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SHORT-TERM CONSULTANCIES TO STATE ENGINEERING CORPORATION

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Technical Report: Manufacture of Automotive Transmissions and Axles

Prepared for the Government of Pakistan by the
United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Frederic N. Maxwell, expert in
Automotive Transmission Manufacture

Backstopping officer: C. Gurkok, Engineering Industries Branch

United Nations Industrial Development Organization

Vienna

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CONTENTS

1. INTRODUCTION

1.1 The writer has completed four previous assignments to the Pakistan Machine Tool Factory under project DP/PAK 75/071/11-07. The present assignment, although funded by a new project, may be considered as extending that earlier work.

The previous assignment dates were as under

17 Jan 1983	to	15 April 1983
21 Sep 1983	to	18 Dec 1983
extended	to	18 Mar 1984
16 Aug 1984	to	10 Nov 1984
11 Jan 1986	to	10 Oct 1986

The present assignment covered the period

16 Dec 1987	to	12 Mar 1988

1.2. Terminals reports were submitted to UNIDO Headquarters, to SIDFA, Islamabad, and to PMTF Management in:

April 1983
December 1984
March 1984
November 1984
September 1986
March 1988

1.3. PER's were completed in:

March 1984
February 1986

1.4. As on all previous occasions, excellent working relations with PMTF staff have persisted. The principal contact during the present assignment has been Mr. S.M. Anis Jafri, Deputy General Manager, responsible for Production Planning and Tool Design. The writer wishes to place on record his thanks and appreciation to Mr. Jafri for his personal and most active co-operation and assistance, as also to the Managing Director, Mr. A.M. Siddiqui, and other members of staff who have been involved in the project.

2. SUMMARY AND RECOMMENDATIONS

2.1. SUMMARY

2.1.1. The writer's previous assignment to PMTF was completed in October 1986. At that time the Managing Director was Maj. General S.A. Bokharee. He was replaced by the present Managing Director, Mr. A.W. Siddiqui in August 1987. As a result, a number of new management initiatives are now being pursued which will have an increasing impact in the immediate future.

2.1.2. It is a matter of great concern that PMTF has problems in recruiting and particularly in retaining, young graduate engineers of high potential. Four of those trained in counterpart situations during the writer's previous visits (since 1983) have subsequently left the company. The problem calls for urgent consideration in anticipation of future technical assistance programs - if these are to be of lasting benefit to the company.

2.1.3. Attention has again been drawn to the importance of training an engineer specialised in all aspects of gear technology in the usage, manufacturing and quality fields. This knowledge and experience cannot be recruited in Pakistan and, since the bulk of the company's business is production of gears and related parts, it is essential to have strength in some depth in this technology.

2.1.4. As has been noted in previous terminal reports and re-emphasised in studies during the present assignment a long term program is needed to upgrade production engineering skills and to create a credible and effective manufacturing data base. Although action to strengthen this function has been initiated during the present assignment, additional input will be needed both in the form of direct support and by giving selected production engineers working experience overseas in an automotive manufacturing environment.

2.1.5 Repeating a similar theme from the last three terminal reports, the need to re-establish an Industrial Engineering capability is again stressed. This should have method study as it's main emphasis, concentrating on areas such as material movement, workplace design and similar issues bearing directly on the efficient use of labour and improvement in productivity. Here again, direct support will be needed over a period of at least one or two years.

2.2. RECOMMENDATIONS

2.2.1. From the examples and instruction given during the course of this assignment, PMTF are in a position to develop further rationalisation studies by grouping similar parts of the Nasr (Berliet) and FIAT programs in line flow configurations. This would improve productivity and would simplify material handling. Most importantly, it would also simplify both production and quality control leading to improved output and greater consistency.

Implementation requires both the professional and numerical strengthening of Production Planning as noted in 2.1.4 and 2.1.5 above.

2.2.2. The attention of PMTF has been drawn to a number of capacity bottlenecks which will adversely affect their ability fully to meet future programs and to maintain effective control of gear quality. These should receive urgent consideration.

2.2.3. Priority needs for future technical assistance have been identified and discussed with PMTF management. These have been the subject of correspondence between the company, the Ministry of Production and UNIDO.

It must be noted, however, that the long term benefits of such assistance depend entirely on the company's ability to recruit and retain counterparts of high quality. Para 2.1.2. above refers.

Activities requiring urgent attention include:

- Replanning of forge shop, including heat treatment.
- Improvement in die casting technology.
- Re-introduction of industrial engineering.
- Up-grading of Production Planning.

2.2.4 Production control, in a batch manufacturing environment is notoriously difficult, even where a good manufacturing data base exists. This is not yet the case at PMTF as noted in 2.1.1. above.

It is the writer's opinion that expert assistance in revising and retraining the Production control operation, (in addition to refining the manufacturing data base) would materially improve output and profitability. There is substantial scope for achieving reductions in inventory in association with improved control of output.

3. NARRATIVE

3.1. MANUFACTURE OF TRUCK AND AGRICULTURAL TRACTOR REAR AXLE SHAFTS

A complete study of the manufacturing operations for four type of axle shaft Bedford Trucks, Bedford Bus, Massey Ferguson and FIAT tractors was undertaken and a proposal developed for in line manufacture of 52,000 shafts per year. A report - 44 pages of text, 4 diagrams and a shopfloor layout was prepared for PMTF management. The report included detailed studies of induction hardening and spline rolling operations, where other components are processed through the same capacity, in addition to recommended operation sequences, work handling, quality control and productivity proposals. Preparation and development of the proposal was also extensively used for the training of counterpart production planning engineers.

3.2. MANUFACTURE OF TRACTION PINIONS FOR PAKISTAN RAILWAYS

A similar, but less detailed, study was made for a proposal to manufacture four types of traction pinions for Pakistan Railway. Although the volume required is relatively small - 1500 total per annum, by batch type operations, substantial cost saving opportunities were identified, as were potential capacity and quality problems. A report - 20 pages and four diagrams was prepared for PMTF management and it's preparation was again used for counterpart training.

3.3. MANUFACTURE OF TRACTION GEARS FOR PAKISTAN RAILWAYS

A proposal of manufacture three types of traction gear for Pakistan Railway, with diameters in the range 650 to 800 mm was investigated. In a brief report the company was advised that these could not be produced satisfactorily with existing machinery and equipment.

3.4. PRODUCTION PLANNING

Written and verbal advice was given on the preparation and validation of workshop operating instructions and on the selection and training of Production Planning engineers. It is pleasing to note that this advice is already being acted upon and that substantial, and long overdue, upgrading of this key function is receiving consideration.

3.5. SPIRAL BEVEL AND HYPOID GEAR MANUFACTURE

Written advice, including re-prints of earlier documentation was provided on machinery requirements to increase rear axle gear capacity.

3.6. MISCELLANEOUS TECHNICAL PROBLEMS

A number of miscellaneous manufacturing problems was investigated and advice given as required.

3.7. SHOP-LAYOUT

Arising from the axle shaft study, there was an evident need to replan the assembly of Bedford gear boxes and axles where existing capacity greatly exceed the anticipated future demand for what is now an absolescent vehicle. A new plan has been prepared for PMTF management, rationalising these facilities and providing for improved work flow through final inspection in the replanned area.

4. OUTPUT OF THE PROJECT

4.1. Report on line production of axle shafts (Ref. 3.1.)

4.2. Report on manufacture of railway traction pinions (Ref. 3.2.)

4.3. Report on manufacture of railway traction gears (Ref. 3.3.)

4.4. Report on manufacturing capacity for rear axle gears (Ref. 3.5.)

4.5. Training given in Production Planning and Method Study

4.6. All minor technical problems raised were dealt with and appropriate documentation provided.

4.7. Advice given on production control and management information.

4.8. Advice given on future requirements for technical assistance.

4.9. Proposed floor plan for assembly inspection area.

Copies of all reports and memoranda are on PMTF files or may be obtained from the writer.

5. AUTHOR'S ACTIVITIES

5.1. [illegible] shaft and report	4.7 weeks
5.2. Railway traction motors study and report	2.0 weeks
5.3. Railway traction gears study and report	0.8 weeks
5.4. Miscellaneous technical problems - study and recommendations	2.5 weeks
5.5. Shop layout planning	0.6 weeks
5.6. Travel, briefing and Terminal Report	1.0 week
Duration of assignment	12.5 weeks

5. COUNTERPART SITUATION

During this assignment the writer has worked closely with the Deputy General Manager, Production Planning and Control, with the Manager, Production Planning and with a counterpart seconded from his staff.

Problem resolution and detail work was undertaken with the staff and specialists directly concerned.

As a previous occasions, the arrangement has worked well and full advantage has been taken of opportunities for on the job training. It is, however, to be regretted that at least four engineers who received training in counterpart situations on previous visits have now left the company.

All action taken has been documented and the relevant information is available within PMTF for future reference or action.