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16854

Final Report

Project : DP/RAB/81/003

Regional Programme for Up-Grading Technical Skills of Manpower of the Arab Iron and Steel Industry in the Regional Arab States

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Contract: 87/SSSM

between

THE UNITED NATIONS DEVELOPMENT ORGANIZATION
(UNIDO)

and

POLYTECHNA, CSSR

Activity Code: DP/12/81.0

December 1987

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1. INTRODUCTION

The purpose of this report is to summarise the work performed by POLYTECHNA (further reffered to as Contractor) in accordance with paragraph 2.01 of the contract. Home Office personnel and technical facilities needed for contract implementation were provided by INORGA (Institute for Management Automation) Branch in Kosice. The report is divided into five substantial parts:

CONTRACT OBJECTIVES specifies the scope of work required form the Contractor in accordance with paragraph 1.01 of the contract and with the UNIDO Terms of Reference dated May 1987.

PERFORMING PROGRAMME IMPLEMENTATION documents the activities and Contract outputs implemented during June-December 1987 aiming at to develop an integrated "Computer-aided Productivity Analysis System of Arab Iron and Steel Plants" (further referred to as COPAS)

In the EVALUATION most relevant technical results of Contract implementation and their potential benefits for the Project are summarised.

RECOMMENDATIONS highlight further long- and short term follow-up tasks for the Arab Iron and Steel Productivity programme in the view of outputs achieved within the framework of this contract..

The APPENDIX of the report incorporates detailed COPAS description and output samples illustrating activities listed in the performing programme of the report.

COPAS was successfuly implemented and tested at the Arab Iron and Steel Union (further refferred to as Field-user). Full system and operating documentation of COPAS software was handed over directly to the Field user in November 1987. Due to lack of space this volume of documentation could not be included into this report.

2. CONTRACT OBJECTIVES

The aim of the Contract was to provide support to the Arab Iron and Steel Union (AISU) in:

a) PROCESSING comparative analysis of the Arab plants and workshops with selected type level ones of industrialized co untries;

b) ELABORATING thereafter global and specific development tasks for the improvement of productivity of the Arab iron and steel plants;

c) TRAINING two (2) AISU's technical staff on the utilisation and future development of the productivity software;

d) ASSIST AISU's technical staff in interpreting and analysing the results of computerized outputs.

Contractor's services (section 2.02 of the Contract) should be carried out three (3) months in the project area by a team comprising the Team Leader and three (3) other specialists, and three point five (3.5) man-months at the Contractor's home office.

3. PERFORMING PROGRAMME

The Contract performing programme, reflecting the Field-user's detailed timing, was implemented during June - December 1987 through the following three phases:

3.1 Initial phase:

a) Team Leader's visit to the AISU in order to elaborate common productivity analysis system specification which served as a fundamental technical document for development and implementation. During the visit final timing of contract performing programme was agreed, too.
(June 14-21, 6 days in Project Area)

b) COPAS database management core software development (July-August, 3 man/months at Home Office)

c) COPAS database management software testing and implementation on the Field-user's HP/Vectra personal computer (September 15-October 2, 2 x 16 days in the Project Area)

3.2 Middle phase:

a) Development of the application part of the COPAS software for comparative productivity analysis, process modelling, energy and material balance computations and for plant layout drafting; COPAS operational documentation preparation (October Novemher, 2 man/months at the Home Office)

b) Advanced training-part 1 for two AISU specialist on the productivity software at INORGA Kosice (October 25-November 5. 1 week at the Home Office)

c) Testing and implementation of the COPAS application software; Productivity analysis processing; Evaluation of the computer outputs (November 16-December 2, 3 x 15 days in Project Area)

3.3 Final Phase:

.....

a) Advanced training-part 2 for two AISU specialist on the COPAS operation and documentation; Consultaions on further application software development (December 10-15 1 week at the Home office - INORGA Kosice)

b) Draft Final Report preparation for the UNIDO (December 1987, 1 week at the Home Office)

As follows from the above list of activities, successfull finalization of services required 2.5 man/month homework more then estimated in the Contract. This additional work should be considered free of charge for this case. Project area services implemented are on the level of Contract schedule.

During the contract implementation the following outputs were handed over to the Field-user:

- COPAS full source program documentation
- COPAS user's guide
- COPAS outputs processed from Field user's data (for samples reffer to APENDIX B)
- Interpretation of the results of computerized productivity analysis

4. RESULTS EVALUATION

The core output component of the Contract is the Computerised Productivity Analysis System (COPAS) which was implemented on the AISU's HP/Vectra personal computer. A detailed technical description of COPAS structure is enclosed in APPENDIX A. Therefore in this section we discuss only the application results of the productivity analysis.

The substantial input data for the analysis were collected by the Field-user's engineering staff form the AISU member companies. For this purpose the AISU Technical Studies Department developed a set of questionnaires for 14 types of workshops. Each questionnaire has a common two-level structure:

- on the first level there are four data goups: production, consumption, equipment and personnel
- second level contains detailed data items related to each data group

A workshop questionnaire in average contains 200 data items. These data were then processed by the COPAS software during the contract implementation. Productivity analysis output formats were specified by the Field-user. From the wide range of outputs processed (see samples enclosed in the APPENDIX B of this report) the most relevant ones are:

- material and energy balance computations processed for three plant types: integrated plants, plants with direct reduction and small-scale plants (e.g. Mini-Mills). These reports show specific and absolute cummulative consumption of material and energy form a given phase of production up to the finil product.

- Capital, organisation and labor productivity output tables processed for each type of workshop highlighting main productivity indicators of the production process.

- Production process parameters modelling programs developed for four workshop types: blast furnace, basic oxygen furnace , continuous casting and electric arc furnace. These interactive modelling tools display in quantitative way the mutual influance of process parameters thus the impact of the used technology on the productivity indicators.

In each output the figures computed for a given workshop or plant are compared with the selected world-level values. These outputs were carefully analysed by the Contractor's productivity analyst during the second mission to the AISU. Results of his detailed findings and recommendations were compiled in a special report which was handed over to the Field-user.

Finally, is important to note the highly qualified professional background of the Field-user, namely the Technical Studies Department of the AISU which is a good precondition for the development, testing, implementation and utilization of a sophisticated productivity analysis system. In view of this fact there is no doubt, the pilot version of productivity analysis system developed within the framework of this contract will be effectively used and further improved by the Field-user.

5. RECOMMENDATIONS

5.1 Recommendations to the Field-user (AISU)

1a - In order to present the main objectives and application results of computer-aided productivity analysis to organize a one week workshop for AISU member company specialists. The workshop programme should include practical demonstrations of COPAS software already implemented at the AISU.

1b - To implement the COPAS software and know-how in selected AISU member companies.

This transfer will give the opportunity to obtain more detailed input data locally avialable in the companies, from which according to real requirements more dedicated productivity analysis outputs can be processed. The AISU is already in the position to provide active support in the introduction and utilisation of COPAS software. The long-term goal of this support should be establishment of a permanent and unified productivity monitoring activity carried out by the companies themselves. Based on these detailed company results important role of the AISU is then to facilitate proper development projects and solutions in the field of :

- introducing new technologies
- production control and maintenance systems
- process control systems
- quality monitoring systems
- management and decission-making techniques
- training programmes.

which will directly fit to real company needs in productivity improvement.

5.2 Recommendations to the UNIDO

2a - To investigate application possibilities of COPAS know-how and and corresponding software outside the Arab Region and/or iron and steel sector:

Flexible and modular structure of the productivity analysis system implemented within the framework of this contract enables real opportunities of its utilization for all types of iron and steel installations. Furthermore, with appropriate questionnaire structure it can be applied to any industry. In this view COPAS can be promoted to a multi-purpose system like COMFAR developed by the UNIDO.

2b - through a technical assistance project to support AISU in its long-term productivity programme:

The development objective of the project is productivity improvement of Arab iron and steel plants by introduction innovative technologies and methods in the fields specified under 1b. Immediate objectives of this project should involve:

- analysis of the current level of plant management in Arab iron and steel plants with output to determine common factors and non-investment oriented trends for productivity upgrade

- based on the above analysis to specify detailed development tasks and their implementation priorities

- to facilitate establishment of AISU System Engineering Center, a new unit which shall provide direct (by turn-key projects) and indirect (consultations and training) support for the member companies.

- to elaborate multi-level training programmes on the subjects closely related to teh implementation of the development tasks. The training levels: managers, developers and operating personnel

Appendix–A

APPENDIX A: COPAS general software description

A.1 Main COPAS components

The COPAS (Computer-aided Productivity Analysis System) is developed as a modular set of following subsystems:

S1: Data base management
S2: Data base retrieval
S3: Working parameters modelling
S4: Graphics service
S5: System management

The data on which these subsystems operate are stored in common data base containig:

- plant and workshop parameter dictionary
- parameter values of collected Arab plants and their workshops
- model plant parameter values
- derived productivity summary data and
- historical data

From application point of view the first COPAS subsystem (S1) provides initial load of data into database and its optional updating. These tasks are carried out by an authorized database administrator.

After the database is created and loaded different productivity analysis can be executed by the subsequent subsystems.

A multi-purpose data retrieval and analysis facility by S2 subsystem providing:

- standard productivity reports processing for each or for selected workshops of a given plant
- material and energy balance reports processing for selected plant
- standard comparative productivity report processing
- nonstandard retrieval functions which can be specified by the productivity analyst in the form of database query language

By composition of standard and nonstandard data retrieval and processing functions a flexible information service is offered for any detailed or global productivity analysis.

A more sophisticated phase of the analysis is plant and workshop working papameters modelling (S3). For each relevant workshop type a dedicated interactive modelling

program is available which simulates effects of changes of a parameter value on other process parameters. Such a sensitivity modelling reveals critical parameters and their quantitative effects on productivity.

The main results of the analysis can be more clearly demonstrated and documented by the Graphics Service (S4) subsystem in the form:

- comparative and/or trend charts of selected parameter values
- workshop layout drafts highlighting main material and energy input/output values
- plant layout drafts illustrating main material and energy flows.

This COPAS system management (S5) provides background functions for COPAS operation, like:

printer and plotter selection, procedures for database creation, making security copies of the database, transfering files between IBM PC/XT/AT and the host computer, etc.

A.2 COPAS operation

The software was inplemented on IBM PC XT/AT compatible personal computer under MS DOS operating system. COPAS programs are written in FORTRAN 77 (80%) and PASCAL (20%) languages. The total source code amounts to 19 000 lines.

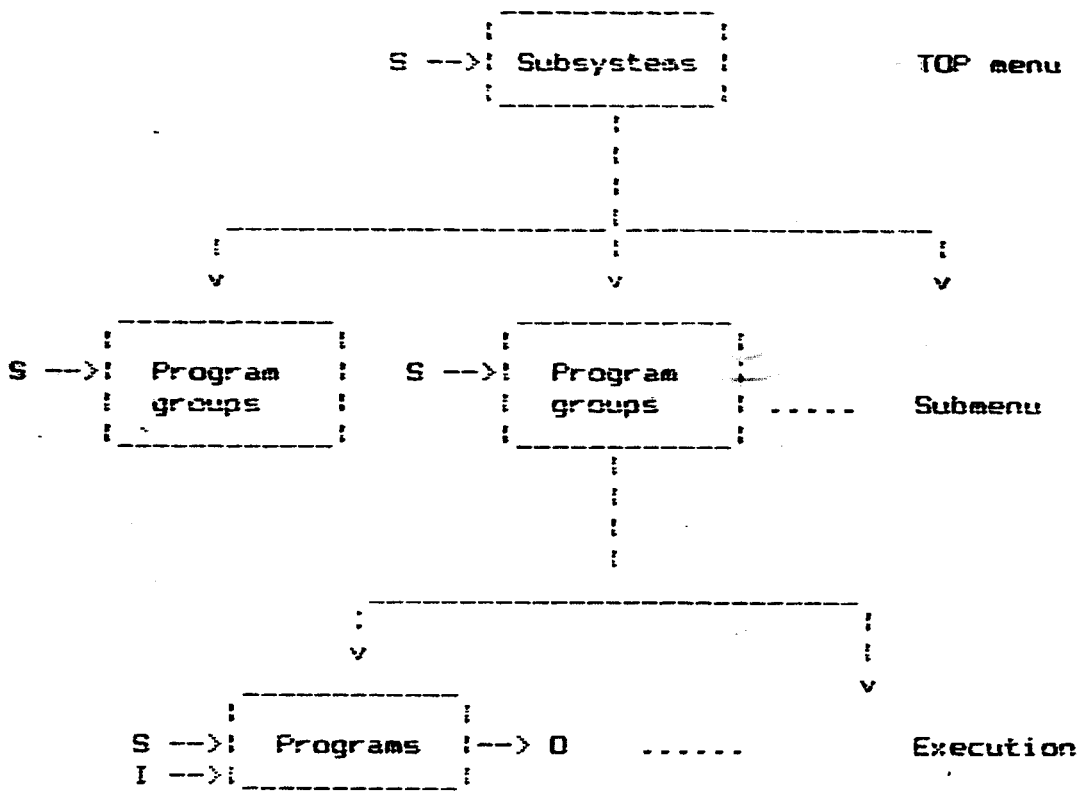
Minimal hardware requirements for COPAS operation:

- AT or XT standard processor
- 640 kB internal memory
- 20 MB hard disk unit
- one 360 kB/1.2 MB floppy disk unit
- Color Monitor
- Low cost printer

Optional features recommended:

- EGA (Advanced Graphics Adapter)
- Arithmetical coprocessor
- A3/A4 size color plotter
- Mouse

From user point of view COPAS and its particular modules are operated through a hierarchical menu set (see Fig.4A). The top menu is the list of subsystems. By simple selections from the menu the productivity analyst can select easily the program function to be executed. Each menu also provides a return choice to its upper menu.



where S = selection, I = data input, O = data output

Figure 4A: COPAS menu structure

This comprehensive operational structure comforms to COPAS modularity which is a key development objective: for a dedicated application the menus can be easily reduced or extended by new program modules.

A.3 COPAS external links

The pilot COPAS version implemented at AISU contains 48 program modules and additional program interface modules to external program systems and to a wide range of host computer systems (see Fig.4B). These external links allow to establish an integrated software and hardware environment for COPAS operation:

- the productivity database (maintained on the IBM PC/XT/AT) can be extracted automatically from a computer database

- some additional data to productivity data base can be entered by analysts, as well

- for special presentations and further processing of COPAS outputs, two worldwide program packages can be utilized:

  SYMPHONY - (trademark of LOTUS Development)
  for tabulated output and function charts

  AUTOCAD - (trademark of Autodesk Inc.)
  for drafting plant and workshop layouts

To both packages, program control and input data transfer is provided automatically from COPAS menu.

Furthermore, COPAS core software can be operated on several types of host computers , as well: database management subsystem versions were developed for PDP 11 series (under RSX 11M operating system) for VAX series (under VMS) for IBM mainframes (under OS/VS) and for MITRA series (under MTM2). This feature offers not only integrated data compatiblity but also compatibility of data structures distributed over computer network.

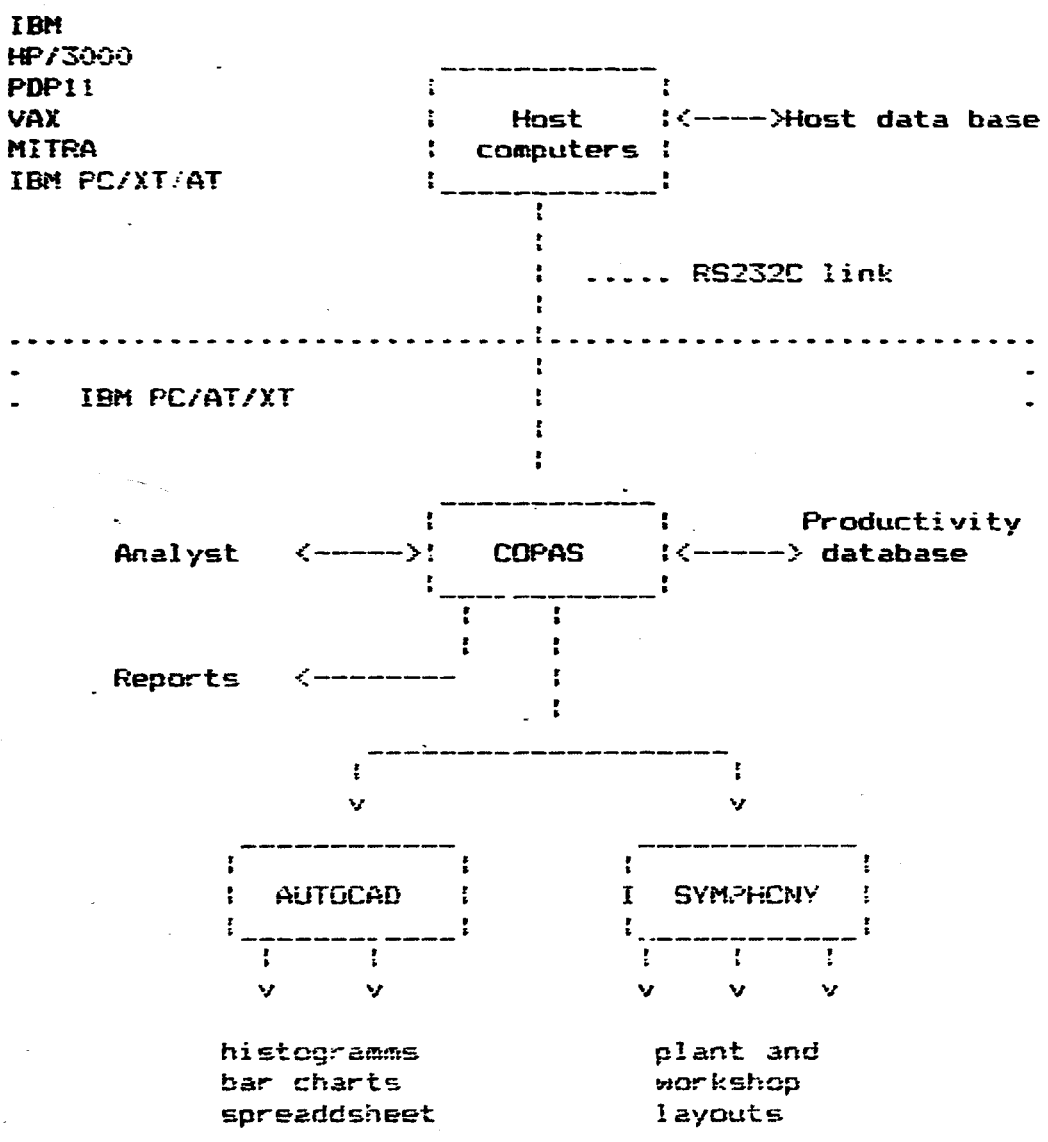


Figure 48: COPAS external links

A.5. Software structure and application examples

In this section we give a brief overview on COPAS software structure through output samples processed. Source and result values used in these samples are illustrative only and do not reflect any real plant condition.

On the first level, the software structure can be demonstrated by a more detailed hierarchical menu list shown in Fig.5A. Figures indicated on righthand side of this list can be found in appendix to this report. Due to lack of space we discuss more relevant COPAS functions and outputs only.

A5.1 COPAS application workflow

Setting up a new COPAS application first we have to allocate space for the new database (function G51). From the expected number of records the space and database structure is created automatically. Current database version can store up to 64 000 records which is sufficient to maintain information on all relevant Arab Iron and Steel plants and on a number of model plants.

Database can be loaded either in batch (G12) from input files transfered from host computer or interactively (G14). The whole or part of this database also can be unloaded (G13) for future use for creation of similar applications.

After this preparatory phase real productivity analysis can be started in subsystems S2,S3 and S4.

Program funcions for analysis we can divide into two classes:

- global analysis functions
- detailed analysis functions

At first, is advisible to carry on global analysis and then - based on its outputs - to focus the scope of investigation to local findings, workshop by workshop within plant.

Global analysis can be started by standard report processing (G21) which produces comprehensive reports on capital, organization and labor productivity by arbitrary plant and workshop stored in the database. Then, plant energy and material throughputs should be processed (G22) in order to obtain a more complex information on production process efficiency.

For detailed investigations the productivity analyst is supported by a set of standard queries (G23) producing additional information and derived data on both Arab and on

selected model plants. Nonstandard information retrievals can be specified and processed by G24. Detailed sensitivity analysis is supported by workshop modelling programs (G3x).

The results of analysis can be documented either in tabulated or in graphical form (G41,G42). Inputs for these presentation can be retrieved from the COPAS database selecting P235 for statistical charts or P236 for plant and workshop layout drafting.

Code	Program functions	Examples
S1	DATABASE MANAGEMENT	
G11	Communication with remote computer	
G12	Loading database in batch	
P111	Loading frames	
P112	Loading plant and workshop parameters	
P113	Loading other batch data	
G13	Unloading database	
G14	Interactive database review and update	(B1)
S2	DATABASE RETRIEVAL	
G21	Standard reports processing	(B2)
P211	Capital productivity	
P212	Organization productivity	
P213	Labor productivity	
G22	Material and energy balance computations	(B3)
P221	Balance for integrated I&S plants	
P222	Balance for plants using direct reduction	
P223	Balance for small-scale plants	
G23	Standard query processing	
P231	Source data dump	
P232	Frame data dump	
P233	Single tabulated review	
P234	Comparative tabulated review	(B4)
P235	Data extract for SYMPHONY	
P236	Data extarct for AUTOCAD	
G24	Nonstandard query processing	
P241	Query specification	(B5)
P242	Query compilation	
P243	Query execution	
P244	Hardcopy service	
S3	WORKSHOP MODELLING	
G31		
....	[Modelling programs by workshops]	(B6)
G313		
S4	GRAPHICS SERVICE	(B7)
G41	Plant and Workshop layout darfting	
P411	[AUTOCAD functions using COPAS extracts]	
G42	Graph processing	
P421	[SYMPHONY functions using COPAS extracts]	
S5	SYSTEM MANAGEMENT	
G51	Database initialization	
G52	Database maintenance	
G521	Database internal dialog	
G522	Database backup and restore	
G523	Database compress	
G524	Database check	
G53	Hardcopy service	

Fig. 4C : COPAS software structure

A5.2 Sample COPAS outputs

In APPENDIX B we have collected a set of seven sample outputs which demonstrate the scope of information service provided by COPAS:

(B1): shows a typical communication screen with productivity database. The upper part contains a selected working parameter data section for BOF workshops, the bottom line contains list of possible interactive data access commands, like : S(Show) to retrieve arbitrary data section, to enter (F), to update (U) or to delete (D) a given record; to trace (T) values of an entity (e.g. fuels, stoppages, etc.) in each plant stored in the database and further data manipulation and hardcopy preparation commands. This communication screen is used by the database administrator to make small-scale updates to database. This is the only entry point (guarded by password) to source data in the system: other COPAS user functions can not modify source data, they can only read them or to derive more aggregate data from source values. This data access policy provides reliable data integrity.

(B2): illustrates a standard productivity summary report sample for a given workshop of a given plant. Capital, organization and labor productivity values are computed from source values stored in the database.

(B3): illustrates a material and energy balance report for process line form Blast Furnace input up to Cold Rolling Mill output. The first part of the report contains detailed input quantities in terms of material and energy values needed for production of 1 ton of:

- semiproduct per process stage (columns MOD/STG, ACT/STG)
- final output form the current stage of process (columns MOD/FIN, ACT/FIN)

where MOD columns contain selected model data and ACT columns contain actual data of the plant indicated in report heading. The final part of the report contains balance summary for the analysed production process chain. Balance computations are developed 3 types of process chains (i.e. plants):

- integrated steel plants
- plants with direct reduction
- small-scale plants

(B4): a standard query processing results. Analyst in this example has selected time parameters (TIME) of all BOF workshops from Algeria and Tunisia. A wide range of such a standard queries is available.

(B5): shows a nonstandard query specification example written in COPAS/SQL retrieval language. Query

specification consists of two main parts: DATA section defines data and query output formats, the ACTION part defines the scope of retrieval. Such special queries can be prepared and then kept in query catalogue either by database administrator or by productivity analyst.

(B6): contains terminal hardcopies collected from a BOF workshop modelling session. The model can simulate five output steel grades (bottom part). For each of them analyst can change (OLD column represents actual technology in the workshop) consumption parameters and then see the effect of changes (NEW column) in consumption, in total production cost and in ferroalloys additions.

(B7): a Blast Furnace layout plotter output containing relevant energy and material values for a given workshop.

Appendix-B

B1 - Interactive database rewiew and update

B2 - Standard reports processing

B3 - Material and energy balance computations

B4 - Standard query processing

B5 - Query specification

B6 - Workshop parameters modelling

B7 - Graphics service

3/1

Computer aided productivity analysis system — Arab Iron & Steel Union

F1 Data base management
F2 Data base retrieval
F3 Modelling
F4 Graphics service
F5 System management
F8 Quit the Copas system
F10 Help service

select the function key

1 manage 2 retriev 3 modell 4 graph 5 system 6 7 8 EXIT

Computer aided productivity analysis system — Arab Iron & Steel Union

COPAS Data Base Management

MENU LEVELS

main menu
› data base management

F1 Loading batch data into the data base
F2 Data base modification
F3 Print service
F8 return to main menu

select the function key

1 load 2 update 3 print 4 5 6 7 8 EXIT

(B) 12,

```
PROJECT: PROD          <          DIALOG READY          >      FORMATS: COPAS
------------ 01-04-88 ------------ SHOW ------------ 11:48:08 ----------
CCS      : WSHOP0 'Continuous casting (slabs)'
CCSA     : . GRP0 'P R O D U C T I O N'
CCSA1    : . . PAR0 -- = 'TOTAL PRODUCTION (ACTUAL)' UNIT T/Y
CCSA10   : . . . PAR0 -- = 'TOTAL PRODUCTION (ACTUAL)' UNIT T/Y
CCSA11   : . . . PAR0 -- = 'CC MACHINE No.1 PRODUCTION' UNIT T/Y
CCSA12   : . . . PAR0 -- = 'CCM No.2 PRODUCTION' UNIT T/Y
CCSA13   : . . . PAR0 -- = 'CCM No.3 PRODUCTION' UNIT T/Y
..AA96   : . . . SHPAR EG1CCS1 '460290' -- '' -- '' MD1CCS1 '460290'
CCSA21   : . . PAR0 -- = 'PRODUCT A SECTION' UNIT aaaaa
CCSA211  : . . . PAR0 -- = 'PRODUCT A' UNIT T/Y
CCSA22   : . . PAR0 -- = 'PRODUCT B SECTION' UNIT aaaaa
CCSA221  : . . . PAR0 -- = 'PRODUCT B' UNIT T/Y
CCSB     : . GRP0 'C O N S U M P T I O N'
CCSB11   : . . PAR0 -- = 'CCM1 LIB. STEEL' UNIT T/Y
..AB20   : . . . SHPAR EG1CCS1 '140000' -- '' -- '' MD1CCS1 '140000'
CCSB12   : . . PAR0 -- = 'TUNDISH REFRACTORIES' UNIT T/Y
CCSB121  : . . . PAR0 -- =  TUNDISH REFRACTORIES' UNIT KG/TLST
CCSB122  : . . . PAR0 -- = 'TUNDISH LINING LIFE' UNIT TONS
CCSB123  : . . . PAR0 -- = 'CONSUMABLE LINERS PER YEAR' UNIT NUMBER
CCSB124  : . . . PAR0 -- = 'NOZZLES PER YEAR' UNIT NUMBER

_____R,F,I,C,D,N,U,S,T,G,0,L,A,(,),?,$,/,0
```

[illegible] CASTING — OPTIMAL PRODUCTIVITY — DATE: 11/29/87
BILLETS — TIME: 15:28:15

	INPUT				OUTPUT				
PLANT:			EG1CCB1	EG3CCB1					
EG1CCB1	HELWAN : CC Billets No. 1								
EG3CCB1	NAMETIN : CC Billets No. 1								
ITEM	DESCRIPTION	UNIT	MODEL VALUE	REAL VALUE	UNIT	MODEL VALUE	REAL VALUE	DIFFERENCE ABSOL	%
CCBA1	TOTAL PRODUCTION	T/Y	222592	160000	T/Y	222592.00	160000.00	160000	71.88
CCBA11	CC MACHINE No.1 PRODUCTION	T/Y	71942	160000	T/Y	71942.00	160000.00	-88058	222.40
CCBB11	CCM1 LIQ. STEEL	T/Y	74540	170213	KG/T	1036.11	1063.83	-95673	102.68
CCBB121	TUNDISH REFRACTORIES	KG/TLST	1	0.53	KG/TLST	1.00	0.53	0.47	53.00
CCBB122	TUNDISH LINING LIFE	TONS	300	280	T	300.00	280.00	20	93.33
CCBB1231	AVGE CONS.LINER LIFE	TONS	450	500	T	450.00	500.00	-50	111.11
CCBB124	NOZZLES PER YEAR	NUMBER	1750	2413	TLST/NOZL	42.59	70.54	-663	165.61
CCBB125	SLIDE GATES CONSUMP/YEAR	NUMBER	20	24	T/SL.G.	3727.00	7092.21	-4	190.29
CCBB126	POURING TUBES PER/YEAR	NUMBER	100	97	TLST/P.TU	745.40	1754.77	3	235.41
CCBB13	MOLDS AVGE LIFE	TONS	3500	1750	T	3500.00	1750.00	1750	50.00
CCBB131	MOLDS CONSUMP.PER YEAR	NUMBER	20	97	TLST/MOUL	3727.00	1754.77	-77	47.08
CCBB132	MOLD (FLUXES) POWDER	KG/Y	56000	150000	KG/TLST	0.75	0.88	-94000	117.30
CCBB14	WATER	M3/Y	800000	1552000	M3/TLST	10.73	9.12	-752000	84.96
CCBB15	ELECTRICITY	KWH/Y	450000	716597	KWH/TLST	6.04	4.21	-266597	69.74
CCBB16	NAT.GAS	M3/Y	95000	107234	M3/TSLT	1.27	0.63	-12234	49.43
CCBA12	CCM No.2 PRODUCTION	T/Y	75731	0	T/Y	75731.00	0.00	75731	0.00
CCBB21	CCM2 LIQ STEEL	T/Y	79250	0	KG/T	1046.47	ERR	79250	ERR
CCBB221	TUNDISH REFRACTORIES	KG/TL.ST	0.8	0	KG/TLST	0.80	0.00	0.8	0.00
CCBB222	TUNDISH LINING LIFE	TONS	350	0	T	350.00	0.00	350	0.00
CCBB231	AVGE CONS.LINER LIFE	TONS	420	0	T	420.00	0.00	420	0.00
CCBB224	NOZZLES PER YEAR	NUMBER	1500	0	TLST/NOZL	52.63	ERR	1500	ERR
CCBB225	SLIDEGATES PER YEAR	NUMBER	22	0	T/SL.G.	3602.27	ERR	22	ERR
CCBB226	POURING TUBES PER Y	NUMBER	110	0	TLST/P.TU	0.01	ERR	110	ERR
CCBB23	MOLDS AVGE LIFE	T	3500	0	T	3500.00	0.00	3500	0.00
CCBB231	MOLDS PER YEAR	NUMBER	20	0	TLST/MOUL	3962.50	ERR	20	ERR
CCBB232	MOLD (FLUXES) POWDER	KG/Y	60000	0	KG/TLST	0.76	ERR	60000	ERR
CCBB24	WATER	M3/Y	700000	0	M3/TLST	8.83	ERR	700000	ERR
CCBB25	ELECTRICITY	KWH/Y	400000	0	KWH/TLST	5.05	ERR	400000	ERR

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CCBB26	NAT.GAS	M3/Y	90000	0	M3/TSLT	1.14	ERR	90000	ERR
CCBA13	CCM No.3 PRODUCTION	T/Y	74914	0	T/Y	74914.00	0.00	74914	0.00
CCBB31	CCM3 LIQ.STEEL	T/Y	78000	0	KG/T	1041.19	ERR	78000	ERR
CCBB321	TUNDISH REFRACTORIES	KG/TL.ST	0.9	0	KG/TLST	0.90	0.00	0.9	0.00
CCBB322	TUNDISH LINING LIFE	TONS	320	0	T	320.00	0.00	320	0.00
CCBB3231	AVGE. CONS. LINER LIFE	T	430	0	T	430.00	0.00	430	0.00
CCBB324	NOZZLES PER YEAR	NUMBER	1620	0	TLST/NOZL	48.15	ERR	1620	ERR
CCBB325	SLIDEGATES PER YEAR	NUMBER	20	0	T/SL.G.	3900.00	ERR	20	ERR
CCBB326	POURING TUBES PER YEAR	NUMBER	95	0	TLST/P.TU	0.01	ERR	95	ERR
CCBB33	MOLDS AVGE LIFE	TONS	4500	0	T	4500.00	0.00	4500	0.00
CCBB331	MOLDS PER YEAR	NUMBER	18	0	TLST/MOUL	4333.33	ERR	18	ERR
CCBB332	MOLD (FLUXES) POWDER	KG/Y	62000	0	KG/TLST	0.79	ERR	62000	ERR
CCBB34	WATER	M3/Y	820000	0	M3/TLST	10.51	ERR	820000	ERR
CCBB35	ELECIRICITY	KWH/Y	445000	0	KWH/TLST	5.71	ERR	445000	ERR
CCBB36	NAT.GAS	M3/Y	92000	0	M3/TSLT	1.18	ERR	92000	ERR
CCBB41	WATER	M3/Y	260000	294900	M3/TSLT	1.168	1.843	-34900	157.79
CCBB421	ELECIR.SPECIF.CONSUMP.	KWH/T	5.8	4.21	KWH/T	5.8	4.21	1.59	72.59

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Additional parameter values for evaluation

Longitudinal cracks ratio	KG/T
Transverse cracks ratio	KG/T
Recovered energy	MJ/T
Reject.product (spec.)	KG/T
Scheduled prod.time	H/Y
Nonsched.maintenance time	H/Y
Wait.time for input mater.	H/Y

	INPUT				OUTPUT				
PLANT:			EG3CCB1	TU1CCB1					
EG3CCB1	NAMETIN : CC Billets No. 1								
TU1CCB1	EL FOULADH : CC Billets No. 1								
								DIFFERENCE	
ITEM	DESCRIPTION	UNIT	MODEL VALUE	REAL VALUE	UNIT	MODEL VALUE	REAL VALUE	ABSOL	%
TIME	Calendar time		8760	8760	H				
CCBA1	TOTAL PRODUCTION	T/Y	160000	182000	T/Y	160000.000	182000.000	-22000.000	113.750
CCBA11	CC MACHINE No.1 PRODUCTION	T/Y	160000	64000	T/Y	160000.000	64000.000	96000.000	40.000
CCBA111	CCM No.1 STOPPAGES DELAYS	H	816	1000	%	12.230	15.152	-2.921	123.886
CCBA1111	MECHANICAL STOP DELAYS	H	200	200	%	2.998	3.030	-0.033	101.091
CCBA1112	ELECTRICAL STOP DELAYS	H	200	200	%	2.998	3.030	-0.033	101.091
CCBA1113	REFRACTORY STOP DELAYS	H	200	200	%	2.998	3.030	-0.033	101.091
CCBA1114	TECHNOLOG.(OPERATIVE) STOP.	H	100	200	%	1.499	3.030	-1.532	202.182
CCBA1115	OVERHAULS	H	16	100	%	0.240	1.515	-1.275	631.818
CCBA1116	OTHERS (SPECIFY) STOP.DEL.	H	100	100	%	1.499	1.515	-0.016	101.091
CCBA112	ANNUAL EFFECTIVE TIME=AET	H	6672	6600	H	6672.000	6600.000	72.000	98.921
CCBA113	CCM No.1 YIELD	%	94	96	%	94.000	96.000	-2.000	102.128
CCBA12	CCM No.2 PRODUCTION	T/Y	0	60000	T/Y	0.000	60000.000	-60000.000	ERR
CCBA121	STOPPAGES DELAYS	H	0	1000	%	ERR	15.152	ERR	ERR
CCBA1211	MECHANICAL STOP DELAYS	H	0	200	%	ERR	3.030	ERR	ERR
CCBA1212	ELECTRICAL STOP DELAYS	H	0	200	%	ERR	3.030	ERR	ERR
CCBA1213	REFRACTORY STOP DELAYS	H	0	200	%	ERR	3.030	ERR	ERR
CCBA1214	TECHNOLOG. (OPERATIVE) STOP.	H	0	200	%	ERR	3.030	ERR	ERR
CCBA1215	OVERHAULS	H	0	100	%	ERR	1.515	ERR	ERR
CCBA1216	OTHER (SPECIFY) STOP.DEL.	H	0	100	%	ERR	1.515	ERR	ERR
CCBA122	ANNUAL EFFECTIVE TIME = AET	H	0	6600	H	0.000	6600.000	-6600.000	ERR
CCBA123	CCM No.2 YIELD	%	0	96	%	0.000	96.000	-96.000	ERR
CCBA13	CCM No.3 PRODUCTION	T/Y	0	56000	T/Y	0.000	56000.000	-56000.000	ERR
CCBA131	STOPPAGES DELAYS	H	0	1000	%	ERR	15.152	ERR	ERR
CCBA1311	MECHANICAL STOP DELAYS	H	0	200	%	ERR	3.030	ERR	ERR
CCBA1312	ELECTRICAL STOP DELAYS	H	0	200	%	ERR	3.030	ERR	ERR
CCBA1313	REFRACTORY STOP DELAYS	H	0	200	%	ERR	3.030	ERR	ERR
CCBA1314	TECHNOLOG. (OPERATIVE) STOP.	H	0	200	%	ERR	3.030	ERR	ERR

CCWA315	OVERHAULS	H	0	100	%	ERR	1.515	ERR	ERR
CCWA316	OTHER (SPECIFY) STOP.DEL	H	0	100	%	ERR	1.515	ERR	ERR
CCWA132	ANNUAL EFFECTIVE TIME=AET	H	0	6600	H	0.000	6600.000	-6600.000	ERR
CCWA133	CCM No.3 YIELD	%	0	96	%	0.000	96.000	-96.000	ERR
CCBB11	CCM1 LIQ. STEEL	T/Y	170213	66700	%	94.000	95.952	-1.952	102.077
CCBB21	CCM2 LIQ STEEL	T/Y	0	62500	%	ERR	96.000	ERR	ERR
CCBB31	CCM3 LIQ.STEEL	T/Y	0	58300	%	ERR	96.055	ERR	ERR
SUM_B		T/Y	170213	187500	%	94.000	97.067	-3.067	103.263
CCBE11	LENGTH	M	0	0					
CCBE12	WIDTH	M	0	0					
MULT_E1		MxM	0	0	T/M2	ERR	ERR	ERR	ERR
CCBE21	LENGTH	M	0	0					
CCBE22	WIDTH	M	0	0					
MULT_E2		MxM	0	0	T/M2	ERR	ERR		
CCBE44	COOLING BED LENGTH x WIDTH	MxM	0	0	T/M2	ERR	ERR	ERR	ERR
CCBE51	LENGTH	M	0	0					
CCBE52	WIDTH	M	0	0					
MULT_E5		MxM	0	0	T/M2	ERR	ERR	ERR	ERR
CCBD14	AVGE HEAT SIZE	TONS	35	20					
CCBD141	NUMBER SEQUENCES	HEATS	2	0		70.000	0.000	70.000	0.000
CCBD161	TUNDISH CAPACITY	TONS	2.58	2		0.074	0.100	-0.026	135.659

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Additional parameter values for evaluation

Scheduled prod.time	H/Y
Nonsched.maintenance time	H/Y
Wait.time for input mater.	H/Y
Reject.product (spec.)	KG/T
CC cast.without conditioning	%
Secondary cooling	TYPE
Breakout rate	NUMB/Y
Recovered energy	MJ/T

[illegible] [illegible] TIME: 12:22:05

INPUT | OUTPUT

PLANT: EG1OCB1 EG3OCB1

EG1OCB1 HELWAN : OC Billets No. 1

EG3OCB1 NAMETIN : OC Billets No. 1

ITEM	DESCRIPTION	UNIT	MODEL VALUE	REAL VALUE	UNIT	MODEL VALUE	REAL VALUE	DIFFERENCE ABSOL	%
OCBA1	TOTAL PRODUCTION	T/Y	222592	160000	T/Y	222592.00	160000.00	62592	71.88
OCBC10	OC TOTAL	NUMBER	460	53	T/PERS	483.90	3018.87	-2534.97	623.87
OCBC11	CONTINUOUS C. MANAGEMENT	NUMBER	4	1	T/PERS	55648.00	160000.00	-104352.00	287.52
OCBC313	SK.WORKERS	NUMBER	12	8	T/PERS	18549.33	20000.00	-1450.67	107.82
OCBC323	SK.WORKERS	NUMBER	100	6	T/PERS	2225.92	26666.67	-24440.75	1198.01
SUMC2	OC.Operation	NUMBER	351	52	T/PERS	634.17	3076.92	-2442.76	485.19
SUMC3	Maintenance - Repairs	NUMBER	215	21	T/PERS	1035.31	7619.05	-6583.74	735.92
SUMC31	Mechanical Maint.repairs	NUMBER	105	10	T/PERS	2119.92	16000.00	-13880.08	754.74
SUMC32	Refractories Maint.repairs	NUMBER	110	11	T/PERS	2023.56	14545.45	-12521.89	718.80

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Additional parameter values for calculation

OCBC21	SUPERVISORS	NUMBER	7	4
OCBC22	FOREMEN	NUMBER	24	4
OCBC23	SKILLED WORKERS	NUMBER	200	36
OCBC24	UNSKILLED WORKERSS	NUMBER	120	8
OCBC311	SUPERVISORS	NUMBER	4	1
OCBC312	FOREMEN	NUMBER	71	1
OCBC313	SK.WORKERS	NUMBER	12	8
OCBC314	UNSK.WORKERS	NUMBER	18	0
OCBC321	SUPERVISORS	NUMBER	1	1
OCBC322	FOREMEN	NUMBER	5	1
OCBC323	SK.WORKERS	NUMBER	100	6
OCBC324	UNSK.WORKERS	NUMBER	4	3

Additional parameter values for evaluation

CCBA111	CCM No.1 STOPPAGES DELAYS	H	7305	816
CCBA112	ANNUAL EFFECTIVE TIME-NET	H	1455	6672
CCBD1	C.C. MACHINE TYPE	—	0	0
CCBD121	CC PLANT NOMINAL CAPACITY	T/Y	350000	160000
CCBD131	STRANDS PER MACHINE	NUMBER	6	3
CCBE21	LENGTH	M	100	0
CCBE22	WIDTH	M	30	0
CCBE23	HEIGHT	M	0	0
	Direct product.workers	NUMBER		
	New workers within cal.time	NUMBER		
	Stabil.workers >5 prod.Year	NUMBER		
	Workers Total - Year before	NUMBER		

(B2) 16

(B3)/1

PLANT: Model WORKSHOP:CONTINUOUS CASTINGS
TYPE :CCM

INPUTS		PER 1 TON/OUTPUT				OUTPUTS		PER 1 TON/OUTPUT			
DESCRIPTION	UNIT	MOD/STG	ACT/STG	MOD/FIN	ACT/FIN	DESCRIPTION	UNIT	MOD/STG	ACT/STG	MOD/FIN	ACT/FIN
-----ENERGY-----	MJ/T	263.0	263.0	292.8	292.8	-----ENERGY-----	MJ/T	134.6	134.0	149.2	149.2
						-ENERGY BALANCE-	MJ/T	129.0	129.0	143.6	143.6
----MATERIAL----	KG/T	1014.0	1014.0	1129.0	1129.0	----MATERIAL----	KG/T	1000.0	1000.0	1113.4	1113.4
						MATERIAL BALANCE	KG/T	14.6	14.0	15.6	15.6
FUELS	MJ/T	42.0	42.0	46.8	46.8						
OXYGEN	MJ/T	7.0	7.0	7.8	7.8	RECOVERED ENERGY	MJ/T	134.0	134.0	149.2	149.2
ELECTRIC POWER	MJ/T	188.0	188.0	209.3	209.3	OTHER ENERGIES	MJ/T	0.0	0.0	0.0	0.0
OTHER ENERGIES	MJ/T	26.0	26.0	28.9	28.9						
LIQUID STEEL	KG/T	1014.0	1014.0	1129.0	1129.0	SLABS	KG/T	1000.0	1000.0		

PLANT: Model WORKSHOP:HOT ROLLING MILL
TYPE :RMM

INPUTS		PER 1 TON/OUTPUT				OUTPUTS		PER 1 TON/OUTPUT			
DESCRIPTION	UNIT	MOD/STG	ACT/STG	MOD/FIN	ACT/FIN	DESCRIPTION	UNIT	MOD/STG	ACT/STG	MOD/FIN	ACT/FIN
-----ENERGY-----	MJ/T	3074.0	3074.0	3375.3	3375.3	-----ENERGY-----	MJ/T	210.0	210.0	230.6	230.6
						-ENERGY BALANCE-	MJ/T	2864.0	2864.0	3144.7	3144.7
----MATERIAL----	KG/T	1014.0	1014.0	1113.4	1113.4	----MATERIAL----	KG/T	1000.0	1000.0	1098.0	1098.0
						MATERIAL BALANCE	KG/T	14.0	14.0	15.4	15.4
FUELS	MJ/T	18.0	18.0	19.8	19.8	OTHER ENERGIES	MJ/T	0.0	0.0	0.0	0.0
OXYGEN	MJ/T	57.0	57.0	62.6	62.6	RECOVERED ENERGY	MJ/T	210.0	210.0	230.6	230.6
ELECTRIC POWER	MJ/T	1098.0	1098.0	1205.6	1205.6						
GAS AND OIL	MJ/T	1901	1901	2087.3	2087.3						
OTHER ENERGIES	MJ/T	0.0	0.0	0.0	0.0						
SLABS	KG/T	1014.0	1014.0	1113.4	1113.4	HOT ROLLED COILS	KG/T	1000.0	1000.0		

(33)/2

PLANT: Model WORKSHOP:COLD ROLLING MILL TYPE :RMC

PLANT: Model WORKSHOP:COLD ROLLING MILL TYPE :RMC

INPUTS		PER 1 TON/OUTPUT				OUTPUTS		PER 1 TON/OUTPUT			
DESCRIPTION	UNIT	MOD/STG	ACT/STG	MOD/FIN	ACT/FIN	DESCRIPTION	UNIT	MOD/STG	ACT/STG	MOD/FIN	ACT/FIN
-----ENERGY-----	MJ/T	3429.0	3429.0	3429.0	3429.0	-----ENERGY-----	MJ/T	0.0	0.0	0.0	0.0
						-ENERGY BALANCE-	MJ/T	3429.0	3429.0	3429.0	3429.0
----MATERIAL----	KG/T	1098.0	1098.0	1098.0	1098.0	----MATERIAL----	KG/T	1000.0	1000.0	1000.0	1000.0
						MATERIAL BALANCE	KG/T	98.0	98.0	98.0	98.0
FUELS	MJ/T	18.0	18.0	18.0	18.0	OTHER ENERGIES	MJ/T	0.0	0.0	0.0	0.0
OXYGEN	MJ/T	10.0	10.0	10.0	10.0	RECOVERED ENERGY	MJ/T	0.0	0.0	0.0	0.0
ELECTRIC POWER	MJ/T	1500.0	1500.0	1500.0	1500.0						
GAS AND OIL	MJ/T	1901	1901	1901.0	1901.0						
OTHER ENERGIES	MJ/T	0.0	0.0	0.0	0.0						
HOT ROLLED COILS	KG/T	1098.0	1098.0	1098.0	1098.0	COLD COILS	KG/T	1000.0	1000.0		

PLANT: Model ENERGY AND MATERIAL BALANCE SUMMARY

WORKSHOPS	INPUT ENERGY(MJ/T)	INPUT WATER(KG/T)	
	ADDED		ADDED
	16573.0	1623.0	
	TO PHASE		
BLAST FURNACE	PIG IRON		
	TO FINAL		
	20749.7	2032.0	780.0
	776.0	1109.0	
	TO PHASE		
BASIC OXYGEN FURNACE	LIQUID STEEL		
	TO FINAL		
876.1	21625.7	1252.0	123.1
	263.0	1014.0	
	TO PHASE		
CONTINUOUS CASTING	SLABS		
	TO FINAL		
292.8	21918.5	1129.0	15.6
	3074.0	1014.0	
	TO PHASE		
HOT ROLLING MILL	HOT ROLLED COILS		
	TO FINAL		
3375.7	25293.8	1113.4	15.4
	3429.0	1098.0	
	TO PHASE		
COLD ROLLING MILL	COLD COILS		
	TO FINAL		
3429.0	28722.8	1098.0	98.0

(E3)/1

COPAS 1.0 | Comparative review | AISU ALGERIA

Enter the following items for comparative review. A question mark (?) is a "WILDCARD" which will always match any character found in that position. An asterisk (*) in the name will match that position and all remaining positions. Use the arrow keys to move and (ESC) key to skip any item.

Plants / Workshops EG3CCB1 EG1CCB1

Parameter class PROD

Parameter range from CCBA1 To CCBB1

Save output data to disk ? Y

O.K.

F1 Execute F2 Correction F8 Exit

(B4) /2

SELECTION FOR COMPARISON DATE: 01-04-88 TIME: 12:24:

PLANTS (WORKSHOPS) EG3CCB1 EG1CCB1
PARAMETER CLASS *

Parameter Name		Class	Unit
CCBA1	TOTAL PRODUCTION	--	T/Y
CCBA11	CC MACHINE No.1 PRODUCTION	--	T/Y
CCBA111	CCM No.1 STOPPAGES DELAYS	--	H
CCBA1111	MECHANICAL STOP DELAYS	--	H

Workshop Name		Class
EG3CCB1	NAMETIN : CC Billets No. 1	--
EG1CCB1	HELWAN : CC Billets No. 1	--

	EG3CCB1	EG1CCB1
CCBA1	160001.000	222592.000
CCBA11	160001.000	71942.000
CCBA111	816.000	7305.000
CCBA1111	200.000	287.000

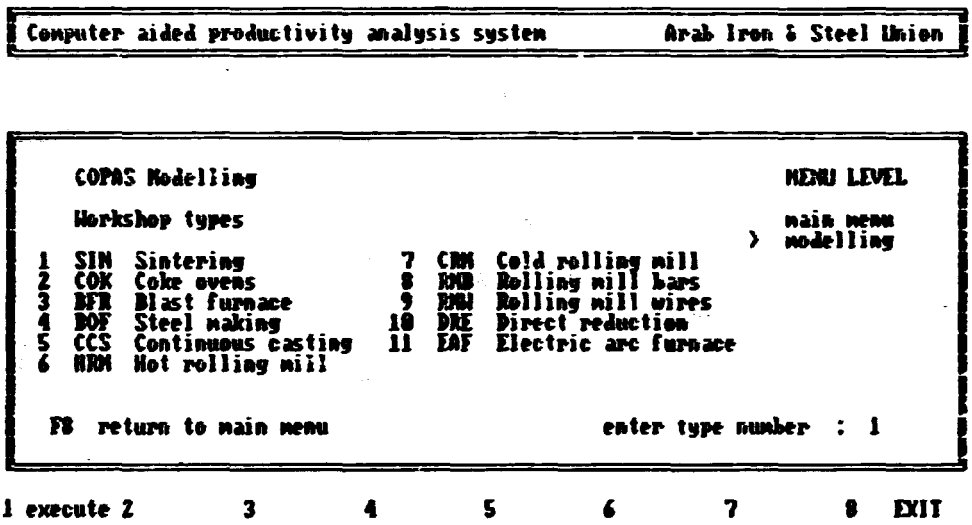
B5

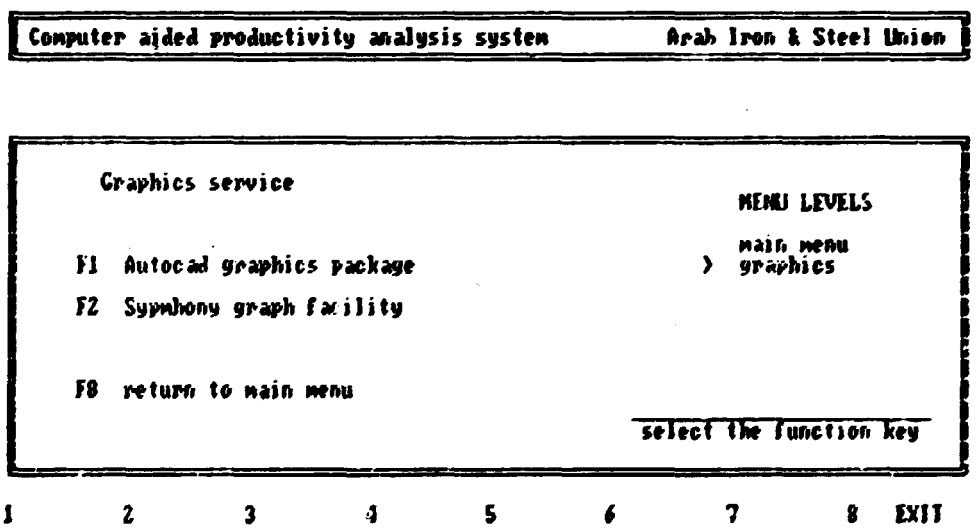
```
COPAS/  SHOW  : Q12                DEPTH=30                  PROJECT : QUERIES
-------------------------------------------------------------------------------
Q12       QUERY Comparative review
DQ12        DATA SECTION
WSHOP2        OBJECT
FHW1          FORMAT ('1. PLANT (WORKSHOP)',T22,8A1,1X,40A1)
FHW2          FORMAT ('2. PLANT  ORKSHOP)',T22,8A1,1X,40A1)
FTPAR2        FORMAT (T75,70A1)
FNPAR2        FORMAT (T67,F12.2)
FPAROH12      FORMAT ('PARAMETER',2X,'DESCRIPTION',T42,'UNIT',T50,'VALUES:')
FLINE         FORMAT (79(1H-))
give2w        FORMAT (1X,'give second WORKSHOP or PLANT identifier to compare')
FNPAR1        FORMAT (T52,F12.2)
FH1-12        FORMAT ('Comparative Source Review'/,1X,25(1H=)/)
FWSHOP1       FORMAT (T58,8A1)
FWSHOP2       FORMAT (T71,8A1)
WSHOP1        OBJECT
AQ12        ACTION SECTION Q12
              CALL ROUTINE SQ11 PAR
              LOAD WSHOP TO WSHOP1
              LOAD again TO WSHOP
              DISPLAY FORMAT give2w
              CALL ROUTINE GWWS PAR
              LOAD WSHOP TO WSHOP2
              ERASE DISPLAY
              CALL ROUTINE SELQ12 PAR
              ! TRACE REFERENCES ON WSHOP1
                SUM ( 1 ) := 0 + SUM ( 10 )
                SUM ( 1 ) + 1
                IF Current CONCEPT <> :NPAR
                CALL ROUTINE Q12CLASS PAR
                IF SUM ( 5 ) <> INTEGER 0
                  GET Current BEFORE
                  IF Current CONCEPT = :NPAR
                    CALL ROUTINE GETNPAR PAR -1
                    BUFFER VARIABLE NPAR IN FORMAT FNPAR1 MODE: 0
                    GOTO LABEL-2
                  IF Current CONCEPT = :TPAR
                    CALL ROUTINE GETTPAR PAR -1
                    BUFFER VARIABLE TPAR IN FORMAT FTPAR MODE: 0
LABEL-2             CALL ROUTINE 2WSHOP PAR
                    IF SUM ( 9 ) = INTEGER 0
                      CLEAR BUFFER: 1 PACK:


                    SUM ( 9 ) + 1
                    CALL ROUTINE GETNPAR PAR -9
                    BUFFER VARIABLE NPAR IN FORMAT FNPAR2 MODE: 0
                    PRINT BUFFER

-------------------------------------------------------------------------------
COPAS/  SHOW  : Q12                   END                   PROJECT : QUERIES
```

E-14


Computer aided productivity analysis system
Arab Iron & Steel Union
COPAS Modelling
MENU LEVEL
Workshop types
main menu
modelling
1 SIN Sintering
2 COK Coke ovens
3 BFR Blast furnace
4 BOF Steel making
5 CCS Continuous casting
6 HRM Hot rolling mill
7 CRM Cold rolling mill
8 RMB Rolling mill bars
9 RMW Rolling mill wires
10 DRE Direct reduction
11 EAF Electric arc furnace
F8 return to main menu
enter type number : 1
1 execute 2 3 4 5 6 7 8 EXIT


Computer aided productivity analysis system
Arab Iron & Steel Union
Graphics service
MENU LEVELS
main menu
graphics
F1 Autocad graphics package
F2 Symphony graph facility
F8 return to main menu
select the function key
1 2 3 4 5 6 7 8 EXIT

Electric Arc Furnace Modelling

OUTPUT STEEL GRADE	content of element in steel %						
	C	Mn	Si	Al	V	Cr	Nb
Deep drawing	0.050	0.300	0.030	0.030			
Killed structural	0.120	0.400	0.200	0.030			
Killed highstrength	0.170	1.300	0.450	0.030			
Killed highstrength microalloy	0.100	1.300	0.300	0.030	0.030		
Electrotechnical,dynamo	0.040	0.250	2.300	0.400			

steeltype choose F2 edit F8 exit <RET> continue

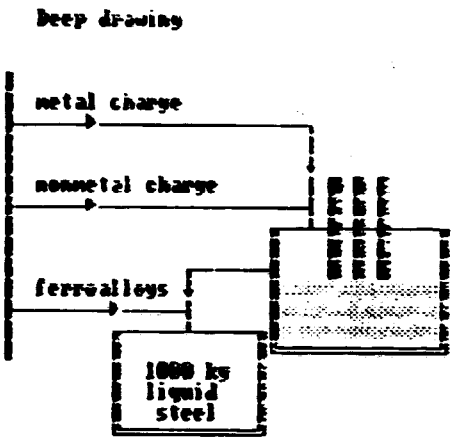
Chemical analysis	C	Mn	Si	Al	V	Cr	Nb
Deep drawing	0.050	0.300	0.030	0.030			
Initial material	0.040	0.120					
Alloys needed	0.010	0.180	0.030	0.030			

	Ferro-alloys & COKE	content X yield [%]							
		C	Mn	Si	Al	V	Cr	Nb	Ca
1.67	FeMnC	6	62						
1.86	FeMn aff		72						
0.51	FeSi			59					
	FeSiCa			27					3
0.42	Al				70				
	FeV					60			
	FeCrC						46		
	FeCr						46		
	FeNb							30	
	COKE	42							

Press <CR> to continue

EAF

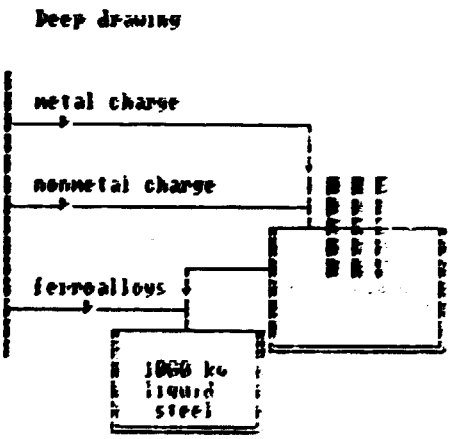
CONSUMPTION /Tlst		old	new
DRI	kg	889.27	889.27
SCRAP	kg	263.49	263.49
SOLID PIG IRON	kg	0.00	0.00
IRON ORE	kg	15.45	15.45
COKE	kg	1.14	1.14
LIME	kg	65.76	65.76
FLUORSPAR	kg	0.47	0.47
MAGNESITE	kg	10.72	10.72
FeMnC	kg	1.67	1.67
FeMn aff	kg	1.06	1.06
FeSi	kg	0.51	0.51
Al	kg	0.43	0.43
	kg		
	kg		
O2	m3	15.30	15.30
NATURAL GAS	m3	1.20	1.20
EL. ENERGY	kWh	812.00	812.00
OTHER COSTS		1.00	1.00
TOTAL COST		2404.28	2404.28



metal 2 edit 3 price 4 cons. 5 costs 6 steel 7 ferro 8 EXIT

EAF

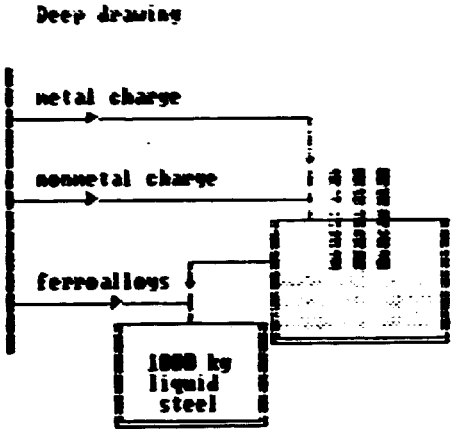
PRICE		old	new
DRI	UP	1400.00	1400.00
SC.AP	UP	1186.66	1186.66
SOLID PIG IRON	UP	2065.63	2065.63
IRON ORE	UP	1486.82	1486.82
COKE	UP	1450.00	1450.00
LIME	UP	372.00	372.00
FLUORSPAR	UP	2560.00	2560.00
MAGNESITE	UP	50.50	50.50
FeMnC	UP	4599.00	4599.00
FeMn aff	UP	10200.00	10200.00
FeSi	UP	5382.00	5382.00
Al	UP	12100.00	12100.00
	UP		
	UP		
O2	UP	470.00	470.00
NATURAL GAS	UP	2560.00	2560.00
EL. ENERGY	UP	870.00	870.00
OTHER COSTS		163.07	163.07
TOTAL COST		2404.28	2404.28



metal 2 edit 3 price 4 cons. 5 costs 6 steel 7 ferro 8 EXIT

EAF

# COST	list	old	new
DRI	kg	1132.98	1132.98
SCRAP	kg	312.67	312.67
SOLID PIG IRON	kg	1.65	1.65
IRON ORE	kg	22.97	22.97
COKE	kg	1.65	1.65
LIME	kg	24.46	24.46
FLUORSPAR	kg	1.20	1.20
MAGNESITE	kg	0.54	0.54
FeMn	kg	7.66	7.66
FeMn aff	kg	10.86	10.86
FeSi	kg	2.74	2.74
Al	kg	5.19	5.19
O2	kg	7.19	7.19
NATURAL GAS	kg	3.00	3.00
EL.ENERGY	kWh	706.44	706.44
OTHER COSTS		163.07	163.07
TOTAL COST		2404.28	2404.28



metal 2 edit 3 price 4 cons. 5 costs 6 steel 7 ferro 8 EXIT

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Slab Casters