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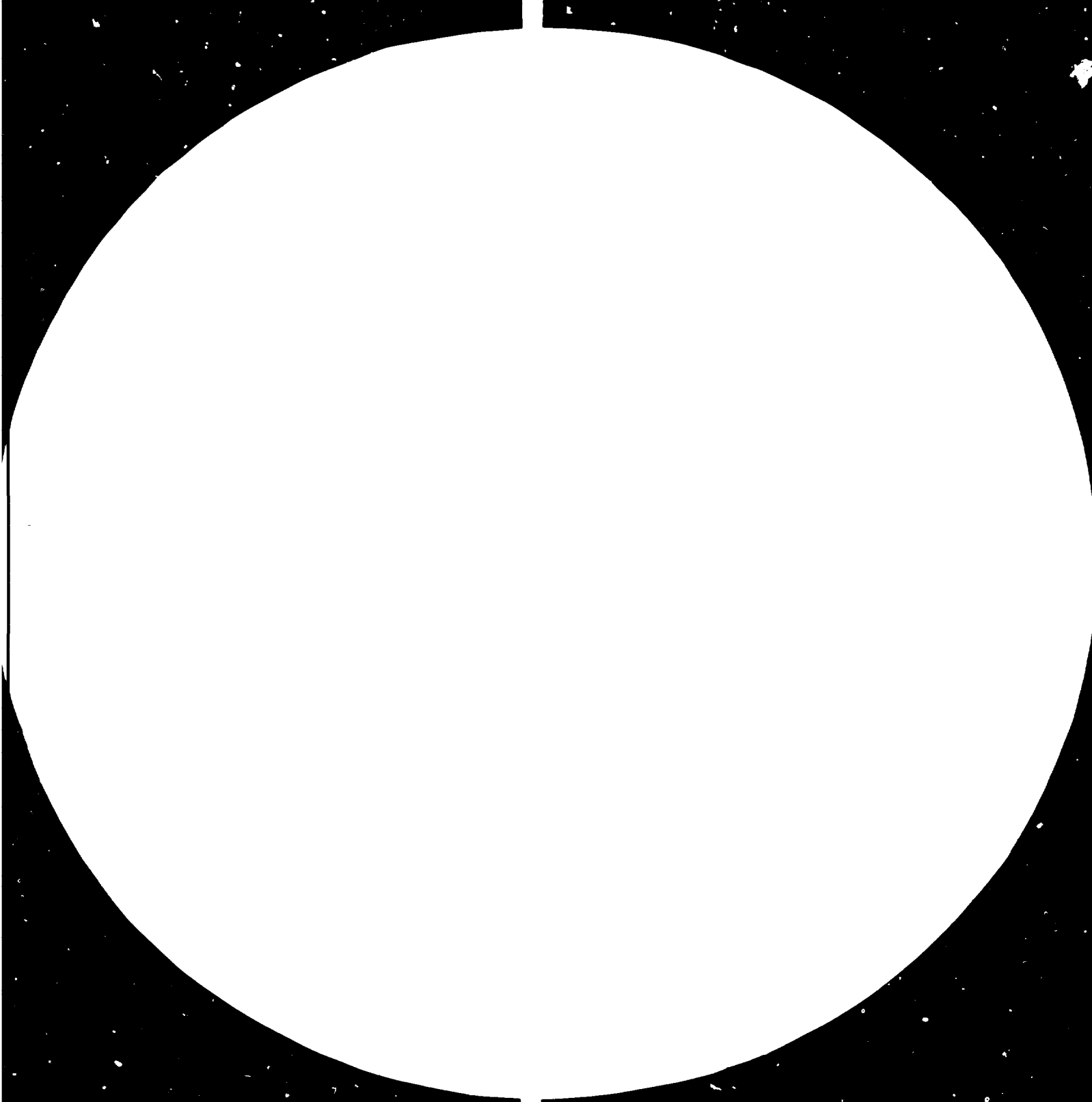

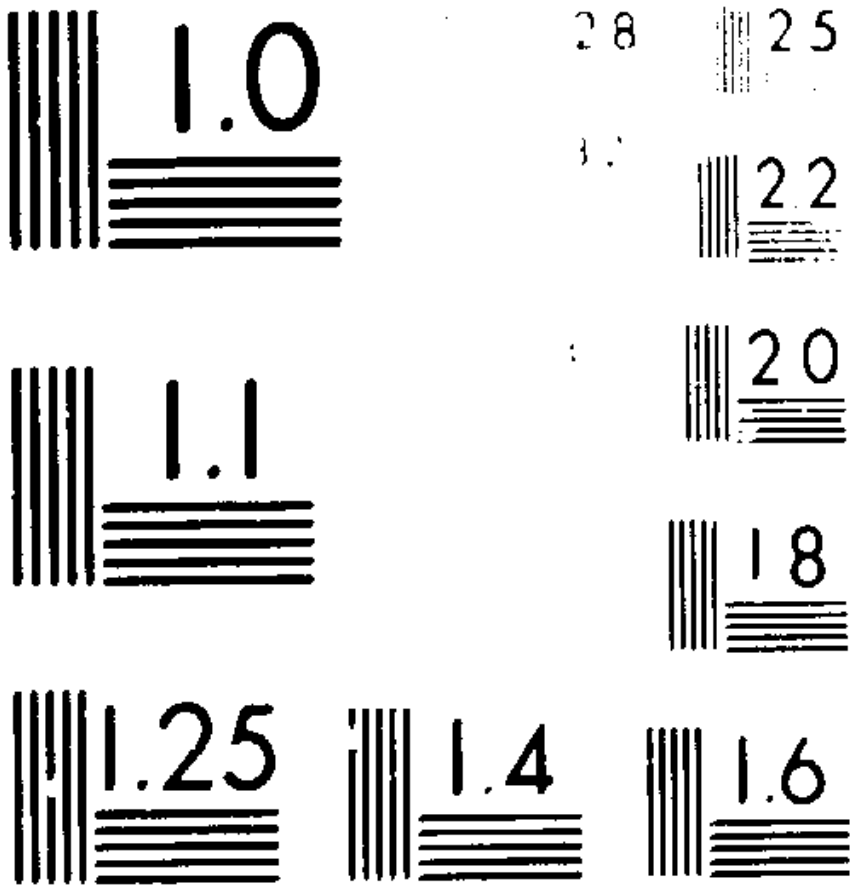
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Specialized Institute
for Engineering Industry

Baghdad - Iraq

Project No. DP/IRQ/77/003

Final Technical Report
about Development, Design, Prototype manufacturing and Testing new Bus family in IRAQ

3021

Prepared by
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Consultant for
Busbody Design
Post No. 11-12/7

Baghdad, 1 July 1982

CONTENTS

A. INTRODUCTION

Consultant for Busbody Design arrived in Baghdad on 1e[th] of April 1982, for a short term assignment of three months in the Specialized Institute for Engineering Industry, (Product Development and Design Department) UNIDO Project DP/IRQ/77/003, Post No. 11-12/7.
The job description, office order detailing the work programme, minutes of the meeting held at State Enterprise for Automotive Industry and the preliminery report are attached to this report as Appendices 1-4.

B. FINDINGS

i) The State Enterprise for Automotive Industries in Iskanderiyah (hereinafter referred to as Automotive Industry) is a producer of bus-bodies, but with limited facilities for:

   a. research, development and design,
   b. manufacturing of components and component parts required for assembly.

ii) The existing production of the small trucks with payload 4 tons, on the basis of licence SAVIEM, and commercial name SAMIR Al-DIN will be ceased by the end of 1982.
The existing production of the buses Reem 03 with 42 seats; Reem 04 with 29 seats and 50 standing passengers as well as Reem 05 with 42 seats will be ceased during first half of 1983.
During second half of 1982 it will start the production of a new longdistance bus Reem 577 under licence agreement with IKARUS, Hungary.

iii) Due to the design concept of the existing bus-bodies, the possibilities for co-operation with the Iraqi industry in manufacturing component parts and components were not until now sufficiently explored.

iv) The Specialized Institute for Engineering Industries (hereinafter referred to as Institute) has in its longrange programme, all activities required for assistance to the Automotive Industry, but until now without experience and with limited facilities.

v) As a result of rapid development of Industry in IRAQ, particulary concerning the Automotive Industry. The State Enterprise for Automotive Industry bought the licence from IKARUS-Hungary for busbody design Bus Reem 577.

Bus Reem 577 is a modern Bus, made on the conventional multi-purpose frame chassie of Scania K 112. Bus is modern shaped with airconditioner and other necessary equipment to suit Iraqi conditions for the passenger comfort-intention of the Automotive Industry is to produce this Bus in the next four years but with some modifications which can be introduced immediately and the main changes which could be introduced in the future.

C. CONCLUSIONS

On the basis of the prototype documentation of the Bus Reem 577 and remarks given by Design Department from Automotive Industry, as well as from customers side and from the "Product Development and Design Department" in the Institute. Consultent for Busbody Design (UNIDO), all modifications and main changes could be devided in two groups reffered as modification on new Busbody Design licenced Bus Reem 57, and the main changes in Design.

Modifications on new busbody Reem 577:

Some of modifications on new bus could be and should be introduced in cooperation with licencer of the Bus 577. The modifications which are proposed to be introduced immediately for coming production which will start in August 1982 are given below.

1. The modifications suggested by the customers side as well as Design Department in Automotive Industry:
   - Inside lamps and loudspeakers should be inserted into the ceiling
   - The head lamps should be rectangular
   - The main door should be hinging type
   - The step-light should be not on the ceiling
   - Four front seats to be supplied with ash-trayes
   - Cleaning the windscreen should be restudied
   - The linking arms on the cover of the luggage space should be the same type as for the engine cover
   - The floor carpet is too expensive and it is not easy for cleaning; should be used plastic carpet;
   - Seat head support should be covered with cloth
   - Number of the emergency hammers is not sufficient
   - The curtains should be sliding type
   - Duct cover for the airconditioner filter should be with locks, but not with screws;

- The toilete door is too narrow ;
- Toilet paneling should be from washable materials;
- The floor cover in the front of toilete door should be the same as for the floor of toilete.
- Separate aircirculating in toilete should be introduced;
- The capacity of the water tank is not sufficient; it should be 300 lit.
- The windows glass should be double and more smoked (50% brown)

2. Modifications suggested by the Consultant

- The main door on new Bus Reem 577 not to be changed, and on intercity bus should be introduced two wings Butterfly door as well as four wings door on City Bus. These suggestions come for two reasons:

  i. This type of door assures tight closing of the door opening, specially because of airconditioning and exchange of warm and cool air.

  ii. Opening of the door is controled by driver from one place. In the case of accident this type of doors are much sure, than hinged type of door (safety angle),

- The light for steps should be placed on right place,
- The linking arms on luggage space should be the same type as on the cover of engine/gas-springs/ the type of existing arms are not safe enough,
- The cover for airconditoner filter should be redesigned because the climate and conditions require more frequent cleaning,
- More efficient aircirculationing in toilet should be reinforced,
- Introduce the separate engine for airconditioner compressor in long distance buses because of the climate and conditions.

  All suggested modifications should be introduced in cooperation and agreement with licencer. Some of them should already be carried out on eight buses in August and to be conveyed in design documentation.

3. The main changes in the design suggested by the consultant.

The new Bus Reem 577 is one modern long distance Bus foreseen for high passenger Comfort. If the licencer accept suggested modifications, this type of bus could be produced for next few years, and thereafter to be replaced by new bus designed, tested and manufactured by local staff.

i) The first main change should be to replace the conventional frame chassie by integral chassie, but to use the same busbody structure,

bearing in mind that the licencer will supply the factory with the fixtures and necessary jigs for the busbody of Reem 577, and they will be used as well as for redesigned Bus.
In the first stage of the proposed programme, new Bus family will be designed that is fully integrated Body and chassie structure bus, which will be the basis for all Buses designed in future stages.
This change is suggested because the experience and trend in the world market is that the integral bus structure is cheaper in production and is more flexible than the buses on conventional chassie as well as the capital investment is lower.

ii) The second change is to replace the window single glasses to double glass and to be smoked to 50% . This change should be carried out in the stage of design, but on the basis of testing efficiency of airconditioner under the Iraqi conditions.

Adventages of the integral busbody structure:

Economy:

The integral busbody structure is better, because of the less weight. The integral chassie is made from square and regtangular steel-tubes available on any market in the world. Even in Iraq there already is a running production of such tubes. Material for the tube production is normal structural steel st. 37 to st. 42.2 weldable and is also available allover the world. The tubes are produced according to DIN Standard 59410. The fixtures and jigs for busbody structure will be the same as for the Bus Reem 577. Investment is only in the manufacturing of fixtures for the chassie.

Technology:

The experience in Busbody production is existing in the factory and the staff is already skilled. The technology for chassie manufacuring does not differ very much from the way of manufacturing the chassie. Integral chassie does not require pressdies and huge expensive presses, which will work not full time through out the year. The chassie is welded in CO_2 atmosphere, and welding machines are already existing in the factory as are the skilled workers.

Flexibility:

Integral chassie is much more flexible to accept set of Components from different producers and this is very important from the customers angle not to be tied only to one sourse.

Comfort:

Integral busbody structure is one oscillatory system and vibrations are more acceptable than in bus made on conventional chassie.

Safety:

In respect of safety, both types are safe enough if they are of good design and are properly tested. In case of accident, longitudinal rigidity of conventional chassie may cause more damage than integral body structure.

Disadvantages of the Integral chassie

- Staff for development and design as well as for testing in the time being is not available in Iraq. The local staff should reach certain level of experience only through practical work. This requires work in the field for number of years.
- The same problem will appear with the staff in Technology Department, though even, they have experience in technology of existing production.
- Equipment for testing and production will be needed.
- The customers are used to conventional design and will take time to accept new design of integral bus body structure.
- The responsibility for development, design, testing and quality of production is only on local staff and Industry who do not yet have sufficient experiance.

Technical explanation and comparison in acceptence of Components from different sources between frame chassie and integral chassie

- The frame chassie is Composed from two side rails and members, crossmenbers rivetted or screwed. On the side rails are already foreseen all holes needed for brackets and for mountening the set of Components.

- That really means that the conventional chassie is designed, manufactured for the Components from certain producer. Replacing this Components with the Components from other suppliers is possible but with more difficulties, even sometimes is not possible for example: the vertical line engine to be replaced with V-type of engine causes many difficulties.

- The integral chassie is designed and composed from the sections pointed for engine mountening, or rear axle with springing, front axle with springing, steering gearbox etc. In the period of design of new integral chassie will be already studied and foreseen to use the Components of different suppliers, but to use the same fixture for chassie assembly. To replace the Components from one to the Components from other supplier is question of small redesign and changes of some tubes.

Bus family with maximaly unified elements

On the basis of the longdistance bus designed in stage 1, in stage No.2 two remaining buses will be designed:

- Intercity bus and
- City bus

In the design period in stage No. 2, the development and design group should study both versions in such a way that the busbody of longdistance bus stays as it is, except opening for doors/number of doors/and type of windows, duct for aircirculating, airconditioning, seats, inner arrangement.

- Intercity bus will have more seats than the long distance bus, airconditioner could with compresor driven by the main engine, smaller capacity of fuel tank and water tank. All other differences will be studied during the design.
- The city bus will not have airconditioner, but good aircirculating system, the windows with possibility to be opened. The doors much wider and butterfly four wings type, because of better passenger circulating through the bus.

As conculusion, the family of the buses should be unified as much as possible.

D. REQUIREMENTS FOR NEW BUS-BODIES DESIGN

The main goal of the development, research and the design by the local staff is to reach independance of any foreign licence.
To achive the goal, the meeting on 8 May 1982 decided the immediate objectives as

> " To develop a family of three maximally unified busbodies based on the licenced long distance bus Reem 577 (licence from IKARUS, Hungary), but with introduction of changed chassie. The up-to-date integral design of chassie and body structure made from square and rectangular steel tubes should be used instead of the existing conventional chassie.
> A technical solution (research, prototype design, manufacturing and testing) should be made on the licenced bus Reem 577 and a separate study should show the economic feasibility of it".

The type of the design should be such, as to reach up-to-date concept as follows:

- Integral design, chassie and the body structure made from square and rectangular steel tubes,
- Airspringing on front and rear axle,
- Lor~ distance, Intercity Bus, as well as City Bus should be designed with rear mounted engine (vertical),
- Version of Intercity Bus should be equiped with airconditioner, but its compressor should be driven by the main engine,
- Long distance-luxory Bus should also be equiped with airconditioner, but compressor should be driven by separate engine,
- In new design sho e introduced maximum possibility to use components, component parts and semi-product manufactured by local industry.

On the above mentioned, comes the main task for the future programme in Automotive Industry and the Institute:
To meet the above objective, the work should be divided in two stages:

STAGE NO.1

The long distance bus will be designed during this stage. There are three phases in this stage:

Phase No.1

- On the basis of the offers and necessary drawings for the basic components from different suppliers in respect to the space needed (size of the busbody) to find advantages and disadvantages of components, their design, weight and other factors,
- On the basis of the findings in above mentioned, as well as on the basis of techno-economic studies in cooperation with Automotive Industry will be chosen the main supplier,
- To study the chassie design to use the basic components from one supplier, and with minor changes on the basic chassie to use components from few other suppliers, if it is demanded, or for some other reason,
- To prepare preliminary sketches of the chassie for the components of the main supplier,
- To prepare the necessary sketches required for changing the chassie if it is demanded to use components produced by other suppliers. The sketches should be detailed as much as to be easy for Design Group in Automotive Industry to give the answer on any question on customers request.

Phase No. 2

- To study final design documentation of the new Bus Reem 577,
- To find out all main and necessary dimensions of the body structure which directly influence the shape and the dimensions of the new integral chassie,
- To prepare preproject of the chassie and busbody structure on the basis on all datas bearing in mind to fulfill all mentioned demands,
- To foresee and suggest all feasible changes on the busbody if it is necessary.

Phase No. 3

On the basis of the findings in Phase 1, and Phase 2, to design the chassie which fits the body structure,

- To prepare prototype documentation for manufacturing the prototype (according the documentation),

- To train the designers through the practical design work,
- To hand-over the prototype documentation step by step to the Bus Design Group and prototype manufacturing group, in Automotive Industry,
- To follow the execution of the prototype and to correct the mistakes or parts according the facilities in the prototype workshop if is necessary, but to keep very strict demands of the design,
- To cooperate with prototype testing group, and to participate in preparation of layout of the strain-gauge and programme which should be prepared for prototype testing,
- On the basis of the findings in the Report prepared by prototype testing group, all weak points or overloaded members should be solved and introduced in documentation,
- To issue the final corrected documentation for "0" series,
- To cooperate with the group of quality control and follow the mistakes in prototype manufacturing if any, to act in proper time,
- To cooperate through Bus Design Group in Automotive Industry with technology department.

STAGE NO. 2

Final result of this stage should be:

- Intercity Bus and
- City Bus

On the basis of the final documentation for long distance Bus which should be developed, designed and prototype tested in Stage No. 1, and Stage No. 2 should be designed two remaining buses with maximally unified parts and components. The procedure in Stage No. 2 will be the same as in first stage, but in this stage will not appear the problem with the Designers, because after two years practical empirience in the Stage No. 1, the subgroups and designers leading them are already existing.

Attachment No 1 show the timing of the phases in stage 1 and 2 and the staff requirements.

To fulfil the task arising from Stage No. 1 and Stage No. 2 four groups in the Institute and Automotive Industry are to be organised in very close cooperation.

E. STRUCTURAL ORGANISATION

1. Busbody development group will have the task to work :

- on research, development and prototype design documentation of future busbodies in Institute,
- to cooperate very close with all other groups involved in the above mentioned two stages,
- to train through practical work the counterparts, designers and draftsmen, preparing them to continue the work without help or any licence,

This group under guidance of one chief-leader of the group should, from the work point of view be devided in 6 sub-groups or teams, and every team should be narrow specialized. Timing and staffing of the teams is shown in attachment No. 1.1

2. Busbody Design Group in the Automotive Industry

Staffing and timing is shown in attachment No. 1.2

- This group should work with prototype documentation, and design documentation as well as required changes and modifications in the Automotive Industry,
- To cooperate very close with Busbody Development Group in Institute,
- To proceed the prototype documentation to the prototype manufacturing group, and to follow the execution of the prototype,
- To cooperate with prototype testing group during the testing period, and specially to take share in discussion on the findings in testing Report,
- To cooperate with the group for technology in Automotive Industry and on request of the technology group to introduce necessary changes caused by production facilities,
- To answer any question by customers, or the other departments of the Automotive Industry,

To follow the production and if something happend to act immediatelly.

3. Prototype manufacturing Group in the already existing prototype workshop in Automotive Industry, attachment. No. 1.5

The task of this group should be:

- To manufacture the prototype acoording the prototype documentation, but very accurate every part, subassembly and assembly should be checked by the quality control department. All necessary changes caused by the facilities or some other reason. But every change should be approved by Busbody Design Group (on the drawing must be: date, reason of changing and signature),
- To cooperate with prototype testing Group during the period of the mutual work. After testing should be introduced necessary changes and especially after testing Report to correct weak points if any.

4. Prototype testing group:

Prototype testing should strictly proceed according to the programme prepared for prototype testing group. After the end of the testing must be prepared final Report with all necessary data for development and design group. Final report should through testing to justify the parameters given or found in preproject or during the design. Testing programme to be proceeded is necessary to have the group of skilled staff and necessary equipment.

In the world and specially in the countries with very developed industry are existing special laboratories for testing with very expensive and complicated equipment. In those laboratories, time for testing is much shorter but more expensive. These specialized test laboratories are equiped also with special test benches capable to imitate conditions as in actual use. To use all kind of multiaxle vibrations and stresses, the bus structure to be tested properly. Such stations are supplied with necessary monitoring recording and computing systems. But those laboratories are used for testing of own Busproduction which is very frequently changed and by other Busproducers even from different countries. That really means they are always occupied with orders for testing.

Facing now the reallity of existing and future production, in Iraq

Consultant's opinion is that, it is not necessary to build such type of laboratory, because almost the same result and quality of testing by carefully prepared programme could be done by much simpler and cheaper equipment and with smaller number of qualified staff which for the time being is not available. One point more, is that the most of necessary equipment is existing either in the Institute or in Automotive Industry. What additional is needed for the new Bus family is be listed in attachment No.1.4

- Recording the stress value on the chassie, and integral busbody structure elements

The integral chassie and busbody structure including side walls, roof, front and rear sides even outer sheeting make one system loaded with own weight, static pay-load, dynamic forces and vibrations during the riding, braking, passing over the roughness on the road and in the curves, all elements in integral body structure are loaded with part of the integral load. The opening for windows, doors, wind-screenetc. are weakening the body structure, therefore, participating members should be reinforced, and very carefully checked through the testing. Special attention must be paid on flexibility and torsional rigidity of the structure. According the scheme of the layout given in testing programme sticking together the straingauges on to closed members, cross members vertical pillars which transfer the force from cross members and anchorages to the sidewalls is a responsible job and must be done by the skilled staff.

- Geometrical dimensions to be checked

  - Length, width, hight and clearance,
  - Crossing capability,
  - Inner measuring, seats, drivers working place passenger compartment and fullfilment the ergonomic requests,
  - Turning radius,
  - Weight measuring loaded and unloaded Bus-mass distribution
    - Weight on front axle, left and right wheel,
    - Weight on rear axle, left and right wheel,
    - Weight left and right side,
    - Detecting the centre of gravity,

- Static stability,

- Testing the output on the rollers proof stand
  - Efficiency of the transmission.
- Measuring of fuel consumption
- Measuring the pollution of exhaust.
- Checking the power group.
- Engine, gearbox, clutch, radiator, airblowing, temperature stability, cooling and heating
- Braking efficiency should be tested on roller proof stand
- Testing in trafic manoeuverability and steerability, road keeping during the riding and braking.
- Testing the noise level
  - in passenger Compartment on few unsymetrical points,
  - Outer value of noise caused by passing bus,
- Testing the efficiency of airconditioner in Passenger Compartment
- Exploitation test with loaded bus in a normal transportation conditions.

For all items for testing in testing programme will be given much more detailed procedure for testing the prototype by the group for testing in cooperation of the International Expert in this field.

F. REQUIREMENT OF NECESSARY LOCAL STAFF (Attachment No.1.5)

BUSBODY DEVELOPMENT GROUP (Attachment No 1.1)

- Mechanical Engineer	9	- 204 m/m
- Electronic Engineer	1	- 9 m/m
- Industrial Designer	1	- 16 m/m
- Draftsman	3	- 66 m/m
Total		295 m/m

BUSBODY DESIGN GROUP (Attachment No.1.2)

FOR STATE NO. 1 - Mechanical Engineer	4	- 82 m/m
- Draftsman	2	- 38 m/m
Total		120 m/m

PROTOTYPE MANUFACTURING GROUP (Attachment No. 1.3)

- Production Engineer	1 - 25 m/m
- Metal worker	3 - 57 m/m
- Welder	1 - 16 m/m
- Electrician	1 - 13 m/m
- Helper	1 - 25 m/m
Total	136 m/m

PROTOTYPE TESTING GROUP (Attachment No. 1.4)

- Mechanical Engineer	1 - 25 m/m
- Electronic Engineer	1 - 4 m/m
- Electrician	1 - 12 m/m
- Busdriver	1 - 8 m/m
Total	49 m/m

Total number of local staff is: 600 man/months
Qualification as follows: (shown in Attech. No. 1.5)

- Mechanical Engineer	14 -311 m/m
- Electronic Engineer	1 - 13 m/m
- Production Engineer	1 - 25 m/m
- Industrial Designer	1 - 16 m/m
- Draftsman	5 -104 m/m
- Electrician	2 - 25 m/m
- Metalworker	3 - 57 m/m
- Welder	1 - 16 m/m
- Busdriver	1 - 8 m/m
- Helper	1 - 25 m/m
Total	600 man/months

BUSBODY DEVELOPMENT GROUP (Attachment No. 1.7)

FOR STAGE NO. 2

- Mechanical Engineer	9 -216 m/m
- Industrial Designer	1 - 24 m/m
- Electronic Engineer	1 - 12 m/m
- Draftsmen	3 - 72 m/m
Total	324 man/months

BUSBODY DESIGN GROUP (Attachment No. 1.6)

- Mechanical Engineer	4 - 96 m/m
- Draftsman	2 - 48 m/m
Total	144 men/months

PROTOTYPE MANUFACTURING GROUP (Attachment No. 1.7)

- Production Engineer	1 - 24 m/m
- Metalworker	3 - 72 m/m
- Welder	1 - 24 m/m
- Electrician	1 - 24 m/m
- Helper	1 - 24 m/m
Total	168 men/months

PROTOTYPE TESTING GROUP (Attachment No. 1.7)

- Mechanical Engineer	1 - 24 m/m
- Electronic Engineer	1 - 12 m/m
- Electrician	1 - 24 m/m
- Busdriver	1 - 24 m/m
Total	84 men/months

Total number, local staff in St. No. 2 - 720 m/m
Qualification as follows: (Attachment No. 1.6)

- Mechanical Engineer	14 - 336 m/m
- Production Engineer	1 - 24 m/m
- Industrial Designer	1 - 24 m/m
- Electronic Engineer	1 - 24 m/m
- Draftsmen	5 - 120 m/m
- Metalworker	3 - 72 m/m
- Welder	1 - 24 m/m
- Busdriver	1 - 24 m/m
- Helper	1 - 24 m/m
Total	30 per - 720 m/m

Total Engineer/months in Stage No. 1 (Attachment No. 1.5)

- Mechanical Engineer	14 - 311 m/m
- Production Engineer	1 - 25 m/m
- Electronic Engineer	1 - 13 m/m
- Industrial Designer	1 - 16 m/m
Total	Eng/months 365 m/m

Total Engineer/months in Stage No. 2 (Attachment No. 1.5)

- Mechanical Engineer	14 - 336 m/m
- Production Engineer	1 - 24 m/m
- Industrial Designer	1 - 24 m/m
- Electronic Engineer	1 - 24 m/m
	Total Eng/months 408 m/m

Total number Engineer/months for Stage No. 1 and No. 2 - 773 m/m

Total number all other staff for Stage No. 1 and No. 2 - 547 m/m

REQUIREMENT OF INTERNATIONAL STAFF (shown in Attachment No. 1.8)

	Stage No. 1	Stage No. 2	Total
- Busbody Designer	25 m/m	24 m/m	49 m/m
- Metalurg. for Aluminium	3 m/m	-	3 m/m
- Metalurg. for St. tubes	3 m/m	-	3 m/m
- Foreman in Prot. worksh.	12 m/m	24 m/m	36 m/m
- Industrial Designer	12 m/m	18 m/m	30 m/m
- Testing Engineer	9 m/m	12 m/m	21 m/m
- Technolog.for rubber	2 m/m	-	2 m/m
- Technolog.for plastic	2 m/m	-	2 m/m
- Technolog.for glass	-	3 m/m	3 m/m
Total	68 m/m	81 m/m	149 m/m

SUMMARY

1. The existing production is too old and does not fit to modern requirements for transportation. All production are based on conventional chassie as licenced design. The shape is not modern and with very square shape of the body. Passenger comfort in this Bus is on pretty low level and this production will be cancelled by the end of this year.

2. The new licenced Bus Reem 577 is a modern long distance bus with high passenger comfort, nicely shaped and with airconditioning. On this bus will be introduced some modifications with agreement of licencer, some of them will be introduced immediately and some of them in near future. Production of this Bus will start from beginning of the next year 1983 and will continue until the new IRACIBus family reach the stage of production. That period will be not more than three years.

3. The modifications on new bus Reem 577 are mentioned and listed in Final Report Page No. 2 under the item "Modifications".

4. The main changes in design are to replace the conventional chassie by integral busbody structure, which will allow the design of three Buses as representative of the family-longdistance, Intercity and City Bus. All three types should be designed with maximally unified Busbody and the chassie capable to be supplied with Components from different suppliers.

5. To fullfil this task should be organized four groups :-
Development and design group, Busbody design group, prototype manufacturing group and testing group. The necessary staff local and international is given in Final Report page No.14,16. The qualifications and duties of the staff are given in attachments.

6. The Work Plan is explained in details and it will last for stage No. 1 (long distance Bus) 25 months and in stage No. 2 (Intercity and City Bus) will last 24 months, altogether will be 49 months for complete Bus - family. The number of man/months of local staff is 1320, and number of man/months of International staff is 148.

7. It is foreseen that during the preparatory period some members of the groups are sent to the foreign factories, to be attached to the design and research department to be in a picture what is the rough frame of proposed project and to get atleast the basic Idea what is expected from them.

On the end of the report, a list of necessary equipment for testing is

RECOMMENDATIONS

- As it is mentioned in Summary, it is advisable to stop the existing production line,
- To continue production of modified new Bus Reem 577 for few years, as to reach the production stage of new bus family,
- Development and Design new family Buses on the basis of licenced Bus Reem 577, to use existing equipment and fixtures supplied by licencer for Bus structure manufacturing,
- To develop three main representative of the Bus family maximelly unified to cover the needs of passenger transportation,
- To build up the own staff of Engineers capable to proceed further work,
- To start with "preparatory stage" as soon as possible to prepare necessary requirements for the beginning of the stage No. 1 . In preparatory period should be prepared:
  - necessary datas, drawings from different suppliers to be able to start with study and design and to prepare necessary staff, local and international for the start and to prepare, at least, the offers from different suppliers for equipment for testing.

PERSONAL OBSERVATIONS

The consultant would like to say that in "Product Development and Design Department" is a good working atmosphere with excellent relationship and mutual respect between consultant, counterparts and the staff.

The consultant wishes to express his deepest appreciation to Dr. Abid Ali Sahib Abbas, Director General of SIET, for his support and cooperation.

The consultant also wishes to express his great gratitude to Dr. Abdul Matti Al-Khaffaf, Director of Product Development and Design Department, on the useful suggestions and great help. Must be also underlined the help and excellent cooperation of his counterparts specially of Miss Saheb Saadi Abdul Karim, Engineer in Design Department.

Great help to the consultant was given by Mr. Stevan Buranj, Chief Technical Adviser with his excellant experience in leading experts and his knowledge of domestic conditions.

Ljubisav Gavrilović

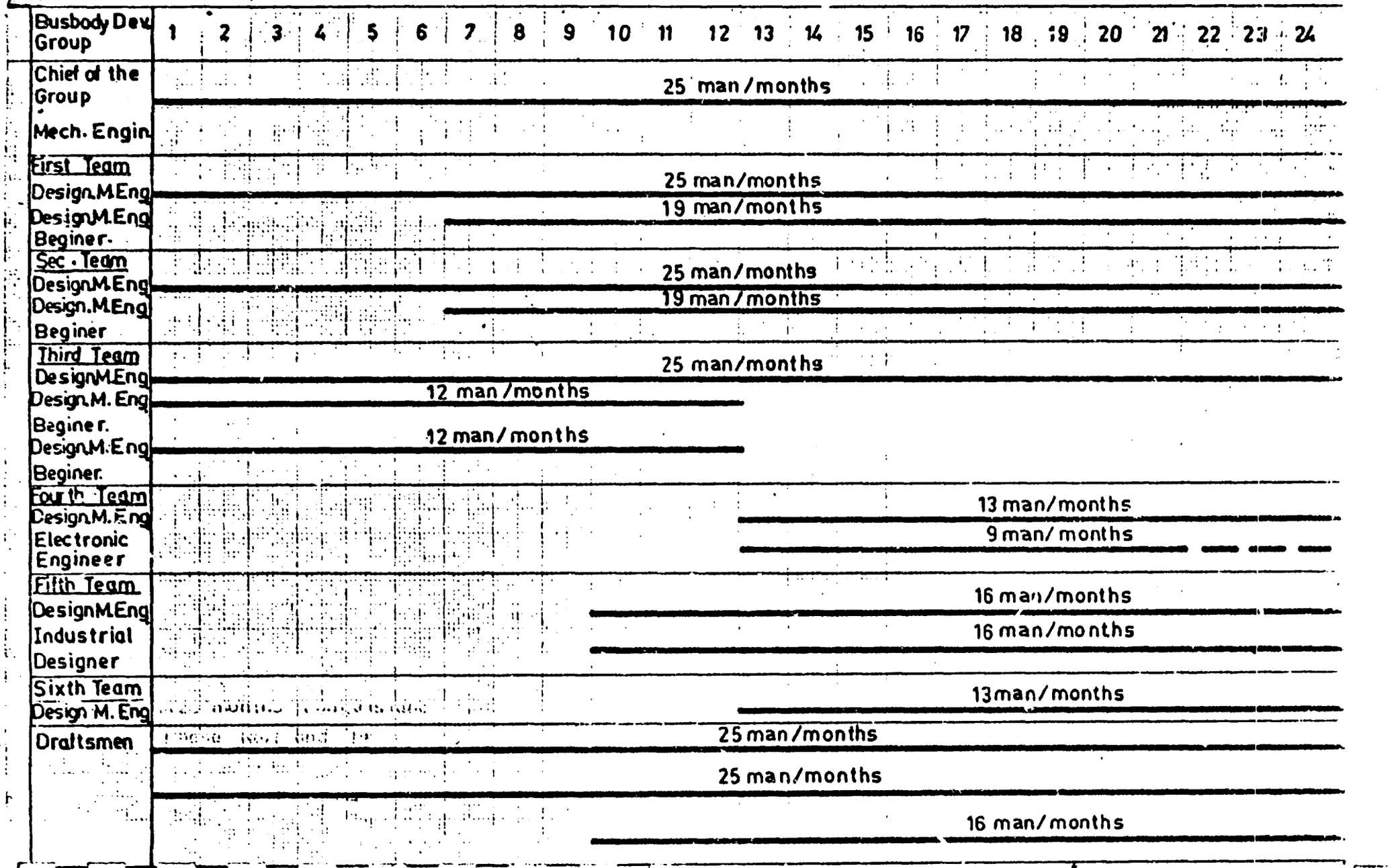
Baghdad, 21 June 1981

Ljubisav Gavrilovic
UNIDO Consultant for
Busbody Design

STAGE No.1 (25 months) Longdistance Bus, integral chassie and busbody structure

ATTACHMENT 1.1

Phase No.1 and Phase No.2 - 9 months, Phase No.3 - 16 months. LOCAL STAFF IN TNSTITUTE

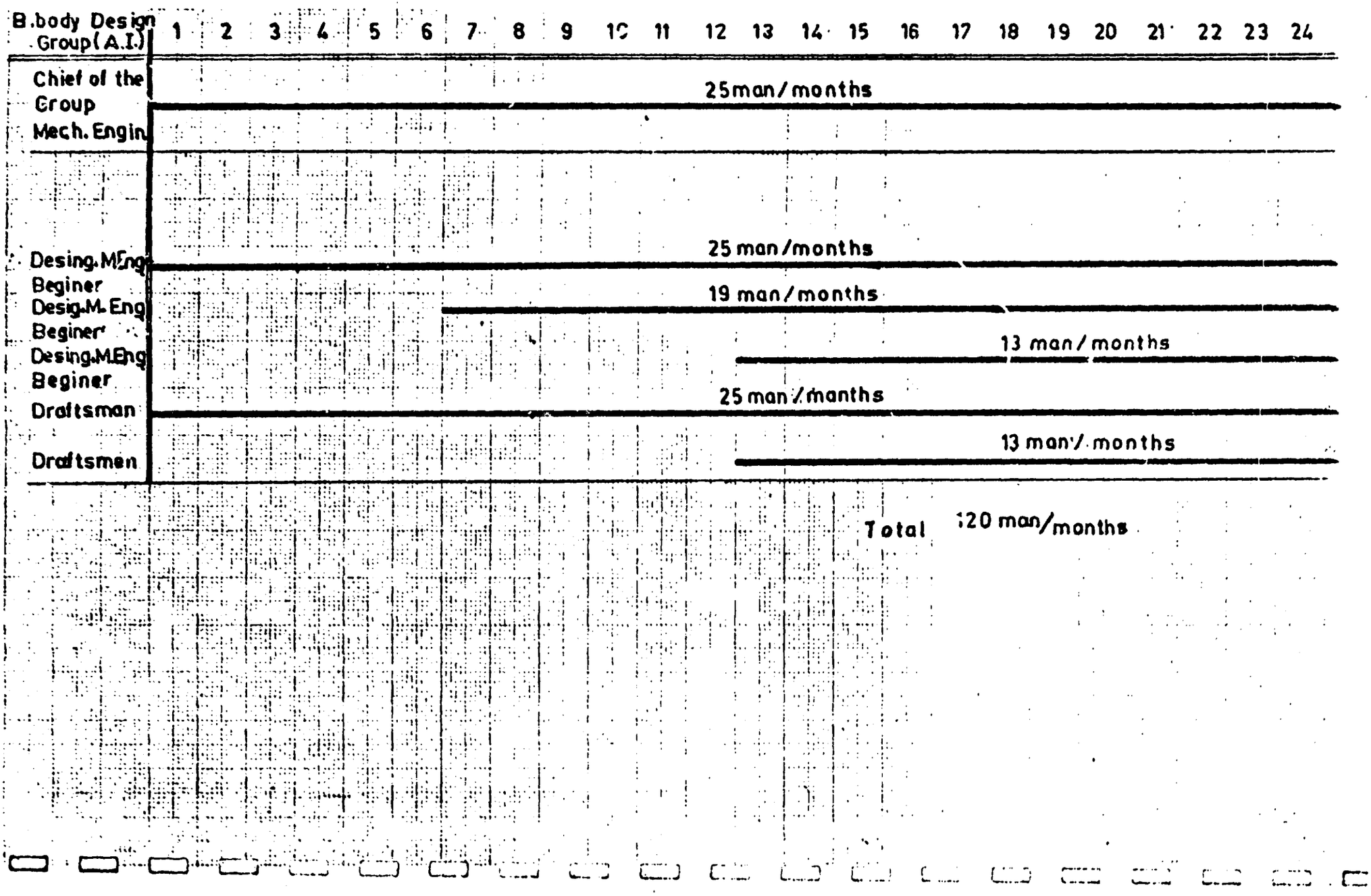


Total 235 man/months

STAGE No. 1 - Longdistanse Bus

ATTACHMENT No. 1-2

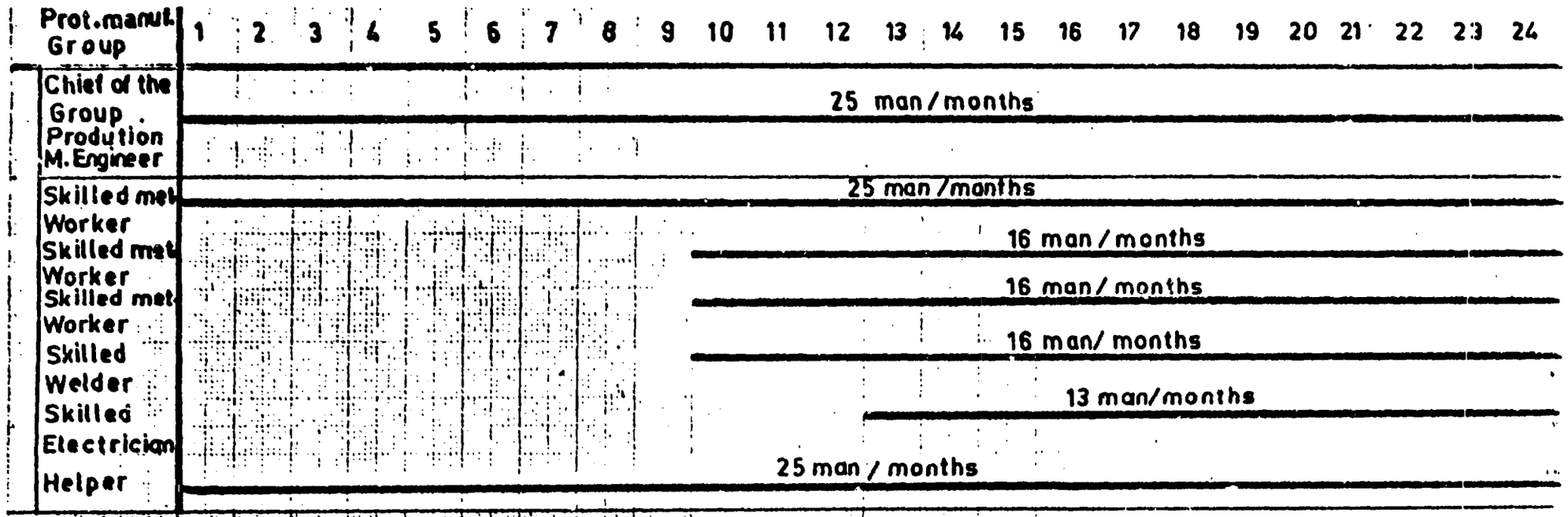
LOCAL STAFF IN AUTOMOTIVE INDUSTRY



STAGE No 1 – Longdistance Bus

ATTACHMENT No. 1.3

LOCAL STAFF IN THE Automotive Industry



Total 136 man/months

STAGE NO.1 - Longdistance Bus

ATTACHMENT No. 1.4

LOCAL STAFF IN AUTOMOTIVE INDUSTRY

Prot. testing Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Chief of the Test.Group	25 man/months																							
Testing Eng.														4 man/mo										
Electr. Eng.														12 man/months										
Skilled Electrician																		8 man/months						
Busdriver																								

Total 49 man/months

STAGE No 1-AND STAGE No 2 -LOCAL STAFF NEEDED QUALIFICATION

ATTACHMENT No. 1-5

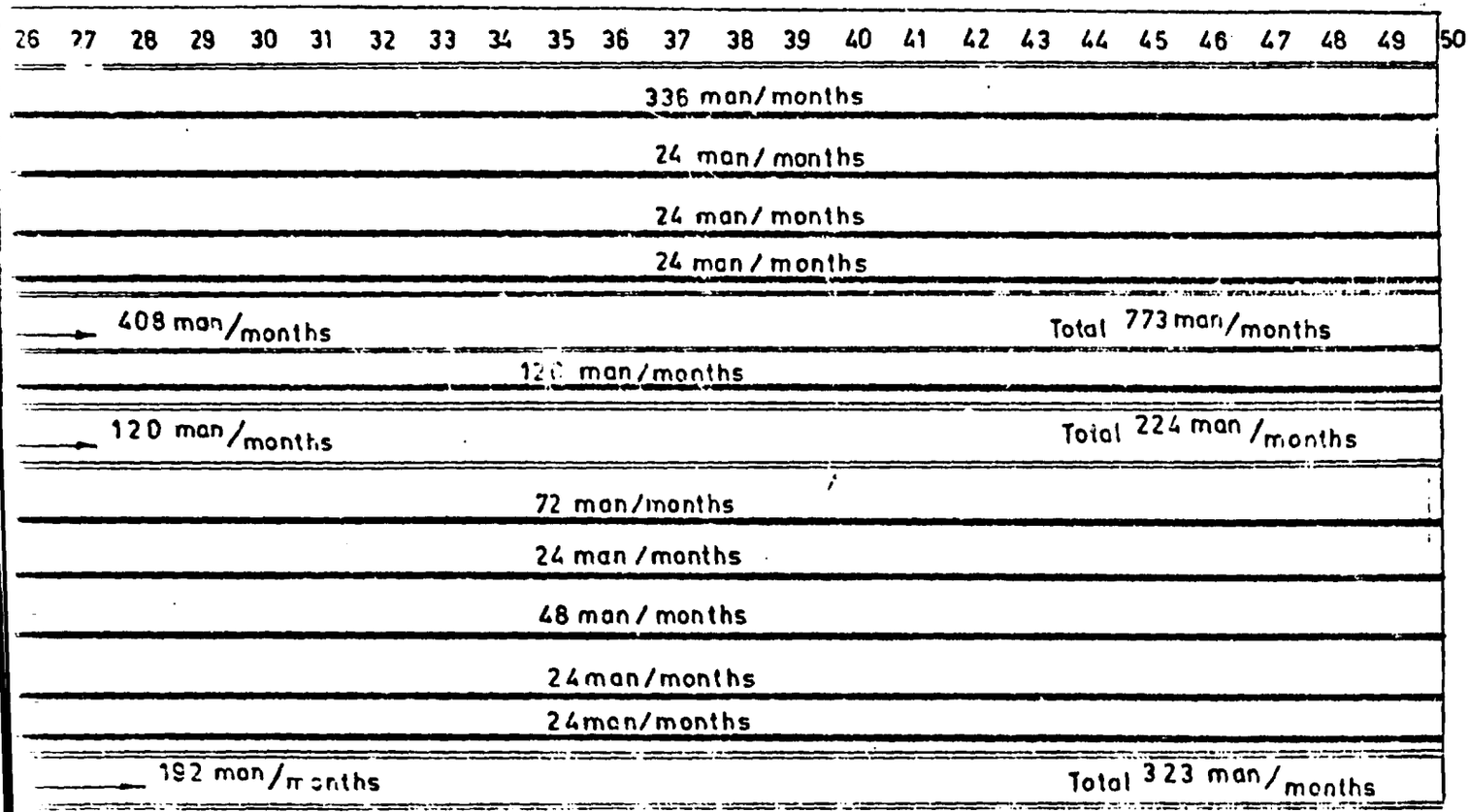
LONGDISTANCE ; INTERCITY AND CITY BUS

PHASE No 1 · No 2 | PHASE No 3 | Stage No. 1

QUALIFICATION	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
Mechanical Engineer										311 man/months															
Production Engineer										25 man/months															
Electronic Engineer													13 man/months												
Industriel Designer																									
Total 365 man/months																									
Draftsman										104 man/months															
Total 104 man/months																									
Skilled metal worker										57 man/months															
Skilled welder										16 man/months															
Skilled electrician													25 man/months												
Busdriver mechanic																		8 man/months							
Helper										25 man/months															
Total 131 man/months																									

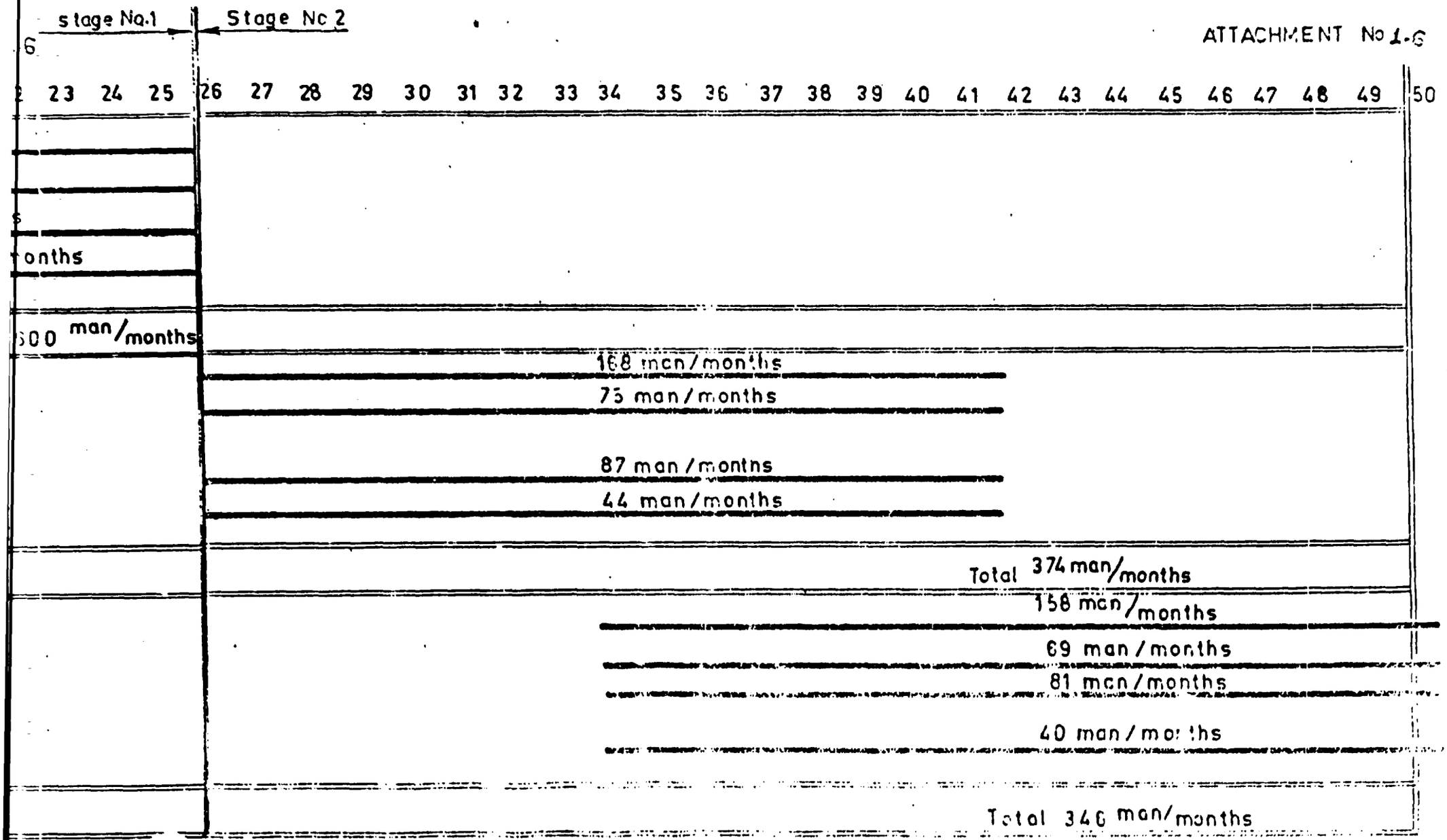
ATTACHMENT No 1-5

Stage No. 2



Total 1320 man/months

ATTACHMENT No 1-6



Total (Longdistance Bus) 600 + (Intercity bus) 374 + (City) 346 = 1320 man/months.

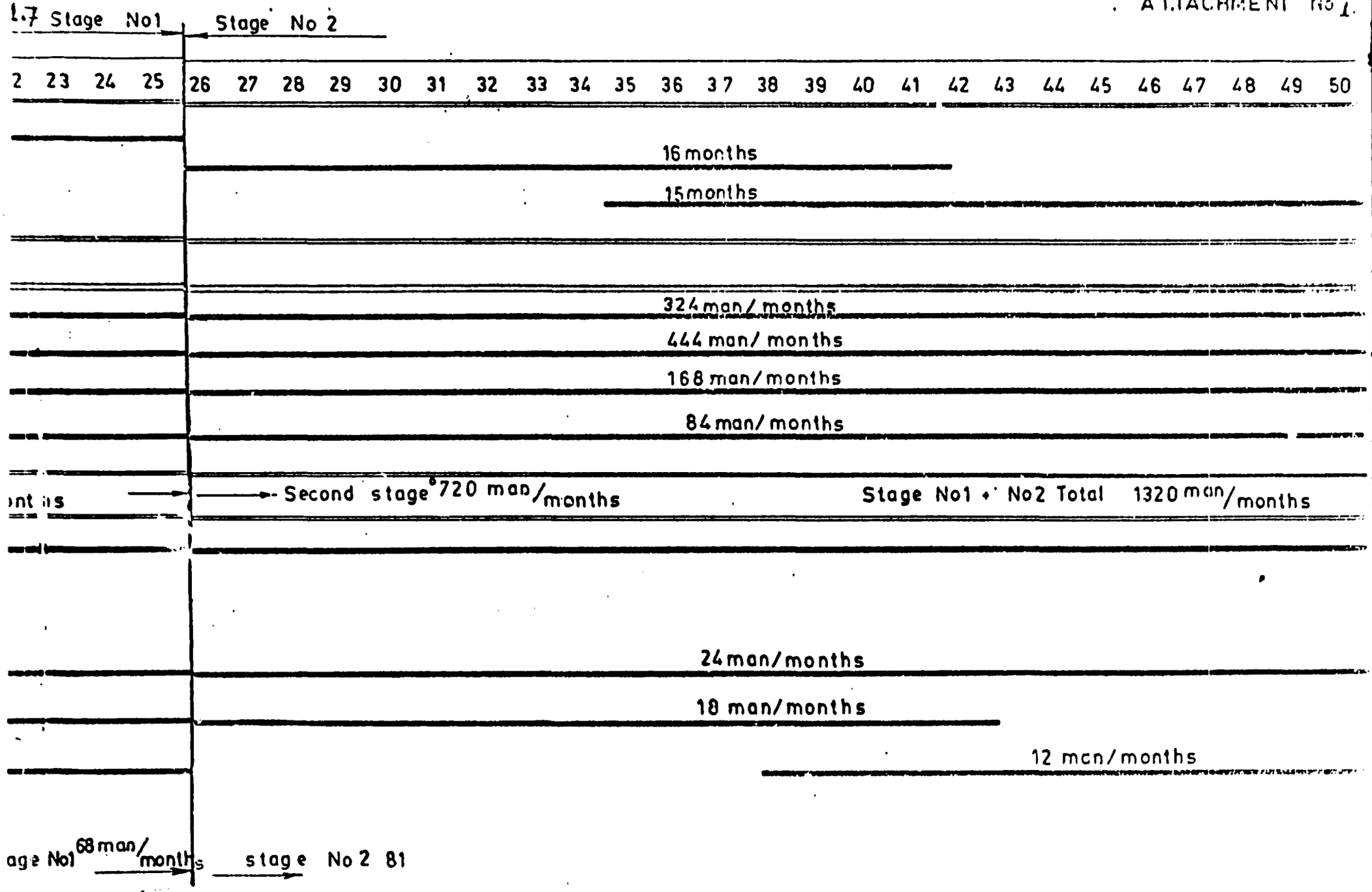
TIMING LONGDISTANCE INTERCITY AND CITY BUS LOCAL STAFF INTERNATIONALE EXPERTS
STAGE No 1 A[illegible] No 2

ATTACHMENT N

TIMING AND STAF.	3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
Longdistance Bus	23 months
Intercity Bus	
City Bus	
LOCAL STAFF	
Development Design Gr.	295 man/months
Busbody Design group	120 man/months
Prottotype manuf group	136 man/months
Prototyp Test group	49 man/months
INTERNATIONAL EXPERTS	First stage 600 man
Busbody design M. Eng	25 man/months
Metalurg for Aluminium	3 man/months
Metalurg Steel tubes	3 man/months
Forman in protot w.	12 man/months
Industrial Designer	12 man/months
Testing Engineer	3 man/mont
Technolog for rubber	2 man/months
Technolog for plastic	2 man/months

Tota

ATTACHMENT No 1.



REQUEST FOR INTERNATIONAL EXPERTS FOR STAGE No1 AND No 2 — ATTACHMENT No

PHASE No1 + PHASE No 2 — PHASE No 3

STGE No 1 INTRNATIONAL EXPERTS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Busbody Designer M. Engineer										25 man/months										
Metalurg. for Aluminium Cons										3 man/months										
Metalurg. for steel tubes Cons										3 man/months										
Foreman in prot. workshop														12 man/months						
Inustrial Designer														12 man/months						
Testing Engineer																	9 man/months			
Technolog. for rubber																2man/months				
Technolog. for plastic																2man/months				
STAGE No 2. INTen. EXPERTS																				
Busbody Designer M. Engineer																				
Foreman in prototype																				
Industrial Designer																				
Testing Engineer																				
Technolog. for glass																				

ATTACHMENT No 1.9

Stage No 1 | Stage No 2

21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49

24 man/months

24 man/months

18 man/months

12 man/months

BUSBODY DESIGNE - 49 m/m
METALURC ALUMINIUM - 3 m/m
METALURC ST. TUBES - 3 m/m
FOREMAN - 36 m/m
INDUSTR. DES. - 30 m/m
TESTING ENG. - 21 m/m
TECHNOLOGIST - rubber - 2 m/m
TECHNOLOGIST - plastic - 2 m/m
TECHNOLOGIST - glass - 3 m/m

TOTAL 149 man/months

JOB DESCRIPTION ATTACHMENT NO. 2.1

Post title EXPERT IN BUSBODY DESIGN

Qualification University degree in Mechanical Engineering, specialized in Automotive Industry with long experience in Busbodies Design Familiarity with the trend of up-to-date busbody design and manufacturing, as well as use of various new materials and standards.

Duties Expert will be attached through the Chief Technical Adviser to the Product, Development and Design Department of the S.I.E.I., and will be expected to:

1. Work on the busbody design of the integral busbody structure in the Group "Busbody Development". The structure of the busbody should be designed from square and rectangular steel-tubes.
2. Train the counterparts and junior Engineers Designers through practical work in the field of Busbody Design.
3. Cooperate very close with other groups involved in design, prototype manufacturing and testing.

Duration Expected: 49 months

Starting time From the beginning to the end of the Project.

JOB DESCRIPTION ATTACHMENT NO.2.2

Post title EXPERT IN BUSBODY TESTING

Qualification University degree in Electronic Engineering with long practical experience in measuring number of technical data, to be checked under different test conditions and load parameters on integral busbody structure. Experience in using electronic, and other necessary equipment for testing. Preparing the programme for testing, prepering the final report of testing and findings. Familiarity in strength calculation on the base of diagrams.

Duties The Expert will be attached through Chief Technical Adviser to the Prototype testing group in Automotive Industry and will be expected to:

1. To prepare the programme for prototype testing and directly to operate the instruments. To proceed the final calculation, final report and findings.
2. Train the counterparts and junior testing engineers and electricians.
3. Cooperate very closely with Research, Design and Prototype manufacturing group.

Duration Expected: Stage No. 1-12 months; Stage No. 2-18 months

Starting time Stage No. 1-13 months from the beginning the project.
Stage No. 2-25 months from the beginning the project.

JOB DESCRIPTION ATTACHMENT NO. 2.3

Post title	EXPERT-FOREMAN IN PROTOTYPE MANUFACTURING GROUP, AUT. INDUSTRY.
Qualification	Highly skilled worker, with long practical experience, not less than 20 years, in the field of prototype bus-body integral structure manufacturing. Experience in preparing temporary fixtures working experience with steel, aluminium and sheet-metal. General knowledge in welding steel, sheet-metal and aluminium.
Duties	The Expert will be attached through the Chief Technical Adviser to the Prototype manufacturing group in Automotive Industry and will be expected to: 1. Work on the execution of the prototype, integral chassie and bus structure. Preparing temporary fixtures and jigs on the basis of prototype documentation. 2. Train the counterparts and other local workers on the correct way to proceed the prototype execution. 3. Cooperate very closely with research, design and testing groups.
Duration	Expected: [illegible] months
Starting time	Stage No. 1-[illegible] months from the beginning of the Project through all Stage No. 2.

JOB DESCRIPTION ATTACHMENT NO.2.4

Post title	EXPERT INDUSTRIAL DESIGNER IN PRODUCT DEVELOPMENT AND DESIGN DEPARTMENT OF THE S.I.E.I.
Qualification	University degree, with long experience in Busbody Design, shaping and inner equipment and arrangement of Bus Saloon. Knowledge to meet the latest ergonomic requirements, and good feeling for the colours and combinations.
Duties	The Expert will be attached through the Chief Technical Adviser to the Product, Development and Design Department of the S.I.E.I. and will be expected to: 1. Work on new busdesign and permanent improvement of the new Bus family. 2. Train the counterparts and junior Industrial Designers. 3. Cooperate very closely with Development Group, Design Group as well as with prototype manufacturing and testing groups.
Duration	21 months: Stage No. 1-9 months and Stage No. 2-12 months
Starting time	Stage No. 1-16 months from the beginning Stage No. 2-36 months from the beginning to the end of the Stage.

JOB DESCRIPTION ATTACHMENT NO. 2.5

Post title	CHIEF OF RESEARCH, DEVELOPMENT AND DESIGN GROUP IN S.I.E.I.
Qualification	University degree, in Mechanical Engineering Specialized in Automotive Industry Experience not less than 10 years in the field. Chief should have experience to establish good relations and the atmosphere in cooperation with junior staff.
Duties	To work on Embody Design and Development in "Product Development and Design Department in the S.I.E.I. To lead and to coordinate the work of all six subgroups from the beginning to the final documentation for "0" series. To cooperate with prototype manufacturing and testing group.
Duration	Permanent
Starting time	From the beginning of the Project.

JOB DESCRIPTION ATTACHMENT NO. 2.6

Post title	DESIGNER, MECH. ENGINEER, LEADER OF THE SUBGROUPS TEAMS
Qualification	University degree, Mechanical Engineering Specialized in Automotive Industry or General Mechanical Engineering. Experience not less than two years in the Engineering Field.
Duties	Designer will be expected to work on the chassie design, specially on running units and components to guide the sub-group to be responsible for that part of the field, to co-operate with the Chief and very closely to cooperate with all other subgroups. Designer will be attached to the Product Development and Design Department of the S.I.E.I.
Duration	Permanent
Starting time	From the beginning of the Project.

JOB DESCRIPTION ATTACHMENT NO.2.7

Post title	DESIGNER MECH. ENG. IN BUSBODY DEVELOPMENT GROUP IN S.I.E.I.
Qualification	University degree, in Mechanical Engineering, specialized in Automotive Industry. BEGINNER
Duties	Designer will be expected to work on chassie design, specially on running unit with components designer will be attached to the "Product Development and Design Department" of the S.I.E.I., through the practical work to get experience in design and cooperation with the Engineers from other groups.
Duration	Permanent
Starting time	From the beginning two Engineers, six months from the beginning two Engineers.

JOB DESCRIPTION ATTACHMENT NO. 2.8

Post title	ELECTRICAL ENGINEER - ELECTRONIC
Qualification	University degree in Electrical Engineering, Specialized in Electronic. Experience in operation of eletronic equipment and general knowledge in layout scheme for the wiring in the Automotive Field. Experience not less than two years in the field.
Duties	To work on preparing the scheme for layout for the chassie and the Bus to participate in preparation of the programme for testing in cooperation with Expert for testing. Engineer will be attached to the "Product Development and Design Department" in the S.I.E.I. first nine months, and then after should be attached to the Prototype Testing Group in Automotive Industry. To cooperate very closely with all other groups during the design period and also with design prototype manufacturing groups.
Duration	Permanent
Starting time	12 months after the beginning.

JOB DESCRIPTION ATTACHMENT NO. 2.9

Post title	INDUSTRIAL DESIGNER IN BUSBODY DEVELOPMENT GROUP
Qualification	University degree Some experience in Busbody Design and shaping with the feeling for the colours and combinations with some knowledge in ergonomic field.
Duties	To work on the Busbody Design and permanent improvement of the shape, inner arrangement to reach high passanger comfort. To work in the "Product Development and Design Department" of the S.I.E.I. to cooperate with the group for prototype manufacturing as well as busbody design, prototype manufacturing and testing groups to fullfil special requests of the customers.
Duration	Permanent
Starting time	12 months after the beginning of the Project.

JOB DESCRIPTION ATTACHMENT NO. 2.10

Post title	CHIEF OF THE BUSBODY DESIGN GROUP IN AUTOMOTIVE INDUSTRY
Qualification	University degree in Mechanical Engineering, Specialized in Automotive Industry. Experience not less than five years in this field. Experience in cooperation with the production, and prototype manufacturing. Experience with documentation.
Duties	To work in Busbody Design Group in the Automotive Industry to lead the group of junior designers. To cooperate with Research and Development Group in Institute. To supervise the manufacturing of the prototype, cooperation with the staff from quality control and prototype testing group. To participate in preparing testing programme and final discussion on the findings in the report.
Duration	Permanent
Starting time	From the beginning of the Project.

JOB DESCRIPTION ATTACHMENT NO. 2.11

Post title	DESIGNER IN THE DESIGN GROUP IN AUTOMOTIVE INDUSTRY
Qualification	University degree in Mechanical Engineering, Specialized in Automotive Industry. BEGINNER
Duties	Designer will be expected to work on design to cooperate with the production, to be introduced with the prototype documentation. The Designer will pass through research and development group in the Institute and will be attached to the design group in Automotive Industry.
Duration	Permanent
Starting time	From the beginning one engineer, from six month after beginning one engineer, and after 12 months one engineer.

JOB DESCRIPTION ATTACHMENT NO. 2.12

Post title	CHIEF OF THE PROTOTYPE MANUFACTURING GROUP
Qualification	University degree in Mechanical Engineering, specialized in Production. Practical experience not less than 10 years.
Duties	To work in the prototype manufacturing group and to keep strictly way of the prototype documentation in close co-operation with the staff from quality control department. To organize the work with testing group in the period of time before the testing. To organize supplying necessary material needed for prototype manufacturing. To supervise condition of existing and necessary equipment for prototype execution.
Duration	Permanent
Starting time	From the beginning of the Project.

JOB DESCRIPTION ATTACHMENT NO. 2.13

Post title	SKILLED METALWORKER IN PROTOTYPE MANUFACTURING GROUP
Qualification	Skilled worker with long practical experience in the prototype workshop. Experience not less than 15 years. To have work experience with steel, sheet metal and aluminium, to have some knowledge in welding,
Duties	To work on prototype manufacturing according the prototype documentation. To cooperate with the staff from the quality control department.
Duration	Permanent
Starting time	From the beginning of the Project one worker after nine months two workers more.

JOB DESCRIPTION ATTACHMENT NO.2.14

Post title	SKILLED WELDER FOR STEEL AND ALUMINIUM WELDING
Qualification	Skilled welder, attested for electrical arc, flame and CO_2 welding. Experience not less than 12 years.
Duties	To work in prototype manufacturing group in the Automotive Industry, specially on the welding of the tubes-members of the chassie and bus structure, as well as sheet metal. To follow the instructions given on the drawings.
Duration	Permanent
Starting time	Nine months after the beginning of the Project.

JOB DESCRIPTION ATTACHMENT NO. 2.15

Post title SKILLED ELECTRICIAN IN PROTOTYPE MANUFACTURING GROUP

Qualification Skilled Electrician. Experience in the field of layout wiring in the Automotive Industry, and some experience in operating electronic equipment.
Experience not less than 10 years.

Duties To work in prototype manufacturing group.
To cooperate with electronic engineer responsible for scheme, or to work with electronic equipment in testing group and to cooperate with electronic engineer and expert in testing-group.

Duration [illegible]

Starting time [illegible] of the project.

JOB DESCRIPTION ATTACHMENT 2.16

Post title	SKILLED ELECTRICIAN IN TESTING GROUP
Qualification	Skilled Electrician. Experience in the field of layout wiring in the Automotive Industry, and some experience in operating electronic equipment. Experience not less than 10 years.
Duties	To work in prototype testing group. To cooperate with electronic engineer responsible for scheme, or to work with electronic equipment in testing group and to co-operate with electronic engineer and expert in testing group.
Duration	Permanent
Starting time	For prototype testing group 17 months after the beginning of the Project.

JOB DESCRIPTION ATTACHMENT NO. 2.17

Post title	CHIEF OF THE PROTOTYPE TESTING GROUP IN AUTOMOTIVE INDUSTRY
Qualification	University degree in Mechanical Engineering Experience not less than 10 years.
Duties	To lead the prototype testing group in Automotive Industry and to organize all necessary preparations for testing of material and equipment. To supervise the condition of electronic equipment to be ready in any time for operation. To participate in preparing testing programme and testing. To proceed the programme on the most correct way and to organise the mutual work with the prototype manufacturing group. To cooperate very closely with all groups involved in this Project.
Duration	Permanent
Starting time	From the beginning of the Project.

JOB DESCRIPTION ATTACHMENT NO. 2.18

Post title	BUSDRIVER IN THE PROTOTYPE TESTING GROUP IN AUTOMOTIVE INDUSTRY
Qualification	Skilled Busdriver and mechanic Experience not less than 15 years.
Duties	To be attached to the prototype testing group expected to drive the prototype bus. To maintain all necessary equipment mechanical or hydraulic. To take care of the bus to be in order/engine, radiator, brakes etc.
Duration	Permanent
Starting time	17 months after the beginning of the Project.

ATTACHMENT NO 3

LIST OF TESTING EQUIPMENT

The list of necessary equipment for testing is attached. All equipments have already been ordered by the Institute and are due for delivery in near future. It is the Consultant's considered opinion that it is not necessary to organise two testing laboratories for the same purpose in two places when the distance between them is not more than 40 kilometer. Besides the distance, the equipments ordered by the Institute cover much wider field than is required for bus testing. For example, Vehicle roller proof stand (output the engine power upto 300 kw through the wheels) is on order. The rollers are integrated with test stand, performance brakes for tractive effort vehicles effective on driving wheels.

However one strain gauge amplifier with more than 40 input cables should also be ordered by the Institute because on a bus chassie and bus body structure the points to be tested are considerably larger. The decision on model and number of input cable plugs should be taken by Testing Engineer in the Institute.

EQUIPMENT FOR MECHANICAL RESEARCH AND DEVELOPMENT

Item No.	Qty	Description
ML - 22		Fuel consumption tests for tractors and trucks power 35-300 HP.
ML - 22.1	1	Volume method - calibrating flasks.
ML - 22.2	1	Weighing method.
ML - 22.3	1	Continual method.
ML - 23.1	1	Smoke tests of tractors and trucks engine. Filtering method.
ML - 23.2	1	Comparator method.
ML - 24		Test station of injector pumps for calibration of up to 12 cylinder diesel engine pumps.
		Main specifications
		1. Electric motor 7.5 KW with Variable Mechanical drive upto 4600 r.p.m.
		2. Molti shot count system to give 100-1000 shots in multiples of 100.
		3. Quick Action clamps and mounting blocks and brackets.
		4. Distance between bed to centre 150 mm.
		5. 220-380V/3ph./50HZ.
ML - 25		Test station for hydraulic pumps used for complete testing of main hydraulic, control and power steering systems or for agricultural and industrial machines, tractors, fork liftstrucks.
		Main specifications
		1. pressure range: 0-350 bar
		2. Temperature range: upto 150°C with thermister thermometer.
		3. Flow range: 20-100 litre/minute.
		4. The device should include remote sensor for temp., and speed.
ML - 26		Test station for starting motors (starters) used for testing automotive starter motors, Voltage 6; 12 and 24 V.D.C.
ML - 27	1	Test station for oil and fuel filters of tractors and trucks engine. Special ultrasonic plant or any , for unload system as oil and fuel filters for cleaning, lucgvering and testing.
ML - 28	1	Stand for testing syringe of agricultural machine. Main technical data: max. test load 200 KN. max. cross head travel 1000 mm.

Item No.	Qty	Description
		Load measuring range 10 mN....200 KN Load display analogue, digital. Diagram indication: Load-Deformation, Deformation-Load, Deformation-Time, Load-Time.
ML - 29	1	Stand for testing gears, couplings and shafts of tractors, trucks and agricultural machine.
ML - 7		Rule and tape measures:
	5	Rule length - 2m
	5	"" - 3m
	5	"" - 5m
	5	Rule tape length 10m
	3	"" 20m
	2	"" 50m
ML - 8		Mass parameters test:
ML - 8.1		Analytical balance, double pan, capacity
	1	2Kg, sensitive to 5mg. with balance masses set.
ML - 8.2		Analytical balance digital read out. Weighing range 160g. Single pan, Readability 0. 1mg.
ML - 8.3		Density balance for the measurement of liquid densities up-to 2
ML - 8.4	1	Titling balance, capacity 2Kg, sensitive 5mg.
ML - 9		Equipment for measuring accelerations:
ML - 9.1		Transducer for linear movement. Range
	2	0-50mm. error ± 0.5%
ML - 9.2	11	Vibrograph. Range of amplitude 0.01-15mm, frequency 2-300 HZ
ML - 9.3	2	Accelerameter - Speedometer. Range - 5 to + 25g, error ± 2%
ML - 10		Equipment for measuring the angular movements, speeds and accelerations
ML - 10.1	1	Potentiometer. Range upto 337°, error 0.1%
ML - 10.2	1	Impulsometer electronic. Range 1000 impulses
ML - 11		Instrument for measuring the temperatures of following:
ML - 11.1	2	Thermometer for vegetables. Range - 10°C to + 50°C
ML - 11.2	5	Soil thermometer. Range - 10°C to + 70°C
ML - 11.3	3	Resistance thermometer for liquids and gases Range 0 - 150°C
ML - 11.4	10	Resistance thermometer for bearings: 0 to 120°C
ML - 12		Instruments for time measuring:
ML - 12.1	1	Stop watch, digital, split action, display to one hour. Accuracy ± 1S/24h.

Item No.	Qty	Description
ML - 12.2	2	Stop watch with main dial 0 to 60 x 0.2S, and subsidiary dial 0 to 60 x 1 min
ML - 12.	2	Digital timer scaler and frequencymeter following data: - timer range 0-999.9S. Accuracy ± 0.5% - scaler ratemeter range 0-999.9 X 10 counts, accuracy ± 0.5%, max. count rate 2000 S-1 - frequencymeter range at max. sensitivity 10 KHZ to 200 KHZ
ML - 13		Pressure measuring instruments:
ML - 13.1	5	Manometer universal, range 1-40 Kg/Cm^2
ML - 13.2	5	Manometer for accurate measuring, range 1-100 Kg/Cm^2, error 0.25%
ML - 13.3	5	Vacuumeter universal, range upto 1 Kg/Cm^2
ML - 13.4	2	Manovacuumeter, range 1-25 Kg/Cm^2
ML - 14		Instrument for air speed and direction measuring:
ML - 14.1	2	Anemometer for air speed, range 50-1000 m/min
ML - 14.2	2	Windmeter, range 50-2500 m/min for speed and upto 300° for direction
ML - 15	1	Multimeter unit for measuring of braking distance for tractors
ML - 16	2	Sound level indicator, range 40-110d BA
ML - 17		Tachometers:
ML - 17.1	2	Tachometer, hand type, scale calibrated 0 to 5000 rev/min, complete with spindle
ML - .2	3	Tachometer for measuring the speed of rotation in either direction, scale graduated 0 to 500 rev/min with x10 and x100 range switch for reading upto 50000 rev/min and device to lock pointer position
ML - 18.1	2	Soil compactnessmeter, range 0-100 Kg/Cm^2
ML - 18.2	2	Instrument for measuring coefficient of friction between soil and metals
ML - 18.3	2	Instrument for measuring coefficient of friction between soil and other materials, range 0-0.9
ML - 18.4	2	Instrument for determination soil clod strength, range 10-100 Kg.
ML - 18.5	2	Instrument for determination soil sticking, range upto 300 g/Cm^2
ML - 19		Moisturemeters:
ML - 19.1	2	Soil moisture tensiometer for max. depth of 30 Cm and humidity upto 70%. Error ± 1%
ML - 19.2	2	Green moisturemeter, range 10-40% error ± 0.5%
ML - 19.3	2	Moisturemeter for several kind of agricultural materials. Error ± 1%

Item No.	Qty	Description
ML - 20		Augers:
ML - 20.1	2	Soil auger-cylindrical, for withdrawing unbroken samples of soil for analysis
ML - 20.2	2	Soil auger-helical. Suitable for heavy soil. Helix X 200mm long x 38mm diameter on stem
ML - 21	2	Soil sieves-A set of six brass nesting sieves, holes diameter range 0.2 - 50mm.

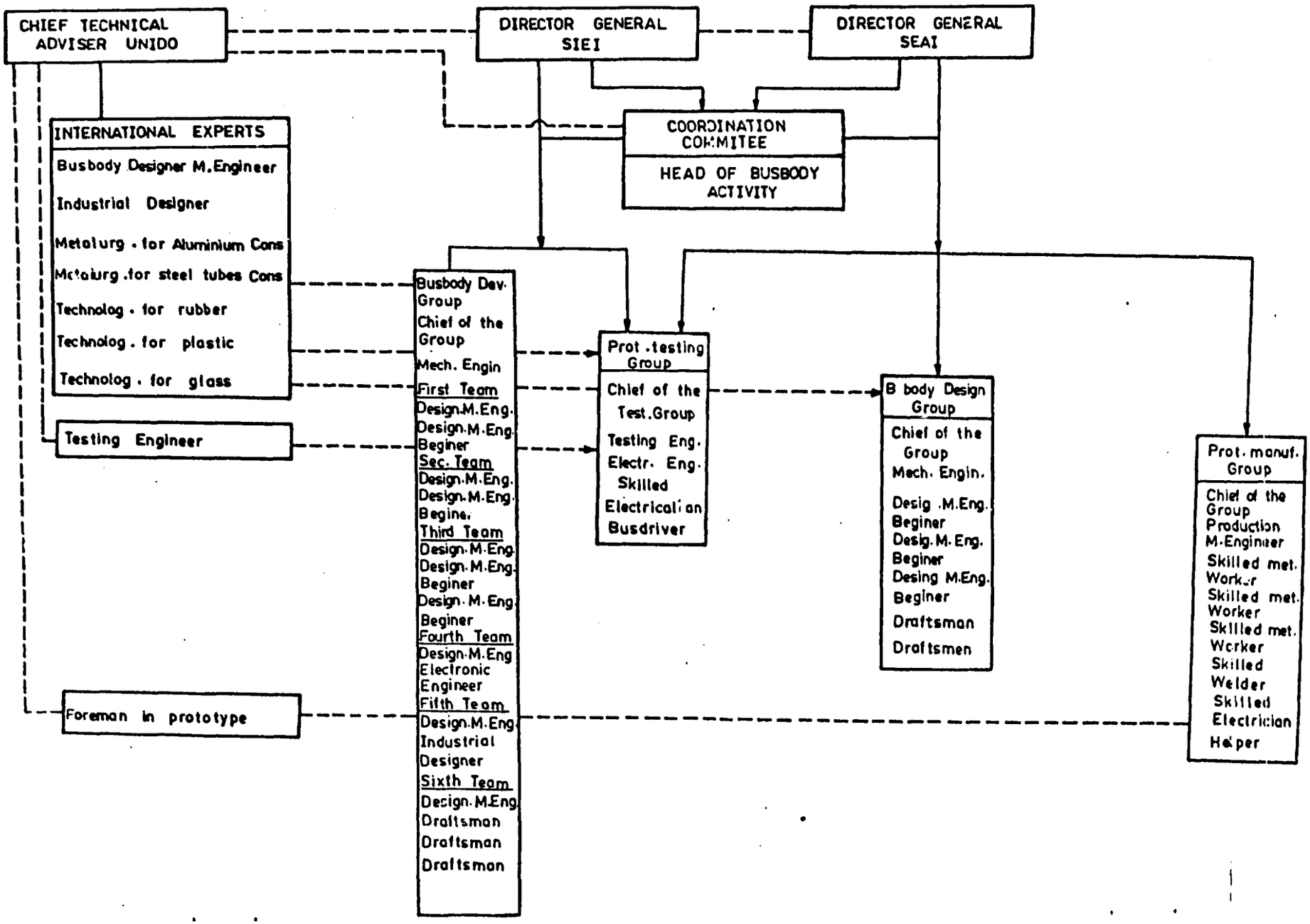
ELECTRICAL EQUIPMENT LABORATORY FOR TESTING AND DEVELOPMENT OF ELECTRICAL PRODUCTS

Item No.	Qty	Description
EL 1	1	High voltage source Input 220V 50 c/s
EL 5	1	Set Precision Multirange voltmeters upto 600V
EL 11	1	Voltage and current Recorder
EL 17	1	Vibration Meter (for motors machines)
EL 18	1	Dynamometer (Max. scale 3KW)
EL 19	1	Singal Generator
EL 27	8	Set thermo-couples with wire and compensating wire
EL 28	1	Temperature Recorder for temperature measurement with the aid of thermocouples
EL 31	2	Battery testing hydrometer
EL 32	5	Battery testing thermometer Accuracy within $\pm$ 0.5°C
EL 33	1	Battery charging and discharging unit
EL 34	1	Bunsen Burner equipment for flammability test on insulating materials
EL 38	1	Cathode Ray Oscilloscope (CRO)
EL 40	1	Reversible switch

Item No.	Qty	Description
		The stand is requested for measuring such as bending moments and torque moments————etc and contacts stresses for gear's teeth.
ML - 30	1	Stands for testing chains and belts of tractors and agricultural machines. Set of several drives comprising V-belt, timing-belt, Wedge-belt, chain drive————etc.
ML - 31	1	Stand for testing hand and foot brakes. Brake tester for tractors and vehicles with axel weights upto 13t.
ML - 32		Several stands for testing and determination of wearing resistance of agricultural working parts. It should include appartuse for rolling and sliding resistance, friction on a horizantal and inclined plane, Axial friction appertus.
ML - 33	1	Equipment for testing the seeding and fertilizer apparatuses for measuring phisc-mechanical properties of the fertilizer, humidity, grain structure, specific weight, coefficient of sliding friction, flow angle, destroying angle————etc.
ML - 34	1	Station for testing the irrigation water pumps, power upto 50 HP, for measuring the following parameters: 1. Capacity 2. Head 3. Speed 4. Temperature of bearings————etc.
ML - 35	1	Brake testing stand for tractors and trucks engine. Power upto 300 HP, r.p.m. upto 3000. This stand is required for determination of effective performance engine running-in-test, endurance test.
ML - 36	1	Diagnostic mobile laboratory for evaluation of the technical state of tractors and trucks engine in field conditions for measuring the condition of the following: Battery, starter , ignition coil, contact breaker point, dwell angle, Top dead centre system, ignition cable and spark plug connection, Cooling System, Carburetor, Cylinder, Condenser, capacitors————etc.

Item No.	Qty	Description
ML - 37(38)	1	Specialized automated strain measurement laboratory designed for high-complexityhall-round tests and investigations of agricultural machines. It should intend to operate for operation in hard soil and climatic (- 10° to + 50°C ambient) conditions and also can be used in the field far from the control testing laboratory. The laboratory should mounted on a frame of a truck and equipped with an automatic measuring system, communication system, test control panel, power supply system and auxilliary equipment which ensures processing of photographs, photo records, stowage of transducers. The laboratory should consist of: 1- transducers for measuring the required parameters (Drawpull, temperature, distance, fuel flow; drive wheel revs., engine speed, time relative humidity, parometric pressure, strain measurement————etc). 2- An instrument case containing a micro-computer system. 3- An instrument panel containing the necessary displace and controls. 4- Tractor cable hardness, 5- A key-board/printer to enter data, and to present the result of the end of each test.
ML - 39	4	Heavy duty portable scales for measuring the weight of a wheel resting anywhere on the surface. The capacity for each should be upto 7.5 ton.

ORGANISATION CHART



Minutes

of the meeting held on 8 May 1982 at the premises of the State Enterprise for Automotive Industries, Iskanderiyah

Present were:

1. From the State Enterprise for Automotive Industries (hereinafter referred to as: Automotive Industry):

- Dr. Mahdi Said Hayder	- Director General
- Mr. Mohammed Haykel	- Chief of Design Section
- Mr. Zakari Ahmed A. Al-Halik	- Engineer in Design Section

2. From the Specialized Institute for Engineering Industries (hereinafter referred to as: Institute):

- Dr. Abid Ali Sahib Abbas	- Director General
- Dr. Abdul Katti Al-Khaffaf	- Director of the Product Development and Design Department
- Miss Sahab Saadi Abdul Karim	- Engineer in Design Department
- Mr. Steven Buranj,	- UNIDO Chief Technical Adviser
- Mr. Ljubisav Gavrilovic	- UNIDO Consultant for Busbody Design.

Subject

1. Preliminary Report prepared by the UNIDO Consultant concerning technical possibilities and organization for establishment of research, development, design, prototype manufacturing and testing activities in field of busbodies.
2. Discussion on future of these activities.

Presentation

1. Mr. Buranj, UNIDO Chief Technical Adviser explained the Preliminary Report in detail.
2. Discussions were held and further explanations on request were given by Mr. Gavrilovic and Mr. Buranj.
3. After discussions, there were made the bellow listed decisions.

Decisions

1. The proposed Alternative No. 2 is accepted as the base for further works. This Alternative No. 2 should be read as follows:

" To develop a family of three maximally unified busbodies based on the licenced longdistance bus Reem 577 (licence from IKARUS, Hungary), but with introduction of changed chassy. The up-to-date intergnal design of chassy and body structure made from square and rectangular steel tubes should be used instead of the existing conventional chassy.

A technical solution (research, prototype design, manufacturing and testing) should be made on the licenced bus Reem 577 and ~~after that~~ a separate study should show the economic feasibility of it.

Therefore, the work should proceed in stages

- changes on the licenced longdistance bus Reem 577
- based on maximally unified elements, design of the remaining two busbodies
  a. intercity bus
  b. city bus.

2. On the licenced longdistance bus Reem 577 slight changes should be introduced so as to maximally suits the (a) exploatation conditions and (b) existing production facilities.

3. In to execute this programme, four working groups should be formed:

No. 1 Busbody Development Group to work on research, development and prototype design of busbodies in the Institute.

No. 2 Busbody Design Group to work with design documentation as well as with required changes and/or modifications in the Automotive Industry.

No. 3 Prototype Manufacturing Working already exists in the Automotive Industry, and

No. 4 Testing Group which will deal with testing of components and components parts in the Institute and with testing of complete bus in the Automotive Industry.

4. The tasks of these groups are:
   - to prepare prototype documentation based on research and development studies;
   - to organize and manufacture the prototypes;
   - to test the prototypes as components/component parts and as complete products;
   - to introduce necessary changes based on results of testings, and
   - to issue the product design documentation for "0" serie of production.

5. These groups will not have task:
   - to organize the local manufacturing (choise of producers, technology, equipment and layout, tool design, tool manufacture, introduction of production and quality of locally produced parts).
   - to organize foreign supplies for components and component parts which temporary could not be produced locally,
   - to prepare all required economic studies.

6. The UNIDO Consultant will prepare a detailed Final Report based on above mentioned decisions. The Final Report should give:
   - work programme,
   - requirements for local staff with brief job descriptions,
   - requirements for international staff with job descriptions,
   - timing for work programme b) local staff and c) international experts.

7. In cooperation with the Management of the Automotive Industry, the UNIDO Consultant will prepare the first initiale list of testing equipment and instruments.

For the Automotive Industry	For the Institute
Dr. Mahdi Said Hayder, Director General	Dr. Abid Ali Sahib Abbas, Director Gene
Mr. Mohammed Mayhol, Chief Design Section	Dr. Abdul Karim Al-Khaffaf, Director Product Development & Design Depart.
Mr. Zahari Ahmed A.Al-Khalik, Engineer	Miss.Sahab Saadi A.Merim, Engineer

Mr. Steven Barcaj, Chief Technical Adviser (UNIDO)

Mr. Ljubisav Gavrilovic, Consultant (UNIDO)

Specialized Institute for Engineering Industries
Baghdad-Iraq

Preliminary Report

On findings, objectives and recommendations for development of busbody design activities in Iraq for discussions.

1. FINDINGS

i) The State Enterprise for Automotive Industries in Iskanderiyah (hereinafter referred to as: Automotive Industry) is a producer of bus-bodies, but with limited facilities for:

a. research, development and design,
b. manufacturing of components and component parts required for assembly.

ii) The existing production of the small trucks with payload 4 tons, on the base of licence SAVIEM, and commercial name SALAH AL-DIN will be ceased by the end of 1982.
The existing production of the buses Reem 03 with 42 seats; Reem 04 with 29 seats and 50 standing passengers as well as Reem 05 with 44 seats will be ceased during first half of 1983.
During second half of 1982 it will start the production of a new longdistance bus Reem 577 under licence agreement with IKARUS, Hungary.

iii) Due to the design concept of the existing busbodies, the possibilities for co-operation with the Iraqi industry in manufacturing component parts and components were not until now sufficiently explored.

iv) The Specialized Institute for Engineering Industries (hereinafter referred to as: Institute) has in its longrange programme all activities required for assistance to the Automotive Industry, but until now without experience and with limited facilities.

2. OBJECTIVES

Direct objectives

i) To improve the new longdistance bus Reem 577 which will be produced under licence agreement with IKARUS, Hungary so as to maximally suit:

a. the exploatation conditions, and
b. the existing production facilities.

ii) To develop a family of busbodies which should cover the main exploatation needs with view on the following conditions:

a. to be based on either own design or improvement of some licence,
b. to meet all up-to-date trends in busbody design and manufacturing, and
c. the design concept should be oriented towards use of locally produced materials, components parts and components.

Consecuent objectives

iii) To establish permanent specialized activities for research, development and design of busbodies with corresponding organizational structures.

iv) To organize on a wide scale local manufacture of component parts and components.

3. EXPLANATIONS

i) The decision to abandon the production of the existing buses Reem 03, Reem 04 and Reem 05 might be technically advisable due to permanent and rather quick development of such products in the industrially developed countries. The economical consequense and timing should be subject of a separate study which could be prepared by the Institute's Techno-Economic Studies Department.

ii) The objective to improve the new longdistance bus Reem 577 has to be approached on the following way:

a. to collect the remarks through (1) Visual check and (2) Local research testing of prototype (see attachment No. 1);

b. to study the concept of the bus and the remarks through design documentation (Remark: Not prototype documentation);

c. to make draft solutions for the feasible remarks only ; and

d. to agree with the licencer IKARUS, Hungary to introduce the changes in the design documentation and in the production.

iii) The objective to develop a family of busbodies has to be approached on the following way:

a. to form a group which will permanently work on research, development and prototype design of the busbodies. The group should be specialized and beside of the current work has closely to follow the develo ment trends in the field of busbodies;

b. the Automotive Industry's design office should deal with the prototype documentation as well as permanently with the product design documentation due eventual demands, production changes and improvements;

c. the Automotive Industry have already a workshop for manufacturing the prototypes. Prototype manufacturing activity should be considered as permanent one while production changes or improvements are always demanded;

d. to form a group which will deal with testing and follow up the remarks obtained from the exploatation.
This group should be very closely connected with the group described under para a. research, development and prototype design.

If these groups are formed with the explained programmes for their works, then the objective to develop a family of busbodies could be fulfilled. The work plan for every group is subject of a separate study, based on decisions concerning:

a. design concept (own or improvement of licance),
b. priority,
c. planned time,
d. actual number of working staff, and
e. involvement of the Automotive Industry's and the Institute's other departments in study of possibilities for local manufacturi

iv) The consequent objective as to establish permanent specialized activities for research, development and design of busbodies is with establishment of the above mentioned four groups practically solved.

v) The consequent objective as to reach a wide scale local manufacture of component parts and components should be mutual task of the Automotive Industry's and the Institute's Production Engineering Departments in co-operation with the Institute's Techno-Economic Studies Department.

vi) Description of the desired technical conditions

a. Versions of the busbodies

a. Citybus for 100 passangers; 29 seats and 71 standing places,
b. Intercity bus for 50 passanger (seats), and
c. Longdistance Luxory bus for 42 - 45 passangers.

b. Type of design

- Intergral design, chassy and busbody structure made from square and rectangular steel tubes ;
- Air springing on front and rear axles;
- Citybus, intercity bus and longdistance luxory bus should be designed with rear mounted vertical engine;
- Version of intercity bus should be with airconditioning;
- Longdistance-luxory bus should be equiped with airconditioning but with separate engine (specially for airconditioner only) , with luxory equipment and specially, with luxory seats;
- In the new design should be introduced maximal possibility to use the components and component parts from local industry;
- The new design should be so flexible to accept major components from diferent producers; and
- The design conception should be maximally up-to-date.

4. Recommendations

i) Objectives

a. to form a specialized organizational structure which will have as permanent work programme research, development and design in field of busbodies;

b. to suggest improvements on the new longdistance bus Reem 577.

c. to develop a family of 3-three maximally unified busbodies which would cover the main exploatation needs, based on:

either Alternative No. 1

- own design

or Alternative No. 2

- licenced longdistance bus Reem 577, but with changed chassy if a prior detailed study (research, prototype design, prototype manufacturing and testing) shows techno-economic feasibility for such concept.

ii) Organizational structure

a. in the Product Development and Design Department Section to form specialized groups for:

1. research, development and prototype design of busbody (hereinafter referred to as: Busbody Development Group)

2. testing of busbodies, complete and components (hereinafter referred to as: Busbody Testing Group);

b. in the Automotive Industry to form in the existing Design Department a Group specialized for these busbodies only (hereinafter referred to as: Busbody Design Group)

c. in the Automotive Industry to use the Prototype Manufacturing Workshop (hereinafter referred to as: Prototype Workshop).

iii) Timing:

Alternative No. 1

For development of a family of busbodies from the concept through research, prototype documentation, prototype manufacturing and testing upto the design documentation for "0" serie of production will be needed approximately 48 months.

Alternative No. 2

The prior detailed study with prototype documentation, prototype manufacturing and testing of longdistance bus Reem 577 with changed chassy will require approximately 24 month.
If the concept of changes will be economically feasible, then it will be needed approximately additional 24 month for developing and completing all works on the two remaining busbodies (intercity-bus and citybus).

iv) Staffing

There should be a team composed of local and international staff. The international staff should be narrowly specialized in this field, while the local staff could be with limited emperience except for the workers needed.

a. Alternative No. 1

1. Total number of local staff required is not more then approximately 30, of them 12 B.Sc. Engineers;

2. Total man month of international experts required is approximately 1/4 m/m, of that min. 12 m/m for various consultancy mainly connected with materials and local production.

b. Alternative No. 2

1. Total number of local staff will remain the same, but it should proceed in stages;

2. Total man months of international experts will be slightly reduced on approximately 126 m/m only, and it should proceed also in stages.

v. Advantages/Disadvantages

a. Advantages

1. The busbody research, development and design activity will be introduced in Iraq as a permanent one and the staff will be trained;

2. The improvement of the new longdistance bus Reem 577 will be made;

3. Alternative No. 1

- a family of up-to-date concept of busbodies will be introduced;
- the concept of design will allow high degree of flexibility on demands and relatively low investments in equipment and tooling;
- the Automotive Industry will not be bound to one supplier only, i.e. all components and component parts which for the time being cannot be produced in Iraq, could be obtained from various suppliers.

4. Alternative No. 2, if it is techno-economically feasible.

- change of the chassy on the new licenced busbody will allow higher degree of flexibility. This means that the chassy will be designed for use of the basic main components from one supplier only. But, it will be possible to use the same design of chassy with minor alterations for introduction and regular use of basic main components from few other suppliers, if it is demanded or gives higher economy.
- two additional new busbodies on the same design principle and with maximal use of components and component parts from the new licenced bus will be made.

b. Disadvantages

1. Rather big number of qualified local staff should be devoted for this work only.

2. International staff is needed for quite a long period and their availability must be sinchronized.

Sinchronizing the availability of international staff is very difficult.
Additional extra funds should be obtained for financing the international staff.

3. The start and progress of the work depend on:
   - availability of the local staff in required number and qualifications,
   - sinchronized availability of the international staff as to form a team for various required specializations, and
   - availability of final design documentation, but not prototype design documentation for the licenced longdistance bus Reem 577 - for the Alternative No. 2 only.

4. Risk on timing is rather big.

5. Risk on techno-economical aspect of local manufacturing is also rather big.

6. If alternative No. 2 is accepted, then the percentage of local manufacturing is lower and the Automotive Industry could be still bound to one supplier only.

vi) Possibility for immediate start.

In the both alternatives, the work should be devided in phases. The number and details of phases will be shown in the detailed programme of work.
As the first few phases have to deal with a) establishment of groups, b) collecting technical datas and informations, c) research studies and d) preliminary design, therefore the work could start immediately. During this starting period which will require approximately 9-12 months a limited number of local staff will be needed only while the need for international staff is very limited. From the other end, this period could be sufficient to the managements to insure all requirement in local staff, in international staff as a team and in providing the most needed instrumentations.
Such concept allows immediate start and maximal use of all existing facilities.

vii) Additional recommendations

a. Based on the decision, detailed programme of work, requirement and timing will be prepared in form of a Final Report.

b. The requirements for testing equipment and measuring instruments will be separatelly prepared together with the Automotive Industry.

c. A separate study should be made concerning the team of international staff. The study should deal with way of recruitment, cost and funds for financing. Based on results and decisions, arrangements should be made as to provide the required expertise on time.

Baghdad, 6 May 1982

Lj. Gavrilovic
UNIDO Consultant in Busbody Design
SIEI - Baghdad

Attachment No. 1

Remarks on the new licenced long-distance bus Reem 577

1. Inside lamps and loudspeakers should be inserted into the ceiling.
2. The head lamps should be rectangular.
3. The main door should be linging type.
4. The step-light should be not on the ceiling.
5. Four front seats to be supply with ash-trayes.
6. Cleaning the windscreen should be restudied.
7. The linking arms on the cover of the luggage space should be the same type as for the engine cover.
8. The floor carpet is to expensive and it is not easy for cleaning; should be used plastic carpet;
9. Seat head support should be covered with cloth.
10. Number of the emergency hammers is not sufficent.
11. The curtains should be sliding type.
12. Duc cover for the airconditioner filter should be with locks, but not with screws;
13. The toilete door is too narrow;
14. Toilet paneling should be from washable material;
15. The floor cover in the front of toilete door should be the same as for the floor of toilete.
16. Separate aircirculating in toilete should be introduced.
17. The capacity of the water tank is not sufficient; it should be 300 lit.
18. The windows glass should be double and more smoked (50% brown)

CONSULTANT'S WORK PLAN

1- 1. To study the already existing busbodies in Iskanderiyah, including:

The manufacturing possibilities documentation, materials, feeding industries.

2. To study the new bus and to put down the modifications and improvements needed.

3. Proposal for producing future bus.

4. Training of counterparts and to select material and standards needed for the job.

5. To put two reports, preliminary report to show the work procedure to be approved by higher authorities, final report which must contain detail proposal for establishing busbody design section and its research, testing laberatories, prototype manufacturing, staff needed, and the training of the staff, in addition to have a complete programme for expalining design stages upto have final product for Iraqi bus as design and manufacturing.

2- Eng. Sahab Saadi Abdul Karim,)
Eng. Nasreen Amen) both are counterparts

3- It is valid from 1982/4/10 to 1982/07/10

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNIDO

Project of the Government of the Republic of Iraq

Specialized Institute for Engineering Industries (SIEI)

JOB DESCRIPTION

DP/IRQ/77/003

Post No. 11-12/J/31.9.A

POST TITLE : Consultant for busbody design.

DURATION : Three months.
If the assessment for redesign and unification of the busbody is positive, an expert post might be opened with minimum one year duration.

DUTY STATION : Baghdad, with possibility of travel within the country.

PURPOSE OF CONSULTANCY ASSIGNMENT : The State Enterprise for Automotive Industry, Iskanderiyah-on the outskirts of Baghdad is producing busbodies under old licence from IKARUS (Hungary). There is an aim to modernise and unify the bodies, introduce airconditioning and introduce some changes in materials using aluminium too. The objective is to clarify the technical reality of this aim and if positive to specify the requirements through a detailed work programme.

DUTIES : The Consultant will be attached, through the Chief Technical Adviser to the Product Development and Design Department of the SIEI and he will be expected to:

(1) Study the overall situation with the existing busbodies (suitability, licence and other documentation, production, used technology, quality, etc.),

(2) Study the aims which are expected to be reached with eventual redesign of the busbodies.

(3) Give assessment on technical possibility and suitability for redesign of busbodies as well as on expected fulfillment of aims.

(4) If the assessment is positive, to work out a detailed Work Programme with specification of all requirements and a foreseen time-table.

(5) Give instructions and guidance for start of preparatory works on redesign of busbodies.

QUALIFICATION : University degree in mechanical engineering with long years practical experience in busbody design and excellant knowledge of up-to-date trends in bus design and manufacturing as well as in use of various new materials and standards.

LANGUAGE : English, Arabic language is an asset.

BACKGROUND INFORMATION

: The Republic of Iraq has a growing engineering industry and has laid emphasis on the raising of industrial productivity through the use of modern products and up-to-date production methods. There are already established agricultural machineries, trailers, buses, transformers, electric and household equipment industries.
In addition, the National Plan has given high priority to further expansion of the mechanical and electrical industries. The existing productions are introduced mainly under various types of licence agreements. There are social, mixed and private sectors.

The Government has established the "Specialized Institute for Engineering Industries" through Law No. 128 in 1972 with the main objective of assisting the development of engineering industries in Iraq, and to extend this assistance to other Arab States at later stage.

The Institute is an autonomous body and has a Board of Directors. It is headed by a Director General and has an initial basic engineering and supporting staff. The Institute has already been functioning since 1973 but on a very limited scale. It has temporary premises but will be relocated in its new headquarters in Baghdad, where will have well-equiped manufacturing workshops beside of technical offices and necessary premises.

The Project is designed to develop the Institute along up-to-date scientific lines so that it could effectively render services and training in the following areas: (a) Product Development and Design, (b) Production Engineering, (c) Prototype Manufacturing (products, special tools, sophisticated components and parts), (d) Quality Control and Inspection, (e) Industrial Information and Documentation, and (f) Techno-Economic Studies.

Bearing in mind the rapid expansion of the engineering industry and urgent needs for its assistance, the

Government of Iraq has agreed with the United Nations Development Programme to include this project into the Country Programme 1977 - 1981 and partially 1982 - 1986. The executing Agency is the United Nations Industrial Development Organization. The duration of the Project is six years and nine months starting from 1 October 1977. The Government Contribution is ID. 4,700,000 and the UNDP Contribution totals US $ 3,931,302.-.

There will be thirteen UNIDO Experts for the implementation of this project as well as some short-term Consultant.

Busbody Manufacturing in Iraq

The State Enterprise for Automotive Industries, Iskanderiyah - on the outskirts of Baghdad have production of three types of buses according to the old licence from IKARUS (Hungary). The production capacity is 1,000 buses per year. The locally manufactured parts of the busbodies are reaching approximately 45% in value. There are intentions to establish a big automotive manufacturing plant in Iraq, but the bodies production most likely will remain in this Enterprise as a specialised one.

Beside these buses based on the licence from IKARUS, there are productions of trucks and lorries in cooperation with SCANIA (SWEDEN), titled IRAQ - SCANIA.

It should be mentioned that the State Establishment for Aluminium-Semis Nassoriyah is a big producer of commercial quality of aluminium materials in various shapes and sizes and there is firm intention to utilize this products in busbodies manufacturing; if would be needed alloyed types of aluminium products might be produced too.