	17	
205	PF	CM	PRODUCTION PLANNING	CENTR.MAINT.FAC	43	7JUN76	[illegible]	23AUG76	22JUL77	0	0	0	
207	PL	CM	COST CONTROL	CENTR.MAINT.FAC	26	7JUN76	24DEC76	20DEC76	22JUL77	25	0	17	
208	TD	CM	CODING SYSTEM	CENTR.MAINT.FAC	26	7JUN76	24DEC76	20DEC76	22JUL77	25	0	17	
210	MG	CM	SPECIAL SYSTEMS AND TECHNIQUES	CENTR.MAINT.FAC	43	7JUN76	[illegible]	23AUG76	22JUL77	0	0	0	
209	TD	CM	INFORMATION BASE AND FILES	CENTR.MAINT.FAC	30	23AUG76	22APR77	25OCT76	22JUL77	9	0	1	
303	PF	CS	PREVENTIVE MAINTENANCE	CENT.SPAREP.PR.	30	23AUG76	22APR77	25OCT76	22JUL77	9	0	9	
305	PF	CS	PRODUCTION PLANNING	CENT.SPAREP.PR.	43	23AUG76	22JUL77			0	0	0	
306	PL	CS	MATERIAL ADMINISTRATION	CENT.SPAREP.PR.	30	23AUG76	22APR77	25OCT76	22JUL77	9	0	0	
308	TD	CS	CODING SYSTEM	CENT.SPAREP.PR.	43	23AUG76	22JUL77			0	0	0	
310	MG	CS	SPECIAL SYSTEMS AND TECHNIQUES	CENT.SPAREP.PR.	34	23AUG76	22APR77	25OCT76	22JUL77	9	0	9	
109	TD	CO	INFORMATION BASE AND FILES	CENTRAL ORGAN.	39	4OCT76	5AUG77			0	0	0	
307	PL	CS	COST CONTROL	CENT.SPAREP.PR.	26	18OCT76	22APR77	20DEC76	22JUL77	9	0	0	
309	TD	CS	INFORMATION BASE AND FILES	CENT.SPAREP.PR.	17	13DEC76	15APR77	20FEB77	22JUL77	10	0	10	
601	CG	MF	ORGANIZATION	METALL FACT.	17	28MAR77	19AUG77	22AUG77	16DEC77	17	0	0	
603	PF	MF	PREVENTIVE MAINTENANCE	METALL FACT.	69	28MAR77	22SEP78			0	0	0	
605	PF	MF	PRODUCTION PLANNING	METALL FACT.	52	28MAR77	28APR78	22AUG77	22SEP78	17	0	17	
606	PL	MF	MATERIAL ADMINISTRATION	METALL FACT.	52	28MAR77	28APR78	22AUG77	22SEP78	17	0	17	
608	TD	MF	CODING SYSTEM	METALL FACT.	52	28MAR77	28APR78	22AUG77	22SEP78	17	0	17	
701	CG	TF	ORGANIZATION	TRANSP.FACTORY	17	25JUL77	18NOV77	21NOV77	24MAR78	17	0	0	
602	PF	MF	WORK ORDER SYSTEM	METALL FACT.	39	25JUL77	28APR78	21NOV77	22SEP78	17	0	17	
703	PF	TF	PREVENTIVE MAINTENANCE	TRANSP.FACTORY	69	25JUL77	22DEC78			0	0	0	
705	PF	TF	PRODUCTION PLANNING	TRANSP.FACTORY	52	25JUL77	25AUG78	21NOV77	22DEC78	17	0	17	
706	PL	TF	MATERIAL ADMINISTRATION	TRANSP.FACTORY	52	25JUL77	25AUG78	21NOV77	22DEC78	17	0	17	
708	TD	TF	CODING SYSTE	TRANSP.FACTORY	52	25JUL77	25AUG78	21NOV77	22DEC78	17	0	17	
604	PF	MF	MAINTENANCE PLANNING	METALL FACT.	34	22AUG77	21APR78	[illegible]	22SEP78	18	[illegible]	[illegible]	

OPTIMA
NORWEGIAN
COMPUTING CENTER
03 DEC 75

PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79
TIME UNIT: WEEK

ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
609	TD	MF	INFORMATION BASE AND FILES	METALL FACT.	36	22AUG77	21APR78	2JAN78	22SEP78	10	0	10	
801	CG	SF	ORGANIZATION	SHEET PROC.FACT	17	19SEP77	20JAN78	23JAN78	20MAY78	17	0	0	
803	PF	SF	PREVENTIVE MAINTENANCE	SHEET PROC.FACT	69	19SEP77	16FEB79			0	0	0	
805	PF	SF	PRODUCTION PLANNING	SHEET PROC.FACT	52	19SEP77	20OCT78	23JAN78	16FEB79	17	0	17	
806	PL	SF	MATERIAL ADMINISTRATION	SHEET PROC.FACT	52	19SEP77	20OCT78	23JAN78	16FEB79	17	0	17	
808	TD	SF	CODING SYSTEM	SHEET PROC.FACT	52	19SEP77	20OCT78	23JAN78	16FEB79	17	0	17	
607	PL	MF	COST CONTROL	METALL FACT.	26	17OCT77	21APR78	27FEB78	22SEP78	10	0	10	
702	PF	TF	WORK ORDER SYSTEM	TRANSP.FACTORY	39	24OCT77	25AUG78	27FEB78	22DEC78	17	0	17	
901	CG	CF	ORGANIZATION	COOKING FACTORY	17	14NOV77	17MAR78	20MAR78	11AUG78	17	0	0	
903	PF	CF	PREVENTIVE MAINTENANCE	COOKING FACTORY	69	14NOV77	13APR79			0	0	0	
905	PF	CF	PRODUCTION PLANNING	COOKING FACTORY	52	14NOV77	15DEC78	20MAR78	13APR79	17	0	17	
906	PL	CF	MATERIAL ADMINISTRATION	COOKING FACTORY	52	14NOV77	15DEC78	20MAR78	13APR79	17	0	17	
908	TD	CF	CODING SYSTEM	COOKING FACTORY	52	14NOV77	15DEC78	20MAR78	13APR79	17	0	17	
704	PF	TF	MAINTENANCE PLANNING	TRANSP.FACTORY	36	21NOV77	18AUG78	3APR78	22DEC78	10	0	0	
709	TD	TF	INFORMATION BASE AND FILES	TRANSP.FACTORY	36	21NOV77	18AUG78	3APR78	22DEC78	10	0	10	
802	PF	SF	WORK ORDER SYSTEM	SHEET PROC.FACT	39	19DEC77	20OCT78	24APR78	16FEB79	17	0	17	
401	CG	MU	ORGANIZATION	MAINT UNIT FACT	8	16JAN78	10MAR78			0	0	0	
1001	CG	CF	ORGANIZATION	COOKING FACTORY	17	16JAN78	[illegible]MAY78	29MAY78	6OCT78	17	0	0	
1003	PF	EF	PREVENTIVE MAINTENANCE	ENERGY FACTORY	69	16JAN78	8JUN79			0	0	0	
1005	PF	EF	PRODUCTION PLANNING	ENERGY FACTORY	52	16JAN78	9FEB79	29MAY78	8JUN79	17	0	17	
1006	PL	EF	MATERIAL ADMINISTRATION	ENERGY FACTORY	52	16JAN78	9FEB79	29MAY78	8JUN79	17	0	17	
1008	TD	EF	CODING SYSTEM	ENERGY FACTORY	52	16JAN78	9FEB79	29MAY78	8JUN79	17	0	17	
707	PL	TF	COST CONTROL	TRANSP.FACTORY	26	23JAN78	18AUG78	5JUN78	22DEC78	10	0	10	
804	PF	SF	MAINTENANCE PLANNING	SHEET PROC.FACT	36	23JAN78	13OCT78	5JUN78	16FEB79	10	0	0	
809	TD	SF	INFORMATION BASE AND FILES	SHEET PROC.FACT	36	23JAN78	13OCT78	5JUN78	16FEB79	10	0	10	
902	PF	CF	WORK ORDER SYSTEM	COOKING FACTORY	39	20FEB78	15DEC78	17JUL78	13APR79	17	0	17	
1101	CG	BF	ORGANIZATION	BUDAPEST ROLMI	17	13MAR78	6AUG78	7AUG78	1DEC78	17	0	0	
402	PF	MU	WORK ORDER SYSTEM	MAINT UNIT FACT	36	13MAR78	1DEC78			0	0	0	
403	PF	MU	PREVENTIVE MAINTENANCE	MAINT UNIT FACT	36	13MAR78	1DEC78			0	0	0	
404	PF	MU	MAINTENANCE PLANNING	MAINT UNIT FACT	36	13MAR78	1DEC78			0	0	0	
406	PL	MU	MATERIAL ADMINISTRATION	MAINT UNIT FACT	36	13MAR78	1DEC78			0	0	0	
408	TD	MU	CODING SYSTEM	MAINT UNIT FACT	36	13MAR78	1DEC78			0	0	0	
1103	PF	BF	PREVENTIVE MAINTENANCE	BUDAPEST ROLMI	69	13MAR78	3AUG79			0	0		
1105	PF	BF	PRODUCTION PLANNING	BUDAPEST ROLMI	52	13MAR78	6APR79	7AUG78	3AUG79	17	0	17	
1106	PL	BF	MATERIAL ADMINISTRATION	BUDAPEST ROLMI	52	13MAR78	6APR79	7AUG78	3AUG79	17	0	17	
1108	TD	BF	CODING SYSTEM	BUDAPEST ROLMI	52	13MAR78	6APR79	7AUG78	3AUG79	17	0	17	
807	PL	SF	COST CONTROL	SHEET PROC.FACT	26	20MAR78	13OCT78	21AUG78	16FEB79	10	0	10	
904	PF	CF	MAINTENANCE PLANNING	COOKING FACTORY	36	20MAR78	8DEC78	21AUG78	13APR79	10	0	0	
909	TD	CF	INFORMATION BASE AND FILES	COOKING FACTORY	36	20MAR78	8DEC78	21AUG78	13APR79	10	0	10	
1002	PF	EF	WORK ORDER SYSTEM	ENERGY FACTORY	39	17APR78	9FEB79	11SEP78	8JUN79	17	0	17	
407	PL	MU	COST CONTROL	MAINT UNIT FACT	26	15MAY78	1DEC78			0	0	0	
907	PL	CF	COST CONTROL	COOKING FACTORY	26	22MAY78	8DEC78	16OCT78	13APR79	10	0	10	
1004	PF	EF	MAINTENANCE PLANNING	ENERGY FACTORY	36	22MAY78	2FEB79	16OCT78	8JUN79	10	0	0	
1009	TD	EF	INFORMATION BASE AND FILES	ENERGY FACTORY	36	22MAY78	2FEB79	16OCT78	8JUN79	10	0	10	
409	TD	MU	INFORMATION BASE AND FILES	MAINT UNIT FACT	21	[illegible]	24NOV78	[illegible]	1DEC78	[illegible]	0	1	

OPTIMA [illegible]

*** TIME LISTING ***

PAGE 3

COMPUTING PROJECT NO. 1
CENTER [illegible] - STEEL WORKS IMPLEMENTATION PLAN
[illegible] THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: [illegible]
PLANNED FINISH:
COMPUTED FINISH: [illegible]
TIME UNIT: WEE-

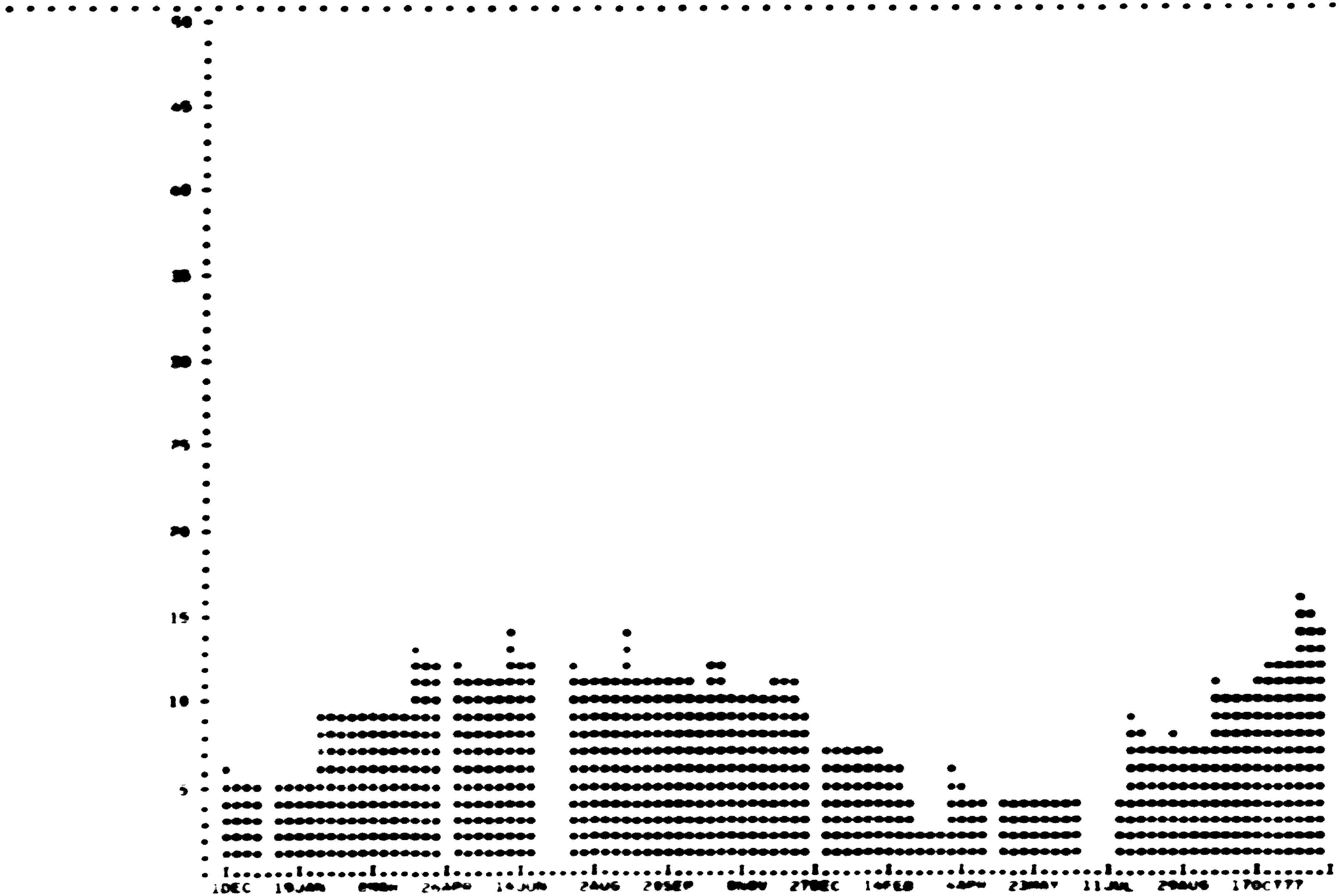
ACTIVITY IDENTIFICATION	ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT TOTAL	FLOAT SEC.	FLOAT FREE	UP DATE
[illegible] FF [illegible]	[illegible] SYSTEM	BUDAPEST [illegible]	30	[illegible]	[illegible]	[illegible]	[illegible]	37	0	37	
[illegible] PL [illegible]	[illegible] CONTROL	[illegible] FACTORY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	30	0	30	
[illegible] FF [illegible]	[illegible] PLANNING	BUDAPEST [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	30	0	0	
[illegible] TO [illegible]	[illegible] BASE AND FILES	BUDAPEST [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	30	0	30	
[illegible] PL [illegible]	[illegible] CONTROL	BUDAPEST [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	30	0	30	

TOTAL RESOURCES IN HISTOGRAM FORM

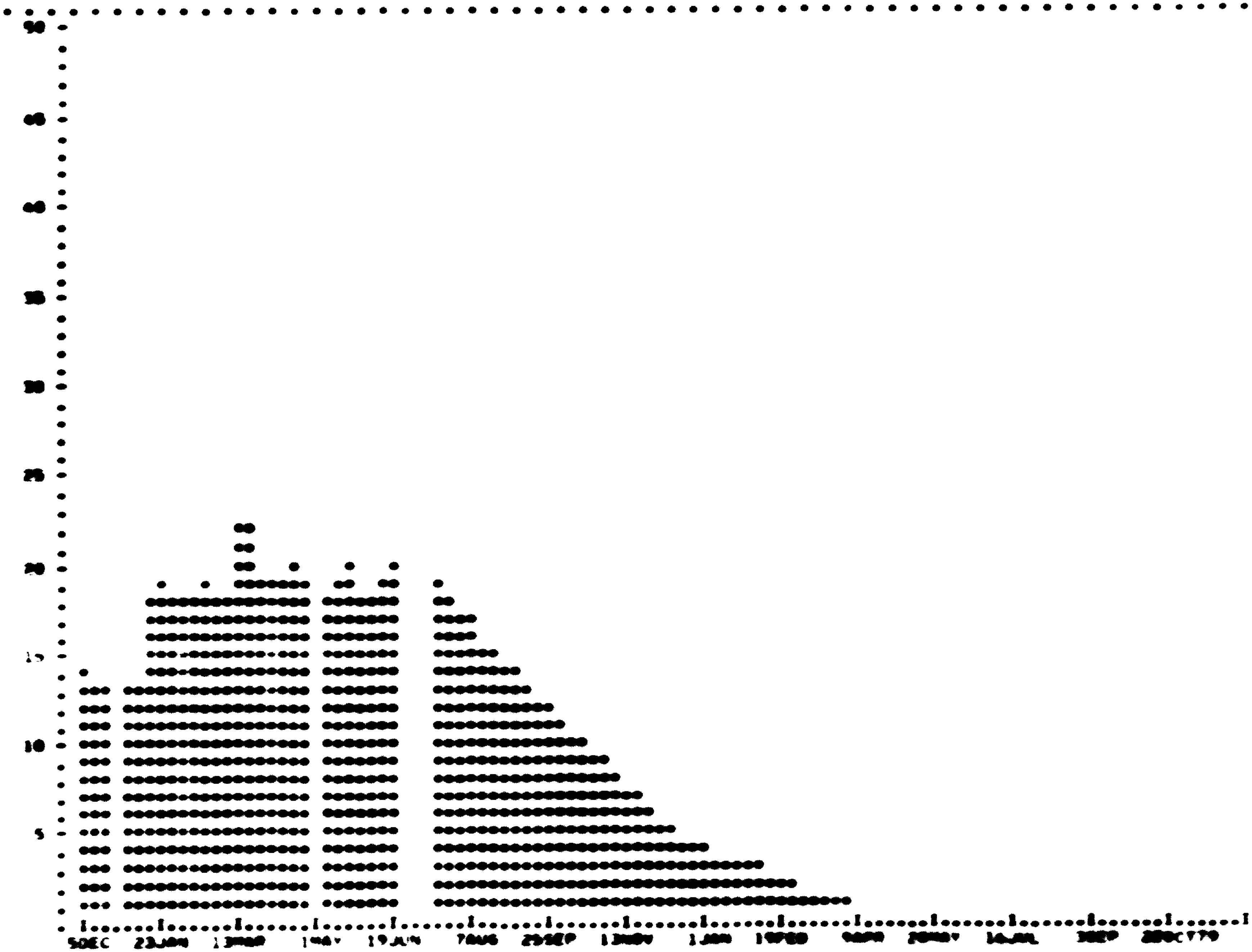
PAGE 1

COSTCATEGORIES: ACTIVITYCOST . OVERHEADCOST . RESOURCECOST

PROJECT NO. 1



OPTIMA ... TOTAL RESOURCES IN HISTOGRAM FORM ... PAGE 2
NORWEGIAN COSTCATEGORIES: ACTIVITYCOST . OVERHEADCOST . RESOURCECOST C.U: [illegible]
COMPUTING PROJECT NO. 1
CENTER [illegible] IRON - STEEL WORKS IMPLEMENTATION PLAN OUTPUT START: 10DEC75 T.U. INPUT: [illegible]
[illegible] DEC 75 THE ACTIVITIES ARE PLACED IN EARLIEST POSITION OUTPUT FINISH: [illegible] T.U. OUTPUT: [illegible]



OPTIMA
NORWEGIAN
COMPUTING CENTER
09 DEC 75

* * * ACCUMULATED RESOURCES IN TABLE FORM * * *

COSTCATEGORIES: ACTIVITYCOST , OVERHEADCOST , RESOURCECOST

COMPUTING PROJECT NO. 1

DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN

THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

PAGE 1
C.U: [illegible]
OUTPUT START: 1DEC75
OUTPUT FINISH: [illegible]
T.U. INPUT: WEEK
T.U. OUTPUT: WEEK

									ACCUM. LOAD
1DEC75	[illegible]	5	5	5	*****	5	5	.	31.
19JAN76	5	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	13	12	12	.	190.
[illegible]	*****	12	11	11	11	11	10	.	[illegible]
[illegible]	10	12	*****	*****	*****	12	11	.	270.
[illegible]	11	11	11	10	11	11	11	.	[illegible]
[illegible]	11	11	11	10	12	12	10	.	[illegible]
[illegible]	10	10	10	11	11	11	[illegible]	.	[illegible]
[illegible]	*****	7	7	7	7	7	7	.	[illegible]
[illegible]	6	[illegible]	6	8	2	8	[illegible]	.	575.
[illegible]	5	6	6	*****	6	6	6	.	[illegible]
[illegible]	6	6	6	6	6	*****	*****	.	[illegible]
11JUL77	*****	6	[illegible]	[illegible]	7	7	[illegible]	.	[illegible]
29AUG77	7	7	7	11	10	10	10	.	725.
17OCT77	11	12	12	12	16	15	14	.	817.
5DEC77	14	13	13	*****	13	13	10	.	[illegible]
23JAN78	19	16	19	18	19	16	10	.	1329.
13MAR78	22	22	19	19	19	20	19	.	1169.
[illegible]	*****	16	19	20	18	18	19	.	1281.
19JUN78	20	*****	*****	*****	19	18	17	.	1395.
7AUG78	17	15	15	14	14	13	12	.	1455.
25SEP78	12	11	10	10	[illegible]	[illegible]	[illegible]	.	1524.
13NOV78	7	7	6	5	5	6	6	.	1562.
1JAN79	6	3	3	3	3	3	2	.	1583.

OPTIMA
NORWEGIAN
COMPUTING
CENTER
03 DEC 75

*** ACCUMULATED RESOURCES IN TABLE FORM ***

COSTCATEGORIES: ACTIVITYCOST , OVERHEADCOST , RESOURCECOST

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

PAGE 2
C.U: 1000KRON

OUTPUT START: 1DEC75
OUTPUT FINISH: 1AUG79

T.U. INPUT: WEEK
T.U. OUTPUT: WEEK

									ACCUM. LOAD
10FEB79	2	2	1	1	1	1	1	.	1982.
16JUL79	0	0	0	[illegible]	[illegible]	[illegible]	[illegible]	.	1982.

OPTIMA *** STRUCTURE *** PAGE 1
NORWEGIAN
COMPUTING PROJECT NO. 1 PROJECT START: [illegible]
CENTER [illegible] - STEEL WORKS IMPLEMENTATION PLAN PLANNED FINISH: TIME UNIT: [illegible]
[illegible] DEC 75 THE ACTIVITIES ARE SORTED ACCORDING TO INTERNAL REPRESENTATION COMPUTED FINISH: [illegible]

PREDECESSORS				ACTIVITY([illegible])		SUCCESSORS		
		A10	**	1001(9)	**	[illegible]	1006	ST(13)1002
						[illegible]		
		ST(13)1001	**	1002(10)	**	[illegible]		
		A10	**	1003(9)	**	[illegible]		
		1001	**	[illegible]	**	ST(0)1007	[illegible]	
		A10	**	[illegible]	**	[illegible]		
		A10	**	[illegible]	**	[illegible]		
		ST(0)1006	**	1007(11)	**	[illegible]		
		A10	**	[illegible]	**	[illegible]		
		1001	**	[illegible]	**	[illegible]		
		A11	**	[illegible]	**	[illegible]	1106	ST(13)1102
						[illegible]		
		ST(13)1101	**	[illegible]	**	[illegible]		
		A11	**	[illegible]	**	[illegible]		
		1101	**	[illegible]	**	ST(0)1107	[illegible]	
		A11	**	[illegible]	**	[illegible]		
		A11	**	[illegible]	**	[illegible]		
		ST(0)1106	**	1107([illegible])	**	[illegible]		
		A11	**	[illegible]	**	[illegible]		
		1101	**	[illegible]	**	[illegible]		
			**	[illegible]	**			
		[illegible]	**	[illegible]	**	[illegible]		
		[illegible]	**	[illegible]	**	[illegible]		
		[illegible]	**	[illegible]	**	[illegible]		
			**	[illegible]	**	[illegible]	[illegible]	505
						[illegible]	501	
		[illegible]	**	[illegible]	**	[illegible]	[illegible]	605
						[illegible]	601	
		A05	**	A07(5)	**	700	706	705
						703	701	
		A06	**	[illegible](6)	**	[illegible]	[illegible]	805
						803	801	
		A07	**	[illegible](7)	**	900	906	905
						903	901	
		A08	**	A10(8)	**	1000	1006	1005
						1003	1001	
		A09	**	A11(9)	**	1100	1106	1105
						1103	1101	
106	105	104	**	[illegible](2)	**	201		
109	108	107						
		110						
205	204	201	**	[illegible](5)	**	202		
208	207	206						
	210	209						

CONTINUES ./.

OPTIMA
NORWEGIAN
COMPUTING PROJECT NO. 1
CENTER DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
03 DEC 75 THE ACTIVITIES ARE SORTED ACCORDING TO INTERNAL REPRESENTATION

*** STRUCTURE ***

PAGE 2

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: [illegible]
TIME UNIT: WEEK

PREDECESSORS				ACTIVITY(RANK)		SUCCESSORS		
305	303	301	--	B03(7)	--	Z03		
308	307	306						
	310	309						
403	402	401	--	B04(13)	--	Z04		
407	406	404						
	409	408						
503	502	501	--	B05(6)	--	Z05		
506	505	504						
509	508	507						
603	602	601	--	B06(8)	--	Z06		
606	605	604						
609	608	607						
703	702	701	--	B07(9)	--	Z07		
706	705	704						
709	708	707						
803	802	801	--	B08(10)	--	Z08		
806	805	804						
809	808	807						
903	902	901	--	B09(11)	--	Z09		
906	905	904						
909	908	907						
1003	1002	1001	--	B10(12)	--	Z10		
1006	1005	1004						
1009	1008	1007						
1103	1102	1101	--	B11(13)	--	Z11		
1106	1105	1104						
1109	1108	1107						
			--	A01(0)	--	A02	B02	
		A01	--	A02(1)	--	A03	B03	
		A02	--	A03(2)	--	A04		
		A03	--	A04(3)	--	A05	B06	
		A04	--	A05(4)	--	A06	B07	
		A05	--	A06(5)	--	A07	B08	
		A06	--	A07(6)	--	A08	B09	
		A07	--	A08(7)	--	A09	B10	A04
		A08	--	A09(8)	--	A11		
		B01	--	Z01(3)	--			
		B02	--	Z02(6)	--			
		B03	--	Z03(8)	--			
		B04	--	Z04(14)	--			
		B05	--	Z05(5)	--			
		B06	--	Z06(9)	--			
		B07	--	Z07(10)	--			
		B08	--	Z08(11)	--			
		B09	--	Z09(12)	--			
		B10	--	Z10(13)	--			

OPTIMA NORWEGIAN COMPUTING CENTER 03 DEC 75

*** STRUCTURE ***

PAGE 3

PROJECT NO. 1
DANAKE IRON - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO INTERNAL REPRESENTATION

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79
TIME UNIT: WEEK

PREDECESSORS			ACTIVITY(RANK)		SUCCESSORS		
	011	**	211(10)	**			
		**	101(0)	**	ST(0)107	ST(0)106	ST(0)105
					ST(0)104		
	ST(0)101	**	104(1)	**	001		
	ST(0)101	**	105(1)	**	001		
	ST(0)101	**	106(1)	**	001		
	ST(0)101	**	107(1)	**	001		
		**	108(0)	**	109	001	
	108	**	109(1)	**	001		
		**	110(0)	**	001		
	007	**	201(2)	**	ST(0)201	ST(0)210	ST(0)200
					ST(0)207	ST(0)206	ST(0)205
					ST(0)204	002	
	ST(0)201	**	204(3)	**	002		
	ST(0)201	**	205(3)	**	002		
	T(0)201	**	206(3)	**	ST(0)208	002	
	ST(0)201	**	207(3)	**	002		
	T(0)201	**	208(3)	**	002		
	ST(0)206	**	209(4)	**	002		
	ST(0)201	**	210(3)	**	002		
ST(0)201	003	**	301(3)	**	ST(0)310	ST(0)308	ST(0)306
					ST(0)305	ST(0)303	003
	ST(0)301	**	303(4)	**	003		
	T(0)301	**	305(4)	**	003		
	T(4)301	**	306(4)	**	ST(0)307	003	
	T(0)306	**	307(5)	**	ST(0)309	003	
	T(0)301	**	308(4)	**	003		
	T(0)307	**	309(6)	**	003		
	T(0)301	**	310(4)	**	003		
	006	**	401(9)	**	400	400	404
					403	402	004
	401	**	402(10)	**	004		
	401	**	403(10)	**	004		
	401	**	404(10)	**	004		
	401	**	406(10)	**	ST(0)407	304	
	ST(0)406	**	407(11)	**	ST(0)409	004	
	401	**	408(10)	**	004		
	T(6)407	**	409(12)	**	004		
	005	**	501(1)	**	504	ST(6)502	005
	ST(5)501	**	502(2)	**	005		
	005	**	503(1)	**	005		
	501	**	504(2)	**	ST(4)509	ST(4)507	005
	005	**	505(1)	**	005		
	005	**	506(1)	**	005		
	ST(4)506	**	507(3)	**	005		
	005	**	508(1)	**	005		

CONTINUES ./.

OPTIMA
NORWEGIAN
COMPUTING CENTER
03 DEC 75

*** S T R U C T U R E ***

PAGE [illegible]

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO INTERNAL REPRESENTATION

PROJECT START: [illegible]
PLANNED FINISH:
COMPUTED FINISH: [illegible]
TIME UNIT: WEEK

PREDECESSORS		ACTIVITY([illegible])		SUCCESSORS		
ST(4)5[illegible]	--	5[illegible](3)	--	[illegible]		
A[illegible]	--	601(5)	--	[illegible]	[illegible]	ST(13)[illegible]2
				[illegible]		
ST(13)601	--	602(6)	--	[illegible]		
A[illegible]	--	6[illegible](5)	--	[illegible]		
601	--	6[illegible](6)	--	ST([illegible])[illegible]7	[illegible]	
A[illegible]	--	[illegible]	--	[illegible]		
A[illegible]	--	[illegible](5)	--	[illegible]		
ST([illegible])[illegible]	--	[illegible]7(7)	--	[illegible]		
A[illegible]	--	[illegible](5)	--	[illegible]		
[illegible]1	--	[illegible]	--	[illegible]		
A07	--	701(6)	--	7[illegible]	7[illegible]	ST(13)7[illegible]2
				[illegible]7		
ST(13)701	--	702(7)	--	[illegible]7		
A07	--	70[illegible]	--	[illegible]7		
701	--	70[illegible](7)	--	ST([illegible])7[illegible]7	[illegible]7	
A07	--	70[illegible]	--	[illegible]7		
A07	--	70[illegible]	--	[illegible]7		
ST([illegible])70[illegible]	--	707([illegible])	--	[illegible]7		
A07	--	70[illegible]	--	[illegible]7		
701	--	70[illegible](7)	--	[illegible]7		
A[illegible]	--	[illegible]01(7)	--	[illegible]	[illegible]	ST(13)[illegible]2
				[illegible]		
ST(13)[illegible]01	--	[illegible]02([illegible])	--	[illegible]		
A[illegible]	--	[illegible]03(7)	--	[illegible]		
[illegible]01	--	[illegible]	--	ST([illegible])[illegible]7	[illegible]	
A[illegible]	--	[illegible](7)	--	[illegible]		
A[illegible]	--	[illegible](7)	--	[illegible]		
ST([illegible])[illegible]	--	[illegible]7([illegible])	--	[illegible]		
A[illegible]	--	[illegible](7)	--	[illegible]		
[illegible]01	--	[illegible]	--	[illegible]		
A[illegible]9	--	901([illegible])	--	9[illegible]	9[illegible]	ST(13)902
				[illegible]		
ST(13)901	--	902(9)	--	[illegible]		
A[illegible]	--	903([illegible])	--	[illegible]		
[illegible]01	--	90[illegible](9)	--	ST([illegible])907	9[illegible]	
A[illegible]9	--	90[illegible]	--	[illegible]		
A[illegible]9	--	90[illegible]	--	[illegible]		
ST([illegible])90[illegible]	--	907(10)	--	[illegible]		
A[illegible]	--	90[illegible]	--	[illegible]		
[illegible]01	--	90[illegible](9)	--	[illegible]		

- TIME SCHEDULE SORTED ACCORDING TO AREA 1-11

- GANTT-CHART SORTED ACCORDING TO AREA 1-11

OPTIMA
NORWEGIAN
COMPUTING
CENTER
03 DEC 75

*** T I M E   L I S T I N G ***

PROJECT NO. 1
DANSKE JERN - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 5AUG77

PAGE 4
ALPHACODE: CO
TIME UNIT: WEEK

ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
100	TD	CO	CODING SYSTEM	CENTRAL ORGAN.	39	1DEC75	1OCT76			0	0	0	
110	MG	CO	SPECIAL SYSTEMS AND TECHNIQUES	CENTRAL ORGAN.	65	1DEC75	8APR77	8MAR76	5AUG77	13	0	13	
101	CG	CO	ORGANIZATION	CENTRAL ORGAN.	78	1DEC75	5AUG77	19MAR76	11NOV77	14	0	0	
105	PF	CO	PRODUCTION PLANNING	CENTRAL ORGAN.	26	2FEB76	27AUG76	10JAN77	5AUG77	44	0	44	
104	PF	CO	MAINTENANCE PLANNING	CENTRAL ORGAN.	43	2FEB76	24DEC76	6SEP76	5AUG77	27	0	27	
107	PL	CO	COST CONTROL	CENTRAL ORGAN.	43	2FEB76	24DEC76	6SEP76	5AUG77	27	0	27	
108	PL	CO	MATERIAL ADMINISTRATION	CENTRAL ORGAN.	56	2FEB76	1APR77	17MAY76	5AUG77	14	0	14	
109	TD	CO	INFORMATION BASE AND FILES	CENTRAL ORGAN.	39	4OCT76	5AUG77			0	0	0	

*** G A N T T - D I A G R A M ***

PAGE 5
ALPHACODE: CO

OPTIMA
NORWEGIAN
COMPUTING
CENTER
03 DEC 75

PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

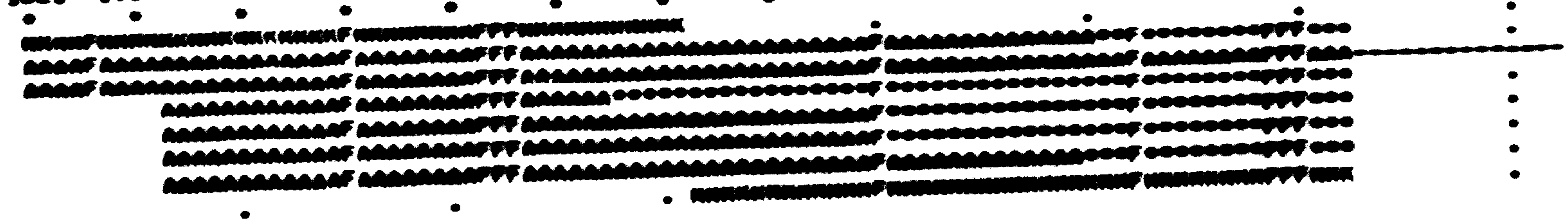
PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79

T.U. INPUT: WEEK
T.U. OUTPUT: WEEK

HORIZONTAL PART NO. 4
VERTICAL PART NO. 1

K : CRITICAL ACTIVITY
A : ACTIVITY WITH FLOAT
- : TOTAL (PRIMARY) FLOAT
* : FREE FLOAT
D : DUMMY ACTIVITY
F : SPECIFIED HOLIDAY
< : NEGATIVE TOT. FLOAT

ACTIVITY IDENTIFICATION | 1DEC | 19JAN | 8MAR | 26APR | 14JUN | 2AUG | 20SEP | 8NOV | 27DEC | 14FEB | 4APR | 23MAY | 11JUL | 29AUG | 17OCT77



100	TD	CO
110	MG	CO
101	CG	CO
105	PF	CO
104	PF	CO
107	PL	CO
106	PL	CO
109	TD	CO

OPTIMA *** T I M E   L I S T I N G *** PAGE 3
NORWEGIAN ALPHACODE: CM
COMPUTING PROJECT NO. 1 PROJECT START: 1DEC75
CENTER DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN PLANNED FINISH: TIME UNIT: WEEK
03 DEC 75 THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME COMPUTED FINISH: 3AUG79

ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UF DATE
201	CG	CM	ORGANIZATION	CENTR.MAINT.FAC	26	5APR76	29OCT76			0	0	0	
204	PF	CM	MAINTENANCE PLANNING	CENTR.MAINT.FAC	26	7JUN76	24DEC76	20DEC76	22JUL77	25	0	17	
206	PL	CM	MATERIAL ADMINISTRATION	CENTR.MAINT.FAC	26	7JUN76	24DEC76	30AUG76	4MAR77	9	0	8	
207	PL	CM	COST CONTROL	CENTR.MAINT.FAC	26	7JUN76	24DEC76	20DEC76	22JUL77	25	0	17	
208	TD	CM	CODING SYSTEM	CENTR.MAINT.FAC	26	7JUN76	24DEC76	20DEC76	22JUL77	25	0	17	
205	PF	CM	PRODUCTION PLANNING	CENTR.MAINT.FAC	43	7JUN76	6MAY77	23AUG76	22JUL77	8	0	0	
210	KG	CM	SPECIAL SYSTEMS AND TECHNIQUES	CENTR.MAINT.FAC	43	7JUN76	6MAY77	23AUG76	22JUL77	8	0	8	
209	TD	CM	INFORMATION BASE AND FILES	CENTR.MAINT.FAC	34	23AUG76	22APR77	25OCT76	22JUL77	9	0	1	

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                                   * * *   G A N T T - D I A G R A M   * * *              PAGE      4
OPTIMA                                                                                    ALPHACODE:        C
NORWEGIAN                                                                PROJECT   START:   1DEC75
COMPUTING   PROJECT NO.  1                                               PLANNED   FINISH:            T.U.  INPUT: WEEK
 CENTER     DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN                COMPUTED FINISH:   3AUG79    T.U.  OUTPUT: WEEK
03 DEC 75   THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  K : CRITICAL ACTIVITY            - : TOTAL(PRIMARY) FLOAT      D : DUMMY ACTIVITY       < : NEGATIVE    HORIZONTAL PART NO.  3
  A : ACTIVITY WITH FLOAT          * : FREE FLOAT                F : SPECIFIED HOLIDAY      TOT. FLOAT    VERTICAL   PART NO.  1
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  ACTIVITY
IDENTIFICATION  . 1DEC  19JAN  8MAR  26APR  14JUN  2AUG  20SEP  8NOV  27DEC  14FEB  4APR  23MAY  11JUL  29AUG  17OCT77
                .  *      *      *      *      *      *      *      *      *      *      *      *      *      *      *
                .                                                          .            .            .            .
    201  CG  CM .                     KKKFKKKKKKKKKFFFKKKKKKKKKKKKKKKKK
    204  PF  CM .               .            AAAFFFAAAAAAAAAAAAAAAAAAAAAAAF****************F-------FFF-      .
    206  PL  CM .               .            AAAFFFAAAAAAAAAAAAAAAAAAAAAAAF---------     .            .       .
    207  PL  CM .               .            AAAFFFAAAAAAAAAAAAAAAAAAAAAAAF****************F-------FFF-      .
    208  TD  CM .               .            AAAFFFAAAAAAAAAAAAAAAAAAAAAAAF****************F-------FFF-      .
    205  PF  CM .               .            AAAFFFAAAAAAAAAAAAAAAAAAAAAAAFAAAAAAAAAAAAAAAAA-------FFF-      .
    210  HG  CM .               .            AAAFFFAAAAAAAAAAAAAAAAAAAAAAAFAAAAAAAAAAAAAAAAA-------FFF-      .
    209  TD  CM .               .             .       AAAAAAAAAAAAAAAAAAFAAAAAAAAAAAAAAAAA-------FFF-      .
```

OPTIMA
NORWEGIAN
COMPUTING
CENTER
03 DEC 75

••• TIME LISTING •••

PAGE 5
ALPHACODE: CS

PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79

TIME UNIT: WEEK

ACTIVITY IDENTIFICATION		ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
301	CG	CS ORGANIZATION	CENT.SPAREP.PR.	26	7JUN76	24DEC76			0	0	0	
303	PF	CS PREVENTIVE MAINTENANCE	CENT.SPAREP.PR.	34	23AUG76	22APR77	25OCT76	22JUL77	9	0	9	
306	PL	CS MATERIAL ADMINISTRATION	CENT.SPAREP.PR.	34	23AUG76	22APR77	25OCT76	22JUL77	9	0	0	
310	KG	CS SPECIAL SYSTEMS AND TECHNIQUES	CENT.SPAREP.PR.	34	23AUG76	22APR77	25OCT76	22JUL77	9	0	9	
305	PF	CS PRODUCTION PLANNING	CENT.SPAREP.PR.	43	23AUG76	22JUL77			0	0	0	
308	TD	CS CODING SYSTEM	CENT.SPAREP.PR.	43	23AUG76	22JUL77			0	0	0	
307	PL	CS COST CONTROL	CENT.SPAREP.PR.	26	1OCT76	22APR77	20DEC76	22JUL77	9	0	0	
309	TD	CS INFORMATION BASE AND FILES	CENT.SPAREP.PR.	17	13DEC76	15APR77	20FEB77	22JUL77	10	0	10	

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OPTIMA                                  * * *  G A N T T - D I A G R A M  * * *                          PAGE     6
NORWEGIAN                                                                                                ALPHACODE:      CS
COMPUTING   PROJECT NO.  1                                                      PROJECT  START:  1DEC75
 CENTER     DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN                       PLANNED  FINISH:              T.U.  INPUT: WEEK
03 DEC 75   THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME         COMPUTED FINISH:  3AUG79       T.U.  OUTPUT: WEEK
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
  K : CRITICAL ACTIVITY          - : TOTAL(PRIMARY) FLOAT       D : DUMMY ACTIVITY       < : NEGATIVE    HORIZONTAL PART NO.   5
  A : ACTIVITY WITH FLOAT        * : FREE FLOAT                 F : SPECIFIED HOLIDAY     TOT. FLOAT    VERTICAL   PART NO.   1
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
  ACTIVITY              *
IDENTIFICATION          * 1DEC  19JAN  8MAR  26APR  14JUN  2AUG  20SEP  8NOV  27DEC  14FEB  4APR  23MAY  11JUL  29AUG  17OCT77
                        *
      301  CG  CS       *
      303  PF  CS       *
      306  PL  CS       *
      310  KG  CS       *
      305  PF  CS       *
      308  TD  CS       *
      307  PL  CS       *
      309  TD  CS       *
```

OPTIMA
NORWEGIAN
COMPUTING
CENTER
03 DEC 75

*** T I M E   L I S T I N G ***

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PAGE 0
ALPHACODE: MU
PROJECT START: [illegible]
PLANNED FINISH:
COMPUTED FINISH: [illegible]
TIME UNIT: WEEK

ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
401	CG	MU	ORGANIZATION	MAINT UNIT FACT	0	10JAN70	10MAR70			0	0	0	
402	PF	MU	WORK ORDER SYSTEM	MAINT UNIT FACT	34	13MAR70	1DEC70			0	0	0	
403	PF	MU	PREVENTIVE MAINTENANCE	MAINT UNIT FACT	34	13MAR70	1DEC70			0	0	0	
404	PF	MU	MAINTENANCE PLANNING	MAINT UNIT FACT	34	13MAR70	1DEC70			0	0	0	
406	PL	MU	MATERIAL ADMINISTRATION	MAINT UNIT FACT	34	13MAR70	1DEC70			0	0	0	
408	TD	MU	CODING SYSTEM	MAINT UNIT FACT	34	13MAR70	1DEC70			0	0	0	
407	PL	MU	COST CONTROL	MAINT UNIT FACT	26	[illegible]	1DEC70			0	0	0	
409	TD	MU	INFORMATION BASE AND FILES	MAINT UNIT FACT	21	12JAN70	[illegible]	10JAN70	1DEC70	1	0	1	

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                                   * * *   G A N T T - D I A G R A M   * * *                              PAGE   10
 OPTIMA                                                                                                  ALPHACODE:      NU
 NORWEGIAN                                                                       PROJECT   START:   1DEC75
 COMPUTING   PROJECT NO.  1                                                      PLANNED   FINISH:            T.U.  INPUT: WEEK
  CENTER     DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN                       COMPUTED FINISH:   3AUG79    T.U.  OUTPUT: WEEK
 03 DEC 75   THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME
 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   K : CRITICAL ACTIVITY             - : TOTAL(PRIMARY) FLOAT       D : DUMMY ACTIVITY       < : NEGATIVE    HORIZONTAL  PART NO.  0
   A : ACTIVITY WITH FLOAT           * : FREE FLOAT                 F : SPECIFIED HOLIDAY      TOT. FLOAT    VERTICAL    PART NO.  2
 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   ACTIVITY
 IDENTIFICATION   . 5DEC  23JAN  13MAR  1MAY  19JUN  7AUG  25SEP  13NOV  1JAN  19FEB  9APR  28MAY  16JUL  3SEP  20OCT79

      401  CG   NU
      402  PF   NU
      403  PF   NU
      404  PF   NU
      406  PL   NU
      408  TD   NU
      407  PL   NU
      409  TD   NU
```

OPTIMA NORWEGIAN COMPUTING CENTER 03 DEC 75

••• TIME LISTING •••

PAGE 9
ALPHACODE: [illegible]

PROJECT NO. I
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: [illegible]

TIME UNIT: WEEK

ACTIVITY IDENTIFICATION		ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
501	CG	RM ORGANIZATION	ROLLING MILLS	13	1DEC75	[illegible]	[illegible]	11JUN76	13	0	0	
505	PF	RM PRODUCTION PLANNING	ROLLING MILLS	52	1DEC75	7JAN77	10MAY76	10JAN77	21	0	21	
506	PL	RM MATERIAL ADMINISTRATION	ROLLING MILLS	52	1DEC75	7JAN77	10MAY76	10JAN77	21	0	21	
508	TD	RM CODING SYSTEM	ROLLING MILLS	52	1DEC75	7JAN77	10MAY76	10JAN77	21	0	21	
503	PF	RM PREVENTIVE MAINTENANCE	ROLLING MILLS	73	1DEC75	10JAN77			0	0	0	
502	PF	RM WORK ORDER SYSTEM	ROLLING MILLS	43	27FEB76	24DEC76	20AUG76	10JAN77	22	0	22	
504	PF	RM MAINTENANCE PLANNING	ROLLING MILLS	47	[illegible]	[illegible]	14JUN76	10JAN77	13	0	0	
507	PL	RM COST CONTROL	ROLLING MILLS	26	5APR76	29OCT76	[illegible]	10JAN77	30	0	30	
509	TD	RM INFORMATION BASE AND FILES	ROLLING MILLS	43	5APR76	[illegible]	[illegible]	10JAN77	13	0	13	

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OPTIMA                                  * * *   G A N T T - D I A G R A M   * * *                          PAGE   11
NORWEGIAN                                                                                                  ALPHACODE:      RM
COMPUTING  PROJECT NO.  1                                                        PROJECT   START:   1DEC75
 CENTER    DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN                         PLANNED   FINISH:          T.U.  INPUT: WEEK
03 DEC 75  THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME           COMPUTED FINISH:  30AUG79  T.U. OUTPUT: WEEK
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  K : CRITICAL ACTIVITY        - : TOTAL(PRIMARY) FLOAT      D : DUMMY ACTIVITY       < : NEGATIVE    HORIZONTAL  PART NO.  9
  A : ACTIVITY WITH FLOAT      * : FREE FLOAT                F : SPECIFIED HOLIDAY     TOT. FLOAT     VERTICAL    PART NO.  1
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  ACTIVITY         .
IDENTIFICATION     . 1DEC  19JAN   8MAR  26APR  14JUN   2AUG  20SEP   8NOV  27DEC  14FEB   4APR  23MAY  11JUL  29AUG  17OCT77
                   .   *      *      *      *      *      *      *      *      *      *      *      *      *      *      *
     501  CG  RM   . AAAAFAAAAAAAAA-------F------.          .            .            .                  .            .
     505  PF  RM   . AAAAFAAAAAAAAAAAAAAAAFAAAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAAAAAAAAFAAAAAAAAAAAAAAAAAAAFAAAAAAA  .            .
     506  PL  RM   . AAAAFAAAAAAAAAAAAAAAAFAAAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAAAAAAAAFAAAAAAAAAAAAAAAAAAAFAAAAAAA  .            .
     508  TD  RM   . AAAAFAAAAAAAAAAAAAAAAFAAAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAAAAAAAAFAAAAAAAAAAAAAAAAAAAFAAAAAAA  .            .
     503  PF  RM   . KKKKFKKKKKKKKKKKKKKKKFKKKKKKKKKFFFKKKKKKKKKKKKKKKKKKKKKKKKKKKKFKKKKKKKKKKKKKKKKKKKFKKKKKKK  .            .
     502  PF  RM   .           AAAAAAAAAAAAFAAAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAAAAAAAAFAAAAAAAAAAAAAAAAAAAFAAAAAAA  .            .
     504  PF  RM   .                 AAAAAAAFAAAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAAAAAAAAFAAAAAAAAAA-------F-------  .            .
     507  PL  RM   .                .    AAAFAAAAAAAAAFFFAAAAAAAAAAAAAAAAA---------FAAAAAAAAAAAAAAAAAAAFAAAAAAA  .            .
     509  TD  RM   .                .    AAAFAAAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAAAAAAAAFAAAAAAAAAAAAAAAAAAAFAAAAAAA  .            .
```

OPTIMA NORWEGIAN COMPUTING CENTER

03 DEC 75

*** T I M E   L I S T I N G ***

PAGE 7
ALPHACODE: NF

PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 10DEC75
PLANNED FINISH:
COMPUTED FINISH: 30AUG79

TIME UNIT: WEEK

ACTIVITY IDENTIFICATION		ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
601	CG	NF ORGANIZATION	METALL FACT.	17	20MAR77	19AUG77	22AUG77	16DEC77	17	0	0	
605	PF	NF PRODUCTION PLANNING	METALL FACT.	52	20MAR77	20APR78	22AUG77	22SEP78	17	0	17	
606	PL	NF MATERIAL ADMINISTRATION	METALL FACT.	52	20MAR77	20APR78	22AUG77	22SEP78	17	0	17	
608	TD	NF CODING SYSTEM	METALL FACT.	52	20MAR77	20APR78	22AUG77	22SEP78	17	0	17	
603	PF	NF PREVENTIVE MAINTENANCE	METALL FACT.	60	20MAR77	22SEP78			0	0	0	
602	PF	NF WORK ORDER SYSTEM	METALL FACT.	39	25JUL77	20APR78	21NOV77	22SEP78	17	0	17	
604	PF	NF MAINTENANCE PLANNING	METALL FACT.	34	20AUG77	21APR78	2JAN78	22SEP78	30	0	0	
609	TD	NF INFORMATION BASE AND FILES	METALL FACT.	34	20AUG77	21APR78	2JAN78	22SEP78	30	0	30	
607	PL	NF COST CONTROL	METALL FACT.	26	17OCT77	21APR78	27FEB78	22SEP78	30	0	30	

Attachment 11.6

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OPTIMA                          * * *   G A N T T - D I A G R A M   * * *                 PAGE      0
NORWEGIAN                                                                                 ALPHACODE:      WF
COMPUTING  PROJECT NO.  1                                               PROJECT  START:   1DEC75
 CENTER    DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN                PLANNED  FINISH:            T.U.  INPUT: WEEK
03 DEC 75  THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME   COMPUTED FINISH:  3AUG79    T.U. OUTPUT: WEEK
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  K : CRITICAL ACTIVITY          - : TOTAL(PRIMARY) FLOAT   D : DUMMY ACTIVITY       < : NEGATIVE   HORIZONTAL PART NO.  7
  A : ACTIVITY WITH FLOAT        * : FREE FLOAT             F : SPECIFIED HOLIDAY    TOT. FLOAT     VERTICAL   PART NO.  1
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  ACTIVITY             .
IDENTIFICATION         . 1DEC  19JAN  8MAR  26APR  14JUN  2AUG  20SEP  8NOV  27DEC  14FEB  4APR  23MAY  11JUL  29AUG  17OCT77
                       .
     601  CG   WF      .
     605  PF   WF      .
     606  PL   WF      .
     608  TD   WF      .
     603  PF   WF      .
     602  PF   WF      .
     604  PF   WF      .
     609  TD   WF      .
     607  PL   WF      .
```

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OPTIMA                        *** G A N T T - D I A G R A M ***                              PAGE      1
NORWEGIAN                                                                                    ALPHACODE:    WF
COMPUTING  PROJECT NO.  1                                               PROJECT   START:  1DEC75
 CENTER    DANNIE IRON - STEEL WORKS IMPLEMENTATION PLAN                PLANNED   FINISH:            T.U.  INPUT: WEEK
03 DEC 75  THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME  COMPUTED  FINISH:  30AUG79   T.U.  OUTPUT: WEEK
 K : CRITICAL ACTIVITY          - : TOTAL(PRIMARY) FLOAT      D : DUMMY ACTIVITY     < : NEGATIVE   HORIZONTAL PART NO.  7
 A : ACTIVITY WITH FLOAT        * : FREE FLOAT                F : SPECIFIED HOLIDAY    TOT. FLOAT  VERTICAL   PART NO.  2
  ACTIVITY
IDENTIFICATION    1DEC  23JAN  13MAR  1MAY  19JUN  7AUG  28SEP  13NOV  1JAN  18FEB  8APR  28MAY  16JUL  3SEP  20OCT79
    001 CO WF
    005 PF WF
    006 PL WF
    008 TD WF
    003 PF WF
    002 PF WF
    004 PF WF
    009 TD WF
    007 PL WF
```

*** TIME LISTING ***

PAGE 11

PROJECT NO. 1

THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START:

TIME UNIT:

ACTIVITY	ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
[illegible]	[illegible]	[illegible]	17	[illegible]	[illegible]	[illegible]	[illegible]	17	0	0	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	17	0	17	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	17	0	17	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	17	0	17	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			0	0	0	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	17	0	17	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	
[illegible]	[illegible] AND FILES	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	[illegible]	

```
                                   * * *  G A N T T - D I A G R A M  * * *                             PAGE   34
OPTIMA                                                                                                 ALPHACODE:      TF
NORWEGIAN                                                                   PROJECT   START:   1DEC75
COMPUTING  PROJECT NO.  1                                                   PLANNED   FINISH:              T.U.  INPUT: WEEK
CENTER     BANDUE IRON - STEEL WORKS IMPLEMENTATION PLAN                    COMPUTED  FINISH:  3AUG79      T.U.  OUTPUT: WEEK
03 DEC 75  THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  K : CRITICAL ACTIVITY          - : TOTAL(PRIMARY) FLOAT      D : DUMMY ACTIVITY        < : NEGATIVE     HORIZONTAL  PART NO.  11
  A : ACTIVITY WITH FLOAT        * : FREE FLOAT                F : SPECIFIED HOLIDAY       TOT. FLOAT     VERTICAL    PART NO.   1
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   ACTIVITY          .
IDENTIFICATION       . 1DEC  19JAN  8MAR  26APR  14JUN  2AUG  20SEP  8NOV  27DEC  14FEB  4APR  23MAY  11JUL  29AUG  17OCT77
                     .   .     .     .      .      .      .     .      .     .      .     .     .      .      .      .
       T01  CG  TF   .           .            .            .            .            .            .    AAAAAAAAAAAAAAAAAAAAA--
       T05  PF  TF   .           .            .            .            .            .            .    AAAAAAAAAAAAAAAAAAAAAAA
       T06  PL  TF   .           .            .            .            .            .            .    AAAAAAAAAAAAAAAAAAAAAAA
       T08  TD  TF   .           .            .            .            .            .            .    AAAAAAAAAAAAAAAAAAAAAAA
       T03  PF  TF   .           .            .            .            .            .            .    AAAAAAAAAAAAAAAAAAAAAAA
       T02  PF  TF   .           .            .            .            .            .            .            .AAAAAA
       T04  PF  TF   .           .            .            .            .            .            .            .     AA
       T09  TD  TF   .           .            .            .            .            .            .            .     AA
       T07  PL  TF   .           .            .            .            .            .            .            .
```

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                                   * * *   G A N T T - D I A G R A M   * * *                          PAGE    15
OPTIMA                                                                                                ALPHACODE:      TF
NORWEGIAN
COMPUTING   PROJECT NO.  1                                                           PROJECT   START:   DEC75
  CENTER    DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN                            PLANNED   FINI                T.U.  INPUT: WEEK
03 DEC 75   THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME               COMPUTED FINIS      679   T.U. OUTPUT: WEEK
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
  K : CRITICAL ACTIVITY          - : TOTAL(PRIMARY) FLOAT      D : DUMMY ACTIVITY        < : NEGATIVE    HORIZONTAL  PART NO.  11
  A : ACTIVITY WITH FLOAT        * : FREE FLOAT                F : SPECIFIED HOLIDAY      TOT. FLOAT     VERTICAL    PART NO.   2
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
   ACTIVITY              *
IDENTIFICATION           * 5DEC   23JAN   13MAR   1MAY   19JUN   7AUG   25SEP   13NOV   1JAN   19FEB   9APR   28MAY   16JUL   3SEP   22OCT79
                         *   *      *       *       *      *       *      *       *       *      *       *      *       *       *      *
                         *
      701   CG   TF      *  ---F-------------                  *             *                *             *             *             *
      705   PF   TF      *  AAAFAAAAAAAAAAAAAAAAAAFAAAAAAAFFFAAAAAA******************  *             *             *             *
      706   PL   TF      *  AAAFAAAAAAAAAAAAAAAAAAFAAAAAAAFFFAAAAAA******************  *             *             *             *
      708   TD   TF      *  AAAFAAAAAAAAAAAAAAAAAAFAAAAAAAFFFAAAAAA******************  *             *             *             *
      703   PF   TF      *  KKKFKKKKKKKKKKKKKKKKKKFKKKKKKKFFFKKKKKKKKKKKKKKKKKKKKKKKK  *             *             *             *
      702   PF   TF      *  AAAFAAAAAAAAAAAAAAAAAAFAAAAAAAFFFAAAAAA******************  *             *             *             *
      704   PF   TF      *  AAAFAAAAAAAAAAAAAAAAAAFAAAAAAAFFFAAAAA-------------------  *             *             *             *
      709   TD   TF      *  AAAFAAAAAAAAAAAAAAAAAAFAAAAAAAFFFAAAAA*******************  *             *             *             *
      707   PL   TF      *         AAAAAAAAAAAAAAAFAAAAAAAFFFAAAAA*******************  *             *             *             *
```

OPTIMA
NORWEGIAN
COMPUTING
CENTER
03 DEC 75

*** TIME LISTING ***

PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79

PAGE 10
ALPHACODE: SF
TIME UNIT: WEEK

ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
001	CG	SF	ORGANIZATION	SHEET PROC.FACT	17	19SEP77	20JAN78	23JAN78	26MAY78	17	0	0	
005	PF	SF	PRODUCTION PLANNING	SHEET PROC.FACT	52	19SEP77	20OCT78	23JAN78	16FEB79	17	0	17	
006	PL	SF	MATERIAL ADMINISTRATION	SHEET PROC.FACT	52	19SEP77	20OCT78	23JAN78	16FEB79	17	0	17	
008	TD	SF	CODING SYSTEM	SHEET PROC.FACT	52	19SEP77	20OCT78	23JAN78	16FEB79	17	0	17	
003	PF	SF	PREVENTIVE MAINTENANCE	SHEET PROC.FACT	69	19SEP77	16FEB79			0	0	0	
002	PF	SF	WORK ORDER SYSTEM	SHEET PROC.FACT	39	19DEC77	20OCT78	24APR78	16FEB79	17	0	17	
004	PF	SF	MAINTENANCE PLANNING	SHEET PROC.FACT	34	23JAN78	13OCT78	5JUN78	16FEB79	18	0	0	
009	TD	SF	INFORMATION BASE AND FILES	SHEET PROC.FACT	34	23JAN78	13OCT78	5JUN78	16FEB79	18	0	18	
007	PL	SF	COST CONTROL	SHEET PROC.FACT	26	20MAR78	13OCT78	21AUG78	16FEB79	18	0	18	

```
OPTIMA                                  * * *   G A N T T - D I A G R A M   * * *                      PAGE   12
NORWEGIAN                                                                                                ALPHACODE:      SF
COMPUTING  PROJECT NO.  1                                                              PROJECT  START:  1DEC75
 CENTER    DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN                               PLANNED  FINISH:           T.U.  INPUT: WEEK
03 DEC 75  THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME                  COMPUTED FINISH:  3AUG79   T.U. OUTPUT: WEEK
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  K : CRITICAL ACTIVITY            - : TOTAL(PRIMARY) FLOAT       D : DUMMY ACTIVITY      < : NEGATIVE   HORIZONTAL PART NO.  10
  A : ACTIVITY WITH FLOAT          * : FREE FLOAT                 F : SPECIFIED HOLIDAY     TOT. FLOAT   VERTICAL   PART NO.   1
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   ACTIVITY           .
IDENTIFICATION        . 1DEC  19JAN   8MAR  26APR  14JUN   2AUG  20SEP   8NOV  27DEC  14FEB   4APR  23MAY  11JUL  29AUG  17OCT77
                      .   .      .      .      .      .      .      .      .      .      .      .      .      .      .      .
     001  CG   SF     .                 .             .             .             .             .             .       AAAAAAAAAAA
     005  PF   SF     .                 .             .             .             .             .             .       AAAAAAAAAAA
     006  PL   SF     .                 .             .             .             .             .             .       AAAAAAAAAAA
     008  TD   SF     .                 .             .             .             .             .             .       AAAAAAAAAAA
     003  PF   SF     .                 .             .             .             .             .             .       KKKKKKKKKKK
     002  PF   SF     .                 .             .             .             .             .             .              .
     004  PF   SF     .                 .             .             .             .             .             .              .
     009  TD   SF     .                 .             .             .             .             .             .              .
     007  PL   SF     .                 .             .             .             .             .             .              .
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                                    * * *   G A N T T - D I A G R A M   * * *                                        PAGE   13
 OPTIMA                                                                                                              ALPHACODE:     SF
NORWEGIAN                                                                                PROJECT   START:   1DEC75
COMPUTING   PROJECT NO.  1                                                               PLANNED  FINISH:            T.U.  INPUT: WEEK
 CENTER     DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN                                COMPUTED FINISH:   3AUG79   T.U. OUTPUT: WEEK
03 DEC 75   THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  K : CRITICAL ACTIVITY           - : TOTAL(PRIMARY) FLOAT       D : DUMMY ACTIVITY       < : NEGATIVE    HORIZONTAL PART NO.  1C
  A : ACTIVITY WITH FLOAT         * : FREE FLOAT                 F : SPECIFIED HOLIDAY      TOT. FLOAT    VERTICAL    PART NO.  2
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   ACTIVITY       . 5DEC   23JAN   13MAR    1MAY   19JUN    7AUG   25SEP   13NOV    1JAN   19FEB    9APR   28MAY   16JUL    3SEP   22OCT79
IDENTIFICATION    .   .       .       .       .       .       .       .       .       .       .       .       .       .       .       .
                  .                                                                                   .             .             .
     001  CG  SF  .  AAAFAAA---------------F---                                                       .             .             .
     005  PF  SF  .  AAAFAAAAAAAAAAAAAAAAAFAAAAAAAFFFAAAAAAAAAAAAAA*******************                .             .             .
     006  PL  SF  .  AAAFAAAAAAAAAAAAAAAAAFAAAAAAAFFFAAAAAAAAAAAAAA*******************                .             .             .
     008  TD  SF  .  AAAFAAAAAAAAAAAAAAAAAFAAAAAAAFFFAAAAAAAAAAAAAA*******************                .             .             .
     003  PF  SF  .  KKKFKKKKKKKKKKKKKKKKKFKKKKKKKFFFKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK                .             .             .
     002  PF  SF  .    AFAAAAAAAAAAAAAAAAAFAAAAAAAFFFAAAAAAAAAAAAA--------------------                .             .             .
     004  PF  SF  .          AAAAAAAAAAAAAAFAAAAAAAFFFAAAAAAAAAAAAA********************               .             .             .
     009  TD  SF  .          AAAAAAAAAAAAAAFAAAAAAAFFFAAAAAAAAAAAAA********************               .             .             .
     007  PL  SF  .                .AAAAAAFAAAAAAAFFFAAAAAAAAAAAAA********************               .             .             .
```

OPTIMA NORWEGIAN COMPUTING CENTER 03 DEC 75

*** TIME LISTING ***

PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79

PAGE 2
ALPHACODE: CF
TIME UNIT: WEEK

ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
901	CG	CF	ORGANIZATION	COOKING FACTORY	17	14NOV77	17MAR78	20MAR78	11AUG78	17	0	0	
905	PF	CF	PRODUCTION PLANNING	COOKING FACTORY	52	14NOV77	15DEC78	20MAR78	13APR79	17	0	17	
906	PL	CF	MATERIAL ADMINISTRATION	COOKING FACTORY	52	14NOV77	15DEC78	20MAR78	13APR79	17	0	17	
908	TD	CF	CODING SYSTEM	COOKING FACTORY	52	14NOV77	15DEC78	20MAR78	13APR79	17	0	17	
903	PF	CF	PREVENTIVE MAINTENANCE	COOKING FACTORY	69	14NOV77	13APR79			0	0	0	
902	PF	CF	WORK ORDER SYSTEM	COOKING FACTORY	30	20FEB78	15DEC78	17JUL78	13APR79	17	0	17	
904	PF	CF	MAINTENANCE PLANNING	COOKING FACTORY	34	20MAR78	8DEC78	21AUG78	13APR79	18	0	0	
909	TD	CF	INFORMATION BASE AND FILES	COOKING FACTORY	34	20MAR78	8DEC78	21AUG78	13APR79	18	0	18	
907	PL	CF	COST CONTROL	COOKING FACTORY	26	22MAY78	8DEC78	16OCT78	13APR79	18	0	18	

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 OPTIMA                        *** G A N T T - D I A G R A M ***                                            PAGE      2
NORWEGIAN                                                                                                   ALPHACODE:     CF
COMPUTING   PROJECT NO.  1                                                           PROJECT   START:   1DEC75
 CENTER     DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN                            PLANNED  FINISH:            T.U.  INPUT: WEEK
03 DEC 75   THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME               COMPUTED FINISH:   3AUG79   T.U. OUTPUT: WEEK
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  K : CRITICAL ACTIVITY             - : TOTAL (PRIMARY) FLOAT       D : DUMMY ACTIVITY      < : NEGATIVE   HORIZONTAL PART NO.  2
  A : ACTIVITY WITH FLOAT           * : FREE FLOAT                  F : SPECIFIED HOLIDAY     TOT. FLOAT   VERTICAL   PART NO.  1
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   ACTIVITY                 .
IDENTIFICATION              . 1DEC  19JAN  8MAR  26APR  14JUN  2AUG  20SEP  8NOV  27DEC  14FEB  4APR  23MAY  11JUL  29AUG  17OCT77
                            .   .     .      .     .      .      .     .      .     .      .      .     .      .      .      .
                            .                                                                                                AAA
      901   CB   CF         .            .            .            .            .            .            .            .  AAA
      905   PF   CF         .            .            .            .            .            .            .            .  AAA
      906   PL   CF         .            .            .            .            .            .            .            .  AAA
      908   TD   CF         .            .            .            .            .            .            .            .  KKK
      903   PF   CF         .            .            .            .            .            .            .            .
      902   PF   CF         .            .            .            .            .            .            .            .
      904   PF   CF         .            .            .            .            .            .            .            .
      909   TD   CF         .            .            .            .            .            .            .            .
      907   PL   CF         .            .            .            .            .            .            .            .
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OPTIMA                                   ***  G A N T T - D I A G R A M  ***                                  PAGE      3
NORWEGIAN                                                                                                     ALPHACODE:      CF
COMPUTING  PROJECT NO.  1                                                         PROJECT  START:   1DEC75
 CENTER    DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN                          PLANNED  FINISH:            T.U.  INPUT: WEEK
03 DEC 75  THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME             COMPUTED FINISH:  3AUG79    T.U. OUTPUT: WEEK
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
  K : CRITICAL ACTIVITY            - : TOTAL(PRIMARY) FLOAT        D : DUMMY ACTIVITY       < : NEGATIVE   HORIZONTAL PART NO.  2
  A : ACTIVITY WITH FLOAT          * : FREE FLOAT                  F : SPECIFIED HOLIDAY      TOT. FLOAT   VERTICAL   PART NO.  2
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
   ACTIVITY              *
IDENTIFICATION           *  5DEC  23JAN  13MAR   1MAY  19JUN   7AUG  25SEP  13NOV   1JAN  19FEB   9APR  28MAY  16JUL   3SEP  22OCT79
                         *   *      *      *      *      *      *      *      *      *      *      *      *      *      *      *
     901   CG   CF       *  AAAFAAAAAAAAAAA------F-------FFF----     *             *             *                   *              *
     905   PF   CF       *  AAAFAAAAAAAAAAAAAAAAAFAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAA*****************                  *              *
     906   PL   CF       *  AAAFAAAAAAAAAAAAAAAAAFAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAA*****************                  *              *
     900   TD   CF       *  AAAFAAAAAAAAAAAAAAAAAFAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAA*****************                  *              *
     903   PF   CF       *  KKKFKKKKKKKKKKKKKKKKKFKKKKKKKFFFKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK                  *              *
     902   PF   CF       *            AAAAAAAAAAFAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAA*****************                  *              *
     904   PF   CF       *              .AAAAAAFAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAA-----------------                  *              *
     909   TD   CF       *              .AAAAAAFAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAA*****************                  *              *
     907   PL   CF       *              *         AAAAAFFFAAAAAAAAAAAAAAAAAAAAAA*****************                  *              *
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OPTIMA
NORWEGIAN
COMPUTING
CENTER
03 DEC 75

*** TIME LISTING ***

PAGE 6
ALPHACODE: EF

PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79

TIME UNIT: WEEK

ACTIVITY IDENTIFICATION		ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
1001	CG	EF ORGANIZATION	ENERGY FACTORY	17	16JAN78	19MAY78	22MAY78	6OCT78	17	0	0	
1005	PF	EF PRODUCTION PLANNING	ENERGY FACTORY	52	16JAN78	9FEB79	22MAY78	8JUN79	17	0	17	
1006	PL	EF MATERIAL ADMINISTRATION	ENERGY FACTORY	52	16JAN78	9FEB79	22MAY78	8JUN79	17	0	17	
1008	TD	EF CODING SYSTEM	ENERGY FACTORY	52	16JAN78	9FEB79	22MAY78	8JUN79	17	3	17	
1003	PF	EF PREVENTIVE MAINTENANCE	ENERGY FACTORY	69	16JAN78	8JUN79			0	0	0	
1002	PF	EF WORK ORDER SYSTEM	ENERGY FACTORY	39	17APR78	9FEB79	11SEP78	8JUN79	17	0	17	
1004	PF	EF MAINTENANCE PLANNING	ENERGY FACTORY	34	22MAY78	2FEB79	16OCT78	8JUN79	18	0	0	
1009	TD	EF INFORMATION BASE AND FILES	ENERGY FACTORY	34	22MAY78	2FEB79	16OCT78	8JUN79	18	0	18	
1007	PL	EF COST CONTROL	ENERGY FACTORY	26	7AUG78	2FEB79	11DEC78	8JUN79	18	0	18	

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                                          *** G A N T T - D I A G R A M ***                                      PAGE     7
 OPTIMA                                                                                                          ALPHACODE:      EF
NORWEGIAN                                                                          PROJECT   START:  1DEC75
COMPUTING  PROJECT NO.  I                                                          PLANNED  FINISH:              T.U.  INPUT: WEEK
 CENTER    DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN                           COMPUTED FINISH:  3AUG79      T.U. OUTPUT: WEEK
03 DEC 75  THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  K : CRITICAL ACTIVITY              - : TOTAL(PRIMARY) FLOAT        D : DUMMY ACTIVITY        < : NEGATIVE    HORIZONTAL  PART NO.   6
  A : ACTIVITY WITH FLOAT            * : FREE FLOAT                  F : SPECIFIED HOLIDAY      TOT. FLOAT     VERTICAL    PART NO.   2
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  ACTIVITY           .
IDENTIFICATION       . 5DEC  23JAN  13MAR   1MAY  19JUN   7AUG  25SEP  13NOV   1JAN  19FEB   9APR  20MAY  16JUL   3SEP  22OCT79
                     .   *      *      *      *      *      *      *      *      *      *      *      *      *      *      *
    1001  CG  EF     .        AAAAAAAAAAAAAAAFAA-----FFF------------                                        .             .
    1005  PF  EF     .        AAAAAAAAAAAAAAAFAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA*****************   .             .
    1006  PL  EF     .        AAAAAAAAAAAAAAAFAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA*****************   .             .
    1000  TD  EF     .        AAAAAAAAAAAAAAAFAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA*****************   .             .
    1003  PF  EF     .        KKKKKKKKKKKKKKKFKKKKKKKFFFKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK   .             .
    1002  PF  EF     .               .   AAFAAAAAAAFFFAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA*****************   .             .
    1004  PF  EF     .               .       AAAAAFFFAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA-----------------   .             .
    1009  TD  EF     .               .       AAAAAFFFAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA*****************   .             .
    1007  PL  EF     .               .      .         AAAAAAAAAAAAAAAAAAAAAAAAA*****************   .             .
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OPTIMA
NORWEGIAN
COMPUTING
CENTER
03 DEC 75

PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

*** TIME LISTING ***

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79

PAGE 1
ALPHACODE: BF
TIME UNIT: WEEK

ACTIVITY IDENTIFICATION		ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
1101	CG	BF ORGANIZATION	BUDAPEST ROLMI	17	13MAR78	4AUG78	7AUG78	1DEC78	17	0	0	
1105	PF	BF PRODUCTION PLANNING	BUDAPEST ROLMI	52	13MAR78	6APR79	7AUG78	3AUG79	17	0	17	
1106	PL	BF MATERIAL ADMINISTRATION	BUDAPEST ROLMI	52	13MAR78	6APR79	7AUG78	3AUG79	17	0	17	
1108	TD	BF CODING SYSTEM	BUDAPEST ROLMI	52	13MAR78	6APR79	7AUG78	3AUG79	17	0	17	
1103	PF	BF PREVENTIVE MAINTENANCE	BUDAPEST ROLMI	69	13MAR78	3AUG79			0	0	0	
1102	PF	BF WORK ORDER SYSTEM	BUDAPEST ROLMI	39	19JUN78	6APR79	6NOV78	3AUG79	17	0	17	
1104	PF	BF MAINTENANCE PLANNING	BUDAPEST ROLMI	34	7AUG78	30MAR79	11DEC78	3AUG79	18	0	0	
1109	TD	BF INFORMATION BASE AND FILES	BUDAPEST ROLMI	34	7AUG78	30MAR79	11DEC78	3AUG79	18	0	18	
1107	PL	BF COST CONTROL	BUDAPEST ROLMI	26	2OCT78	30MAR79	5FEB79	3AUG79	18	0	18	

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OPTIMA                                  *** G A N T T - D I A G R A M ***                  PAGE     1
NORWEGIAN                                                                                  ALPHACODE:     BF
COMPUTING   PROJECT NO. 1                                       PROJECT   START:  1DEC75
 CENTER     DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN       PLANNED   FINISH:          T.U.  INPUT: WEEK
03 DEC 75   THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME   COMPUTED FINISH:  3AUG79  T.U. OUTPUT: WEEK
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  K : CRITICAL ACTIVITY        - : TOTAL(PRIMARY) FLOAT    D : DUMMY ACTIVITY       < : NEGATIVE   HORIZONTAL PART NO.  1
  A : ACTIVITY WITH FLOAT      * : FREE FLOAT              F : SPECIFIED HOLIDAY    TOT. FLOAT     VERTICAL   PART NO.  2
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   ACTIVITY       .
IDENTIFICATION    . 5DEC  23JAN  13MAR  1MAY  19JUN  7AUG  25SEP  13NOV  1JAN  19FEB  9APR  28MAY  16JUL  3SEP  22OCT79

     1101  CG  BF .
     1105  PF  BF .
     1106  PL  BF .
     1108  TD  BF .
     1103  PF  BF .
     1102  PF  BF .
     1104  PF  BF .
     1109  TD  BF .
     1107  PL  BF .
```

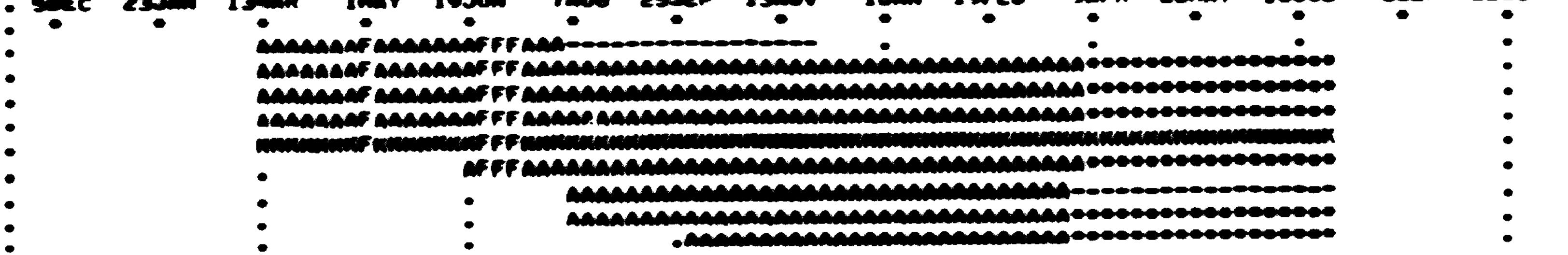

[illegible]
[illegible]
COMPUTING
CENTER
20 DEC 75

*** TIME LISTING ***

PAGE 1
ALPHACODE: CS

PROJECT NO. 1
[illegible] - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: [illegible]
PLANNED FINISH:
COMPUTED FINISH: [illegible]

TIME UNIT: WEEK

ACTIVITY IDENTIFICATION				ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT TOTAL	FLOAT SEC.	FLOAT FREE	UP DATE
[illegible]	CS	[illegible]	ORGANIZATION	[illegible] WALLS	13	[illegible]	[illegible]	[illegible]	[illegible]	13	0	0	
[illegible]	CS	[illegible]	ORGANIZATION	CENTRAL ORGAN.	70?	[illegible]	[illegible]	[illegible]	[illegible]	16?	0	0	
[illegible]	CS	[illegible]	ORGANIZATION	[illegible]	26?	[illegible]	[illegible]			0	0	0	
[illegible]	CS	CS	ORGANIZATION	[illegible]	26?	[illegible]	[illegible]			0	0	0	
[illegible]	CS	[illegible]	ORGANIZATION	[illegible] FACT.	17	[illegible]	[illegible]	[illegible]	[illegible]	17	0	0	
[illegible]	CS	[illegible]	ORGANIZATION	TRANSP.FACTORY	17	[illegible]	[illegible]	[illegible]	[illegible]	17	0	0	
[illegible]	CS	[illegible]	ORGANIZATION	SHEET PROC.FACT	17	[illegible]	[illegible]	[illegible]	[illegible]	17	0	0	
[illegible]	CS	[illegible]	ORGANIZATION	COATING FACTORY	17	[illegible]	[illegible]	[illegible]	[illegible]	17	0	0	
[illegible]	CS	[illegible]	ORGANIZATION	[illegible] UNIT FACT	0	[illegible]	[illegible]			0	0	0	
[illegible]	CS	[illegible]	ORGANIZATION	COATING FACTORY	17	[illegible]	[illegible]	[illegible]	[illegible]	17	0	0	
[illegible]	CS	[illegible]	ORGANIZATION	[illegible]	17	[illegible]	[illegible]	[illegible]	[illegible]	17	0	0	

OPTIMA
NORWEGIAN
COMPUTING
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03 DEC 75

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

*** TIME LISTING ***

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79

PAGE 3
ALPHACODE: PF
TIME UNIT: WEEK

ACTIVITY IDENTIFICATION		ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
505	PF	RM PRODUCTION PLANNING	ROLLING MILLS	52	1DEC75	7JAN77	10MAY76	10JUN77	21	0	21	
503	PF	RM PREVENTIVE MAINTENANCE	ROLLING MILLS	73	1DEC75	10JUN77			0	0	0	
105	PF	CO PRODUCTION PLANNING	CENTRAL ORGAN.	26	2FEB76	27AUG76	10JAN77	5AUG77	44	0	44	
104	PF	CO MAINTENANCE PLANNING	CENTRAL ORGAN.	43	2FEB76	24DEC76	6SEP76	5AUG77	27	0	27	
502	PF	RM WORK ORDER SYSTEM	ROLLING MILLS	43	2FEB76	24DEC76	2AUG76	10JUN77	22	0	22	
504	PF	RM MAINTENANCE PLANNING	ROLLING MILLS	47	8MAR76	4MAR77	14JUN76	10JUN77	13	0	0	
204	PF	CM MAINTENANCE PLANNING	CENTR.MAINT.FAC	26	7JUN76	24DEC76	20DEC76	22JUL77	25	0	17	
205	PF	CM PRODUCTION PLANNING	CENTR.MAINT.FAC	43	7JUN76	6MAY77	23AUG76	22JUL77	0	0	0	
303	PF	CS PREVENTIVE MAINTENANCE	CENT.SPAREP.PR.	34	23AUG76	22APR77	25OCT76	22JUL77	9	0	9	
305	PF	CS PRODUCTION PLANNING	CENT.SPAREP.PR.	43	23AUG76	22JUL77			0	0	0	
605	PF	MF PRODUCTION PLANNING	METALL FACT.	52	20MAR77	20APR78	22AUG77	22SEP78	17	0	17	
603	PF	MF PREVENTIVE MAINTENANCE	METALL FACT.	69	20MAR77	22SEP78			0	0	0	
602	PF	MF WORK ORDER SYSTEM	METALL FACT.	39	25JUL77	20APR78	21NOV77	22SEP78	17	0	17	
705	PF	TF PRODUCTION PLANNING	TRANSP.FACTORY	52	25JUL77	25AUG78	21NOV77	22DEC78	17	0	17	
703	PF	TF PREVENTIVE MAINTENANCE	TRANSP.FACTORY	69	25JUL77	22DEC78			0	0	0	
604	PF	MF MAINTENANCE PLANNING	METALL FACT.	34	22AUG77	21APR78	2JAN78	22SEP78	18	0	0	
805	PF	SF PRODUCTION PLANNING	SHEET PROC.FACT	52	19SEP77	20OCT78	23JAN78	16FEB79	17	0	17	
803	PF	SF PREVENTIVE MAINTENANCE	SHEET PROC.FACT	69	19SEP77	16FEB79			0	0	0	
702	PF	TF WORK ORDER SYSTEM	TRANSP.FACTORY	39	24OCT77	25AUG78	27FEB78	22DEC78	17	0	17	
905	PF	CF PRODUCTION PLANNING	COOKING FACTORY	52	14NOV77	15DEC78	20MAR78	13APR79	17	0	17	
903	PF	CF PREVENTIVE MAINTENANCE	COOKING FACTORY	69	14NOV77	13APR79			0	0	0	
704	PF	TF MAINTENANCE PLANNING	TRANSP.FACTORY	34	21NOV77	18AUG78	3APR78	22DEC78	18	0	0	
802	PF	SF WORK ORDER SYSTEM	SHEET PROC.FACT	39	19DEC77	20OCT78	24APR78	16FEB79	17	0	17	
1005	PF	EF PRODUCTION PLANNING	ENERGY FACTORY	52	16JAN78	9FEB79	22MAY78	8JUN79	17	0	17	
1003	PF	EF PREVENTIVE MAINTENANCE	ENERGY FACTORY	69	16JAN78	8JUN79			0	0	0	
804	PF	SF MAINTENANCE PLANNING	SHEET PROC.FACT	34	23JAN78	13OCT78	5JUN78	16FEB79	18	0	0	
902	PF	CF WORK ORDER SYSTEM	COOKING FACTORY	39	20FEB78	15DEC78	17JUL78	13APR79	17	0	17	
402	PF	MU WORK ORDER SYSTEM	MAINT UNIT FACT	34	13MAR78	1DEC78			0	0	0	
403	PF	MU PREVENTIVE MAINTENANCE	MAINT UNIT FACT	34	13MAR78	1DEC78			0	0	0	
404	PF	MU MAINTENANCE PLANNING	MAINT UNIT FACT	34	13MAR78	1DEC78			0	0	0	
1105	PF	BF PRODUCTION PLANNING	BUDAPEST ROLMI	52	13MAR78	6APR79	7AUG78	3AUG79	17	0	17	
1103	PF	BF PREVENTIVE MAINTENANCE	BUDAPEST ROLMI	69	13MAR78	3AUG79			0	0	0	
904	PF	CF MAINTENANCE PLANNING	COOKING FACTORY	34	20MAR78	8DEC78	21AUG78	13APR79	18	0	0	
1002	PF	EF WORK ORDER SYSTEM	ENERGY FACTORY	39	17APR78	9FEB79	11SEP78	8JUN79	17	0	17	
1004	PF	EF MAINTENANCE PLANNING	ENERGY FACTORY	34	22MAY78	2FEB79	16OCT78	8JUN79	18	0	0	
1102	PF	BF WORK ORDER SYSTEM	BUDAPEST ROLMI	39	19JUN78	6APR79	6NOV78	3AUG79	17	0	17	
1104	PF	BF MAINTENANCE PLANNING	BUDAPEST ROLMI	34	7AUG78	30MAR79	11DEC78	3AUG79	18	0	0	

OPTIMA
NORWEGIAN
COMPUTING CENTER
03 DEC 75

* * * T I M E L I S T I N G * * *

PAGE 4
ALPHACODE: PL

PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79
TIME UNIT: WEEK

ACTIVITY IDENTIFICATION			ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
506	PL	RM	MATERIAL ADMINISTRATION	ROLLING MILLS	52	1DEC75	7JAN77	10MAY76	10JUN77	21	0	21	
107	PL	CO	COST CONTROL	CENTRAL ORGAN.	43	2FEB76	24DEC76	6SEP76	5AUG77	27	0	27	
106	PL	CO	MATERIAL ADMINISTRATION	CENTRAL ORGAN.	56	2FEB76	1APR77	17MAY76	5AUG77	14	0	14	
507	PL	RM	COST CONTROL	ROLLING MILLS	26	5APR76	29OCT76	29NOV76	10JUN77	30	0	30	
206	PL	CM	MATERIAL ADMINISTRATION	CENTR.MAINT.FAC	26	7JUN76	24DEC76	30AUG76	4MAR77	9	0	0	
207	PL	CM	COST CONTROL	CENTR.MAINT.FAC	26	7JUN76	24DEC76	20DEC76	22JUL77	25	0	17	
306	PL	CS	MATERIAL ADMINISTRATION	CENT.SPAREP.PR.	34	23AUG76	22APR77	25OCT76	22JUL77	9	0	0	
307	PL	CS	COST CONTROL	CENT.SPAREP.PR.	26	18OCT76	22APR77	20DEC76	22JUL77	9	0	0	
606	PL	MF	MATERIAL ADMINISTRATION	METALL FACT.	52	28MAR77	28APR78	22AUG77	22SEP78	17	0	17	
706	PL	TF	MATERIAL ADMINISTRATION	TRANSP.FACTORY	52	25JUL77	25AUG78	21NOV77	22DEC78	17	0	17	
806	PL	SF	MATERIAL ADMINISTRATION	SHEET PROC.FACT	52	19SEP77	20OCT78	23JAN78	16FEB79	17	0	17	
607	PL	MF	COST CONTROL	METALL FACT.	26	17OCT77	21APR78	27FEB78	22SEP78	18	0	18	
906	PL	CF	MATERIAL ADMINISTRATION	COOKING FACTORY	52	14NOV77	15DEC78	20MAR78	13APR79	17	0	17	
1006	PL	EF	MATERIAL ADMINISTRATION	ENERGY FACTORY	57	16JAN78	9FEB79	22MAY78	8JUN79	17	0	17	
707	PL	TF	COST CONTROL	TRANSP.FACTORY	26	23JAN78	18AUG78	5JUN78	22DEC78	18	0	18	
406	PL	MU	MATERIAL ADMINISTRATION	MAINT UNIT FACT	34	13MAR78	1DEC78			0	0	0	
1106	PL	BF	MATERIAL ADMINISTRATION	BUDAPEST ROLMI	52	13MAR78	6APR79	7AUG78	3AUG79	17	0	17	
807	PL	SF	COST CONTROL	SHEET PROC.FACT	26	20MAR78	13OCT78	21AUG78	16FEB79	18	0	18	
407	PL	MU	COST CONTROL	MAINT UNIT FACT	26	15MAY78	1DEC78			0	0	0	
907	PL	CF	COST CONTROL	COOKING FACTORY	26	22MAY78	8DEC78	16OCT78	13APR79	18	0	18	
1007	PL	EF	COST CONTROL	ENERGY FACTORY	26	7AUG78	2FEB79	11DEC78	8JUN79	18	0	18	
1107	PL	BF	COST CONTROL	BUDAPEST ROLMI	26	2OCT78	30MAR79	5FEB79	3AUG79	18	0	18	

*** T I M E   L I S T I N G ***

PAGE 5
ALPHACODE: TD

OPTIMA
NORWEGIAN
COMPUTING CENTER
03 DEC 75

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME

PROJECT START: 1DEC75
PLANNED FINISH:
COMPUTED FINISH: 3AUG79

TIME UNIT: WEEK

ACTIVITY IDENTIFICATION		ACTIVITY DESCRIPTION		ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
100	TD	CO CODING SYSTEM	CENTRAL ORGAN.	39	1DEC75	1OCT76			0	0	0	
500	TD	RM CODING SYSTEM	ROLLING MILLS	52	1DEC75	7JAN77	10MAY76	10JUN77	21	0	21	
509	TD	RM INFORMATION BASE AND FILES	ROLLING MILLS	43	5APR76	4MAR77	2AUG76	10JUN77	13	0	13	
200	TD	CM CODING SYSTEM	CENTR.MAINT.FAC	26	7JUN76	24DEC76	20DEC76	22JUL77	25	0	17	
209	TD	CM INFORMATION BASE AND FILES	CENTR.MAINT.FAC	34	23AUG76	22APR77	25OCT76	22JUL77	9	0	1	
300	TD	CS CODING SYSTEM	CENT.SPAREP.PR.	43	23AUG76	22JUL77			0	0	0	
109	TD	CO INFORMATION BASE AND FILES	CENTRAL ORGAN.	39	4OCT76	5AUG77			0	0	0	
309	TD	CS INFORMATION BASE AND FILES	CENT.SPAREP.PR.	17	13DEC76	15APR77	20FEB77	22JUL77	10	0	10	
600	TD	MF CODING SYSTEM	METALL FACT.	52	20MAR77	20APR78	22AUG77	22SEP78	17	0	17	
700	TD	TF CODING SYSTE	TRANSP.FACTORY	52	25JUL77	25AUG78	21NOV77	22DEC78	17	0	17	
609	TD	MF INFORMATION BASE AND FILES	METALL FACT.	34	22AUG77	21APR78	2JAN78	22SEP78	18	0	18	
800	TD	SF CODING SYSTEM	SHEET PROC.FACT	52	19SEP77	20OCT78	23JAN78	16FEB79	17	0	17	
900	TD	CF CODING SYSTEM	COOKING FACTORY	52	14NOV77	15DEC78	20MAR78	13APR79	17	0	17	
709	TD	TF INFORMATION BASE AND FILES	TRANSP.FACTORY	34	21NOV77	18AUG78	3APR78	22DEC78	18	0	18	
1000	TD	EF CODING SYSTEM	ENERGY FACTORY	52	16JAN78	9FEB79	22MAY78	8JUN79	17	0	17	
809	TD	SF INFORMATION BASE AND FILES	SHEET PROC.FACT	34	23JAN78	13OCT78	5JUN78	16FEB79	18	0	18	
400	TD	MU CODING SYSTEM	MAINT UNIT FACT	34	13MAR78	1DEC78			0	0	0	
1100	TD	BF CODING SYSTEM	BUDAPEST ROLMI	52	13MAR78	6APR79	7AUG78	3AUG79	17	0	17	
909	TD	CF INFORMATION BASE AND FILES	COOKING FACTORY	34	20MAR78	8DEC78	21AUG78	13APR79	18	0	18	
1009	TD	EF INFORMATION BASE AND FILES	ENERGY FACTORY	34	22MAY78	2FEB79	16OCT78	8JUN79	18	0	18	
409	TD	MU INFORMATION BASE AND FILES	MAINT UNIT FACT	21	12JUN78	24NOV78	19JUN78	1DEC78	1	0	1	
1109	TD	BF INFORMATION BASE AND FILES	BUDAPEST ROLMI	34	7AUG78	30MAR79	11DEC78	3AUG79	18	0	18	

OPTIMA ••• TIME LISTING ••• PAGE 2
NORWEGIAN ALPHACODE: KG
COMPUTING PROJECT NO. 1 PROJECT START: 1DEC75
CENTER DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN PLANNED FINISH: TIME UNIT: WEEK
03 DEC 75 THE ACTIVITIES ARE SORTED ACCORDING TO EARLIEST START TIME COMPUTED FINISH: 3AUG79

ACTIVITY IDENTIFICATION		ACTIVITY DESCRIPTION	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	FLOAT PRIM.	FLOAT SEC.	FLOAT FREE	UP DATE
110	KG	CO SPECIAL SYSTEMS AND TECHNIQUES CENTRAL ORGAN.	65	1DEC75	8APR77	8MAR76	5AUG77	13	0	13	
210	KG	CM SPECIAL SYSTEMS AND TECHNIQUES CENTR.MAINT.FAC	43	7JUN76	6MAY77	23AUG76	22JUL77	8	0	0	
310	KG	CS SPECIAL SYSTEMS AND TECHNIQUES CENT.SPAREP.PR.	36	23AUG76	22APR77	25OCT76	22JUL77	9	0	9	

OPTIMA NORWEGIAN COMPUTING CENTER

RESOURCE LOADING IN HISTOGRAM FORM

PAGE 1
RESOURCE: ORG

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
03 DEC 75 THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

OUTPUT START: 1DEC75
OUTPUT FINISH: 6AUG79

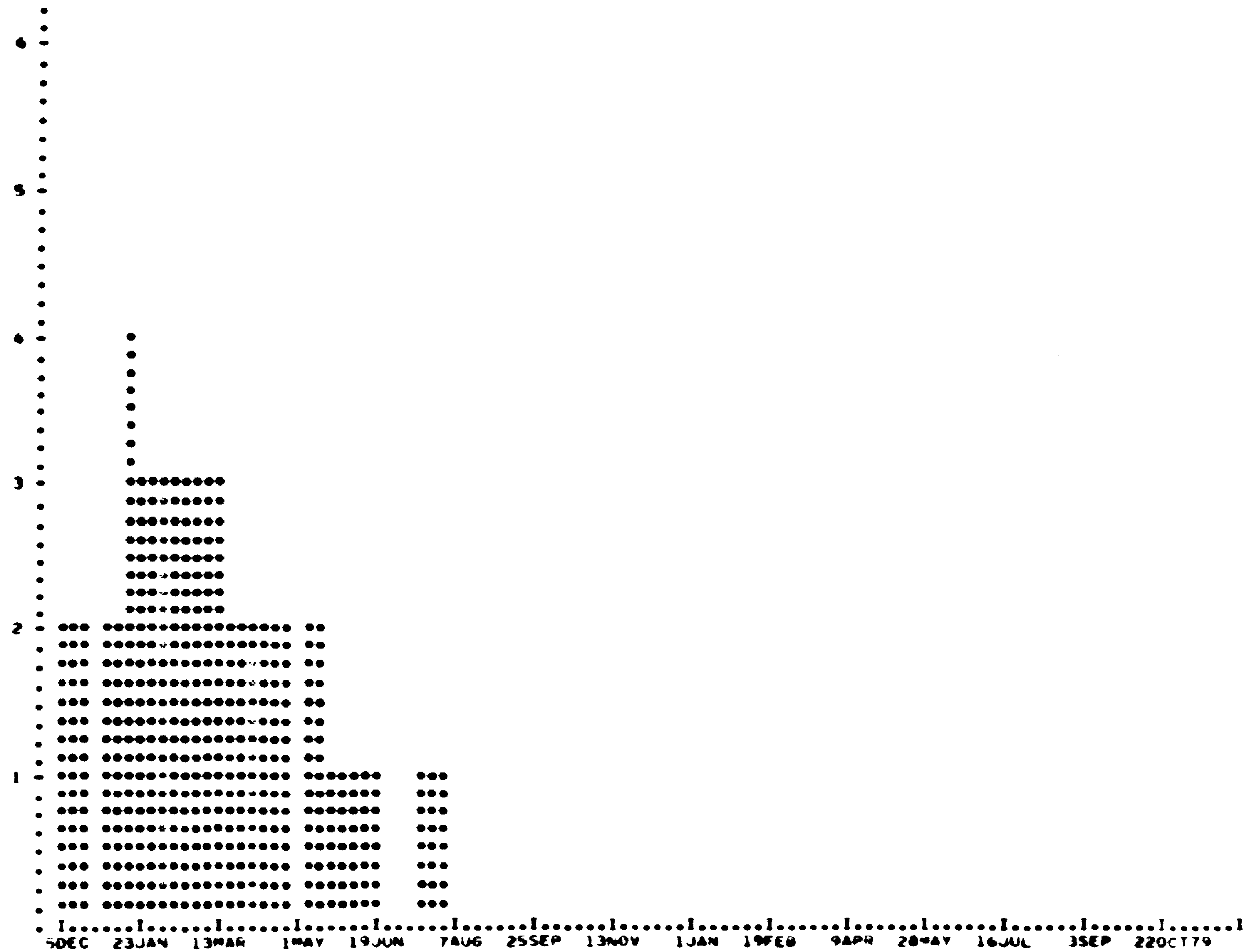
T.U. INPUT: WEEK
T.U. OUTPUT: WEEK

NORWEGIAN
COMPUTING PROJECT NO. 1
CENTER DANUBE IRON . STEEL WORKS IMPLEMENTATION PLAN
03 DEC 75 THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

RESOURCE: ORG

OUTPUT START: 1DEC75
OUTPUT FINISH: 6AUG79

T.U. INPUT: WEEK
T.U. OUTPUT: WEEK



OPTIMA NORWEGIAN COMPUTING CENTER

RESOURCE LOADING IN TABLE FORM

PAGE 1
RESOURCE: ORG

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
03 DEC 75 THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

OUTPUT START: 1DEC75 T.U. INPUT: WEEK
OUTPUT FINISH: 6AUG79 T.U. OUTPUT: WEEK

									ACCUM. LOAD										ACCUM. LOAD
1DEC75	2	2	2	2	*000	2	2	.	12.	19JAN76	2	2	2	2	2	2	2	.	26.
8MAR76	1	1	1	1	2	2	2	.	36.	26APR76	*000	2	2	2	2	2	3	.	49.
14JUN76	3	3	*000	*000	*000	3	3	.	61.	2AUG76	3	3	3	3	3	3	3	.	82.
20SEP76	3	3	3	3	3	3	2	.	102.	8NOV76	2	2	2	2	2	2	2	.	116.
27DEC76	*000	1	1	1	1	1	1	.	122.	14FEB77	1	1	1	1	1	1	2	.	130.
4APR77	2	2	2	*000	2	2	2	.	142.	23MAY77	2	2	2	2	2	*000	*000	.	152.
11JUL77	*000	2	3	3	2	2	1	.	165.	29AUG77	1	1	1	2	2	2	2	.	176.
17OCT77	2	2	2	2	3	2	2	.	191.	5DEC77	2	2	2	*000	2	2	4	.	205.
23JAN78	3	3	3	3	3	3	3	.	226.	13MAR78	3	2	2	2	2	2	2	.	241.
1MAY78	*000	2	2	1	1	1	1	.	240.	19JUN78	1	*000	*000	*000	1	1	1	.	253.

OPTIMA
NORWEGIAN
COMPUTING
CENTER
03 DEC 75

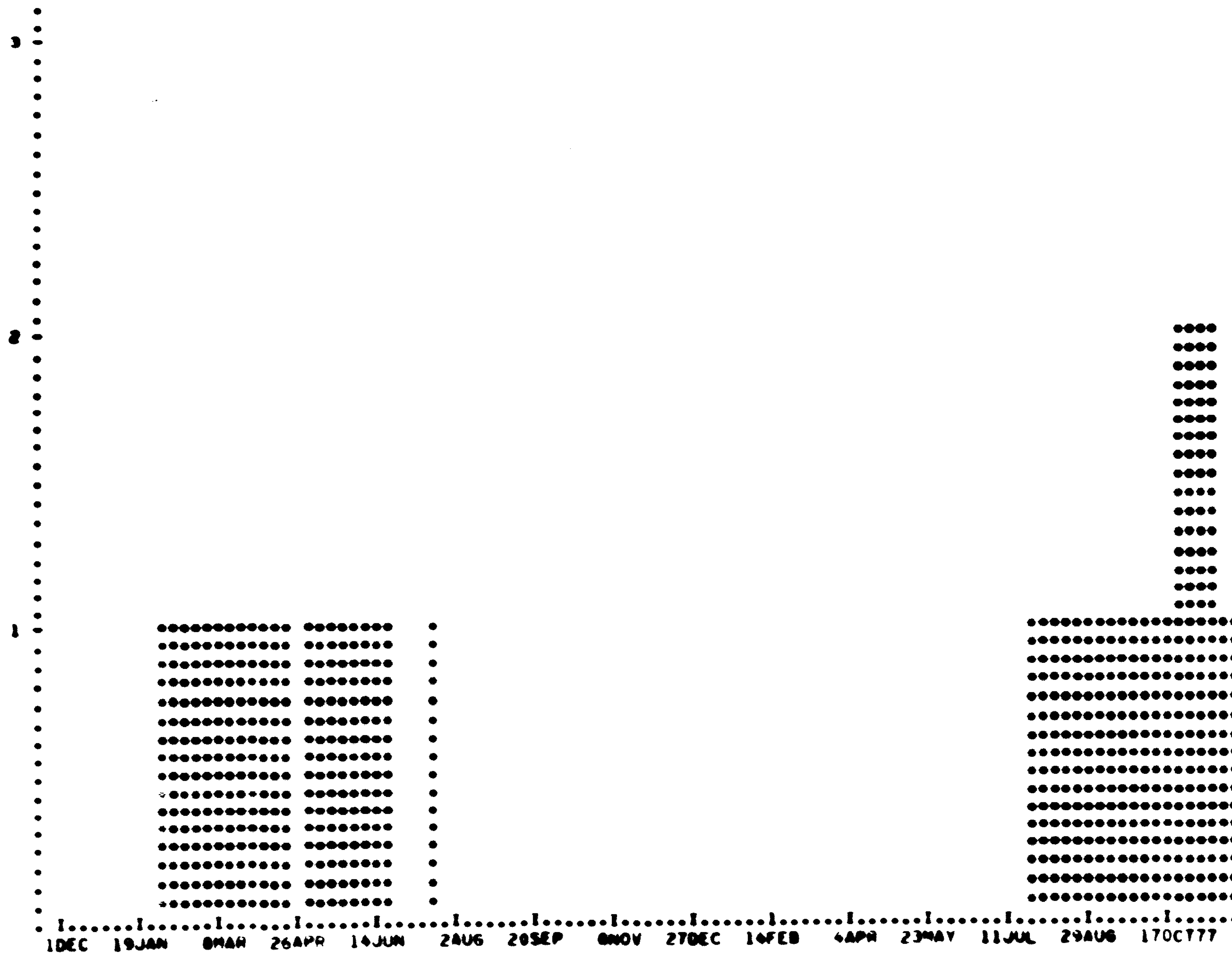
*** RESOURCE LOADING IN HISTOGRAM FORM ***

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

PAGE 1
RESOURCE: WOS

OUTPUT START: 1DEC75
OUTPUT FINISH: 6AUG79

T.U. INPUT: WEEK
T.U. OUTPUT: WEEK



OPTIMA NORWEGIAN COMPUTING CENTER

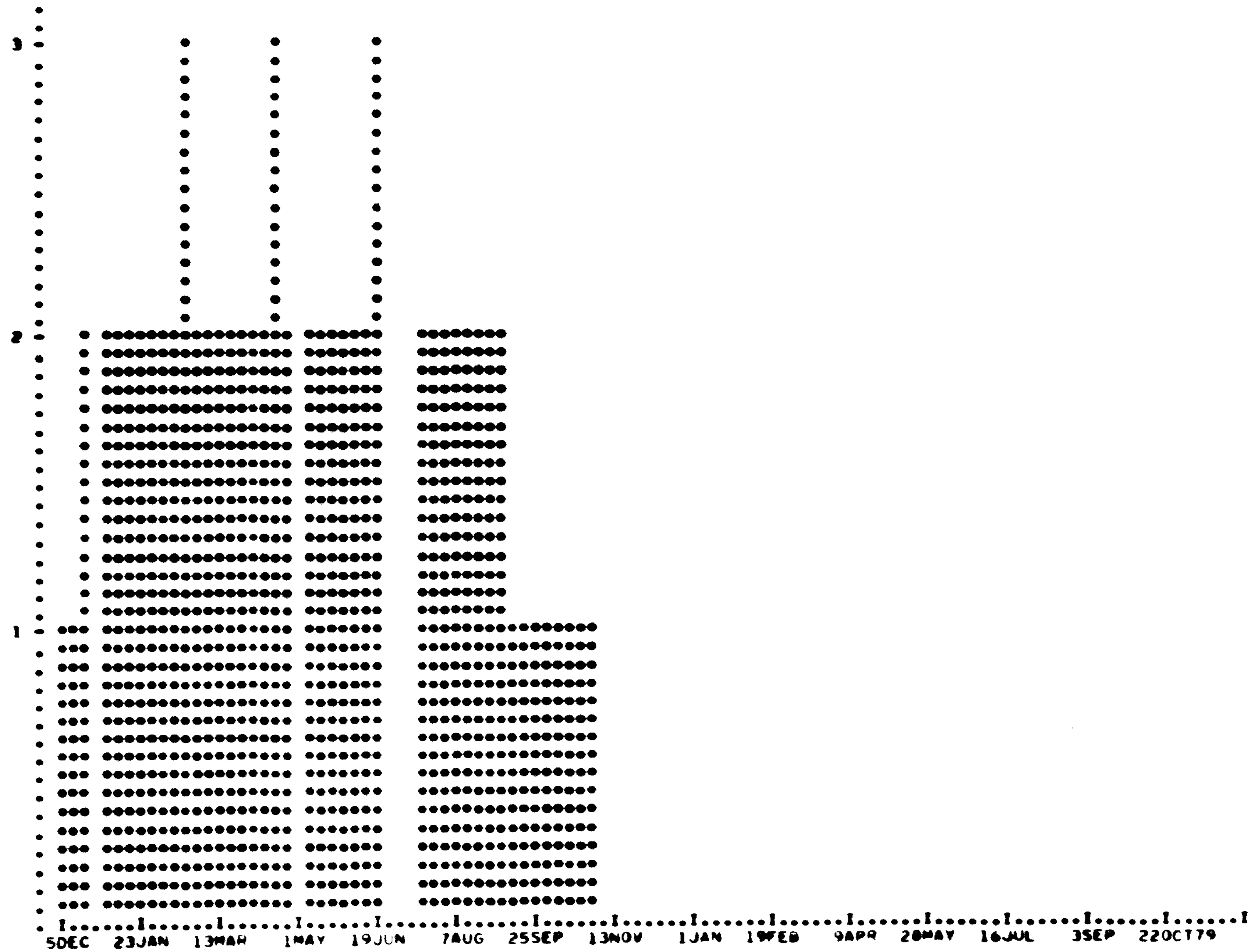
• • • RESOURCE LOADING IN HISTOGRAM FORM • • •

PAGE 2
RESOURCE: WOS

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
03 DEC 75 THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

OUTPUT START: 1DEC75
OUTPUT FINISH: 6AUG79

T.U. INPUT: WEEK
T.U. OUTPUT: WEEK



OPTIMA NORWEGIAN COMPUTING CENTER

03 DEC 75

RESOURCE LOADING IN TABLE FORM

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

OUTPUT START: 1DEC75
OUTPUT FINISH: 6AUG79

PAGE 1
RESOURCE: WOS
T.U. INPUT: WEEK
T.U. OUTPUT: WEEK

								ACCUM. LOAD									ACCUM. LOAD
1DEC75	0	0	0	0	*000	0	0	0.	19JAN76	0	0	1	1	1	1	1	5.
8MAR76	1	1	1	1	1	1	1	12.	26APR76	*000	1	1	1	1	1	1	10.
14JUN76	1	1	*000	*000	*000	1	0	21.	2AUG76	0	0	0	0	0	0	0	21.
11JUL77	*000	0	1	1	[illegible]	1	1	26.	29AUG77	1	1	1	1	1	1	1	33.
17OCT77	1	2	2	2	2	1	1	44.	5DEC77	1	1	2	*000	2	2	2	54.
23JAN78	2	2	2	2	3	2	2	69.	13MAR78	2	2	2	2	2	3	2	84.
1MAY78	*000	2	2	2	2	2	2	96.	19JUN78	3	*000	*000	*000	2	2	2	105.
7AUG78	2	2	2	2	2	1	1	117.	25SEP78	1	1	1	1	1	1	0	123.

OPTIMA NORWEGIAN COMPUTING CENTER

03 DEC 75

* * * RESOURCE LOADING IN HISTOGRAM FORM * * *

PAGE 1

RESOURCE: PMS

PROJECT NO. 1

DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN

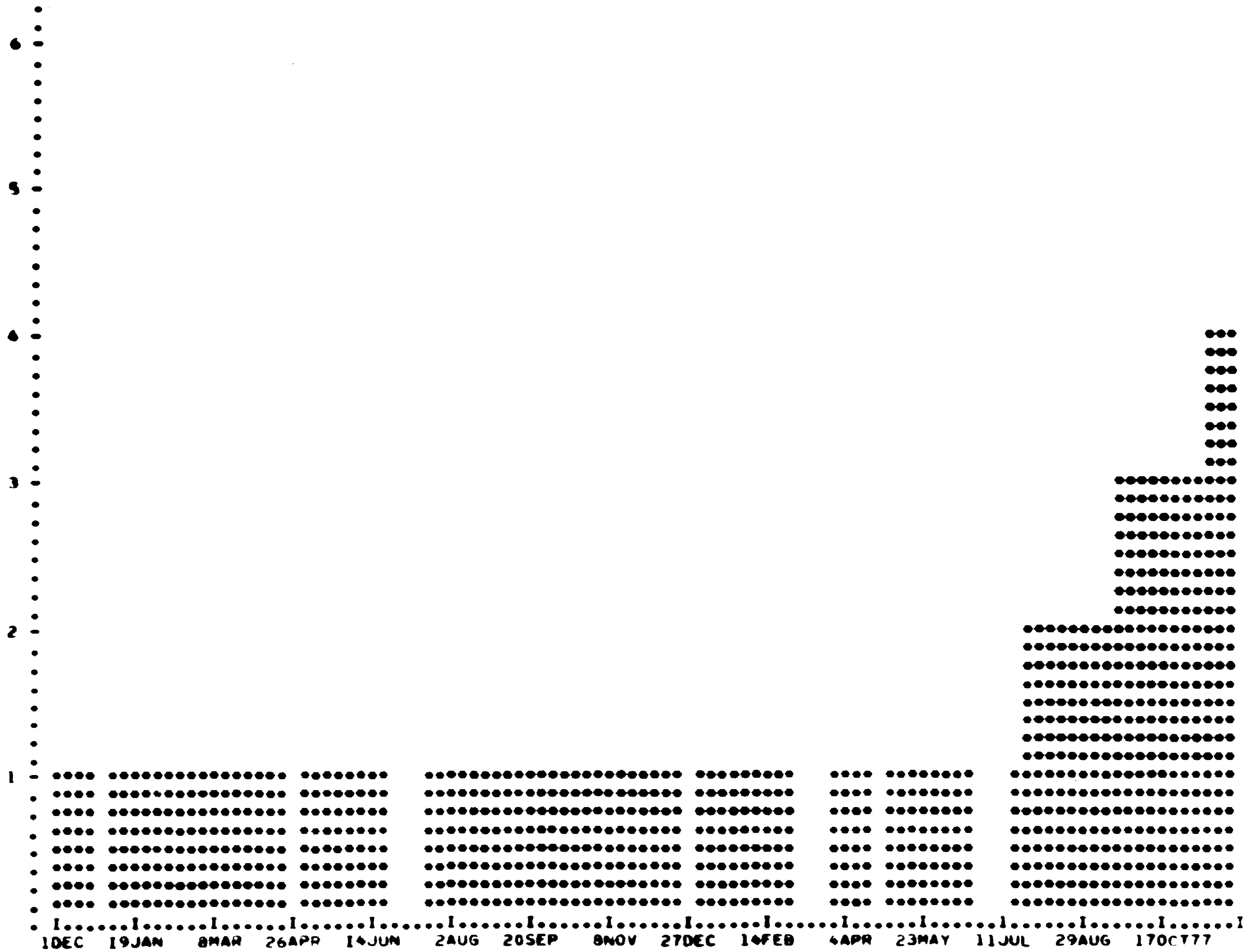
THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

OUTPUT START: 1DEC75

OUTPUT FINISH: 6AUG79

T.U. INPUT: WEEK

T.U. OUTPUT: WEEK



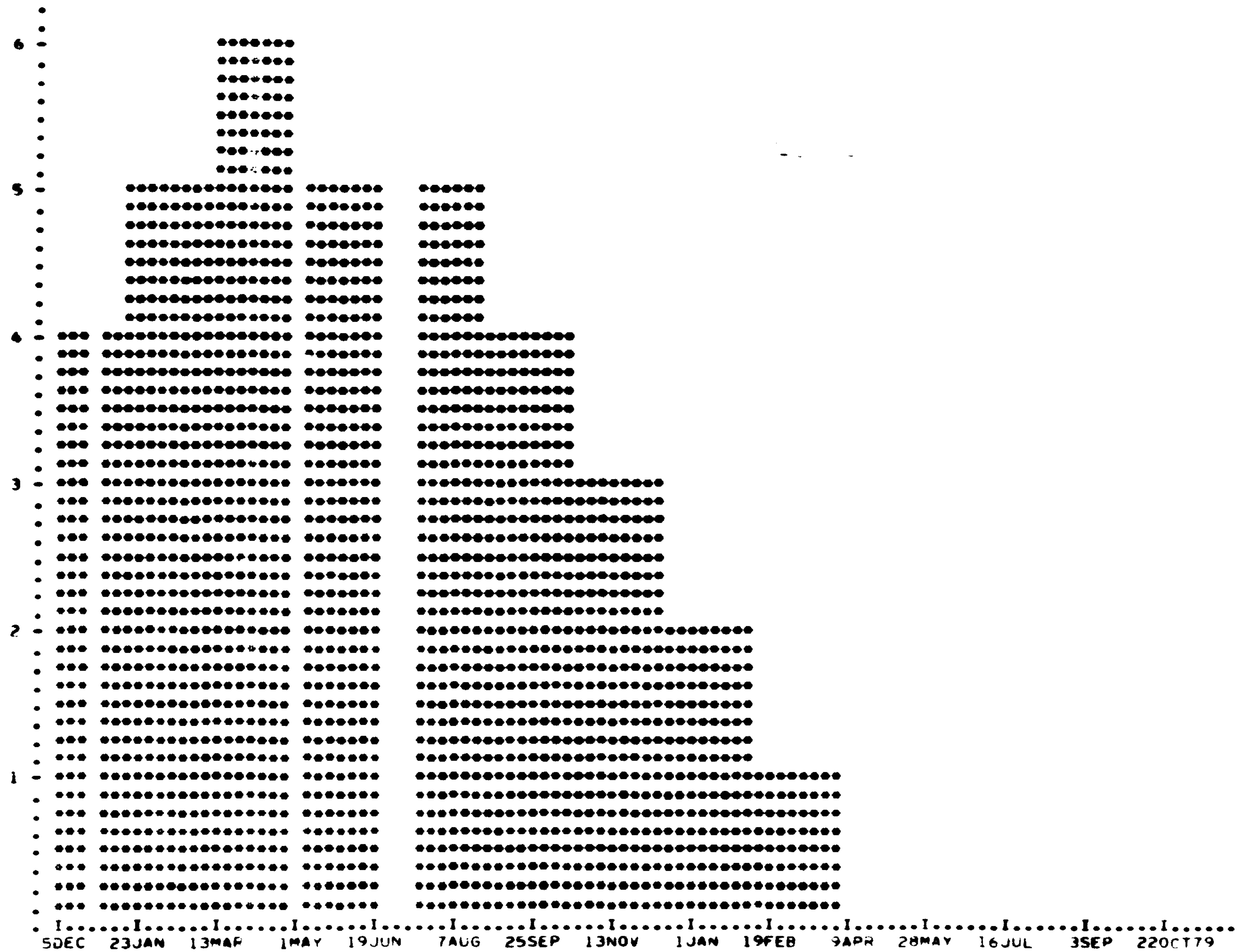
OPTIMA NORWEGIAN COMPUTING CENTER

* * * RESOURCE LOADING IN HISTOGRAM FORM * * *

PAGE 2
RESOURCE: PMS

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
03 DEC 75 THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

OUTPUT START: 1DEC75 T.U. INPUT: WEEK
OUTPUT FINISH: 6AUG79 T.U. OUTPUT: WEEK



OPTIMA
NORWEGIAN
COMPUTING CENTER
03 DEC 75

*** R E S O U R C E   L O A D I N G   I N   T A B L E   F O R M ***

PAGE 1
RESOURCE: [illegible]

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

OUTPUT START: 1DEC75
OUTPUT FINISH: [illegible]

T.U. INPUT: WEEK
T.U. OUTPUT: WEEK

									ACCUM. LOAD										ACCUM. LOAD
1DEC75	1	1	1	1	[illegible]	1	1	.	6.	[illegible]	1	1	1	1	1	1	1	.	13.
[illegible]	1	1	1	1	1	1	1	.	20.	[illegible]	[illegible]	1	1	1	1	1	1	.	26.
[illegible]	1	1	[illegible]	[illegible]	[illegible]	1	1	.	30.	[illegible]	1	1	1	1	1	1	1	.	37.
[illegible]	1	1	1	1	1	1	1	.	[illegible]	[illegible]	1	1	1	1	1	1	1	.	51.
[illegible]	[illegible]	1	1	1	1	1	1	.	57.	[illegible]	1	1	1	0	0	0	1	.	61.
[illegible]	1	1	1	[illegible]	1	1	1	.	67.	[illegible]	1	1	1	1	1	[illegible]	[illegible]	.	72.
11JUL77	[illegible]	1	2	2	2	2	2	.	[illegible]	[illegible]	2	2	2	3	3	3	3	.	101.
17OCT77	3	3	3	3	4	4	4	.	125.	[illegible]	4	4	4	[illegible]	4	4	5	.	150.
23JAN78	5	5	5	5	5	5	5	.	[illegible]	[illegible]	6	6	6	6	6	6	6	.	227.
[illegible]	[illegible]	5	5	5	5	5	5	.	257.	[illegible]	5	[illegible]	[illegible]	[illegible]	5	5	5	.	277.
7AUG78	5	5	5	4	4	4	4	.	300.	[illegible]	4	4	4	4	3	3	3	.	333.
13NOV78	3	3	3	3	3	2	2	.	352.	[illegible]	2	2	2	2	2	2	1	.	365.
19FEB79	1	1	1	1	1	1	1	.	372.	[illegible]	0	0	0	0	0	0	0	.	372.

OPTIMA
NORWEGIAN
COMPUTING
CENTER

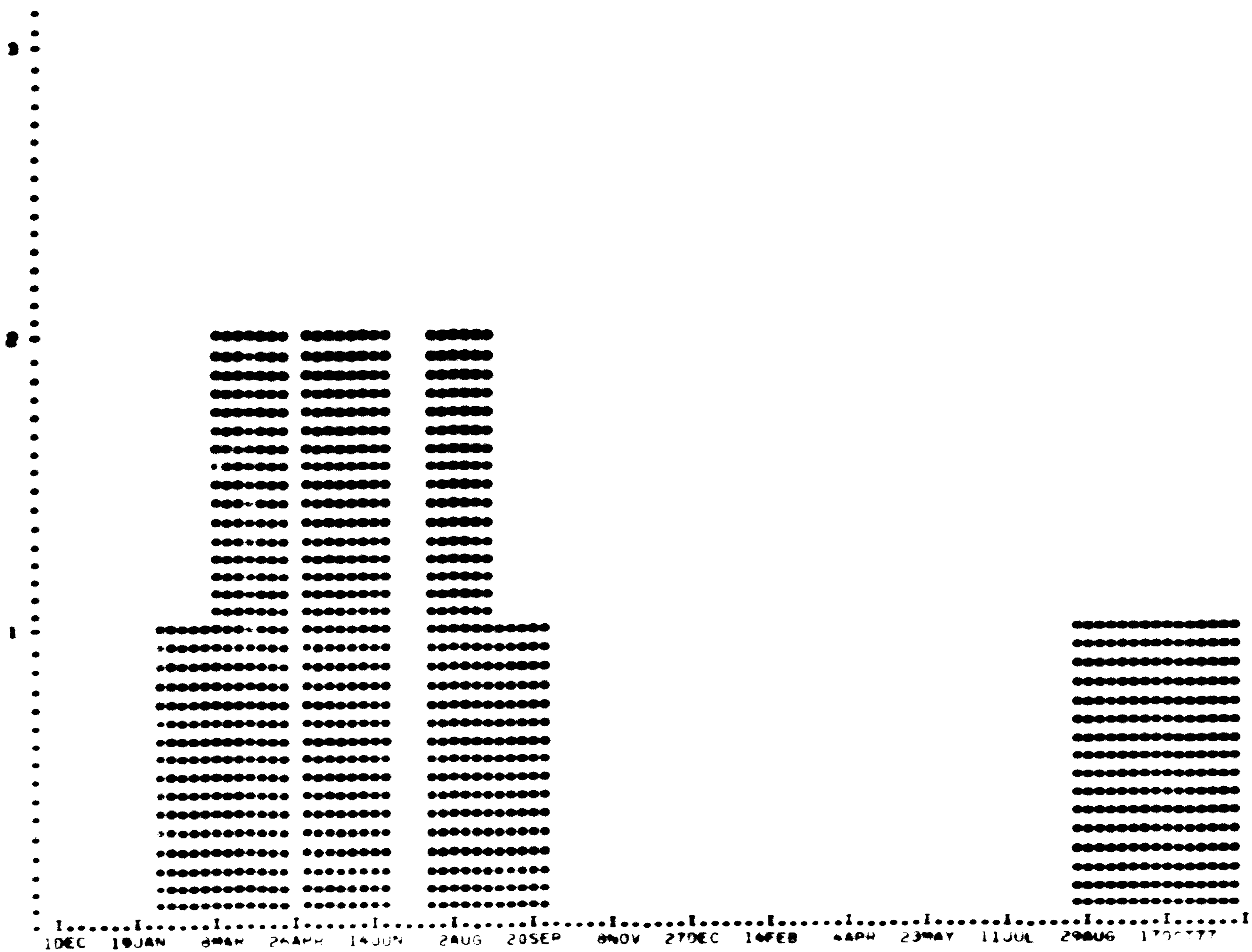
RESOURCE LOADING IN HISTOGRAM FORM

PAGE 1
RESOURCE: [illegible]

PROJECT NO. 1
[illegible] - STEEL WORKS IMPLEMENTATION PLAN
09 DEC 75 THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

OUTPUT START: 1DEC75
OUTPUT FINISH: [illegible]

T.U. INPUT: [illegible]
T.U. OUTPUT: [illegible]



OPTIMA
NORWEGIAN
COMPUTING
CENTER
03 DEC 75

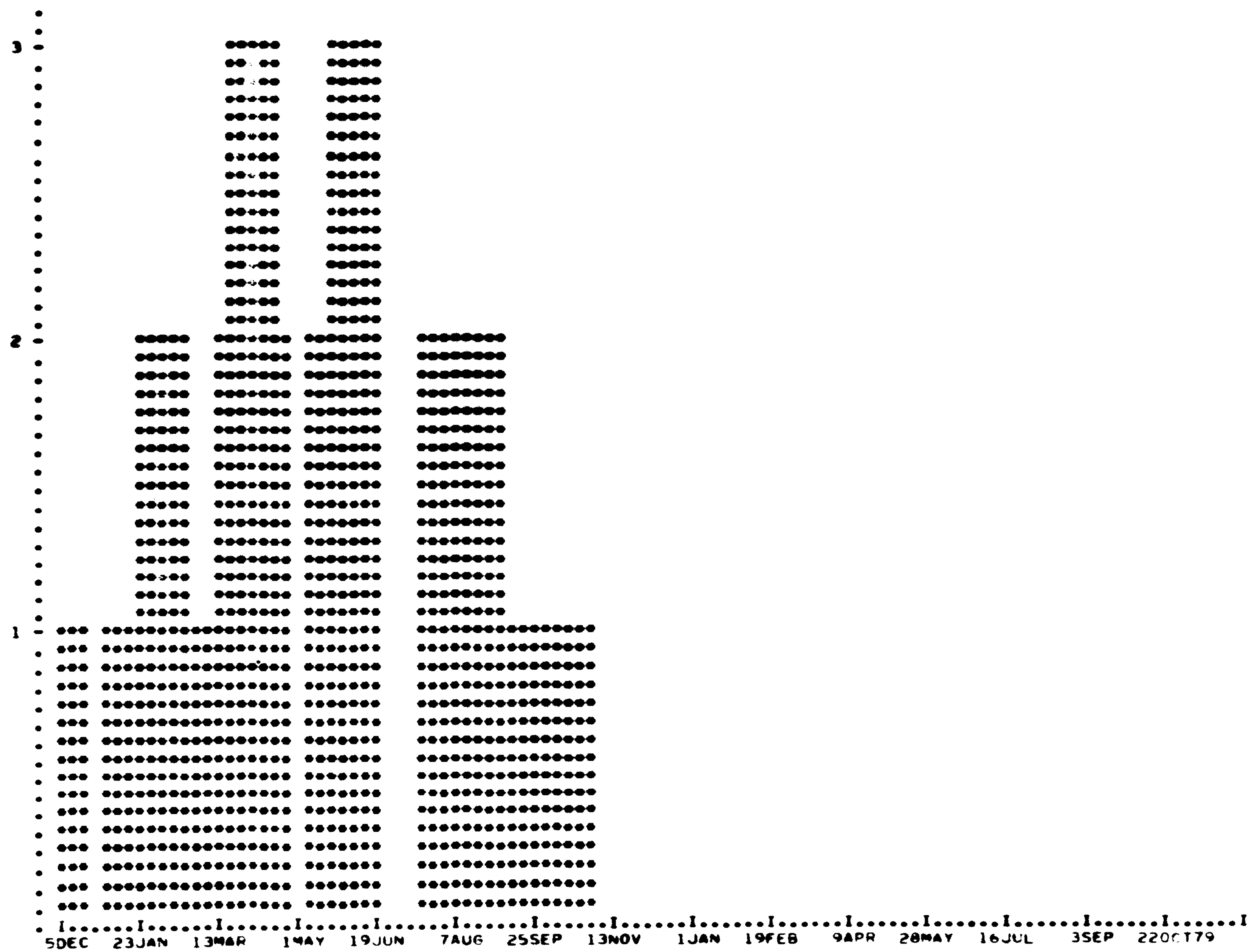
*** RESOURCE LOADING IN HISTOGRAM FORM ***

PAGE 2
RESOURCE: MPL

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

OUTPUT START: 1DEC75
OUTPUT FINISH: 6AUG79

T.U. INPUT: WEEK
T.U. OUTPUT: WEEK



OPTIMA
NORWEGIAN
COMPUTING
CENTER
03 DEC 75

RESOURCE LOADING IN TABLE FORM

PAGE 1
RESOURCE: MPL

PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

OUTPUT START: 1DEC75
OUTPUT FINISH: 6AUG79

T.U. INPUT: WEEK
T.U. OUTPUT: WEEK

									ACCUM. LOAD											ACCUM. LOAD
1DEC75	0	0	0	0	*000	0	0	.	0.	19JAN76	0	0	1	1	1	1	1	.	5.
8MAR76	2	2	2	2	2	2	2	.	19.	26APR76	*000	2	2	2	2	2	2	.	31.
14JUN76	2	2	*000	*000	*000	2	2	.	39.	2AUG76	2	2	2	2	1	1	1	.	50.
20SEP76	1	1	0	0	0	0	0	.	52.	8NOV76	0	0	0	0	0	0	0	.	52.
11JUL77	*000	0	0	0	0	0	1	.	53.	29AUG77	1	1	1	1	1	1	1	.	60.
17OCT77	1	1	1	1	1	1	1	.	67.	5DEC77	1	1	1	*000	1	1	1	.	73.
23JAN78	2	2	2	2	2	1	1	.	85.	13MAR78	2	3	3	3	3	3	2	.	104.
1MAY78	*000	2	2	3	3	3	3	.	120.	19JUN78	3	*000	*000	*000	2	2	2	.	129.
7AUG78	2	2	2	2	2	1	1	.	141.	25SEP78	1	1	1	1	1	1	0	.	147.

Attachment 11.12

OPTIMA NORWEGIAN COMPUTING CENTER

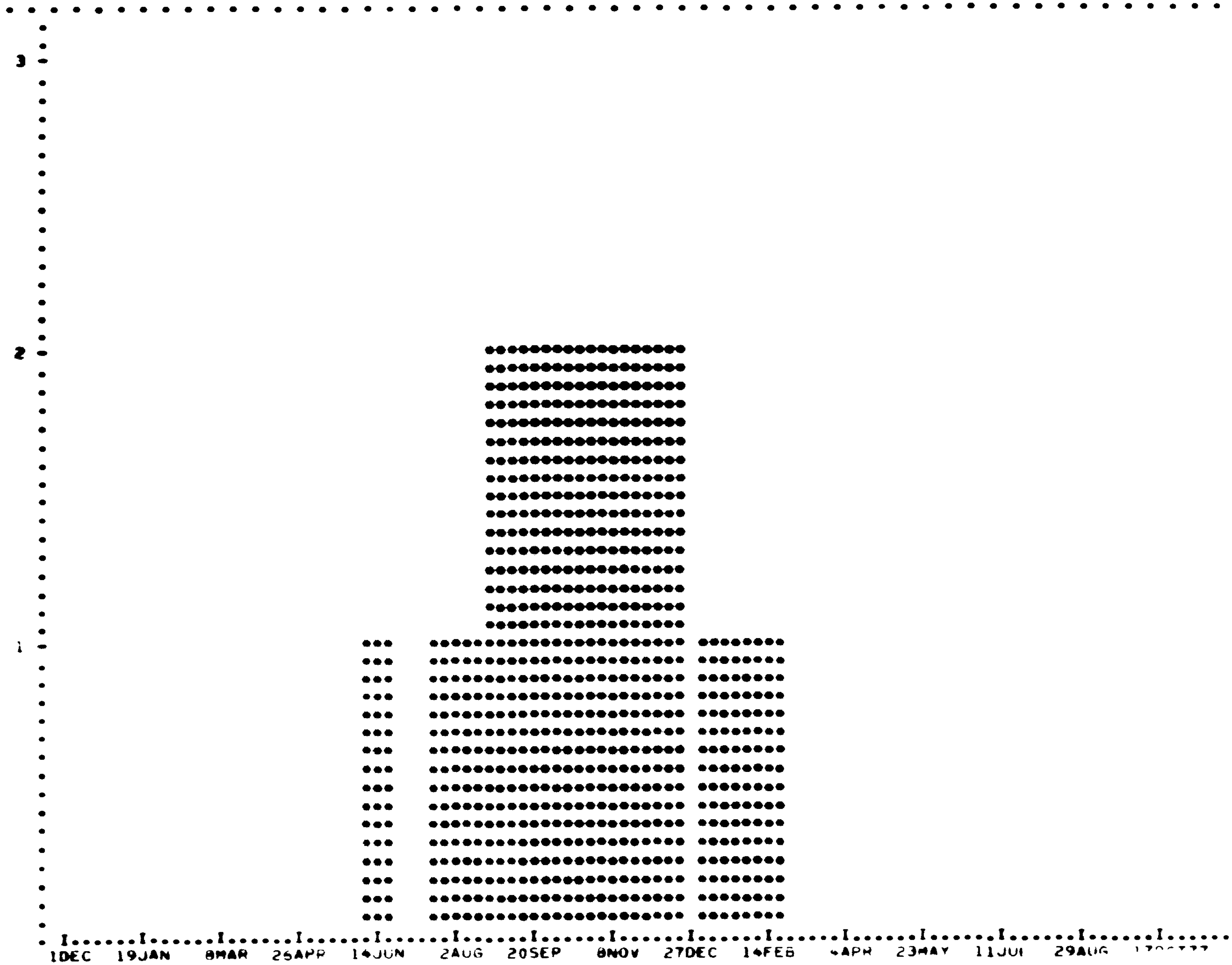
PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
03 DEC 75 THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

* * * RESOURCE LOADING IN HISTOGRAM FORM * * *

PAGE 1
RESOURCE: PPL

OUTPUT START: 1DEC75
OUTPUT FINISH: 6AUG79

T.U. INPUT: WEEK
T.U. OUTPUT: WEEK



OPTIMA
NORWEGIAN
COMPUTING
CENTER
03 DEC 75

RESOURCE LOADING IN TABLE FORM

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

OUTPUT START: 1DEC75
OUTPUT FINISH: 6AUG79

PAGE 1
RESOURCE: PPL
T.U. INPUT: WEEK
T.U. OUTPUT: WEEK

									ACCUM. LOAD										ACCUM. LOAD
8MAR76	0	0	0	0	0	0	0	.	0.	26APR76	*000	0	0	0	0	0	1	.	1.
14JUN76	1	1	*000	*000	*000	1	1	.	5.	2AUG76	1	1	1	2	2	2	2	.	16.
20SEP76	2	2	2	2	2	2	2	.	30.	8NOV76	2	2	2	2	2	2	2	.	44.
27DEC76	*000	1	1	1	1	1	1	.	50.	14FEB77	1	1	0	0	0	0	0	.	52.

OPTIMA NORWEGIAN COMPUTING CENTER

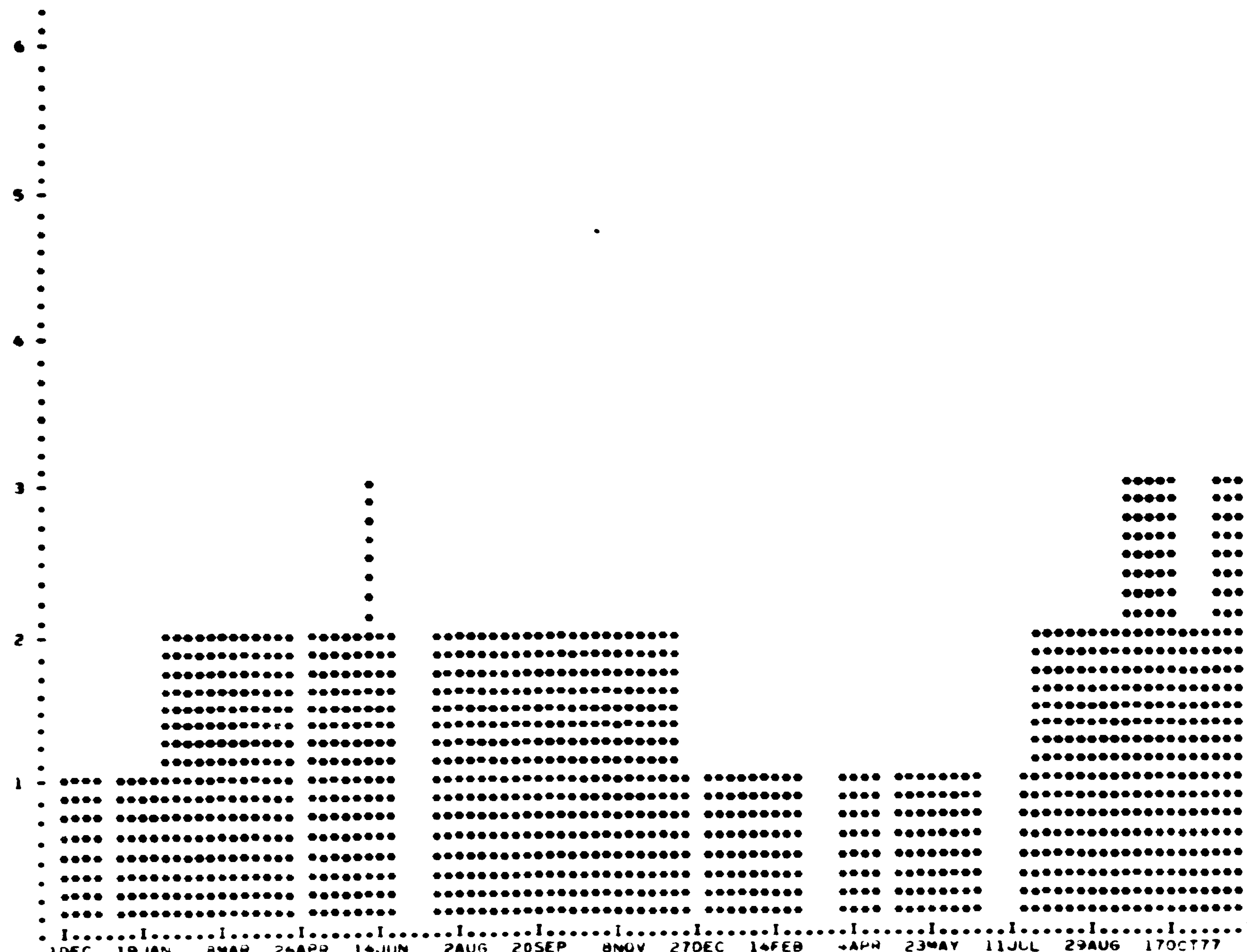
RESOURCE LOADING IN HISTOGRAM FORM

PAGE 1
RESOURCE: MAT

PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
03 DEC 75 THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

OUTPUT START: 1DEC75
OUTPUT FINISH: 6AUG79

T.U. INPUT: WEEK
T.U. OUTPUT: WEEK



OPTIMA
NORWEGIAN
COMPUTING
CENTER
03 DEC 75

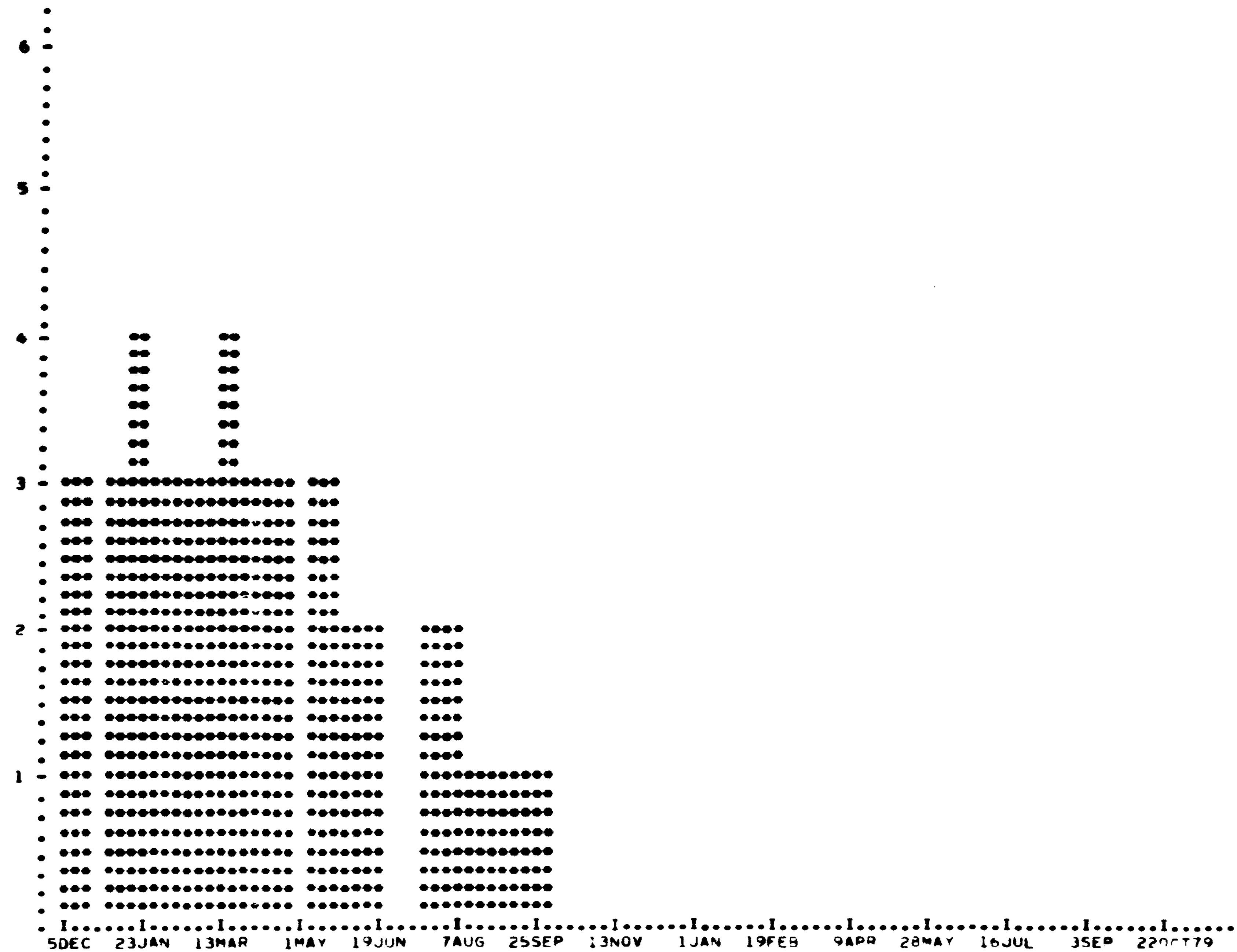
*** RESOURCE LOADING IN HISTOGRAM FORM ***

PAGE 2
RESOURCE: MAT

PROJECT NO. I
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

OUTPUT START: 1DEC75
OUTPUT FINISH: 6AUG79

T.U. INPUT: WEEK
T.U. OUTPUT: WEEK



OPTIMA NORWEGIAN COMPUTING CENTER

RESOURCE LOADING IN TABLE FORM

PAGE 1
RESOURCE: MAT

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN

OUTPUT START: 1DEC75 T.U. INPUT: WEEK
OUTPUT FINISH: 6AUG79 T.U. OUTPUT: WEEK

03 DEC 75 THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

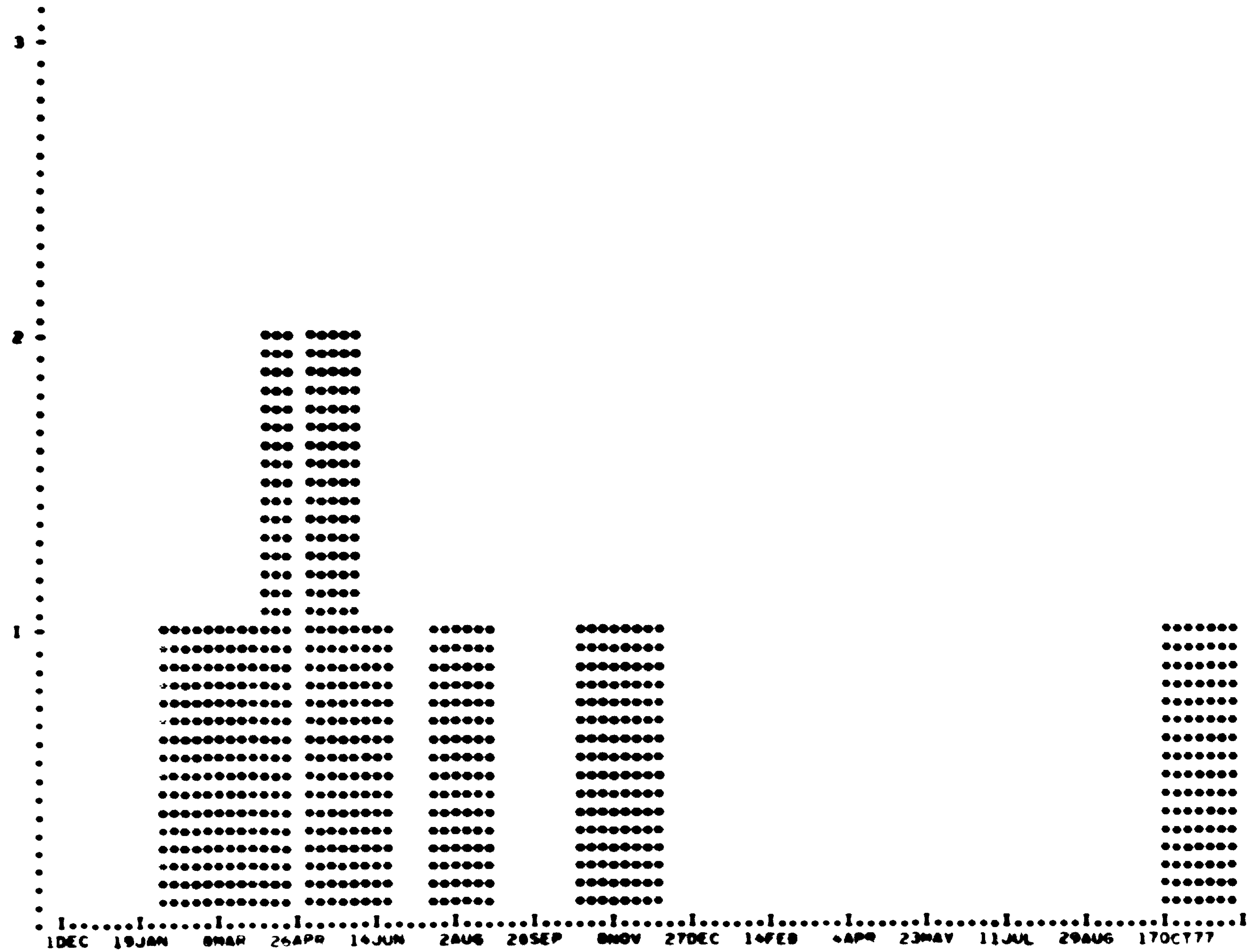
								ACCUM. LOAD									ACCUM. LOAD
1DEC75	1	1	1	1	*000	1	1	6.	19JAN76	1	1	2	2	2	2	2	18.
8MAR76	2	2	2	2	2	2	2	32.	26APR76	*000	2	2	2	2	2	3	45.
14JUN76	2	2	*000	*000	*000	2	2	53.	2AUG76	2	2	2	2	2	2	2	67.
20SEP76	2	2	2	2	2	2	2	81.	8NOV76	2	2	2	2	2	2	1	94.
27DEC76	*000	1	1	1	1	1	1	100.	14FEB77	1	1	1	0	0	0	1	104.
4APR77	1	1	1	[illegible]	1	1	1	110.	23MAY77	1	1	1	1	1	*000	*000	115.
11JUL77	*000	1	2	2	2	2	2	126.	29AUG77	2	2	2	3	3	3	3	144.
17OCT77	3	2	2	2	3	3	3	162.	5DEC77	3	3	3	*000	3	3	4	181.
23JAN78	4	3	3	3	3	3	3	203.	13MAR78	4	4	3	3	3	3	3	226.
1MAY78	*000	3	3	3	2	2	2	241.	19JUN78	2	*000	*000	*000	2	2	2	249.
7AUG78	2	1	1	1	1	1	1	257.	25SEP78	1	1	0	0	0	0	0	259.

OPTIMA *** R E S O U R C E L O A D I N G I N H I S T O G R A M F O R M *** PAGE 1

NORWEGIAN
COMPUTING PROJECT NO. 1
CENTER DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
03 DEC 75 THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

RESOURCE: CST

OUTPUT START: 1DEC75 T.U. INPUT: WEEK
OUTPUT FINISH: 6AUG79 T.U. OUTPUT: WEEK



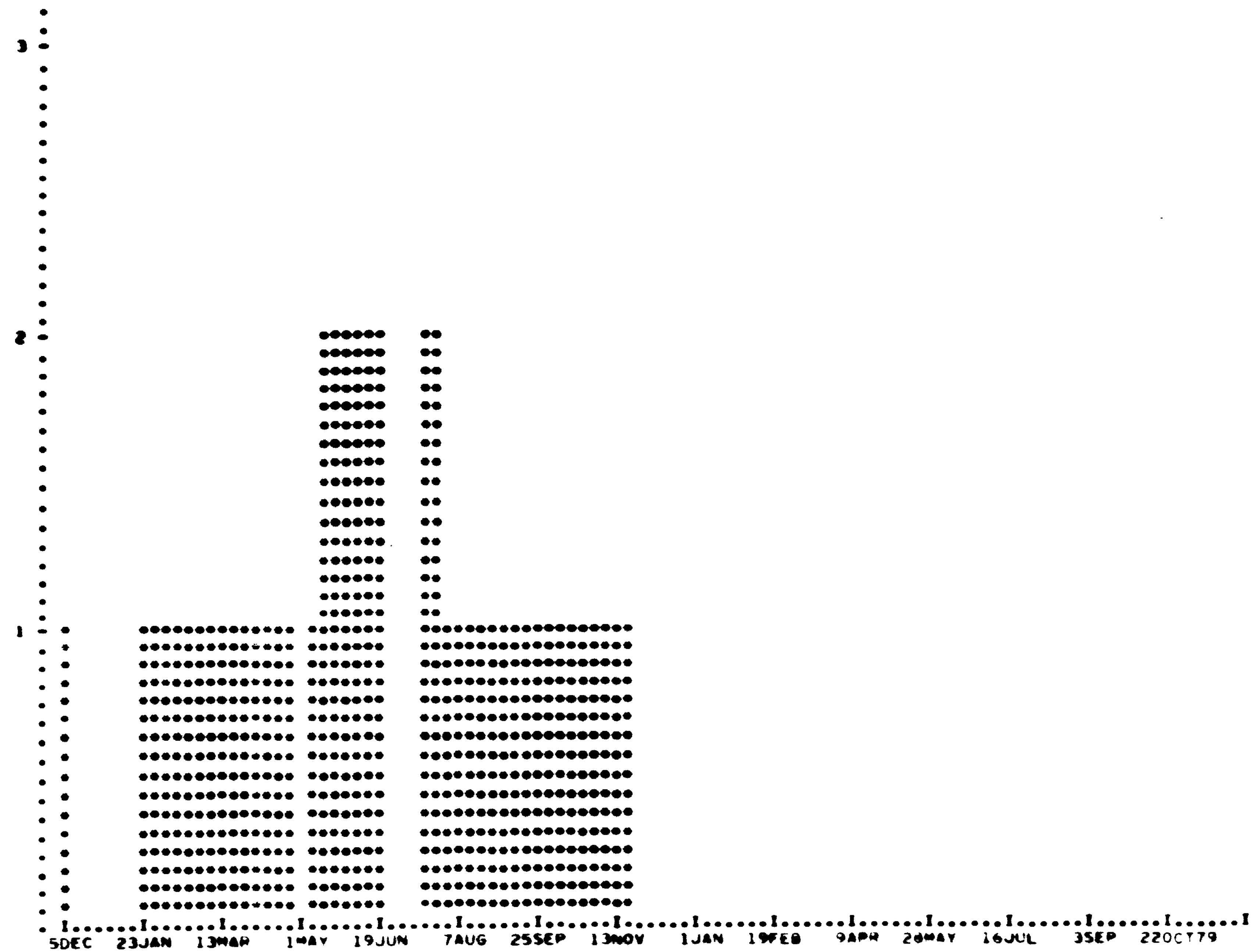
OPTIMA **RESOURCE LOADING IN HISTOGRAM FORM** PAGE 2

NORWEGIAN RESOURCE: CST

COMPUTING PROJECT NO. 1

CENTER DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN OUTPUT START: 1DEC75 T.U. INPUT: WEEK

03 DEC 75 THE ACTIVITIES ARE PLACED IN EARLIEST POSITION OUTPUT FINISH: 6AUG79 T.U. OUTPUT: WEEK



OPTIMA ••••RESOURCE LOADING IN TABLE FORM•••• PAGE 1
NORWEGIAN RESOURCE: CST
COMPUTING PROJECT NO. 1
CENTER DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN OUTPUT START: 1DEC75 T.U. INPUT: WEEK
03 DEC 75 THE ACTIVITIES ARE PLACED IN EARLIEST POSITION OUTPUT FINISH: 6AUG79 T.U. OUTPUT: WEEK

									ACCUM. LOAD										ACCUM. LOAD
1DEC75	0	0	0	0	*000	0	0	.	0.	19JAN76	0	0	1	1	1	1	1	.	5.
8MAR76	1	1	1	1	2	2	2	.	15.	26APR76	*000	2	2	2	2	2	1	.	26.
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OPTIMA
NORWEGIAN
COMPUTING CENTER
03 DEC 75

* * * R E S O U R C E   L O A D I N G   I N   H I S T O G R A M   F O R M * * *

PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

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OUTPUT FINISH: 6AUG79

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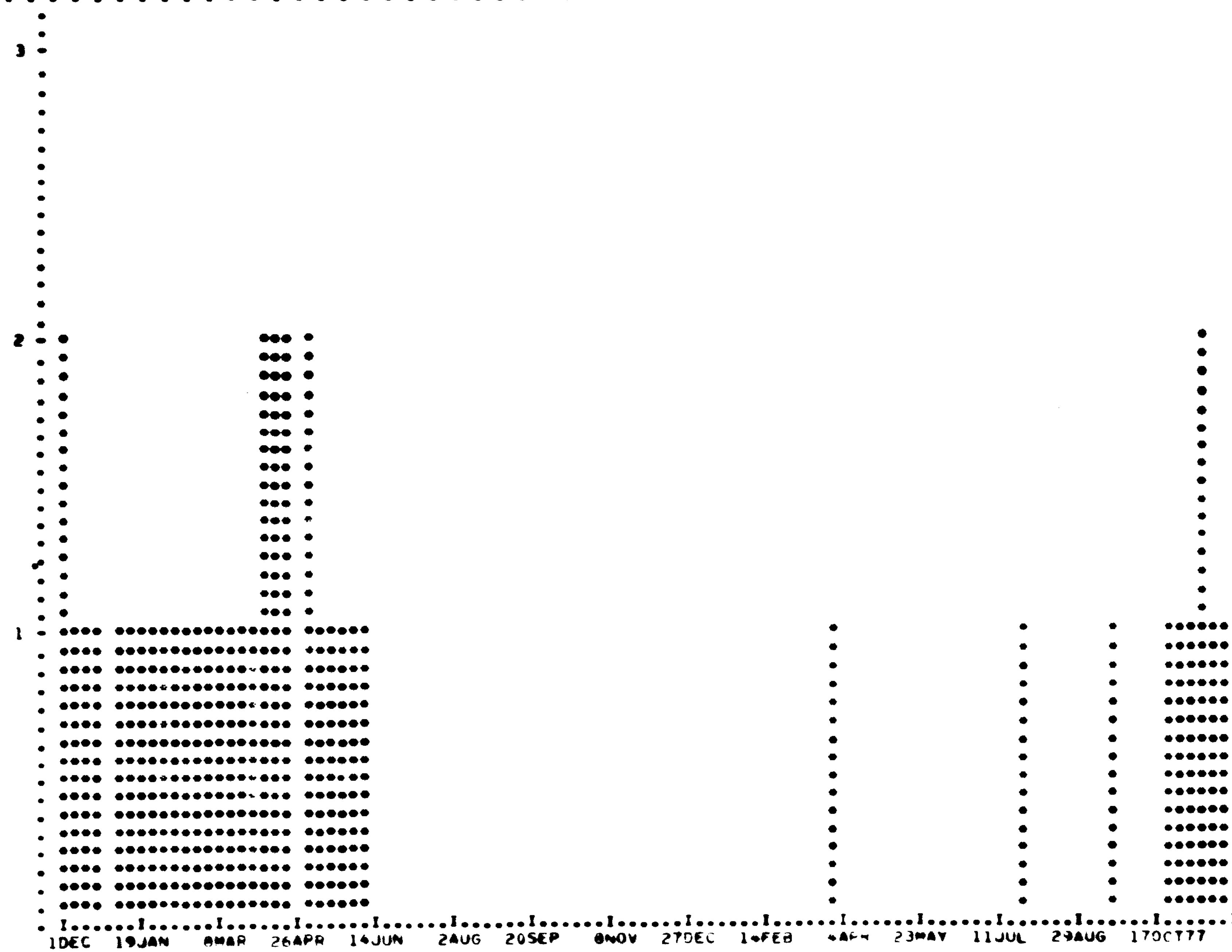
T.U. OUTPUT: WEEK



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NORWEGIAN RESOURCE: COD

COMPUTING PROJECT NO. 1

CENTER DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN OUTPUT START: 1DEC75 T.U. INPUT: WEEK

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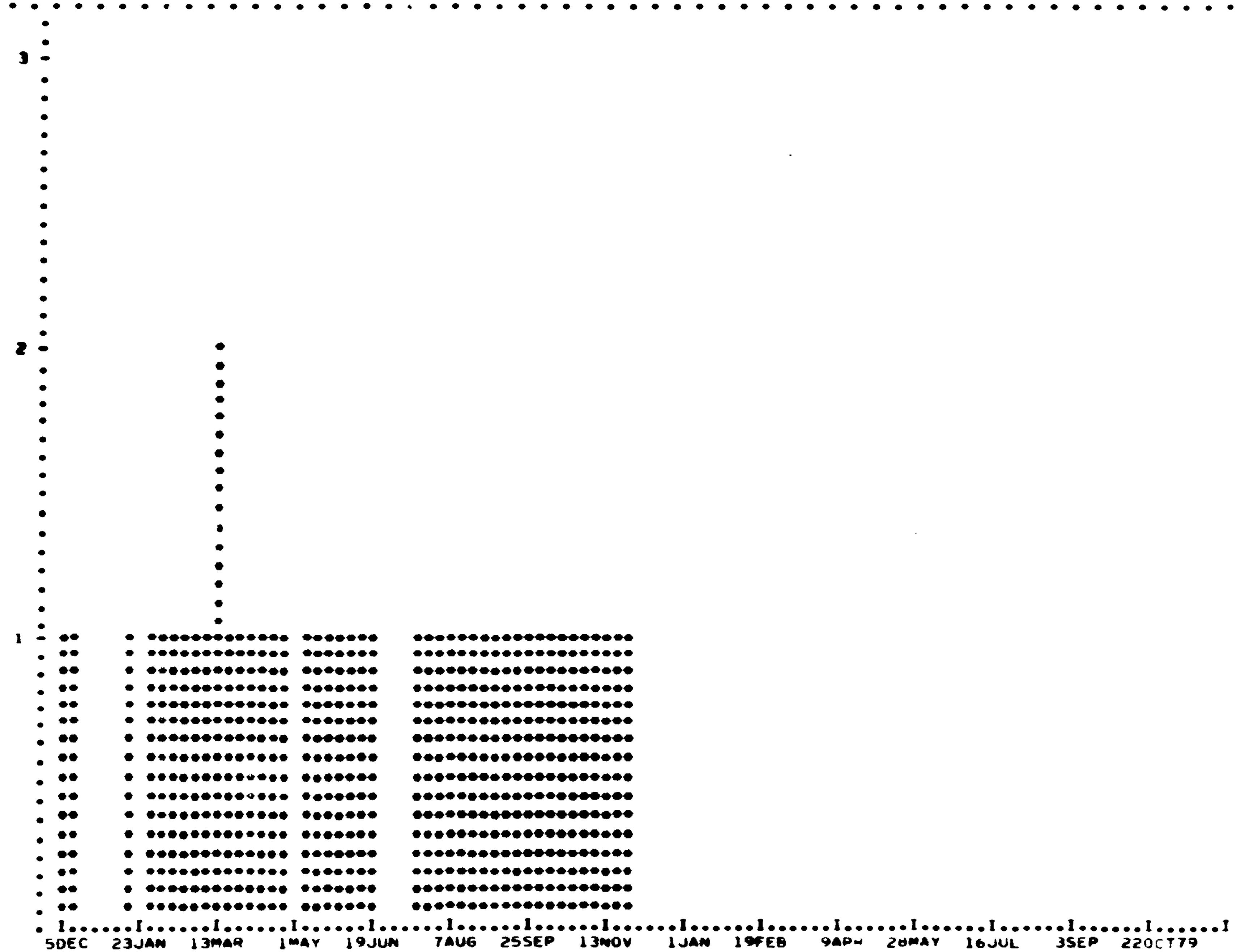

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NORWEGIAN
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CENTER DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
03 DEC 75 THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

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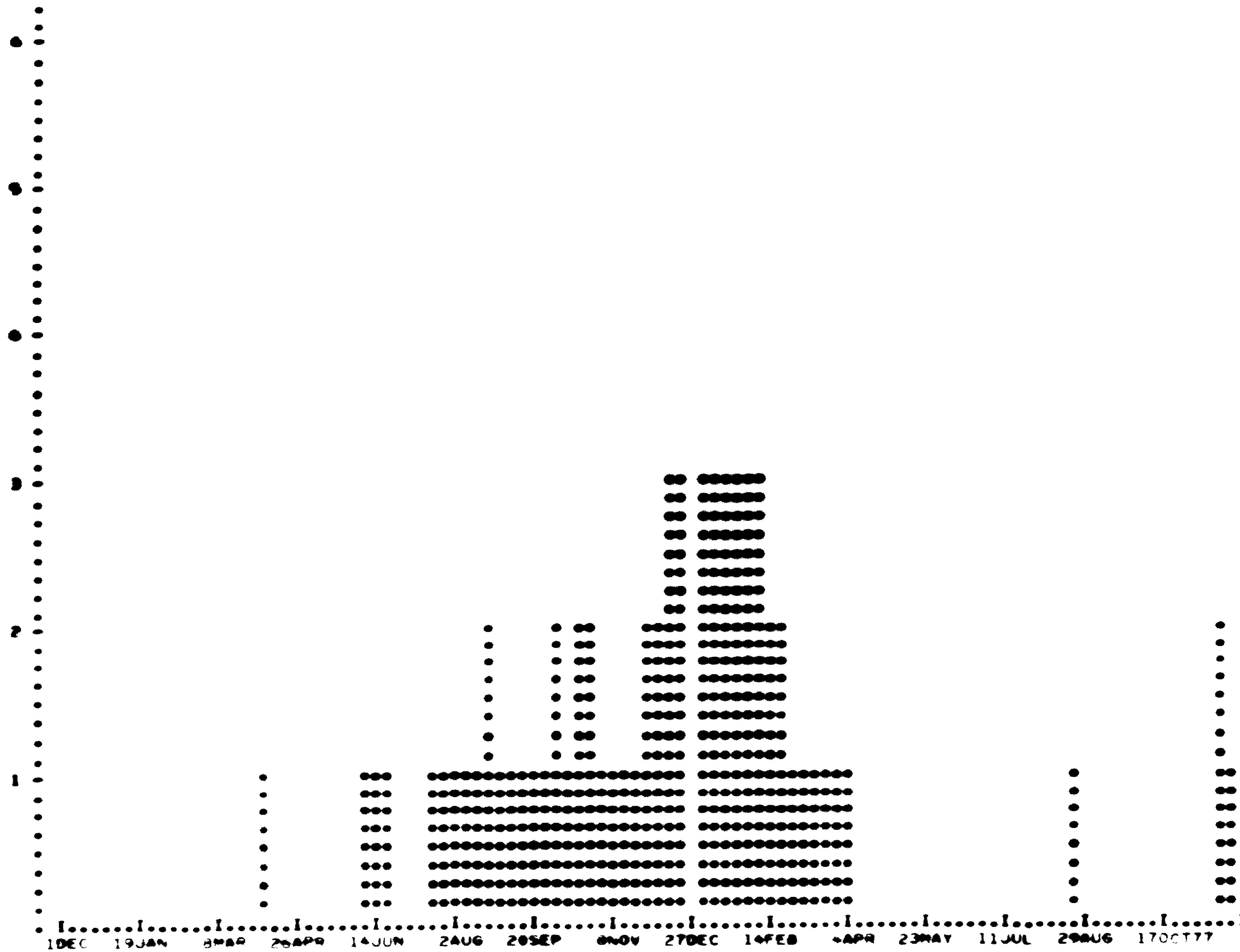
THE ACTIVITIES ARE PLACED IN EARLIEST POSITION



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COMPUTING CENTER

RESOURCE LOADING IN HISTOGRAM FORM

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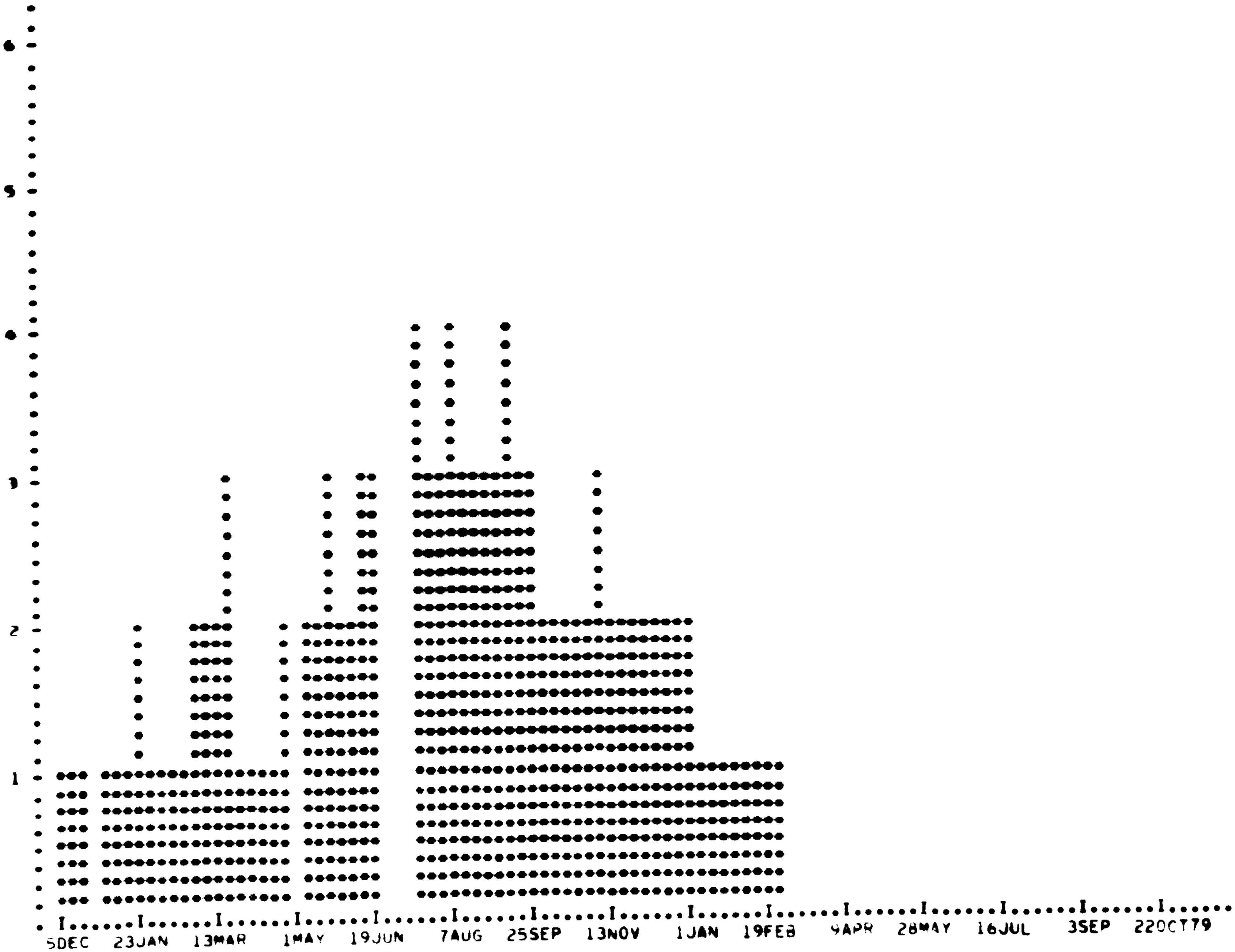

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03 DEC 75

* * * RESOURCE LOADING IN TABLE FORM * * *

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THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

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OPTIMA NORWEGIAN COMPUTING CENTER 03 DEC 75

*** RESOURCE LOADING IN HISTOGRAM FORM ***

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PROJECT NO. 1
DANUBE IRON - STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

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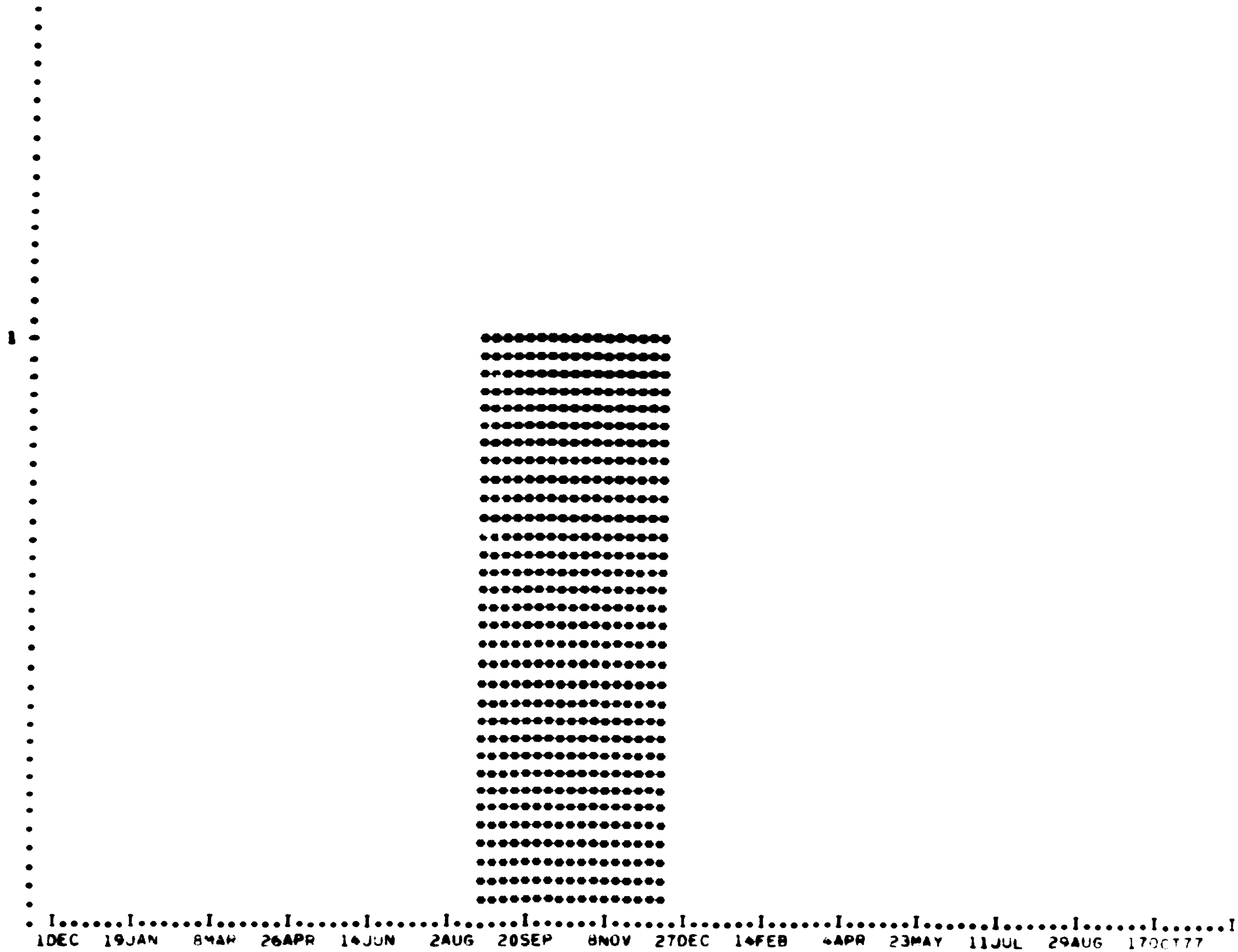

OPTIMA NORWEGIAN COMPUTING CENTER 03 DEC 75

RESOURCE LOADING IN TABLE FORM

PROJECT NO. 1
DANUBE IRON + STEEL WORKS IMPLEMENTATION PLAN
THE ACTIVITIES ARE PLACED IN EARLIEST POSITION

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Attachment 9

IMPLEMENTATION COUNSELLING REPORT

FOR

DANUBE IRON & STEEL WORKS

DECEMBER, 1975

IMPLEMENTATION COUNSELLING REPORT FOR DANUBE IRON & STEEL WORKS

December 1975

IKO-KONSULENT A/S
[illegible] Center, [illegible]
Telefon: 02-27 12 [illegible] - Telex: [illegible]

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Consulting Engineers, Architects & Economists
P.O.Box 9, 1322 Hovik
Norway

TABLE OF CONTENTS

ATTACHMENTS

1. INTRODUCTION

The implementation counselling for the managed maintenance system of the Danube Iron and Steel Works has been completed. A group of 18 future users of the new systems during the total project time of nine months has been trained in operation of the systems.

A great number of meetings have been arranged in order to secure the total organisation's acceptance of the changes recommended.

Some of the proposals are adjusted in order to meet wishes from the different organisational units.

The implementation plan is now accepted by all key persons in the company and authorised by the highest Hungarian authorities.

On request of the Minister of Metallurgical and Mechanical Industry of Hungary, a study has been conducted to determine the consultants' evaluation of the present situation in the company, the proposed managed maintenance system and its potential. This study is attached to this report as Attachment 1.

In connection with the implementation counselling, there is a number of special studies dealing with the implementation of different techniques and methods. To demonstrate this, the following papers are attached to this report:

- Attachment 2, a paper concerning the principles of modern project management; it is a guide for organising the implementation of the managed maintenance system integrated with another main project concerning expansion of the production facilities.

- Attachment 3, a paper concerning a mathematical method for evaluation of optimum spare part stock.

- Attachment 4, a paper concerning a method for introduction of microfilm.

- Attachment 5, a paper concerning the principles of value analyses.

2. SUMMARY OF METHOD OF IMPLEMENTATION COUNSELLING

The idea of the total project has been counselling.

Phase 1 of the project "Introduction to Managed Maintenance" resulted in a 300-page teacher's handbook in managed maintenance and an education programme for all personnel of the Danube Iron and Steel Works who will attend courses in managed maintenance. See UNIDO report: Introduction to Managed Maintenance, July 1975, proposed by IKO-Konsulent A/S.

This advanced training system was elaborated in close cooperation with the person responsible for the training activities. The content of the lectures has been carefully discussed and the special techniques of this type of training have been presented.

Phase 2 of the project "System Development" resulted in a complete description of all systems necessary for introduction of the managed maintenance system. See UNIDO report: System Development Report for the Danube Iron and Steel Works, September 1975, proposed by IKO-Konsulent A/S.

All systems have been developed in close cooperation with the future users. Major systems, such as those for cost control, preventive maintenance, etc. have been tested by trial implementation.

The implementation counselling has been an integrated part of the system development phase of the project.

Phase 3 of the project "Work Plan Preparation" resulted in a detailed plan for implementation of the managed maintenance system in the Danube Iron and Steel Works, to take place over a period of almost four years, beginning in December 1975.

The work plan preparation has been elaborated by use of EDP network technique and is carried out in close cooperation with the management and the staff of the Danube Iron and Steel Works.

The implementation counselling has been an integrated part of the Work Plan Preparation phase of the project.

3. SUMMARY OF THE RESULTS OF THE IMPLEMENTATION COUNSELLING

Implementation counselling seeks to achieve the following:

- Establishment and execution of a completed advanced training programme in managed maintenance.
- Complete description of all systems necessary to form a managed maintenance system.
- Testing and adjustments of the systems to meet special requests from the company.
- Thorough education of 18 future users of the systems.
- Acceptance of the proposed systems by all organisational units of the company.
- Acceptance by all company managers of an implementation plan for the whole project.
- Set-up of an implementation organisation.
- Guarantee that this organisation will be given the tools necessary to manage the implementation.

4. CONCLUSION

With the system implementation, the field work of the project is completed.

It is our opinion that this project has been carried out successfully. However, we want to stress two important points. This success is a result of very good cooperation between UNIDO staff members and the consultants, and we want to thank UNIDO for invaluable assistance. Furthermore, it is our opinion that the counterpart will meet major difficulties in attempts to introduce the proposed systems, due to lack of experience in implementation of such large, sophisticated systems; therefore, we think further UNIDO assistance should be offered.

MEMO CONCERNING IMPROVEMENT POSSIBILITIES IN THE DANUBE IRON AND STEEL WORKS BY INTRODUCTION OF A NEW MANAGED MAINTENANCE SYSTEM

MEMO CONCERNING IMPROVEMENT POSSIBILITIES IN DUNAI VASMÜ (DV) BY INTRODUCTION OF A NEW MANAGEMENT MAINTENANCE SYSTEM

The meeting in DV on 14 October with Mr. Talyigas and Mr. Sömjen and representatives of DU dealt with the following:

1) Our impression of present maintenance conditions in DU

2) The proposed systems to be implemented in a new managed maintenance system

3) Our rough estimation concerning the effect of the proposed changes.

1. PRESENT SITUATION

There are many positive factors in the company's present situation. The technological achievements and past expansion of production show the high quality of workers and management. The continuous improvement of the plant demonstrates the high technical quality of the technical staff.

The programmes for further technological development and expansion of production will ensure even greater improvements in the future. The opportunities for obtaining them at reasonable cost depend mostly on how well the company solves its management problems and in which way Hungarian industry is developed.

Compared with similar plants in Western Europe, we must state that plant conditions are considerably lower and maintenance costs considerably higher than normal. The reasons for this are in our opinion:

- Production has expanded to a level much higher (+25% to +75%) than foreseen when the plant was originally projected. This results in an overload on several points throughout the production line.

  As an example, the hot rolling mill during the first eight months of this year had had 28 breakdowns caused by broken rolls. This is a very high figure and indicates extremely poor quality of the rolls, and/or considerable overload, and/or poor instruction of the operators.

- The description of the present organisation is old and outdated. Job descriptions and descriptions of functions are not coordinated and do not correspond to reality. The quality of the system descriptions varies greatly, and as they are made up individually, they are not well integrated as a whole.

For example, it has been necessary to make new descriptions of all existing systems which we wanted to study. We have never seen an "in-use" description of a system.

- The function of the organisation for the total company is very unclear. There is a lot of overlapping between production and maintenance. Responsibilities are often impossible to place in one organisational unit. The same situation exists within the maintenance function.

  For example, decisions about a major repair involve some 20 different persons and nobody has the final responsibility.

- The organisation is established in such a way as to give priority to production, maintenance possibilities to influence decisions about repair time and conditions in the plant. This is also significant in planning maintenance work and in keeping the maintenance staff efficient.

  For example, in January of this year a large repair demanding approximately 860 maintenance workers in the hot steel mill was decided and planned, in cooperation between production and maintenance staff. The workers were taken from the normal shift, the work was prepared, but then the repair was called off because the production plan had not been fulfilled.

- The level of instruction, education, and motivation of the production workers is not sufficient. User's manuals exist for the equipment, but are not sufficiently developed. Maintenance people are at present instructing production workers in proper operation, even though this is the responsibility of the production foremen.

  For example, blocks coming down the roll table in the hot steel mill are often not properly planed and have large burrs on them. The operator should refuse such blocks, as they harm the equipment and cause down-time and unnecessary maintenance costs.

- The demand for service from the central maintenance shops is unrealistic. The total yearly demand for spare parts amounts to approximately 250 million forints; approximately 40% of this is imported, approximately 30% is bought in Hungary, and approximately 30% is produced by the counterpart.

  Any item used at the plant can in principle be ordered from the central workshops, but:

  - The delivery time for imported spare parts ranges between one and two years

  - The capacity of the Hungarian machine industry often is limited so that delivery is impossible.

- The Hungarian machine industry is not sufficiently equipped for manufacturing many of the spare parts needed by the counterpart.

- The spare parts administration is weak. This causes major difficulties, in some cases poor quality, and often very high costs.

As an example, rolls for the sheet straightener are to be hardened before use. This usually is done by heating the rolls in an induction furnace; but this size furnace does not exist in Hungary. The central maintenance workshops perform the hardening by heating the rolls one by one in a pit furnace. The temperature range cannot be properly controlled and the results are not good. The rolls will have a shorter life and be more expensive.

- The central maintenance workshops are nor efficient. They receive orders from a number of sources (about 30) and each ordering unit can demand delivery time by requiring priority. The existing equipment is often not suitable for the requested jobs, and to use it requires expensive modifications. The documentation, in general, is poor.

  Drawings are not separated by operation, with the result that the blueprints contain many corrections made with different coloured pencils. The workshops in general are not suited for efficient production, the machinery and equipment are inadequate to meet the greatly varying demands for spare parts by the counterpart; heating systems are insufficient in some factories; transport facilities are poor. The tools are not properly organised and their quality varies considerably.

- The administration of spare parts and materials is at present decentralised, poorly organised, and inefficient.

  Often it is impossible to get a realistic delivery time when ordering a spare part. In our samples we found deviations in delivery time from one month to one year for spare parts purchased from outside. Also, we found that some orders given to the central workshops are years old and not filled.

  At present the total value of spare parts in the company amounts to approximately 400 million forints. Approximately 70% of this is produced outside the company and requires delivery times from a few months to two years. Taking this into consideration, the rate of turnover for spare parts is not bad, and the total number of spare parts in stock probably too small. This view is underscored by the fact that approximately 15% of the present spare parts have had no turnover since 1972.

- The technical staff for maintenance is too small. All technicians we talked to mentioned an overload of work. The missing documentation and inefficient planning activities prove this.

  For example, when this UNIDO project was started, 18 technicians from the counterpart were allocated for the different sub-projects and were told by the top management to concentrate on this job. However, their normal functions were not taken over by others, because there is no spare capacity. Therefore, none of these people has been full time on the project and the systems developed are not as integrated as intended.

- The use of modern management tools has been started by the company, but the progress is insufficient. Three years ago the network-planning technique was introduced. However, still today it is used only as a description of the logical structure in a job and not for planning control.

  The use of EDP is minimal. There is sufficient computer capacity with some 40 persons working in this function.

  However, for the maintenance and materials administration no input or output proposals have been presented, and the coding systems used today are unsuitable for EDP. No plans exist for the introduction of EDP in the maintenance function, and no calculations have been made concerning the efforts required.

The present situation, partially described above, forms part of the background for our proposals concerning a new organisation and a new management system for the maintenance function of the Danube Iron and Steel Works.

We are convinced that the introduction of this system will be very advantageous to the company. Improvements can be made in the technical conditions of the plant, the quality of production, and the volume of production, while specific maintenance costs can be reduced.

2. SUMMARY OF THE PROPOSALS

The managed maintenance system of the Danube Iron and Steel Works is completed according to the contract between UNIDO and Norconsult/IKO. The terms of reference for the project are accordingly respected.

Close cooperation between the counterpart and the consultants resulted in a complete system for managed maintenance consisting of:

a) A proposal for future organisation of the maintenance function and its relation to the other parts of the company. The proposed concept includes a centralisation of the maintenance function, a clear separation of responsibilities between production and maintenance, and a division of the maintenance function into logical units according to functions.

b) A system for central planning of all maintenance activities. The proposed system consists of a yearly plan coordinating all maintenance activities by means of a network planning technique.

c) A system for planning of maintenance work to be carried out within each production unit. The proposal consists of a system for planning of projects and repair jobs based on a work-order approach.

d) A system for planning of work, production of spare parts, etc. in the central workshops. The proposed system consists of a general production planning system well suited to the actual production of spare parts.

e) A system for preventive maintenance. The proposed system includes a registration and information system, as well as necessary routines and instructions.

f) A system for administration of spare parts and material. The proposed system consists of a centralised and coordinated material administration based on central files, uniform routines and a simplified decision-making procedure.

g) A cost control system covering all maintenance activities. The proposed system is based on the proposed organisational concept and distributes responsibilities, reporting and control accordingly. Its main objective is to improve cost consciousness throughout the organisation.

h) Coding system for:

Machine numbers
Account numbers
Drawing numbers
Spare parts numbers
Materials numbers

The proposed systems are elaborated as modular systems covering the whole enterprise.

i) Proposals for contents of all necessary data bases and files.

k) Description of EDP files, input and output request necessary for a later conversion to EDP.

l) Recommendation of a method for determining size of stocks and spare parts (see Article 10).

m) Recommendation of a method for project planning by use of EDP network (see Article 10).

n) Recommendation of a method for re-evaluation of plant layout (see Article 10).

o) Recommendation of a method for modern information files, copying equipment, etc. (see Article 10).

p) A complete education programme in maintenance management for both production and maintenance managers. This system is described in a report delivered for UNIDO in July 1975 under contract 75/2-13 (NUM/72/804).

The managed maintenance system is a manual system which can be brought rapidly into action, but a later conversion to EDP has been taken into consideration.

3. RESULTS

The implementation of the above-mentioned systems over a period of approximately three to four years will in our opinion change the situation of DV radically.

The following results will be expected by us as the minimum acceptable performance:

a) Higher quality organisation and maintenance managers to ensure better maintenance.

b) The administrative system will be improved and result in a better utilisation of the maintenance budget.

c) The lifetime of the production equipment, by unchanged production volume, will be improved by 10%.

d) The average breakdown time will be reduced by 15% of present value.

e) The quality of the finished products will be considerably improved.

f) The present maintenance level is below an economic optimum, therefore the demand for maintenance will increase. The new systems will improve maintenance efficiency by 10%; however, this improvement will show up as a higher level of maintenance. No reduction of the maintenance labour force is expected.

g) The efficiency of the central maintenance workshops, that is output per man-hour, will be improved by 10%.

h) A spare part stock will be established based on realistic, economic analyses. This probably means an expansion of the present stock level.

i) The new systems will release the highly technically educated persons in the maintenance function from some of their present time-consuming tasks. However, a large number of tasks demanding highly educated people remain, and we expect the technical staff in the maintenance function to be expanded.

However, we must stress that this is a major task for the organisation of the company, which must be recognised as such if optimum results are to be obtained. The system development phase of this project has been injuriously affected by lack of capacity from the counterpart's organisation. In order to achieve successful implementation of the proposed systems, it will be necessary to allocate qualified full-time personnel to the project for a number of years.

In addition, there are three important conditions:

- The top management of the Danube Iron and Steel Works must consider the implementation of these systems as a responsibility demanding priority.

- The need for maintenance and the potential of the maintenance organisation to meet the demands must be realistically analysed, and changes in capacity must be carried out accordingly.

- The advanced training of managers in modern management techniques must be accelerated at all levels.

The duration of the complete implementation is preliminarily estimated to require approximately four years. This estimate is based on the above-mentioned conditions and some participation by the consultants.

4. CONCLUSION

The proposed time schedule is based on the following assumptions:

1. A group of 8-10 highly qualified engineers and economists working full time on the project.

2. Consultants' participation during the first year of implementation.

3. Considerable participation by other DV personnel, i.e. the EDP Department, Accounting Department and Organisation Department.

4. Considerable participation of the future users of the system, such as maintenance and production managers.

However, the participation of others should not be so great that it will disturb their normal duties.

If the scheduled time is to be reduced to about two years, the project group should be expanded to about 20 men on full-time basis. Furthermore, we estimate that the staff's and the users' participations should be considerably expanded.

For instance, the EDP Department should be supplied with approximately 10 trained system development engineers and at least 15 trained programmers. In addition, some software should be bought from outside.

Each production and maintenance manager should participate in the project at least one day per week. In order not to disturb the production demands, some hundreds supplementary managers will be required.

We must stress that such a schedule seems unrealistic to us.

Attachment 2

PROJECT MANAGEMENT PRINCIPLES

MEMO CONCERNING PROJECT MANAGEMENT

To Mr. Répásy, G., director from IKO-Konsulent, Frydensberg, G.

According to our discussions in the meeting of September 4, I hereby as promised give my comments on organization of the large investment project planned for D.V.

IKO has assisted a number of companies with project management. The method we are using is based on the method developed in the USA for managing the space programs. However, it is adjusted for practical commercial use. For instance, we have developed a large EDP-network program which enables us to control time schedule, use of resources and cost development. This model has been developed over more than 5 years. The large EDP-company UNIVAC has investigated world-wide all existing large EDP-network programs in order to buy the best. In January they bought our program.

The philosophy of our method for project management is simple. A project is a large activity, which normally shall be carried out one time only. A project has a clear objective and it is controlled independently. A project is a development task which shall end up as a running enterprise. A project is defined both in time and in costs.

Therefore a project is very different from the daily work in an enterprise and shall be organized and controlled in a different way.

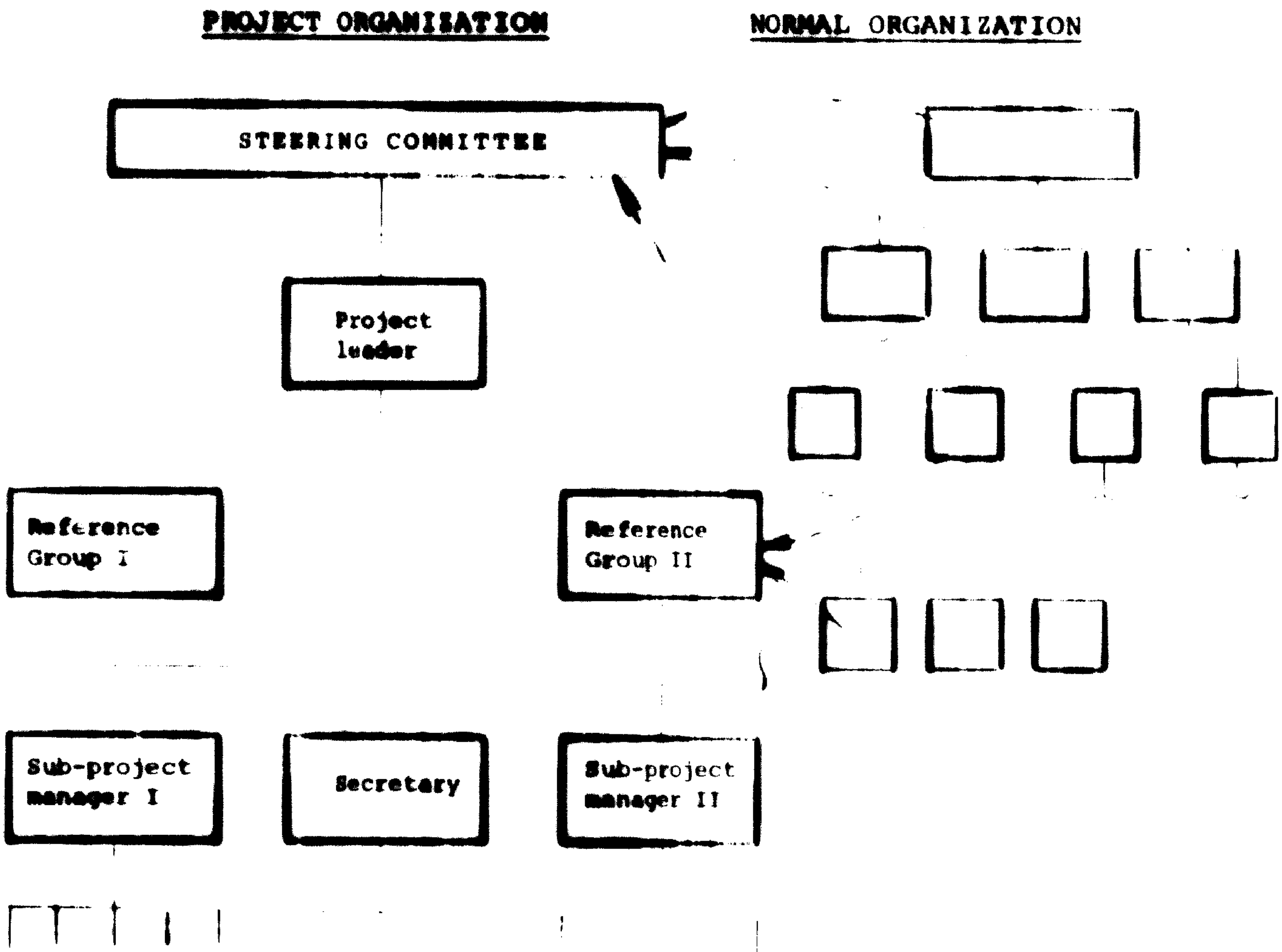
The head of a major project shall be a Steering Committee consisting of 5-10 persons. One person is chairman of this group. The Steering Committee (SC) makes the major decisions, earablishes the objective of the project, gives the economical frames, and the basis time schedule.

Responding to the SC is the project leader. He will be the same man during all the project time. His first duty is to form and guide a planning group for executing the time scheduling and economical plans. He will break the project down to a number of first-degree sub-projects (approx. 20) and a large number of second-degree sub-projects (approx. 100), each of which is again divided into activities.

Responding to the project leader are the managers of the sub-projects. Each manager, managing one or more sub-projects, will define his sub-projects corresponding to the overall objectives of the project. The definition will be controlled by the project leader. The sub-project manager then will complete detailed work plans for his sub-projects. He shall also establish contact to the future user-organization and to all existing units which are involved in or are disturbed by the project.

2/...

This leads to the following structure:



Working on the project are three different kinds of persons:

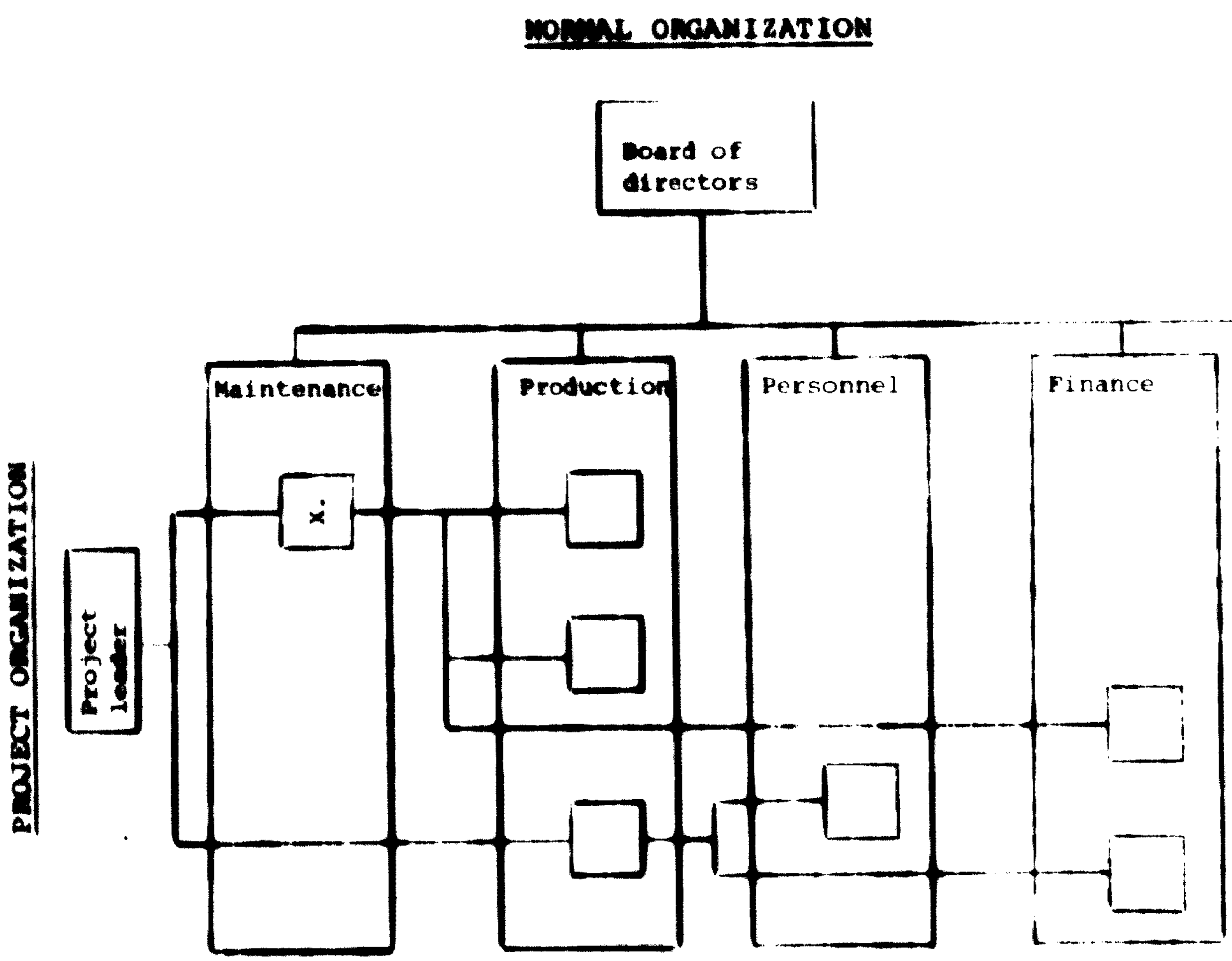
1) Those who are participating part time in reference groups, etc.

2) Those who are transferred to the project organization for a period of time.

3) Those who must work at the same time on the existing production and on the project.

Groups 1) and 2) cause no other problem than to evaluate who is the best person for a certain sub-project taking into consideration both the viewpoints of the existing production, and the project, and the future organization in order to utilize the experience from the project in the best way.

Group 3) often causes problems and therefore a matrix-organization for this is established. The structure is as follows:



Each person in group 3) has two chiefs during the project time. Normally, each person in this group is responding to the normal organization concerning technical problems and personal questions and to the project organization concerning progress in the project.

This organization can function only if good relations between the project leader and the technical managers are established.

A basic condition for controlling large projects is the use of EDP-network planning. This is the only way, during the total project time, to be sure that the planning is ahead of the work done, and the only way in which to get immediate warning in case of deviation from budgets and plans, and the only way to communicate enough detailed information for control.

Another important use of EDP in project management is for the preliminary evaluation of the technical solutions and their impact on the future economy of the company. For this purpose IKO has developed another EDP-program, a kind of budget simulation model. This is not more than one year old, but has already proved valid in approximately 15 companies.

If D.V. wishes to get any more information about the method recommended by IKO, I shall certainly be happy to supply you with such.

9th September, 1975 IKO/GF

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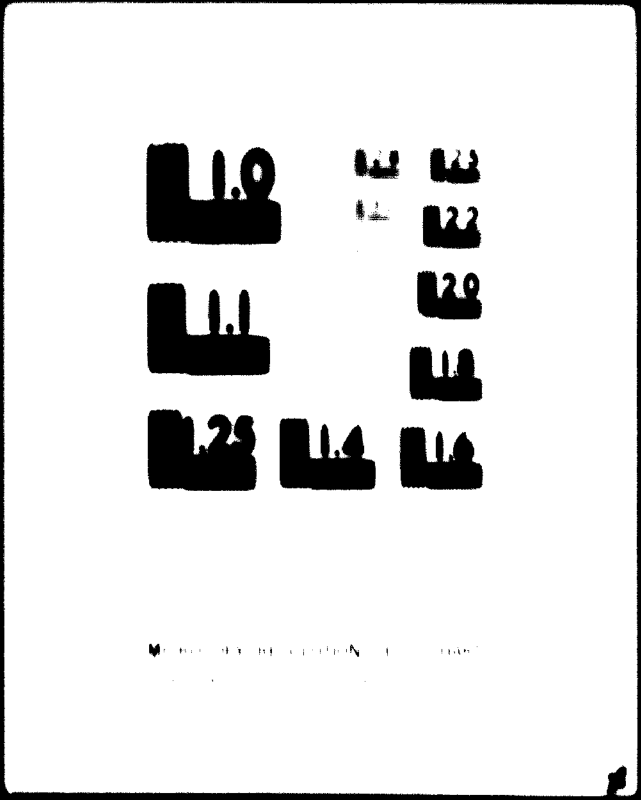

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Attachment 3

METHODS FOR EVALUATION

OF

OPTIMUM SPARE PART STOCK

Basis for the Inventory Control Technique

The techniques which nowadays are applied to managing the maintenance parts are based on:

1. Thorough recording of the material usage to make a statistical forecasting.

2. Knowledge of the usage or the lifetime of the components for calculations.

One of the largest, single expenditures is precisely for components for which

- there is no statistical material (the usage is too low)

  or

- usage or lifetime is unknown.

Nevertheless, one may feel these components are necessary in the production and maintenance functions because it is impossible to know which problems may arise.

These components could be named "unrecorded spare parts" and ought to be considered as insurance against unforeseen events.

Determination of the Size of the Stock

Normally, the calculation of the safety stock can be based on demand and time of delivery in conjunction with a policy regarding the probability for a shortage of spare parts (service level).

The decision of storing "unrecorded spare parts" (which is often a decision of buying or not) requires, however, that more economic aspects be taken into consideration.

The calculation method which is here presented for "unrecorded spare parts" is based on the following assumptions:

1. The possibility of calculating component failure.

2. Advance calculation of the economic consequences of a stop.

3. A purchased spare part will maintain the full value during storage period.

4. If inapplicability or normal consumption occurs the whole investment is used.

If those assumptions are fulfilled the following principal statements can be made.

A spare part is to be kept in stock if and only if:

> the possible cost of breakdown during the remaining lifetime for the machine exceeds the possible costs of inventory and the possible costs of inapplicability.

If this statement is to be converted into mathematical terms the following parameters must be known:

- the frequency of failures with the component
- the function of the failure distribution for the component
- the price or alternative cost of the component
- the costs of breakdown
- the remaining lifetime of the equipment
- the internal interest rate.

However, all the above parameters cannot be known, and therefore the next part of the course includes other available practical methods.

Cost Analysis of Shortage of Spare Parts

In the first place our analysis concerns those components for which purchase or non-purchase may have great economic consequences, both positive and negative.

Our interest is in the economic decision whether or not the spare parts should be stored.

Breakdown causes a certain cost whether or not the spare part needed is in stock. But the magnitude of the costs is directly dependent upon the time used for repairs.

On this basis the following term is used for cost of shortage of spare parts in connection with breakdown in production. The cost of shortage is:

> Difference in total costs until the production item is repaired, which depends on whether or not the spare parts are in stock.

The cost of shortage thus is a function of time, based both on lost production hours and on the period required for purchasing spare parts.

Service Requirements and Economy

For components with high volume usage, ordering and inventory turnover (the quantity expected to be consumed before resupplying) is determined by demand and purchasing.

The safety stock (for components with low volume usage this is generally denoted as stockpile) is determined by the service level requirements. This influences the costs of inventory which will increase in conjunction with increasing safety stock.

The level of service need not be the highest possible, but it must be balanced with the demand in order to give an optimal economic result. This brings about the question of costs with regard to shortage of spare parts.

Figure 1 shows

> a simplified principal model of variable costs as a function of the size of the spare part stock. Costs of purchasing and keeping spare parts in stock increase, whereas costs caused by shortage of spare parts in stock decrease, when spare part stock increases. A certain area is obtained which represents an economic maximum.

Service Level

Service levels may be defined in many different ways, but here the following term is used:

$$\text{Service level} = \frac{\text{Demand that can be satisfied from the stock}}{\text{Total demand}} \times 100$$

We shall use this definition in the following.

A description of total variable costs as a function of the service level can be found in Figure 2.

> Theoretically the service level can be between 0% (no stock) and 100% ("maximum" stock which precludes any shortages). These extremes are to be avoided for components with high volume usage when optimal economic results are desired.

A further discussion of costs of shortages as well as for stockpile will come later.

Fig 1.

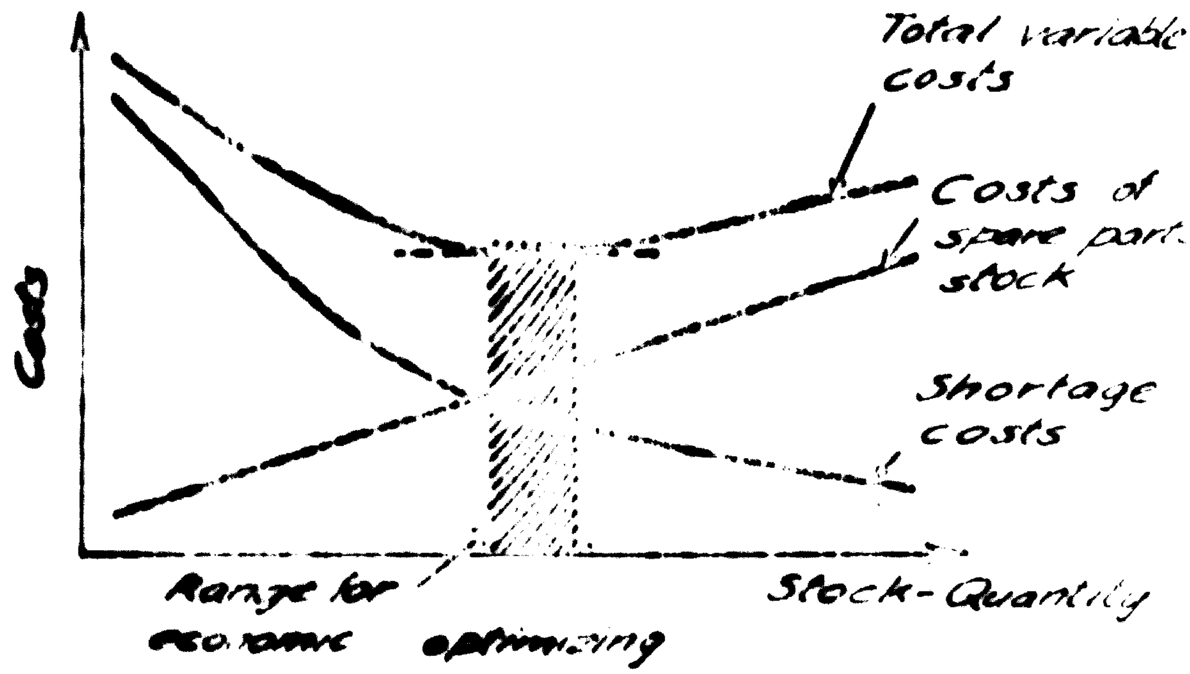
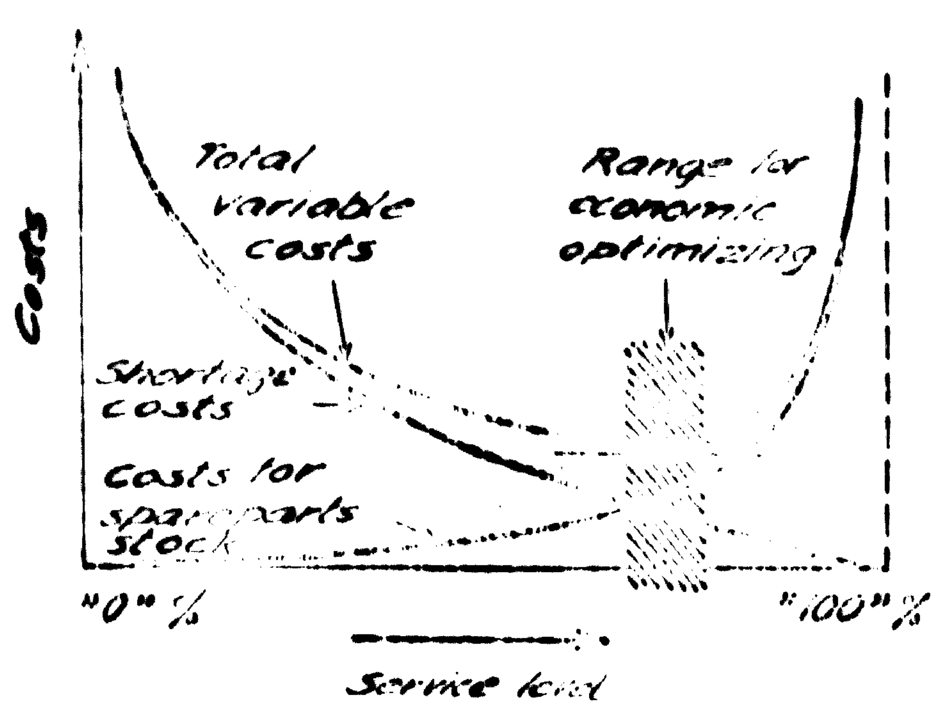

Total variable costs
Costs of spare parts stock
Shortage costs
Costs
Range for economic optimizing
Stock-Quantity

Fig 2


Total variable costs
Range for economic optimizing
Costs
Shortage costs
Costs for spare parts stock
"0" %
"100" %
Service level

In order to estimate relevant probability models for the components of interest, some general models are presented based upon the periodical frequency of demand.

Probability Models

We shall show how materials used in the past three different components, A, B and C, can indicate their very different distributions of demand. The examples are greatly simplified. Figure 3 shows how the demand per component is recorded per period when the length of period is the purchasing time of component (= administrative time in connection with ordering + time of supply + time for receipt).

Examples :

Component A - Period 1: 3 pieces, Period 2: 10 pieces, etc.

Component B - Period 2: 1 piece, Period 2: 2 pieces, etc.

Component C has a greater use and represents several periods.

In Figure 4, all periods with equal demand have been added up separately and the result is shown on the right side of the figure in the histogram.

Component A

The mean demand is $\bar{S}$ = 4.25 units, whereas a demand of three units prevails during most periods.

The distribution may be a typical Poisson distribution (the curve has been expanded in the figure). It is a simplified test to examine whether the standard deviation (σ) is equal to the square root of the mean ($\sqrt{\bar{S}}$).

$$\sqrt{\bar{S}} \stackrel{?}{=} \sqrt{\frac{(S_i - \bar{S})^2}{n}}$$

(The right side of the equation presents the formula for the empirical standard deviation).

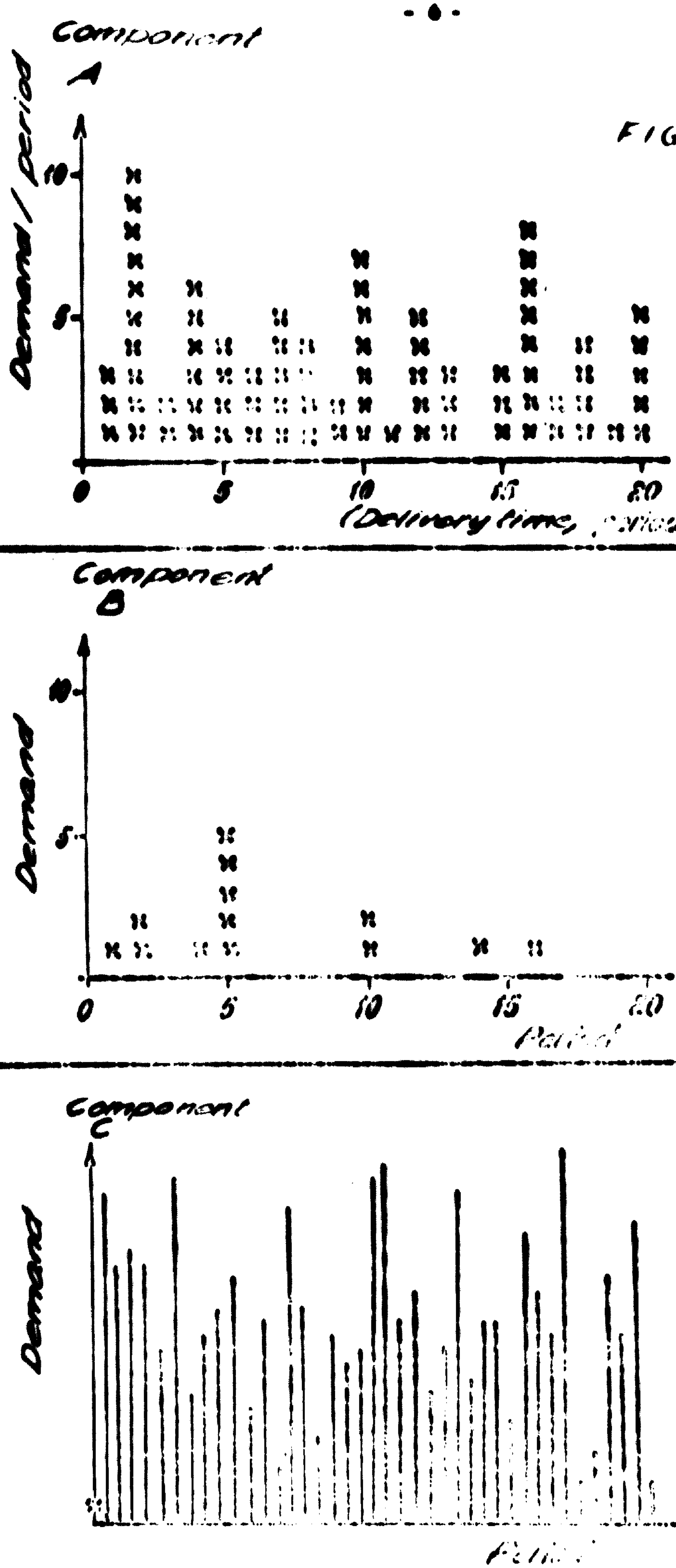
Empirically the Poisson distribution agrees with the real distribution in the case of relatively low demand.

The Poisson distribution with the parameter λ t can be expressed in the following way:

$$P\ (X = x) = \frac{(\lambda\ t)^x}{x\ !}\ e^{-\lambda\ t}$$

[redacted]

FIG 3



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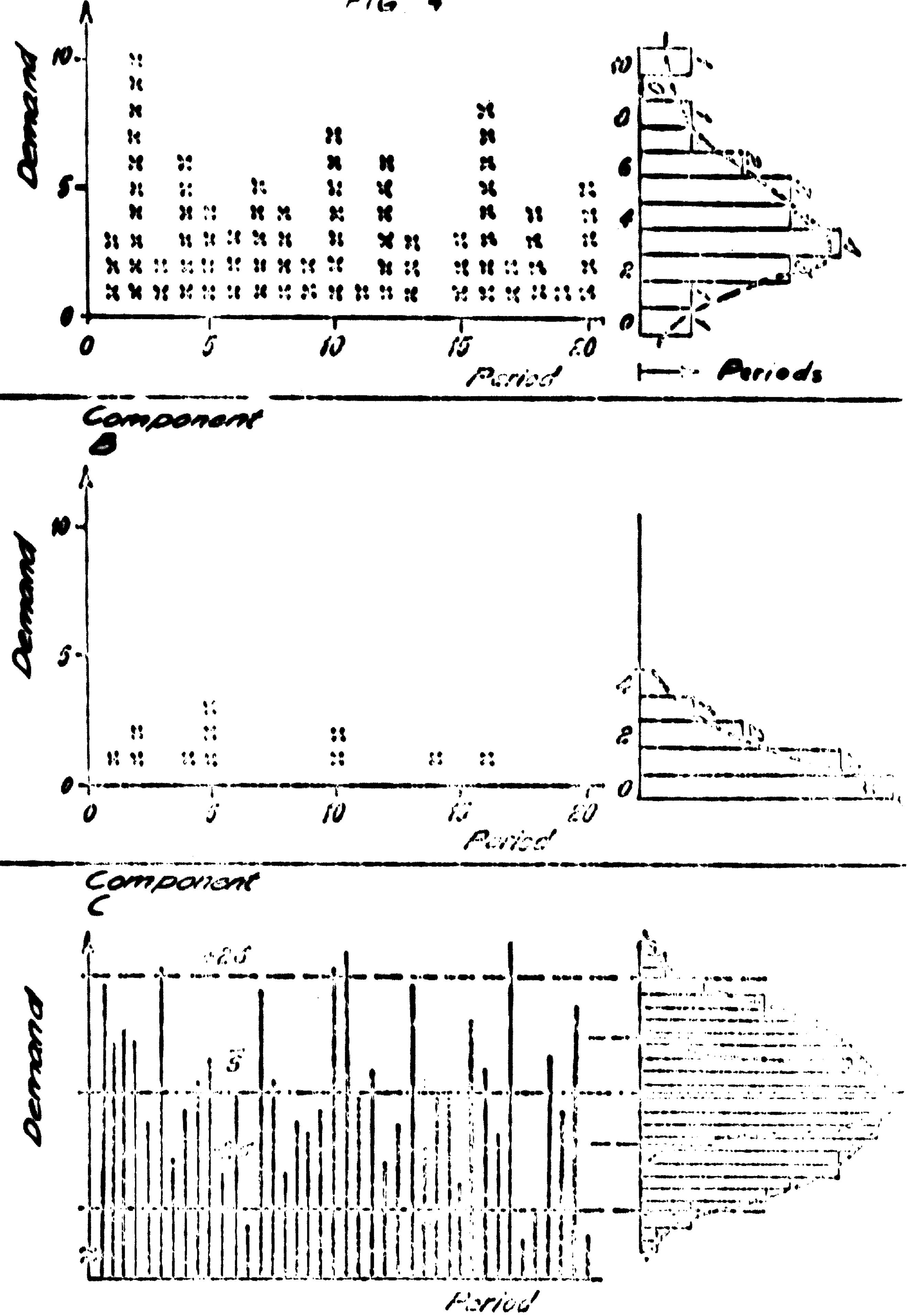
Component A

FIG. 4



where λt is the frequency of events in the period of time $(0,t)$ and $P(X = x)$ is the probability for exact x events in the same interval.

Component B

There has been demand for this component only for about a third of the period. We are interested in the probability for the first event at the time T within the period $(0,t)$.

The probability distribution for T will be:

$$F(t) = P(T \leq t) = 1 - P(T > t)$$

$P(T > t)$ is the probability for the fact that there will be no events within the period, i.e. $x = 0$ in the former equation which gives

$$P(X = 0) = \frac{(\lambda t)^0}{0!} e^{-\lambda t} = e^{-\lambda t}$$

Expressed in our current terms:

The probability for lack of components within the period $(0,t)$

$$\underline{F(t) = 1 - e^{-\lambda t}} \quad (t > 0)$$

This distribution is called the exponential distribution.

Component C

Relatively great demand generally gives a normal distribution. In the figure the demand is distributed around a mean, C. Based on the service level 95.5%, the limits 26 and -26 are depicted on the figure. Between those limits 95.5% of the demand is found. (An example of a smaller distribution around the same mean value is shown too).

Mathematically the normal distribution can be expressed as follows:

$$Y = \frac{1}{\sigma\sqrt{2\pi}} \cdot e^{-\frac{1}{2}\left(\frac{X-\mu}{\sigma}\right)^2}$$

μ = the mean value

σ = the standard deviation

The normal distribution is not very interesting in this connection and will not be further discussed.

In accordance with the former reasoning, our interest is directed towards components with high purchasing and storage costs and correspondingly high costs of losses in accordance with shortages where the probability of shortages during a certain period is difficult to estimate.

The components in question have a very low frequency of usage and often the problem is whether or not to buy a unit.

On the basis of the probability distribution introduced, we are using with good approximation, the exponential distribution as a basis for a model development. The model, which results in a "nomogram for analysis of spare parts", makes a practical application of the total reasoning of shortage costs.

In the following we shall explain the concept "Shortage costs" and the construction of the model.

Cost of Shortages for Spare Parts

The basis is two different situations in connection with breakdown of machinery:

1. Special spare part is in stock
2. Special spare part is not in stock

In both cases loss arises as a consequence of stop time necessary for the repair of machinery. This loss (cost per time unit as a consequence of lack of production) often varies with the time used, which is to be considered when fixing the shortage costs.

The variety may be caused by the possibility that a buffer inventory, for instance, has been "consumed", which increases production costs because of production on another machine, extra time, etc.

In accordance with the previous description the evaluation of the following parameters is needed in order to decide the shortage costs.

K	Cost per time unit (N.B. function of time) until the machine has been repaired.
$T_{without\ stock}$	Number of time units which represents the loss of production until the machine has been repaired when no spare parts are in stock.
$T_{with\ stock}$	Number of time units which represents the loss of production until the machine has been repaired when spare parts are in stock.

$$K_B = K\left({}^{T}\text{without} - {}^{T}\text{stock}\right) + \text{special costs}$$

The above formula applies to the shortage costs.

Taking into consideration K's function of the time, the following term can be used:

$$K_B(t) = K_1(t_1 - t_o) + K_2(t_2 - t_1) + K_3(t_3 - t_2) + \ldots.$$

where

K_1, K_2 .... are current costs for corresponding intervals of time within the period (^{T}without stock $-{}^{T}$with stock).

Figure 5 shows an example of shorage costs with varying K.

Figure When spare parts are not available the repair should be planned and prepared during the purchasing period. This often reduces necessary time of repair compared with immediate repair after breakdown.

The example implies step-wise variety in the cost. A description in accordance with the enclosure gives a good idea of the calculation.

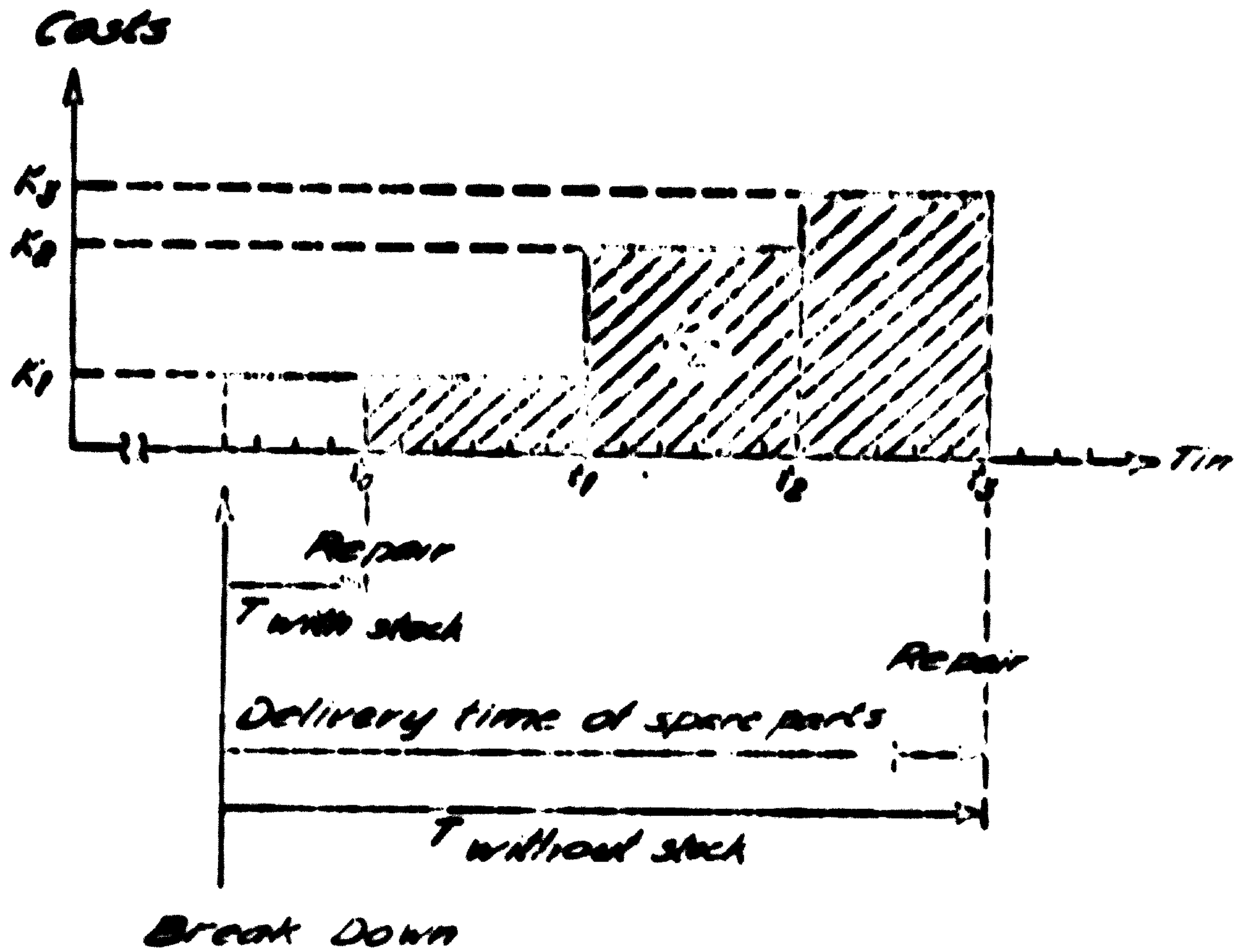
Comments concerning repairs:

K, cost per time unit	All probable alternatives which can contribute to reduced losses should be taken into consideration, e.g. - possibilities of production substitution within own company - borrowing of machinery - production by another company - purchasing of (semi-) products.
^{T}without stock respective of ^{T}with stock time until machinery has been repaired	Attention should be paid to all circumstances that can bring about the shortest possible time of repair, e.g.: - possibility of forwarding spare parts by express - loan from elsewhere - possibilities for manufacturing or repairing spare parts in own or another workshop - access to necessary drawings for manufacturing/repairing/assembling - readiness and know-how within own organisation

[redacted]

FIG. 5

Calculation of shortage costs



$$K_{ts} = K_1(t_1 - t_0) + K_2(t_2 - t_1) + K_3(t_3 - t_2)$$

- purchasing of know-how from outside the company.

K_B shortage costs	At the final evaluation, special costs should be added, e.g. extra workshop costs, etc.

Analysis of Spare Parts

Maintenance costs include among other things costs of material. The material administration ought to be regarded as an integral part of maintenance, and its objective ought to be:

> To minimise under given conditions the costs of capital investment and capital consumption.

The phrase "given conditions" refers to many considerations, among which are fixed service level and production plans and requirement of production availability. For the stock administration of spare parts, the "minimising of costs" implies a weighing between the following types of costs:

1. Probable costs for lack of production and repair of failures when special spare parts are not available.

2. Probable costs for having special spare parts in stock (costs of storage and spare part inapplicability).

Our reasoning is based on a reliability technique which calculates:

- The probability of need for a special spare part during the economic life of the machine.

- Probable cost for lack of production caused by shortage of a special spare part.

- Probable cost of capital investment for a special spare part.

- Probability that special spare parts become inapplicable (e.g. the machine for which they should be used has gone out of production), and costs of spare parts.

A spare part ought to be in stock only if the calculated shortage costs exceed those of inventory and the inapplicability of spare parts.

Model Description

The requirements for storing a spare part:

Calculated shortage cost	>	Calculated cost of inventory	+	Calculated cost of inapplicability of spare parts

The probability of failure, i.e. the need for spare parts during the remaining economic life of a machine's T years is

$$F\ (T) = 1 - e^{-\lambda T}$$

The probability that no defect occur will then be

$$F\ (T) = e^{-\lambda T}$$

From this the following term can be tabulated

Calculated shortage costs	$K_B\ (1 - e^{-\lambda T})$
Calculated costs of inventory	$A \cdot r_1 \cdot \frac{1}{\lambda} (1 - e^{-\lambda T})$
Calculated costs of inapplicability of spare parts	$A \cdot e^{-\lambda T}$

Symbols:

Frequency of failures (frequency of events) = $\frac{1}{Z}$, where Z expresses the mean time between failures (MTBF).

Often information of the current spare part's lifetime is available, and a probable value of Z may be estimated on the basis of former experience. It can be practical to divide up the spare part assortment in "MTBF groups" where the placing of spare parts is made by professional experts within the company.

T — Remaining economic life of a current machine or maintenance item. (Estimate of the length of the machine's productive function in the future).

A — <u>Price of Spare Part</u>

Often the price is known and can be utilised as a parameter in order to find out which calculated shortage cost is necessary to motivate the purchase of the spare part.

Even the total price may be used as a basis for calculation of costs of inapplicability of spare parts because full price must be paid when buying unavailable spare parts.

r_i Interest rate, as an expression for total costs of stock and as a basis for investment decisions. It is realistic to include the following general types of cost in "r":

- Costs of capital	(8-15%)
- Wages and social benefits	(3- 8%)
- Storing facilities	(2- 5%)
- Costs of stock (tools and transport etc.)	(2- 5%)
- Administration costs (control, administration, recording)	(1- 3%)
Total approx.	(15-35%)

The figures vary very much from one company to the other (and from one country to the other).

For the relationship between shortage costs and "maximum acceptable" price of spare parts the following equation can be set up:

$$\boxed{\frac{K_B}{A} > r_i \cdot \frac{1}{\lambda} + \frac{e^{-\lambda T}}{1 - e^{-\lambda T}}}$$

This equation is directly transformed into a nomogram with the following logarithmic scales (Figure 6).

Z years or hours — MTBF, the scale covers 0, 1-20 years or 500 - 150,000 hours. The transformation from years into hours is based on three shifts with one year representing about 8300 hours.

T years — Remaining economic life of the maintenance item. The scale covers 1-20 years.

r_i% — Interest rate for costs of stock. The scale covers 10-50%.

A kr. — Shortage costs. The scale covers 500 - 1,000,000 kr. (or $ etc.)

a and b — Scales for the purpose of finding c.

c — The ratio between shortage costs and maximum acceptable price of spare parts.

An example has been described in the nomogram. Coloured scales have been used in order to preclude misunderstandings. Corresponding scales have the same colour.

Figure 6 shows an example of the application with uncertainty in the parameters:

Encl. 8 Example of utilisation of the nomogram. MTBF has been fixed at 3 years. T is uncertain and has been fixed at 5-10 years. r_i is difficult to calculate, but the area 25-35% has been estimated. Price of spare parts: 3000 kr.

1. Place a ruler between Z = 3 years and T = 5 years respective of 10 years.

   The value of "a" is approximately 0.03 - 0.2.

2. Place a ruler between Z = 3 years and r_i = 0.25 respective of 0.35.

   The value of "b" is approximately 0.75 - 1.05.

3. Maximum variation for a + b = c is approximately 0.78 - 1.25.

4. Find the area 0.78 - 1.25 on the c scale. Draw lines from these ends through A = 3000 kr. and find the corresponding ends in the K_B scale, which gives as result: K_B approximately 2300 - 3700 kr.

If the shortage costs are estimated to be within this area, special discussion is advised.

If K_B is > 3700 kr. the spare part should be bought.

If K_B is < 2300 kr. the spare part should not be bought.

Administration of Stock

Presentation of Problems

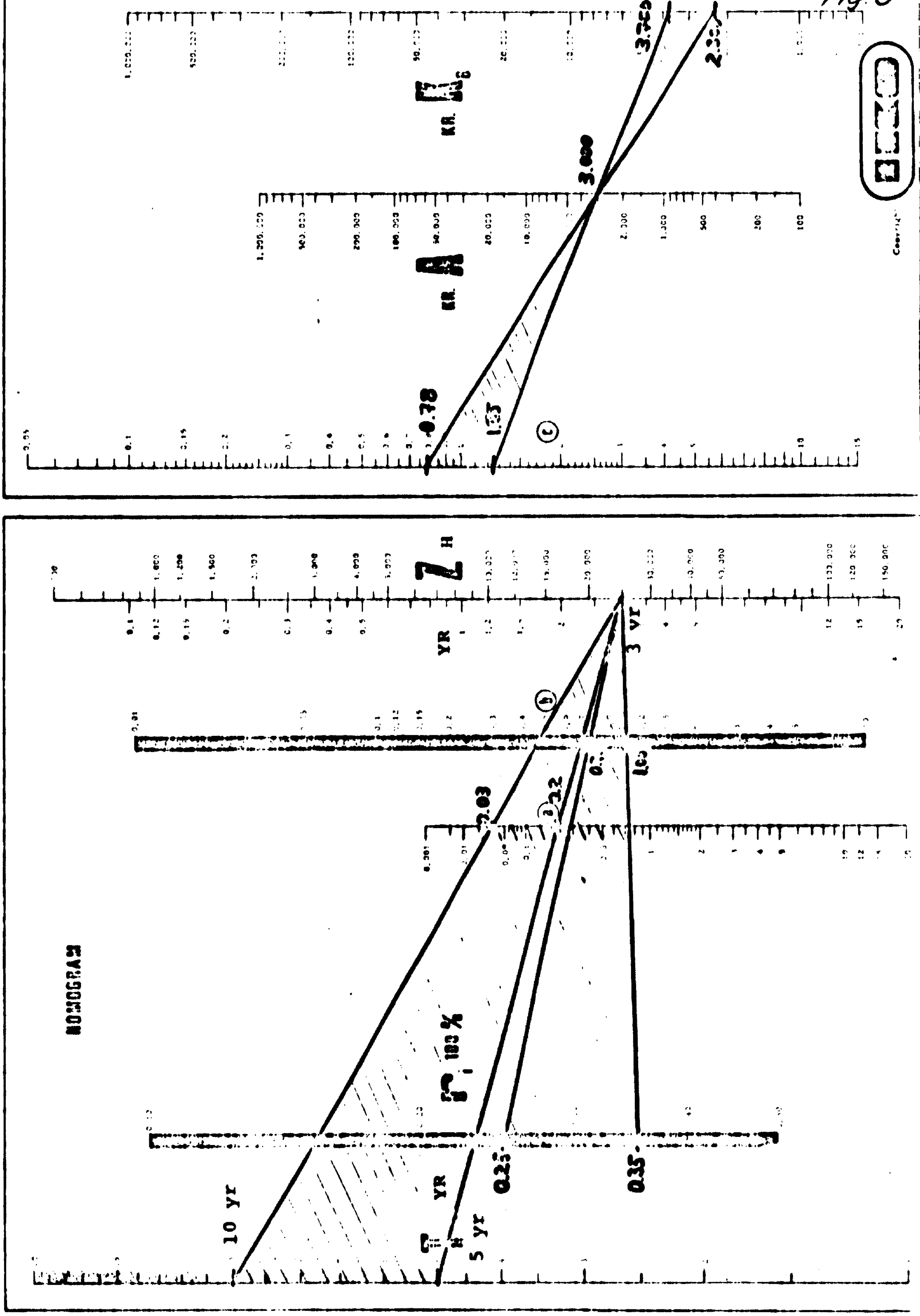
In the literature many descriptions of systems for administration of stock can be found. These descriptions tend then to elucidate general problems of stock and special problems concerning spare parts and consumption material.

A stock system is an administrative system for control and administration of stocked material. If possible, the system should establish a high service level and a low capital investment and low administration costs. Therefore, in this area great conflicts arise when an optimal weighing is difficult to procure and, for that reason, a general system solution can not be presented.

Whether the system is treated completely manually or is based on EDP, there are two questions that ought to be answered in the first place.

- How much has to be ordered?
- When must it be ordered?

Fig. 6



Prognosis

The purpose is to estimate the future demand in a satisfactory manner.

The traditional method for such estimates is to extrapolate future demand from the past. To achieve good results two important conditions are required:

- There must have been over a period of certain systematisation in the demand, so that mathematical formulas can be used.
- The proposals must be based on sufficient historical data.

In EDP systems four prognosis models are often used:

- Horizontal
- Trend
- Seasonal/cyclical
- Trend-seasonal/cyclical

The horizontal demand has irregular deviations around a constant average, whereas the course of trend increases or decreases during a long period. For the seasonal demand it is required that the deviations occur regularly in the same period, e.g. the same year, and that they substantially exceed the average need. Trend-seasonal/cyclical is a combination of the two latter courses.

Exponential Smoothing

For the forecasting of demand different methods can be used, e.g. slighting averages, least squares, etc. A method often used in the EDP system is exponential smoothing which requires very limited data storage and calculation time. It can be of first degree, second degree, etc., and thereby be different for various curves of demand.

However, the most utilised method for horizontal demand is the first degree, that is simple exponential smoothing.

The expected requirement in the period to come (B_{i+1}) is the past period's expected requirement (B_i) plus a fraction (α) of the difference between real demand (E_i) and (B_i), that is

$$B_{i+1} = B_i + \alpha (E_i - B_i)$$

The smoothing factor may vary from 0 to 1. Normally, a value of the magnitude 0.1 - 0.3 is used in order to prevent fluctuations that are too great.

Economic Quantity of Orders

When calculating the so-called economic quantity of orders, the well-known simple square root formula is often used.

$$Q = \sqrt{\frac{2N \cdot S}{A \cdot r}}$$

The symbols are:

- Q Economic quantity of orders
- N Demand per period (e.g. years)
- S Order cost
- A Price per unit
- r Storage factor

The formula gives a cost minimum for costs of orders and stock on condition that:

- these costs are essential
- no quantity discount can be obtained
- the marginal costs of orders with regard to those in stock of another unit are constant
- the total quantity is delivered at the same time
- the packing does not influence the quality

These conditions may, if necessary, be considered through, for instance, variable values or conditions in the calculation.

As far as spare parts are concerned, it is in many cases easier to reorder up to a maximum level.

Reordering Point

In order to administer the stock, reordering point (-level) is often used. This should be of such a magnitude that the quantity generally covers the expected requirement prior to expected time of delivery. If control in relation to reordering point is made only periodically, the requirement under the corresponding time should also be considered. Since the requirement and the purchasing time include uncertainty, a safety stock is an important measure.

That is the reordering point:

$$P = B_i (t_a + t_p) + S$$

The symbols are:

- B_1 Expected requirement per time unit
- t_a Purchasing time
- t_p Time between two controls of reordering point
- S Safety stock

Purchasing Time

The purchasing time is a very important factor for the reordering point. If the uncertainty is great, the safety stock must reflect this.

The purchasing time is the time from which the reordering impulse has been given to when the material is available for usage. It includes delivery time and administrative time for reordering, receipt, control, etc., and transport time which does not influence the delivery time.

Geographical location, agreement with suppliers, etc. influence the purchasing time from one company to another depending upon the system. Moreover, the trade conditions may influence the suppliers' service level and thereby cause greater uncertainty. However, with flexible systems and agreements with suppliers, consumption material and consumption spare parts usually can be procured on short notice.

Requirements During Purchasing Time

A projection method by means of exponential smoothing has been described. If there is a "high and smooth" demand during a long time it is possible by this method to obtain an acceptable average of the requirements during the purchasing time. Moreover, the demand often can be normally distributed.

Normally, most spare parts do not meet this requirement. They have a low frequency, even when taking a long purchasing time into consideration.

Often consumption components have a greater demand but usually a short purchasing time, which often implies a Poisson-distributed demand.

If, moreover, free available local stock is frequently used for cheap components whose consumption is recorded only when there is normal distribution, the recorded practical demand will be very low.

Using the Poisson-distributed demand with a majority of zero values, it is not acceptable to use exponential smoothing with fixed smoothing factor. Another method is to use a variable α with a low value, in case of zero values and a high one in other cases. Naturally, there is a risk that large withdrawal from the stock for a planned work will strongly increase the average demand and thus the reordering point. Perhaps the material ought to be re-ordered externally for this piece of work.

Safety Stock

First and foremost the safety stock should pick up the uncertainty in

- demand (during the purchasing time)
- purchasing time
- stock balance

The safety stock for a certain material gives a certain service level which is here the percentage of the total demand than can be satisfied from the stock.

The service level increases with increasing safety stock. But the costs of the latter increase and grow abnormally high if 100% service is the ultimate aim.

If the distribution of the demand, for instance, is normal, the "degree of deviation" can be found by calculating the Mean Absolute Deviation (MAD):

$$MAD = \frac{1}{n} \cdot \sum_{i=1}^{n} \left|(E_i - \bar{E})\right|$$

Where E_i is the demand in period "i" and E is the arithmetic mean value of the demand.

Between the standard deviation σ and MAD there is the following connection:

$$\sigma = 1.25 \times MAD$$

By using this formula a connection can be obtained between safety stock and service level

$$S = k \times 1.25 \times MAD$$

In this formula "k" is the safety factor or amount of standard deviation from the mean value, e.g.

Service level	**"k"**
50 %	0
84 %	1
98 %	2
99.8%	3

(In statistical tables more accurate statements are made).

Since the service level should first and foremost reflect the costs of shortages, it can in many cases be troublesome to work only with one value in a company. Normally, the costs of shortages vary a great deal between different types of components.

The rules described give only an indication of the methods and problems which are present within this area. Practical and theoretical details can greatly change this simplified picture of reality.

Attachment 4

MICROFILM TECHNIQUE

MEMO CONCERNING MICROFILM

1. Introduction

This paper is a resume of IKO's experience in the field of microfilming. Below is described the state of the art, technique and the economy of this method. However, before introducing microfilm techniques at the Danube Iron and Steel Works, certain Hungarian conditions should be considered, especially who the suppliers are, which services they can rent and what price relations are.

2. State of the Art

The term microfilm refers to the reduction of original documents onto photographic film using one of the various microfilms such as microfilm or microfiche. The micro image appearing on the film can be from one-fifth to 1/22,500th of the size of the original document. And that is where the bulk of the saving comes from. It is estimated that by converting paper files onto microfilm, a company can save up to 90% of the space used to file its documents, thus realising impressive rental space savings.

In addition, there is often greater security by having the information stored on microfilm, and reference to information can be more efficient and quicker.

Basically there are two types of microforms. One is microfilm of 35 mm or 16 mm. Since the information is in sequence, this form is better for archival records. The film roll needs to be wound through a reader either manually or mechanically; these readers are expensive.

The second form is microfiche (French for a file index card) which is more flexible and thus accounts for about 70% of the market. The most common microfiche is a durable sheet of film, 6 inches by 4 inches, and contains 98 pages of information at a reduction ratio of 24, or 208 pages at a reduction of 42.

The equipment needed to run a microfilm system in the office includes a camera to film the documents, film, facilities for film processing, storage cabinets, microfilm readers, printers, duplicators and enlarger printers. It is not essential to have all this equipment as some of the processing can be contracted out. UDT, Britain's largest private financial institution, bought a camera, processor cabinets, readers and duplicators for about £25,000. The company reckons that it is saving about £32,000 a year, against the alternative of extending its paper filing system for customer records.

By 1975, UDT estimates that it would have needed to file some 10 m papers in 1 m customer accounts, requiring some 9000 sq.ft of space. But its customer file library at Holbrook House, Cockfosters, was already occupying 8800 sq.ft. The stimated £32,000 a year savings comes from 70% on space and the rest on staff savings - since an increase of 50% in staff would have been needed to service the larger library. The savings are net on annual consumables like microfiche jackets amounting to some £11,000 a year.

Microfilm market leader in the U.K. is Kodak and the company also claims to have the largest microfilm micropublishing bureau in Europe at its Fulham, South London plant. Because the market was first developed in the U.S., the U.K. market is dominated by the international groups. Bell and Howell, for instance, states the company's 1973 annual report, "is placing prime emphasis on development and sales of micro-imagery equipment, systems and supplies. In terms of sales it is the company's largest and fastest growing business - 46% domestic sales increase in 1973".

That growth for the domestic U.S. market compares with a growth in the same period of 73% for Europe.

Market shares are difficult to come by and the different sectors of the market are shared in different ratios by the participants. Some of the U.K. firms, like Microfilm Reprographics, enjoy substantial business in their fields. Agfa-Gavaert, a newcomer to the market, is hoping to make an impression by forming a rental base.

Broadly, a breakdown of the market by consultants G. Baker and Associates shows that about 40% is business systems and records, 30% engineering documentation, 26% micropublishing and 4% government. Within that breakdown a growing sector of the market is computer output microfilm - a system which provides a method of converting computer-produced magnetic tapes directly into human readable data, but on microfilm instead of on a paper printout.

3. General List of Terminology

3.1 Technical Microfilm Techniques

Normally used for microfilm processing of drawings.

3.2 Administrative Microfilm Techniques

Normally used for microfilm processing of documents, files, etc.

3.3 Aperture Cards

A punch card containing a photo of a 35-mm microfilm.

3.4 Cine Mode/Comic Mode

The orientation of the picture of the film Vertical/Horizontal.

3.5 COM, Computer Output Microfilm

An electronic machine which can convert magnetic tape from the EDP equipment directly for microfilm at a much higher speed (15 - 50 x) than normal printers.

3.6 Diazo-Vesikular

Two different methods for copying microfilm. Developed by Ammo/nium/heating.

3.7 Eye Ball

Large letters, enabling direct reading of the microfilm.

3.8 Jacket

Card for filing parts of film rolls.

3.9 Readers

Equipment necessary for transformation of microfilm to readable material. Normally supplied with copying equipment and then called Reader-Printers.

3.10 Magasin

Casette for film for special readers.

3.11 Micropublishing

The microfilm used directly for communication.

3.12 Microfiche

Film card, normally 105-148 mm covering a number of pictures between 60 and 244.

3.13 Microfilm

Normally in rolls of 16.35 and 105 mm.

3.14 Reduction

The reduction ratio, for instance 48 times reduced, is written as 48X. For the COM system are 24X, 42X and 48X standards.

3.15 Roll Film

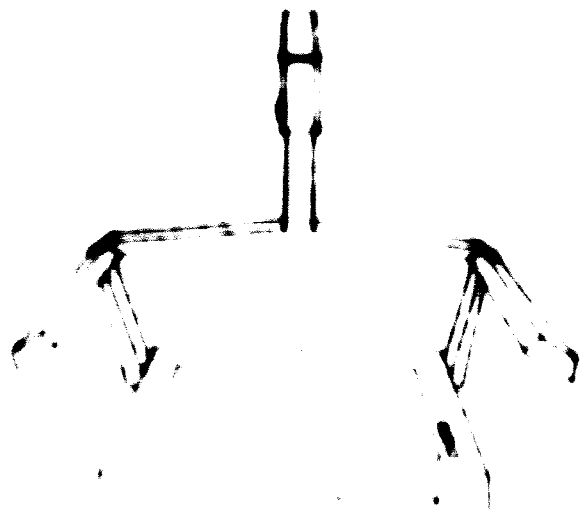
16 or 35 mm film rolls by a standard length of 100 feet.

4. The Microfilm Technique

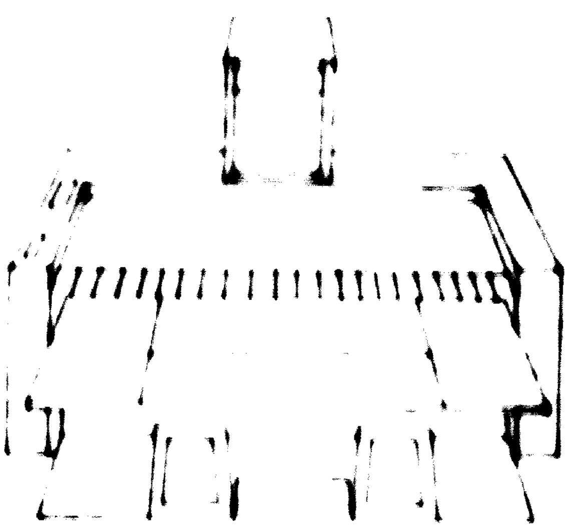
4.1 Microfilming

The conversion of documents to microfilm takes place in a special apparatus using roll film. An exception is the processing of aperture cards, for which exist special cameras for filming, development and mounting of the picture in one process.

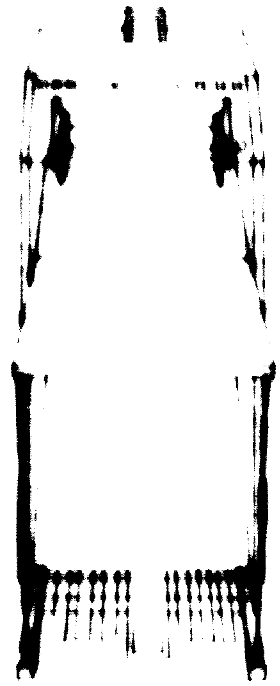
Some typical equipment developed for specific purposes is shown below.



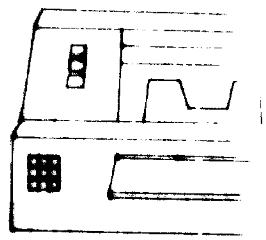
1. Single document, small number, decentralized.



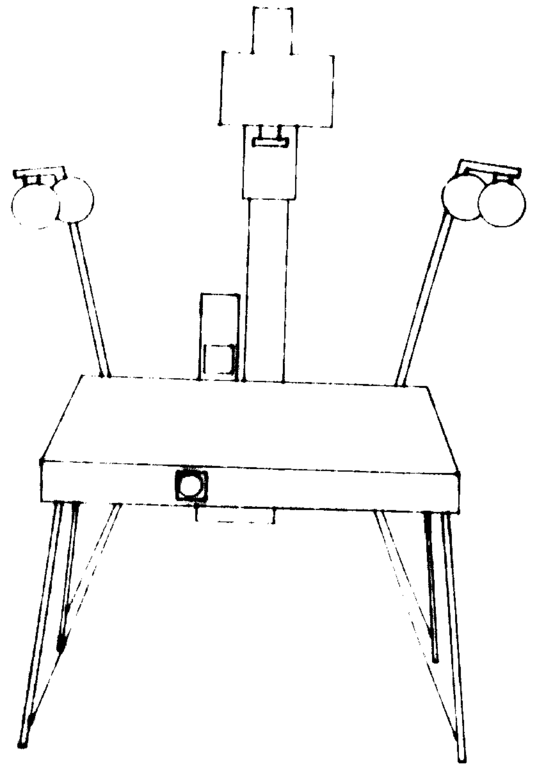
2. Rotation, larger number, decentralized.



3. Automatic feeding, coding, both sides, automatic development, centralized.



4. Endless paper, centralised.

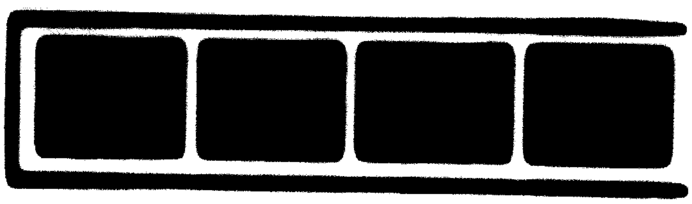


5. Precision-photos, centralised.

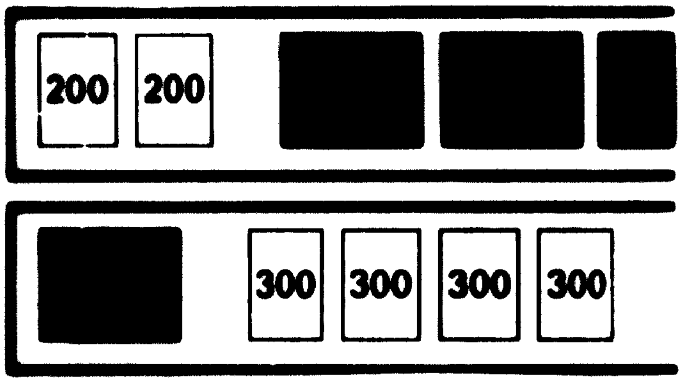
4.2 Recovering

The following is not instructions but a summary.

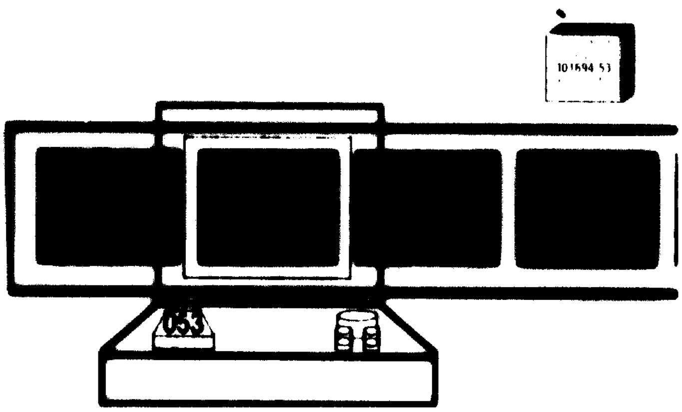
1. With few documents per area, it is enough to mark the roll film, for instance chronologically. The single data can be selected by a flash technique.



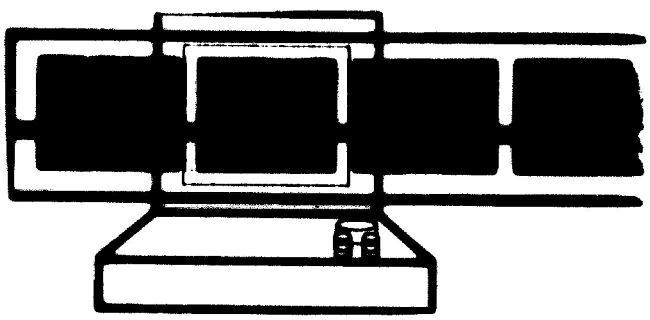
2. With larger amounts, both date and alphabetic sorting and flash techniques can be used. However, then a pre-sorting is necessary.



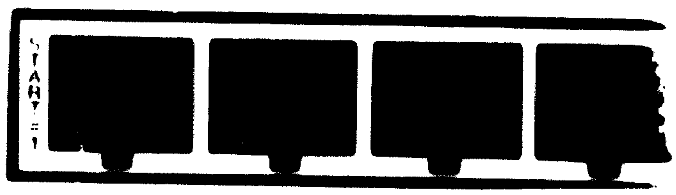
3. Next step is a counter registration, the same technique as used on tape recorders.



4. Code lines - An automatic camera equipped with code-line equipment putting code lines into fixed positions between the pictures. A code-line registrator mounted at the reader gives the possibility of reading a three-digit number.

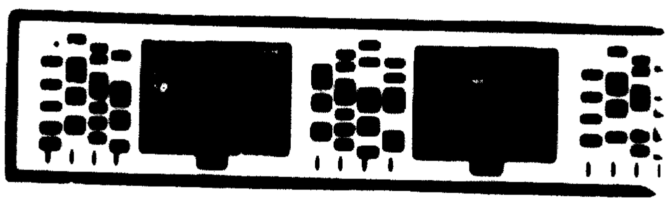


5. Image control - This method is advantageous when operating large amounts with a high frequency of looking up. Each picture is equipped with a square, readable by an electronic unit at the reader, which then can identify a special number, and be called by tipping it into the keyboard. The single document can be coded visually by the camera. By EDP processing of the documents, this code can form a part of the identification. By manual processing it is necessary to establish a journal.

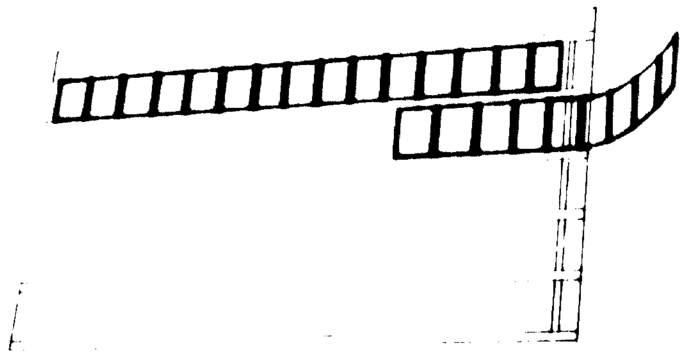


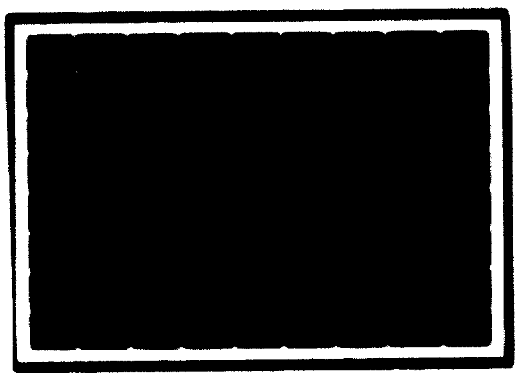
6. Miracode (Copyrighted Kodak terminology) - This method is today the most advanced method on the market. It is based on a binary coding system placed on the film before every photo. This makes it possible to call every document from a keyboard when the code is known. The code can include as many digits as desirable, for example machine no., supply no., date, etc. By manual exposure the coding accordingly will be manual. By EDP and COM the coding can be made automatically.

This method is unsurpassed when there is a demand for many calls in large files.



7. Microfiche - This can be produced in two ways. By use of jackets which by copying can be transformed to microfiche. Or by use of the so-called step and repeat camera. The camera films only on a small part of the 105-mm roll film at a time. The exposures can be controlled in horizontal and vertical direction so that the pictures can be placed in a predetermined coordinate system. The latter method is rather expensive and complicated and will show sufficient rentability only in special situations.





4.3 Economy

The economic elements which form the basis for the decision for using the microfilm technique are very different and very difficult to state exactly without knowing in detail the cash structure in Hungary. However, the general experience of all companies which have implemented the microfilm technique is one of cheaper documentation or quicker communications and a better survey of their information.

Below are mentioned some of the most important economic elements to consider.

1. Production of Film

1.1 Manual systems
central/decentral exposure
automatic single shut exposure

1.2 COM system
number of photos per year
type of output roll film 16/35mm/fiche

1.3 Copying system
number of copies
type of film

2. Use of Microfilm

2.1 Finish
information flow
maintenance of files, etc.

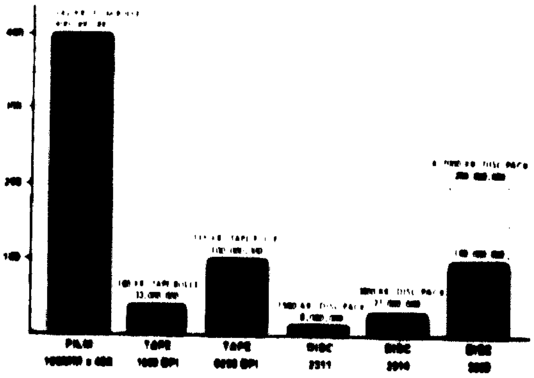
3. Readers

3.1 Demands
frequency
price

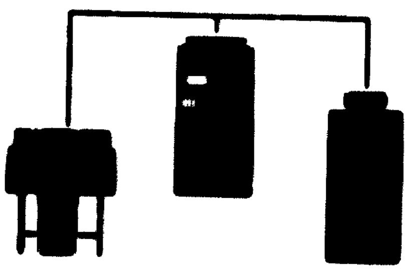
The next page shows some economic relations and figures of the present Danish market.

COMPARATIVE STOCK CAPACITY

Millions characters per unit



WRITING SPEEDS



1-2000 pages per hour	50-100.000 pages per hour
	50 times faster

PAPER COST

STANDARD LEPORELLO

SPECIAL PRINT

35-37 kr .per 1000 pages	70 kr. and up per 1000 pages

HANDLING- AND PACKING COST COMPARISON

Problem: 6000 pages report ir. 4 copies.

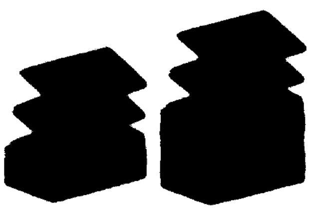
FILM	PAPER
12 min. to duplicate 4 copies and pack in cordboards.	6 hours to split and bind
Price appr. 7,50 kr.	Price appr. 225,-kr.

COPYING COSTS AND SPEED

	FILM	PAPER
1.Copy	2,36 kr./per 1000	37 kr./per 1000
2.Copy	0,97 kr./per 1000	54 kr./per 1000
3.-5.Copy	0,97 kr./per 1000	Falling price
Over 6. Copy	0,97 kr./per 1000	New run
Speed	2.000.000 pages per hour	12000/per hour

FILM/PAPER COST COMPARISON

50.000 pages



100 feet

105mm FILM

200 MIKROFICHE

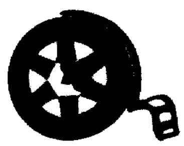
50.000 pages

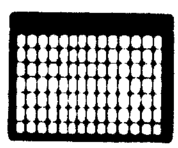
FILM	127kr.
CHEMICALS	15kr.
	142kr.

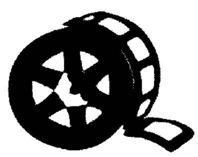
STANDARD PAPER 1850kr.

OFFPRINT. PAPER 3550kr.

FILM COSTS







	Number of pages	Price	Price 100 pages
16mm FILM	6000	23,00	3,85
35mm FILM	16000	42,00	2,65
105x150mm FICHE	270	0,72	2,65

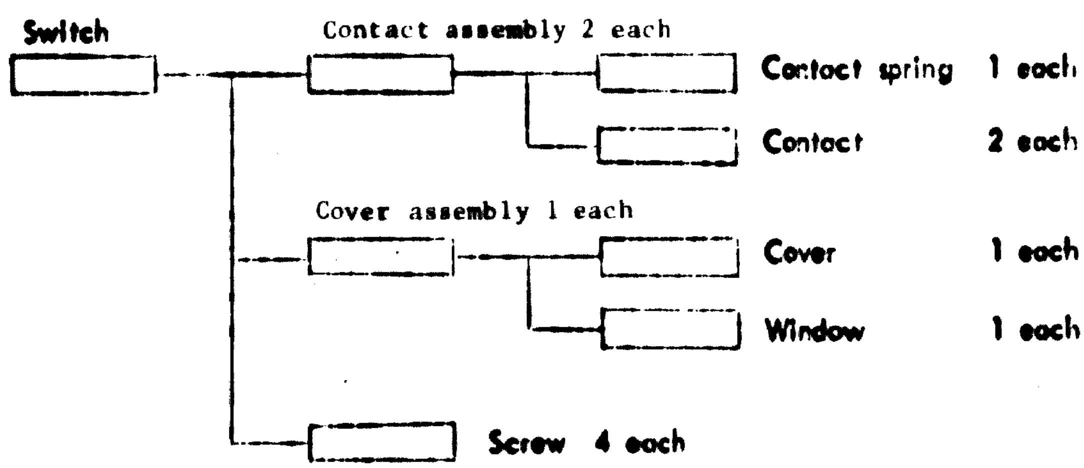
PRINCIPLES OF VALUE ANALYSIS

1. COST MODEL

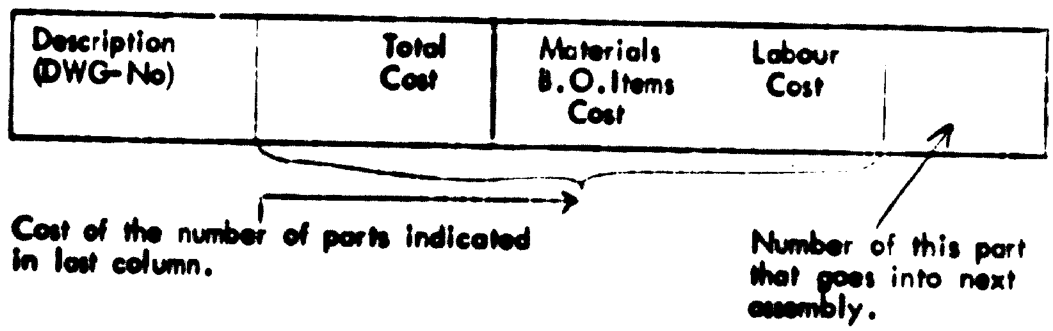
A widely used method of preparing parts lists showing how parts and sub-assemblies build up the product is shown in the following example:

Level 1	Level 2	Level 3	Level 4		Total nos. in products	Description
1					1	Switch assembly
	2				2	Contact assembly
		1			2	Contact spring
		2			4	Contact
	1				1	Cover assembly
		1			1	Cover
		1			1	Window
	4				4	Screw

This parts list tells that the switch is built up as follows:

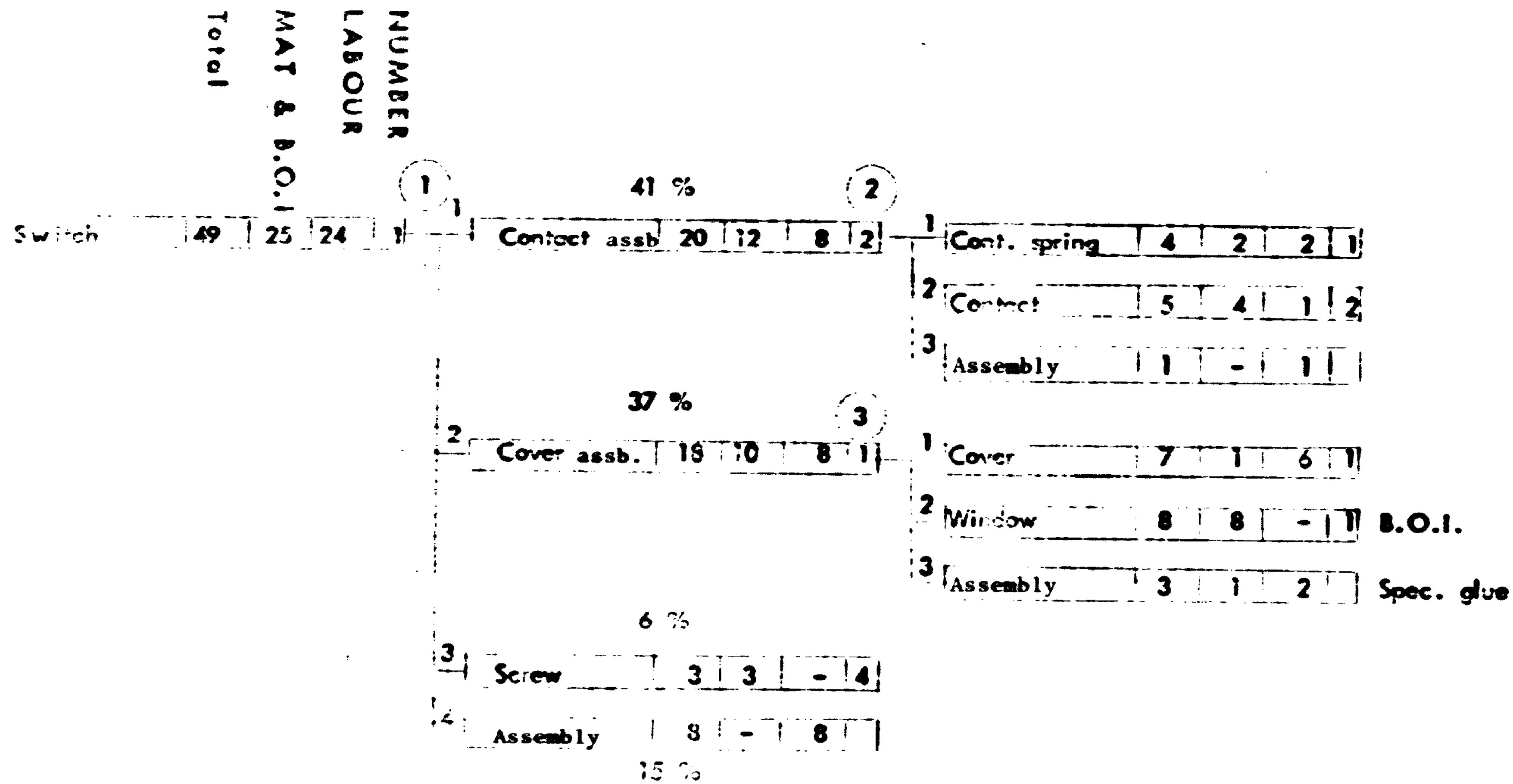


If this model is used as a cost model, the blocks may be filled in as follows:



In the blocks assembly work - castings - overhead, etc. may be mentioned separately as required.

For each assembly an extra block must be added to show assembly cost, labour as well as bulk material used by assembly operations.



For identification purpose it is useful to give the assemblies numbers as indicated 1 2 3
The parts are accordingly identified as 1-1, 1-2, etc.

It is understood that the cost for 1-1 Contact Assembly has been found by adding 2-1, 2-2 and Assembly and multiplying by 2. $(4 + 5 + 1) \times 2 = 20$.

The cost model is very useful in the teamwork to speed the understanding of where the cost goes and how it is built up.

Notes may also be added to the blocks about procedures, etc.

The cost model may also be used to present the overall picture of the product or system and thus for selection of area or project. Percentages can be calculated and added to each block.

Logarithmic Model

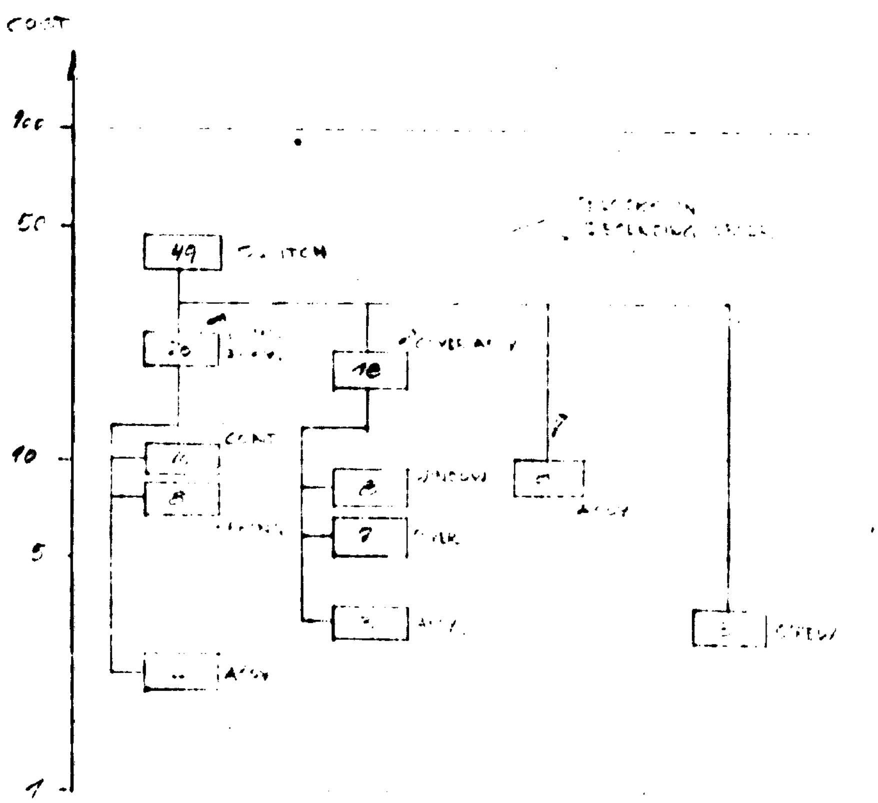
When looking into a complex system to locate VE projects, a logarithmic model may be of use.

The model gives the opportunity to identify main and detail cost areas of the system (a ship - the total expenditure of a company, etc.).

Also, magnitudes of cost throughout the system may be easily compared.

The model may also be useful for the team when studying a single product.

The switch will be presented as follows:



The reason for logarithmic scale is to get the blocks spread throughout the scale.

Calculations of Families

When the parts approach has been chosen for a project, the decision about which parts - assembly operations or sub-assemblies - will be chosen, must also be based on the total number per year of produced parts.

A practical way of presenting this information is:

Value of Families

Item	Descript.	Cost pr. item				Tot	Total cost pr year			
		Lab	Mat	Ass	Total	no.	Lab	Mat	Ass	Total
1-4	Main assy			8	8	1000			8000	[illegible]
2-3	Cont. assy			1	1	10.000			10.000	10.000
3-3	Cover assy		1	2	3	1000		1000	2000	3000
1-3	Screw		0.75			50.000		37.500		37500
2-1	Cont. spring	2	2		4	10.000	20000	20000		40.000
2-2	Contact	0.5	2		2.5	50 000	25.000	100 000		125.000
3-1	Cover	6	1		7	2000	12000	2.000		14000
3-2	Window		8		8	1000		8.000		8.000
	TOTAL	X	X	X	X		57000	[illegible]	20.000	245.500

The value of the switch itself is 1000 x 49 = 49,000.

The value of all the parts and assembly operations throughout the family products is 245,500.

2. PROGRAMMES FOR IMPROVING THE PRODUCTS

2.1 History

Value analysis originated in the United States.

Changes in engineering products were brought about during the Second World War due to a shortage of previously available materials and skills. As these became available again after the war, designs were examined with a view to reverting to the original specifications. In many instances it was found that the changes were not only lower in cost, but were more satisfactory from the customer's point of view.

As a result, efforts were made to produce procedures which would make improvements of this type happen by intention and not as a result of extreme circumstances. It was realised that to do so the function required of the product had to be considered as well as its cost. Value was defined as:

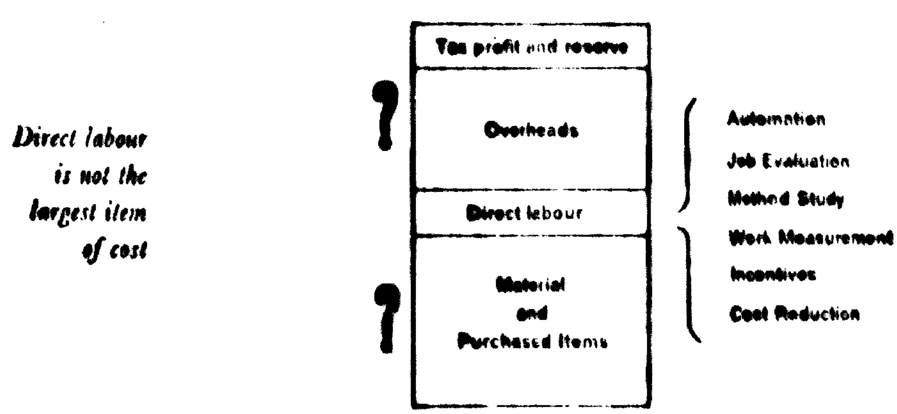
$$\text{Value} = \frac{\text{Function}}{\text{Cost}}$$

These procedures, first developed by the General Electric Company of America, were subsequently employed by the American Department of Defense, and used on the shipbuilding programmes of the 1950s and subsequently on the aerospace programmes.

Today, the technique is used extensively in the U.S.A. as well as in Western Europe. The technique has been further developed in Scandinavia and used as a common problem-solving tool.

2.2 What is VA?

Examination of the management techniques which are used in engineering for profit improvement indicates that the principal target has long been the cost of direct labour (which now constitutes approximately 20% of the cost).



Thus it is apparent that a greater overall improvement could be achieved if the basic design of each scheme or product was studied before released for production.

Just as it is realised that method study should precede work measurement, so ideally a design study should precede method study. It is this role which is played by value analysis.

VA may be defined as:

> an analytica. technique designed to examine all the cost components and functions of a product or system in order to determine whether any cost item can be reduced or eliminated while retaining all necessary functional and quality requirements.

VA gives:

- Better products
- Lower costs
- Improved communications
- Cost consciousness
- Management development
- Organisation development

2.3 Who is Involved?

2.3.1 Teamwork

The teamwork (3-5 persons) is not intended as a substitute for individual skills. However, there are clearly many occasions when the requirements and knowledge of a number of different disciplines need to be used together.

The effectiveness of the teamwork results from using the people who are normally concerned with the product and concentrating their collective abilities and experience in a free but orderly manner on the selected problem.

The composition of each team will differ according to the nature of the project under study. The members should be of sufficient seniority to be able to speak with authority for their respective departments and see that any action agreed to is carried out.

They will not be engaged full time on the project, but will combine the work with their normal duties. Between meeting they are responsible for making investigations of any points arising which affect their specialised fields.

2.3.2 Organisation

Value analysis does not necessarily involve the setting up of a large department, but it is probable that most organisations will appoint a coordinator or a small group to manage and coordinate the various value activities. The coordinator is responsible for guiding and organising the work of the team, for collecting and analysing information, running some meetings, progressing the work allocated to team members and maintaining proper controls and records.

2.4 Philosophy

2.4.1 Value

By defining value = $\frac{\text{Function}}{\text{Cost}}$ one forces the involved persons to combine what a product does with what it costs. Often one equals value to cost.

2.4.2 The Functional Approach

Value analysis is concerned with FUNCTIONS and the way these functions can be performed at the lowest cost. Consequently, a product or system is studied in such a way that the functions are identified and alternative ways of performing them generated. As a result, the initial design or specification is changed either totally or in part to provide a technically equal or improved system or item at lower cost. Similarly, in the study of overheads and administration, the functions are recognised, measured and improved in concept before details of the manufacturing or operating methods required to meet the specifications are established.

Initially then, value analysis questions the concept - the means by which the necessary functions are performed.

In different ways it asks these basic questions:

What is it?
What does it do?
What does it cost?
How else could it be done?
What will that cost?

2.4.3 Attitudes

By making people understand that unnecessary cost is present in any product due to a number of reasons, as e.g.:

Lack of information about users' needs, about material cost, new processes etc.

Lack of time when the design was first set forth

Honest wrong beliefs

Changed circumstances (requirements, specifications etc.)

Fear of failure by change to new ideas. Fear of loss in status or ridicule when putting forward new ideas.

They understand and believe that it is possible to improve products. They also start to accept proposals as a help and not criticism.

2.5 Elements of Value Analysis

2.5.1 Selection

Value analysis should not be applied to everything. The systems, products and items of overhead and administration selected for study should result from careful analysis. The areas selected are those which should yield the greatest results for the least time and effort and with the minimum of risk.

2.5.2 Information

For any selected item, time must be allowed for the relevant costs, specifications and requirements to be collected, analysed and prepared for the use of the designer or team. This is usually the task of a coordinator, who is frequently the only full-time person involved.

2.5.3 Analysis

There are three types of analysis:

a) Cost Analysis is the most usual preliminary of a study. The individual costs of the component parts or elements of the subject are tabulated to an appropriate degree of detail. From such an analysis those which appear to be of disproportionate cost and offer potential for study and improvement can be selected.

b) Functional Analysis requires an accurate definition to be made of the functions performed by the subject under investigation. To understand properly the subject, the definition of functions must be lucid and precise. For this reason it is considered desirable to describe a function by two words, a verb and a noun. For example, a pencil 'makes mark' or a screw may 'join parts'.

c) <u>Function/Cost Analysis</u> is particularly valuable in the study of complex schemes, as an aid to the designer in construction and quite separately as a means of locating areas of poor value in the overhead sector and in some administrative procedures.

2.6 The Procedure

The procedure concentrates the team's skills and knowledge effectively, thus preventing one-sided or time-wasting meetings.

On each selected project the team follows six basic steps:

1. Information - What is it? What does it do? What does it cost?
2. Speculation - How else could it be done?
3. Evaluation - What would that cost?
4. Investigation and Planning
5. Implementation
6. Summary

2.6.1 Information

The scope of the study is established and the necessary costs and other information are collected, analysed and prepared by the coordinator. The functions are described and the areas of high cost or poor value identified by cost analysis and function/cost analysis techniques.

2.6.2 Speculation

At this point the team meets to reach agreement on the areas to be studied and the approach to be used. All must speculate freely and use their creative ability to generate alternative ideas which will perform the required function(s).

Judgement is suspended, ridicule, criticism or evalution are not permitted until the supply of creative ideas is exhausted.

2.6.3 Evaluation

When all ideas have been recorded, each is reviewed in turn and briefly explained. An assessment of the relative cost of each is made on the assumption, at this stage, that each is practicable. Other factors, such as weight and reliability may be included in the first part of the evaluation.

The team makes a systematic assessment of the overall advantages and disadvantages of each low-cost idea. Having taken both cost and function into consideration, the lower cost solutions, which are best from all points of view, are selected for further development.

2.6.4 Planning

After the meeting, the selected idea or ideas will be thoroughly investigated by the team members and the coordinator, using the existing resources of their departments. A plan will then be developed for the implementation of the change.

2.6.5 Implementation

This step will depend on the nature of the proposal. In the case of an existing scheme or product, the coordinator will progress the introduction of the idea through normal channels and, if necessary, arrange for further team meetings to deal with any problems which may arise.

2.6.6 Summary

The outcome will be prepared and circulated. Information collected during the study will be examined with a view to extracting useful cost and other data for future reference.

2.7 Application

2.7.1 Products

In a product sense almost every form of manufactured item is suitable for value analysis study - ships, aircraft, electronics, furniture, food, chemicals, rubber and plastics, buildings, general engineering products, footwear and so on. Products of a "one off" nature are just as likely to yield savings as mass-produced items.

2.7.2 Overheads

Many successful studies have been carried out in maintenance and other items of overhead cost. Some examples are:

- Packaging
- Protective clothing
- Services - steam, electricity, gas etc.
- Tooling
- Containers and pallets
- Office and factory cleaning
- Fire precautions

2.7.3 Management Work and Service Functions

Administration studies present their own particular problems, since unlike the study of "things" there is often no detailed design or specification of activity in existence. In consequence, the team may be led by an organisation and methods specialist who will collect and provide the necessary technical information in much the same way that a designer would do for a manufactured product.

2.8 The Main Requirements

Whichever way a programme is introduced and whichever product or overhead cost areas are tackled initially, there are common requirements.

1. All of the senior levels of direction and management should understand the broad purpose and procedures of value analysis.

2. They should carefully examine the ways it can best help their business and if they decide to go ahead they should determine a basic plan of objectives and the ways in which the results are to be measured.

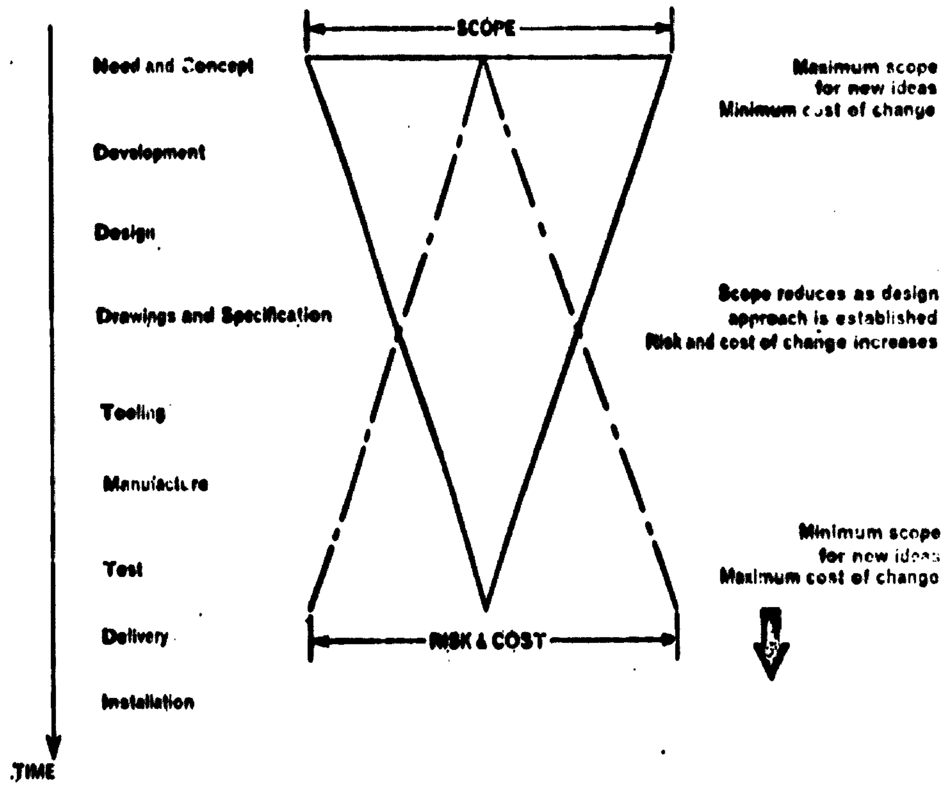
3. The product range and other expenses should be carefully analysed to select the most suitable areas for study in both the short and the long term.

4. A suitable experienced coordinator (or coordinating group) should be appointed to manage and coordinate the work. A full-time coordinator is preferable, although in small companies he may only be justified on a part-time basis.

5. Staff from all levels, who will be involved with the studies directly or indirectly, should receive formal training or appreciation courses.

6. In time, if not initially, the programme should be aimed more at avoiding unnecessary cost in new products than in reducing costs in existing ones. (Investigations of existing products are restricted because of the need to accept basic design approaches and the cost and risk of change and requalification, which is influenced by existing stock levels, tooling, spares requirements, interchangeability, existing catalogues and licence arrangements.)

7. Progress and results should be reviewed regularly and a report made to and acted upon by the management.



The relationship of time to cost of change.

8. If value analysis is promoted as part of corporate profit improvement effort, it should be combined with certain other schemes and practices which have similar objectives. For example, some of the ideas expressed in Company Suggestion Schemes can be channelled more successfully through a value analysis team - which includes the originator - than is probable through some of the usual channels.

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82.06.22