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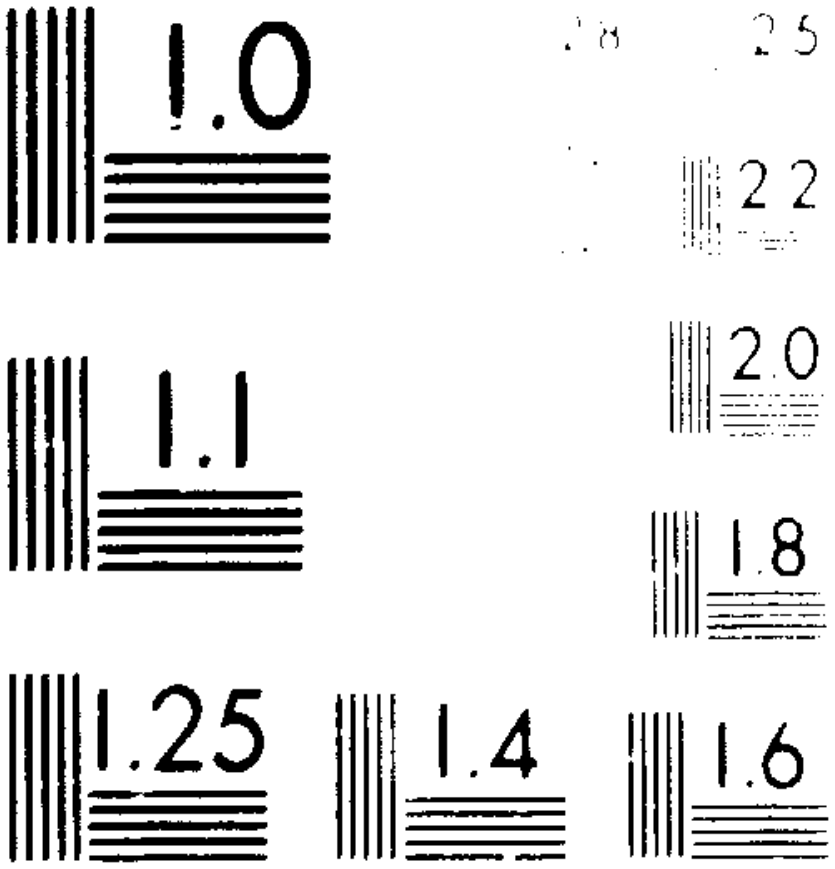
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DEVELOPMENT OF THE CAPITAL GOODS INDUSTRY IN PAKISTAN.

CONSTRUCTION EQUIPMENT.

Final Report for the Government of Pakistan by the United Nations Industrial Development Organization Executing Agency for the United Nations Development Programme.

by

Karl Heinz Oberhuber
Mechanical Engineer

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PREFACE

Pakistan in its development strategy gives emphasis to the progressive development of the capital goods industries and has requested the United Nations Industrial Development Organization (UNIDO) to provide expert assistance to the Ministry of Industry for the implementation of a capital goods industries development project.

Upon preliminary studies and a UNIDO Market Analysis,[1] five sectors were identfied as of particular significance for further industrial development.[2] This report covers the sector

Construction Equipment

and is based on the findings of an originally three-months mission (1 March to 31 May 1982)

Upon the author's arrival at the duty station on 3 March 1982 and his initial meeting with the Director General of the Investment Promotion Bureau (IPB), Mr. Askari Taqvi, it was agreed and approved by the UNIDO Senior Industrial Development Field Field Advisor at the briefing in Islamabad that mining equipment, especially for open-cast mining, and quarry equipment be included in the scope of the mission. The duration of the mission was therefore extended for one month (1 to 30 June 1982)

1/ Romeo R. Bonini, Programming of the Development of the Capital Goods Industry in Pakistan (PAK/76/003/B/01/37)

2/ Karl J.Feil, Machine Tool Industry
Frank A.Greenwood, Textile Machinery
William Hock, Transport Equipment
George W.J.Dziecielewski, Agriculture Machinery
Karl H. Oberhuber, Construction Equipment/Mining Equipment

Although not expressly enumerated in the terms of reference of the author's assignment, the report includes the existing earth-moving and construction equipment and the repair and maintenance facilities. It gives a description of the prevailing problems and finally offers recommendations on the set up of a National Equipment Center and the implementation of a comprehensive equipment rehabilitation project.

As one of the principal objectives of the mission, the author reviewed existing industrial enterprises and evaluated their potentials for integration in a development process of the engineering industry.

With the presentation of this report, the last of five sector reports, stage I of the capital goods industries development project may be considered completed. Stage II of the project must be praxis and implementation oriented with particular empasis to the provision of assistance to the individual enterprises for the transfer of advanced technolgies and manufacturing methods.

Although in United Nations' services, the author gives in this report his personal views and opinions which do not necessari concur with those of UNIDO or any United Nations body. The author invites and would appreciate any critical comments from competent persons and further suggestions in order to find optimal solutions to the manifold problems.

ACKNOWLEDGEMENTS

This report is the result of the very fruitful co-operation between the author and his counterparts and the support he received from the official institutions, in particula from the Investment Promotion Bureau which acted as the counterpart agency for the UNIDO assistance.

The author expresses his gratitute to all the persons who contributed their time and assistance for the implementation of his mission. He wishes to appreciate in particular the warm welcome and valuable co-operation he received during his field trips.

I
INTRODUCTION AND GENERAL ASSESSMENT

Pakistan is in an advanced stage of industrial development and has in recent years built up an industrial potential that provides the basis for further advancement towards the manufacture of the more sophisticated machinery and equipment. From the economic viewpoint, this proceeding is necessary in order to avoid a standstill of the economic development process.

The author inspected the larger engineering industries and found them generally well equipped with machine tools and facilities and therefore qualified to participate in a manufacturing programme for the whole range of earth-moving and road-construction equipment. The limited time of the mission has not permitted to make complete inventories and to determin in detail what parts and components each production plant is able to contribute.

It would therefore be the first step in the second stage of the project to inspect each plant and to determin very accurately what parts and components could be manufactured and what additional machines and facilities are eventually required. For example, automatic gas cutting and electric arc welding equipment is required for the manufacture of the undercarriage of crawler type unites and the frame structures.

Steel and cast iron foundries and machine shops are available for casting and machining gear boxes, track plates, sprockets, rollers, idlers etc. Parts for power transmission, gears, axles, cluches, torque converters etc require high precision machine tools and are probably additionally required.

In view of the industrial potentials and the relatively high standard of the technical outfit of the existing engineering industries, it is recommended to create a concept which utilizes the available capacities to the maximum extent. The parts and components manufactured in the individual production plants will be assembled in a separat Equipment Center.1/

It must be emphasized that the equipment center will not only function as an assembly plant for locally produced and imported parts, but also deal with all matters pertaining to construction equipment. The most important functions of the center will be training of equipment mechanics and operators, undertaking complete overhauls and repairs, rendering preventive maintenance and after sales services, arranging for a spare parts supply system, rendering advisory services to government authorities in policy matters etc.

The principle purpose of the equipment center would be coordinating, controlling and monitoring the manufacture of the various parts and components, undertaking continuous quality controls and rendering advices to the manufacturers regarding selection and procurement of raw materials.

The manufacture of heavy earth-moving and road-construction equipment is an entirely new industrial field for which experience and technological know-how is not available. It is therefore indispensable that technical assistance for the setting up and the running of the equipment center be rendered from bilateral and multilateral sources.

1/ Further details on the functions and the technical outfit on page 20

It is certainly appropriate to be mentioned in this context that the Equipment Center may become a pilot project and a kind of nucleus for industrial co-operation amongst the Islamic Countries in response to the "Islamabad Declaration". 1/

According to the Secretary General of the Islamic Chamber of Commerce, Industry and Commodity Exchange, financial assistance could be made available for this project from the Islamic Development Bank.

1/ The 22-point Islamabad Declaration on industrial co-operation adopted by the Conference of Islamic Industries Ministers 14 to 17 February 1982 in Islamabad.

II

ROAD-CONSTRUCTION AND ROAD-CONSTRUCTION EQUIPMENT

Pakistan in its current Fifth Five-Year Development Plan (1978 - 1983) gives emphasis to the improvement of the infrastructure and the construction and reconstruction of roads and highways. During the plan period 4000 miles (6400 km) of roads are to be improved and 800 miles (1280 km) newly constructed. The extension of the road network to the remote and less developed areas (Baluchistan and the FATA areas) has priority.

According to official figures, a total amount of Rs 7.7 Billion is allocated for the realization of road projects. Whether this amount is really available to the projects could not be confirmed by the officials concerned. No concrete figures could be provided on what road works are and will be carried out during the plan period.

Inadequate resources are thinly spread out on a large number of small contracts and the pace of progress on individual projects is extremly slow. This thinning out of the resources and the prolonged gestation periods of the projects result in no economic returns to the contractors who cannot afford to purchase road-construction equipment for the performance of the contracts. Not only the little volume of the contracts, but also the uncertainty on future contracts make contractors hesitant to invest large amounts in construction machinery.

There are four larg construction companies which have fleets of construction equipment, but are more involved in other projects such as dams, barrages, bridges, air fields, canals, flood control works etc. These companies are also extensively

involved in contracts in the Middle East countries, especially Iraq and Saudi Arabia.

Road works are generally carried out by manual labour which does not roughly come up to the minimum quality standards of road construction as required by the dense road traffic. Especially the narrow roads with bumby hand-made asphalt surfaces not only cause premature destruction of the vehicles, but also are the cause for many accidents.

Systematic road-construction planning does not exist and no figures are available on what road-construction equipment is required for road works in the future. A National Highways Board has been constituted on Federal level, but only responsible for the through-going highways such as the North-South link on the west bank of the Indus and the national roads which are designated as strategic roads. All other roads fall under the jurisdiction of the provinicial authorities which are also responsible for the import of road-construction equipment.

Road-construction equipment is also imported by the National Logistic Cell (NLC) which is operated by the armed forces and also involved in road construction. The Water and Power Corporation (WAPCO) also holds earth-moving and road-construction equipment and imports these items. The various agriculture departments import bulldozers for land levelling and irrigation.

Under these circumstances standardization of construction equipment is unthinkable and the supply of spare parts problematic. Most workshop chiefs complained that the procurement of spare parts is an irksome procedure and it often takes months and more than a year to get an urgently required part on hand.

It was one of the objectives of the mission to look into the situation of the existing earth-moving and road-construction equipment. For that purpose the author visited a series of workshops belonging to the highways departments of the provinces. He also visited the workshop of the National Logistic Cell (NLC) in Karachi and had a meeting with the workshop chief, Lt.Col. Zakir Hasan.

It must be appreciated at this point of the report that this workshop is excellently organized and equipped with most modern machine tools and repair and maintenance facilities. NLC operates more than two thousand heavy trucks and some hundred items of earth-moving and road-construction equipment. They all receive regular preventive maintenance on regular maintenance schedules and all repairs, including engine repairs and complete overhauls, are skillfully carried out. Workshop personnel at all levels receive regular training, both classroom and on-the-job training. Spare parts problems are unknown.

All other workshops visited are exactly the opposite. - In some instances the situation appeared chaotic under which quality repair and maintenance work is impossible. The workshop buildings are old, the few machine tools are generally totally obsolete, in most cases the floors are not paved, pieces of engines and machines are laying around on dusty grounds. As most depressive, however, workshop yards were found cluttered with unserviceable and irreparable construction machines, many are dismanteled and taken apart for inspection and diagnosis, but not put together again. Some machines are cannibalized for spare parts to repair a few others.

A large backlog of repair work has accumulated and it seems highly questionable whether all the repairs will ever be done. Construction machines could hardly be seen working at the construction site, they are either deposed along the road in

defective condition or conglomerated in the workshop yards. It could be observed that almost all machines have engine damages as a result of wrong operation and/or the neglect of the required maintenance.

It can be estimated that 80 to 90 per cent of the entire equipment fleet of the country ist out of order representing a dead value of some hundert million US-Dollar. A portion hereof is super-annuated and totally outworn and represents only scrap value. Some others, however, could yet be repaired.

It is urgently recommended that the entire equipment fleet of the country be surveyed and those machines be selected and inventoried which can be repaired. Spare parts lists are to be prepared and the parts be ordered as soon as possible. The repair of the existing machines is the best exercise for training and for becoming familiar with the technique of construction machinery. This exercise is well appropriate to become a preliminary stage for a gradual local manufacture of these machines.

Those machines, however, which cannot be repaired anymore should be entirely dismantled and their parts be checked and possibly stored in a central warehouse. Some wear parts can easily be reconditioned by hard surface welding, such as track shoes, sprockets, idlers, rollers etc. In most cases crankshafts of engines can be reconditioned by metal spray equipment for metallizing crankshaft bearings. Rehabilitation of worn parts through special surface welding becomes more and more important in developing countries in order to reduce costs of replacement parts and to increase the life span of a construction machine.

In discussions with workshop personnel it is generally claimed that the most crucial problem is the lack of spare parts. It is certainly not the lack of spare parts that creates the problems, it is primarily the unskilled operation of the equipment and the absence of functioning preventive maintenance systems that cause high break down rates and thus an abnormal high demand for spare parts. A well operated and regularly maintained machine very seldom requires spare parts.

What is thus primarily required is the introduction of a well funtioning preventive maintenance scheme and well trained machine operators in order to prevent break downs and, as a result thereof, a high spare parts demand.

It was observed during the survey that most workshop staff are elder people who gained a certain routine and experience, but throughout knowledge of technical functions is lacking. They will sooner or later retire from work and the situation will then become even more critical if it not succeeds to attract young men for these jobs.

In the light of the considerable value which the equipment represents as well as in view of the pressing need to get the machines back to work at the construction sites, a crash programme for equipment rehabilitation is urgently required. The repair and rehabilitation of the deadlined equipment is more economic than the contiuous acquisition of new equipment, even the imports are under soft loan or barter agreements.

The following measures are recommended:

- to make a feasibility study for a Technical Equipment Center which will gradually be expanded and later on become the assembly plant for the locally produced parts and components of heavy construction equipment,

- to initiate a comprehensive and country-wide equipment rehabilitation programme,

- to constitute a National Equipment Authority as the executing agency for the set up and operation of the equipment center and the implementation of the equipment rehabilitation programme,

- to arrange for vocational training of equipment operators, mechanics, electricians, welders etc,

- to establish a spare parts supply system,

- to approach bilateral and multilateral sources for obtaining the necessary technical assistance for the implementation of the said measures.

III

LOCAL MANUFACTURE OF CONSTRUCTION EQUIPMENT

The present circumstances are not favourable to start the local manufacture of heavy construction equipment. Despite Pakistan has gained an advanced stage of industrial development and has built up a considerable industrial potential, the required technological know-how for the manufacture of such sophisticated machinery is not yet available.

On the other hand, Pakistan cannot renounce on further industrial and economic development and accept a halt of the development process. Moreover, the point might be reached where further imports of construction equipment needed for roads and highways become impossible owing to rise in prices in the developed countries and the shortage of foreign exchange. It is, from the pure economic point of view, better to produce construction equipment by its own efforts at nominally higher costs and with lower quality than to halt development. After all, as development in the manufacture of construction equipment proceeds, the quality of the pr[illegible] will steadily improve.

The only practical policy for developing a genuine manufacture of construction equipment is by startig a repair and rehabilitation programme of the existing equipment and by starting manufacturing spare parts and components. By doing this, the programme would gradually change from the mere repair work to the complete manufacture. The greatest advantage of this programme would be that it could start within a relative short delay.

To make such programme successful, it must be flanked by appropriate measures by the Government to protect this infant industry

by banning those items of construction equipment that can be locally produced. The protection of the locally manufactured construction equipment may, but not must, have an unfavourable effect on the user in terms of a reduction in quality and, in some cases, a rise in prices. This, however, has to be accepted in the interest of the economic development of the country.

Chances for substancial exports will be scarce during the first years, but it is indispensable that possibilities for exports be examined particularly to those countries to which trade relations already exist, such as Turkey, Iraq, Saudi Arabia, Egypt, Bangladesh, Indonesia etc.

A series of engineering enterprises of the public and private sector were visited in order to appraise their qualification to participate in an integrated programme for the manufacture of parts and components of construction equipment. Small and medium scale enterprises were generally found to be not qualified to supply parts and components because of the poor quality of their products, their obsolete technical outfit and the insufficient skill of their staff.

- Pakistan Machine Tool Factory Ltd. (PMTF)
  Landhi, Karachi

  This enterprise is built up with assistance from OERLICON, Switzerland.
  Apart from the various types of machine tools such as lathes, milling machines, drilling and boring machines etc, the production programme includes truck components as complete rear axles, gear-boxes, steering gears and all kinds of pressure die castings upto 11.5 kg

  According to the management, hydraulic pumps and steering elements will be included in the production programme in the near future.

The production capacity of the PMTF is utilized to only 50 per cent.
Exports are made to Turkey, Iran and Iraq. The company hopes to increase the production of gears and other components for trucks and tractors.
The company was found well qualified to supply parts for construction machines, such as final drives, oil-disc steering clutches and brakes, power shift transmission gears, torque converter etc.

- Heavy Mechanical Complex Ltd. (HMC)
  Taxila, Rawalpindi District

  This enterprise, the largest of its kind in Pakistan, has been built up with assistance from the People's Republic of China.
  The production is more devoted to complete plants, such as cement, sugar, sulphur acid, brick-making, batching, stone crushing and screening plants, belt conveyors.
  The production further includes static road rollers with chinese engines.

  A complete sugar plant for Indonesia is at present under construction.

  The machine tools and machine shop facilities are entirely of chinese origine.

The company has all facilities to produce heavy engineering items and is thus well qualified to supply undercarriage structures and frames for construction equipment. The quality of the products is fairly good, but improvements are required in design, production methods and quality control. The production capacity is only utilized to 25 to 30 per cent.

It is important to mention that HMC maintains good relations to USA, Germany, Italy and seeks to further expand its production programme with the help from these countries.

- Heavy Foundry and Forge Ltd. (HFF)
  Taxila, Rawalpindi District

This enterprise employes 2250 persons. It has also been planned and built up with financial and technical assistance from the People's Republic of China. It is one of the largest and most modern foundry and forge in Asia.

The steel foundry has an annual output of 43000 tons ofsteel ingots (upto 40 tons) and 6000 tons of steel castings (upto 21 tons).

The cast iron foundry has an annual output of 5000 tons of iron castings (upto 21 tons) and 100 tons of non-ferrous castings.

The hydraulic press shop is equipped with a 3000-tons hydraulic press capable to forge ingots upto a weight of 40 tons.

The iron foundry has three cupolas each 5 tons per hour capacity and two electric induction furnaces (of 1.5 and 0.75 tons filling capacity)

The other major outfit includes modern sand preparation and regeneration, cleaning and heat treatment facilities, machine shop, pattern shop and quality control laboratories.

Upon the installation of some additional facilities and casting equipment, this foundry is able to supply all castings for construction equipment, particularly track shoes, idlers, sprockets, rollers etc.
For the manufacture of diesel engines, HFF could supply engine blocks and heads and the crankshafts, camshafts, connecting-rods etc.
The capacity of HFF ist actually only utilized to 25 per cent.

- Pakistan Engineering C. Ltd. (PECO)
  Lahore

PECO belongs to the leading producer of engineering goods including:

machine tools such as centre lathes, pillar drilling machines with drilling capacity upto 50 mm, shaping machines, hack saws,
slow speed diesel engines (5.5 to 25 hp)
centrifugal pumps, deep well turbine pumps, electric motors,
steel structures, storage tanks,
concrete mixers.

This company appears to be in a position to supply parts and components for asphalt and concrete pavers and for shovel loaders, but also for truck concrete mixers if the technological know-how is provided.

- Ittefaq Foundries Ltd.
  Lahore

This is another leading enterprise involved in the production of engineering goods. The programme includes:

textile machinery, lathes, shapers, drilling machines, diesel engines for stationary purposes, pumping sets for agriculture, rice threshers, harvesting machines, bitumen boilers.

The company was founded in 1940, nationalized 1972 and recently returned to the family Sharif.
The quality of the products needs to be improved and brought up to international standard. The management is very dynamic and it is well conceivable that this company will supply parts and components to construction machinery if modern designs and assistance in modern production methods are provided.

- Nowshera Engineering Co. Ltd.
  Amangarh (Head Office: Peshawar)

  The company was nationalized and returned recently to the original owner. There are about 600 people on the payroll.

  The present production programme includes:
  Steel castings and forgings, steel structures, overhead cranes, round bars and angle iron,
  agriculture equipment, wheat threshers, cultivators, trailors.

This company in its present shape is not in a position to manufacture high quality products as required for construction equipment. If technical assistance is provided, the quality of the products could be improved. Qualitiy control and supervision are urgently required.

- Allwin Engineering Industries Ltd.
  Ladhi, Karachi

  Allwin Engineering Industries was established in 1951 and converted into a Public Limited Company 1967.

  The programme in ludes:
  engine parts viz. pistons, piston rings, cylinder liners, bushes, valves and valve guides,
  laminated springs, radiators, brake drums.

The company is well prepared to also pruduce engine parts for high power diesel engines and to expand the manufacture programm to other parts, such as water pumps for cooling systems, turbo chargers, fuel and oil pumps and filters, nozzles and possibly fuel injection pumps for which, however, high technological know-how ist required.
The company is in liaison with one of the leading manufacturer for automotive parts in Europe and technical assistance appears to be no problem.

According to the Directorate of Industries and Mineral Development of Punjab in Lahore, there are many more engineering enterprises that are able to manufacture parts for construction equipment and diesel engines. No visits to these medium and small scale industries and no evaluation of their capacities could be made because of the limited time available for this preliminary survey.

There are some hundred parts of which construction equipment and diesel engines consist and which can be supplied from small and medium scale industries, as for instance: joints, filter housings and filter elements, gaskets, springs, exhaust pipes and mufflers, hydraulic hoses, starter motors, electrical parts etc.

The import of raw materials creates some difficulties because of the irksome and time consuming administrative and custom procedures. This problem will hopefully be solved when the new Pakistan Steel Mill goes into full operation. It is expected that Pakistan Steel will supply also hot rolled steel plates which are most needed for construction equipment. The manufacture of construction equipment is therefore one of the downstream projects for Pakistan Steel.

IV

TECHNICAL EQUIPMENT CENTER

The solution to the manifold problems in connexion with heavy earth-moving and road-construction equipment necessitates a very effective instrument and concerted efforts of all federal and provincial authorities involved. In the course of the visits to the workshops and the meetings with officials of government agencies the conclusion was reached that there is a definite need in the country for an intensive long-term repair and maintenance programme.

This repair and maintenance programme which includes the local manufacture of the required spare parts is the best practical approach for gaining experience and know-how and for a gradual change towards local manufacture of the entire machine.

Within the framework of this programme, a Technical Equipment Center has to be set up with the following main objectives:

(i) providing training in repair and preventive maintenance to equipment machanics, operators and workshop supervisors, but also to workshop management personnel,

(ii) executing repairs and complete overhaul works in an effort to rehabilitate the great number of defective construction equipment,

(iii) appraise the demand for spare parts and components and arrange for their local manufacture, advise the respective manufacturers on manufacture methods and the selection of the raw materials,
arrange for the establishment of a central spar parts supply system.

(iv) The center will depute instructors to provincial workshops and equipment depots, but also to construction sites throughout the country providing in-the-field training in routine maintena
This could best be done by using mobile r r and service units.

/Annex I/ gives a tentative list of the proposed workshop equipment.

/Annex II, III and IV/ are drafts for Job Descriptions for the first three expatriate experts for the implementation of the repair and maintenance programme.

/Annex V/ is a tentative layout of the repair and maintenance workshop

V

MINING AND MINERAL PROCESSING EQUIPMENT

Pakistan's mineral resources cannot be compared with the large mineral deposits in some other developing countries, but there are, according to geological surveys, a number of minerals such as coal, chromite, marbel, iron and copper ore and fluorite that can be economicly exploited and thus contribute a share to the economic growth of the country. Despite these mineral deposits, the mining industry in Pakistan is yet in a stage of underdevelopment with a contribution to the GNP of less than one per cent.

Upon the constitution of the Pakistan Mineral Development Corporation (PMDC) in 1974, some mining and mineral processing projects are in the planning stage. With the intention to supply 80,000 tons of coal per year to the Karachi Steel Mill, PMDC has built a coal washing plant at the Sharigh Coal Mine in Baluchistan with technical and financial assistance from Canada. Inaugurated in 1980, the plant could not go into operation due to technical difficulties with the coal crushing plant and some minor technical faults.

The most important project is the Saindak copper project in Baluchistan for which, with UNDP assistance, a pre-feasibility study has been carried out which proved a total reserve of 412 million tons of porphyry copper ore with a cut-off grade of 0.25 per cent. In addition to copper, the ore has also small contents of gold, silver, molybdenum and some quantities of iron and sulphur. Pumping tests proved large groundwater reservoirs.

In view of the fact that Pakistan does not have the expertise in large scale mining and processing of copper ore, the Government seeks a partner with experience in these fields for going into a joint venture. The lack of experience and technological know-how and the scarcity of financial resources make it impossible that Pakistan materializes this project by its own efforts.

The original three-months assignment of the author was extended for another month for looking into the possibility to include mining equipment into the sector construction equipment. In fact, construction equipment and mining equipment have much in common and many items of construction equipment can be used in mining operations, especially in open-cast mining. Those kinds of equipment used in opan-cast mining for removal overburden are of much greater dimensions and have much higher capacity than those generally used for construction work. It is the size of the equipment that limits the local manufacture in the present stage of technical development.

This, however, does not mean that when it comes to open-cast mining of lignite, some parts and components of the large excavating equipment could not be made locally, such as buckets, steel structures, crawler plates etc. In India upto 80 per cent of the huge bucket wheel excavators for open-cast lignite mines are manufactured locally.

Discussions with officials involved in mining and mineral processing revealed that the situtation in mining is the same as in road construction. No concrete planning exists and no one could give any specification on what mining equipment will be required in the years ahead.

In order to familiarize himself with the conditions of the coal mines, the author visited three mines of the public sector in Baluchistan, namely:

PMDC Collieries So Range Coal Mine
PMDC Collieries Degari Coal Mine
Sharigh Coal Mine

The PMDC Collieries So Range Coal Mine has problems with two almost new french underground diesel locomotives due to manufacturing faults. Many changes have been carried out, but they are still not in working condition. The most urgent requirements are diesel locomotives for underground operation with flame proof engines, hauling winches, flame proof electro motors, compressors, pumps etc.
The output of this colliery is 150 ton/day/shift.

The PMDC Collieries Degari Coal Mine has similar problems. The management claims that spare parts supply does not work and many problems are are to be attributed to the lack of an effective spar parts supply system. What are most required are ventilation fans, flame proof diesel generators, pumps, compressors, switch gears and a system for man riding at 45 degree inclination and drilling equipment.
The output is about 270 ton/day/two shifts.

The Sharigh Coal Mine has the very same problems with the technical outfit. This mine also needs overground facilities for the transport of the coal from the pit to the newly built coal washing plant with an interim stock pile installation. For this purpose belt conveyors and stock pile facilities are particularly required.

As already mentioned, with technical and financial assistance from Canada, a coal washing plant has been built at the Sharigh Coal Mine. It was the intention to supply 80,000 tons of coal (about 10 per cent of the annual demand) to the Karachi Steel Mill for blending with the high quality import coal. Inaugurated in 1980, the washing plant could not yet go into operation because of difficulties with the coal crusher. A new crusher of chinese origine is now being built in.

Even when the washing plant will go into operation, another problem is likely to arise, namely the transport of the coal to Karachi. The long distance for transport makes the low quality coal more expensive than the high quality imported coal.

Yielding from the survey it can be stated that the entire technical outfit of the three mines is antiquated and in urgent need to be replaced. Many items of overground equipment such as belt conveyors, bunkers, crushers, vibratory screens, thickeners etc could be manufactured locally. The manufacture of the more sophisticated and larger items of equipment such as excavators, hydraulic loaders, heavy dump trucks etc cannot be recommended at the present stage of the engineering industries.

The time available for covering mining equipment was not sufficient, particularly in the view of the significance of mining equipment for the development of the mining industries. The conditions of the three coal mines and coal washing plant in Baluchistan are not necessarily representative for the whole mining and mineral processing industries in Pakistan. It might be that the conditions in other provinces are better. This has to be found out in a country-wide survey within the framework of the capital goods industries development programme.

ANNEX I

Tentative List of proposed Workshop Equipment

(1) Special machines for engine rebuild

- Crankshaft grinding machine for crankshafts up to a length of 1800 mm, diameter of grinding wheel 800 mm, hp of motor, 10
- Flame spray equipment for metallizing crankshaft journals
- Cylinder block and head grinding machine with a maximum grinding length of 1200 mm, hp of motor, 4
- Cylinder boring and honing machine, with a boring and honing capacity with up to 180 mm, hp of motor, 2.5
- Transportable cylinder boring and honing machine
- Valve reconditioning tools and devices for producing accurate and concentric valve seats, valve cone refacer with a stem diameter of up to 16 mm and a head diameter of up to 80 mm (Type "Hunger")
- Complete Engine testing stand with dynamometer.

(2) Undercarriage rebuild equipment for track-type units

- Automatic submerged arc-welding equipment to rebuild track links and shoes, rollers, idlers, etc.
- Roller/idler press for bushing dis-assembly and assembly
- Roller/idler grinder for grinding surfaces and flanges
- Double-end track hydraulic press to dis-assemble and assemble crawler tracks with ram capacity of 150 ton per ram
- Track kicker to move a string of track forward or backward across the press.

(3) General Equipment

- Ramps in heavy steel construction for construction units and trucks (can be made in the centre)
- Steam cleaner and high-pressure washing installation
- Lubrication installation with compressed air lubrication facilities and grease guns
- Oil-changing installation via hose reels with flow meters, water discharge, waste oil drainage
- Tyre repair equipment, combined inflator guns and gauges
- Brake drum turning and grinding machine, turning and grinding diameter up to 600 mm
- Brake lining revetting machine, brake lining grinder
- Hydraulic straightening press, 100/150 ton, and "David" hydraulic power units with various tools and devices
- Machine tools, lathes, milling machines, drilling machines, grinding machines, plate shears, shapers, etc.
- Electric welding generator 320 A and spot welding machine with various devices
- Autogenous welding and cutting equipment
- Forge
- Air compressor
- Work benches with drawers, parallel vices, general hand tools, portable tool kits, cutting tools, electric tools
- Lifting devices, hydraulic jacks, garage jacks, axle stands
- Workshop standard crane 10,000 kg
- Testing equipment for hydraulic and electric systems of construction units

- Universal electric test bench for testing dynamos, ignition dynamos, dynastarts, starters, distributors and automatic spark advance regulators, batteries, collectors, spark timing, spark plugs, etc.

- Injection pump adjustment and test bench, nozzle tester

- Battery charger

- Painting facilities

- First aid and medical facilities, sanitary and fire fighting facilities

- Platform Scale

- Gear Hobbing machine

- Gear grinding machine

- Induction heating (heat treatment) machine

- Electric hardening furnance

- Electric tempering furnance

- Sand blasting equipment

(4) Mobile equipment

- One low-bed semi-trailer with 40 ton pay-load and three-axle traction unit with all-wheel drive,(equipped with a ten- to fifteen ton winch behind the driver's cab to haul the defective equipment on the trailer) winch ropes and pulleys, rear-loading ramps

- One break-down truck with rotary crane mounted on a three-axle and all-wheel driven chassis for heavy on-and-off the road operations, towing load at hook 10 to 12 ton, with front and rear winch

- One ambulance with first-aid and emergency equipment

- One field service unit with mobile lubrication station

DRAFT ONLY

ANNEX II

Request from the Government of Pakistan

JOB DESCRIPTION

POST TITLE	Mechanical Engineer (Expert in heavy road-construction and automotive equipment)
DURATION	Two years, with possibility of extension
DATE REQUIRED	As soon as possible, but not later than ...
DUTY STATION	
PURPOSE OF PROJECT	The Government of Pakistan is initiating a comprehensive programme for repair and rehabilitation of heavy road-building and automotive equipment. Realizing the crucial importance of preventive maintenance and the availability of adequate repair and maintenance facilities, the Government will also upgrade the repair and maintenance workshops and arrange for training of mechanics and other technical personnel.
DUTIES	The expert will assist the Government in the preparation and implementation of the programme, notably:

(i) to assist in surveying and inventorying the national equipment and selecting those that can be economically repaired and rehabilitated.

(ii) to assist in establishing an effective preventive maintenance programme.

(iii) to assist in upgrading repair and maintenance workshops and in acquisition of adequate facilities.

(iv) to assist in making arrangements for training of mechanics and operators, and

(v) to assist in reviewing the organizational structure and to make recommendations for reorganization.

QUALIFICATIONS — Mechanical Engineer with broad background and experience in maintenance and repair of heavy earth-moving, road-building and automotive equipment and with practical experience in workshop operation. University degree.

LANGUAGE — English fluently.

BACKGROUND INFORMATION — In its accelerated programme of expanding activities in construction and reconstruction of roads, highways and the implementation of its infrastructure programme, Pakistan has an increasing demand for heavy construction and transport equipment.

Large amounts of foreign exchange are spent for their acquisition but considerable losses of valuable machinery occur due to inadequacy of repair and maintenance facilities, shortage of spare parts inadequately trained personnel. Life span of equipment is considerably reduced and workshops and motor pools are filled with out-of-order equipment items.

The project follows a UNIDO survey and is in line with its recommendations.

DRAFT ONLY

ANNEX III

Request from the Government of Pakistan

JOB DESCRIPTION

POST TITLE	Mechanical Engineer (Expert in design and construction of plant machinery and equipment)
DURATION	Two years, with possibility of extension
DATE REQUIRED	As soon as possible, but not later than...
DUTY STATION	
PURPOSE OF PROJECT	The government of Pakistan is initiating a comprehensive programme for repair and rehabilitation of heavy road-building and automotive equipment, including the improvement of existing and the set up of new preparation plants for road construction materials. The programme gives emphasis to the domestic fabrication of such machinery.
DUTIES	The expert will assist the Government in the preparation and implementation of the programme, notably: (i) to assist in surveying existing material exploitation and preparation plants and advise in their improvement and the increase of the output. (ii) to assist in design and layout of mobile and stationary preparation plants, including mechanical handling equipment, belt conveyors, elevators, excavators, etc.)

(iii) to assist and advise local manufacturers in design and construction of such machinery.

QUALIFICATIONS

Mechanical Engineer with broad background and experience in machine building, design and construction of stationary and mobile preparation plants and equipment for road-construction material, such as crushers, vibratory screens, belt conveyors, including asphalt and concrete preparation machinery.

BACKGROUND INFORMATION

For its accelerated programme of expanding activities in construction and reconstruction of roads, highways, bridges and the implementation of its infrastructure programme, Pakistan has an increasing demand for construction equipment and machinery, notably for plants and machinery for the exploitation and preparation of raw materials.

In order to save foreign exchange for the importation of the latter machinery and equipment, the government has included in its programme to manufacture these items domestically.

DRAFT ONLY

ANNEX IV

Request from the Government of Pakistan

JOB DESCRIPTION

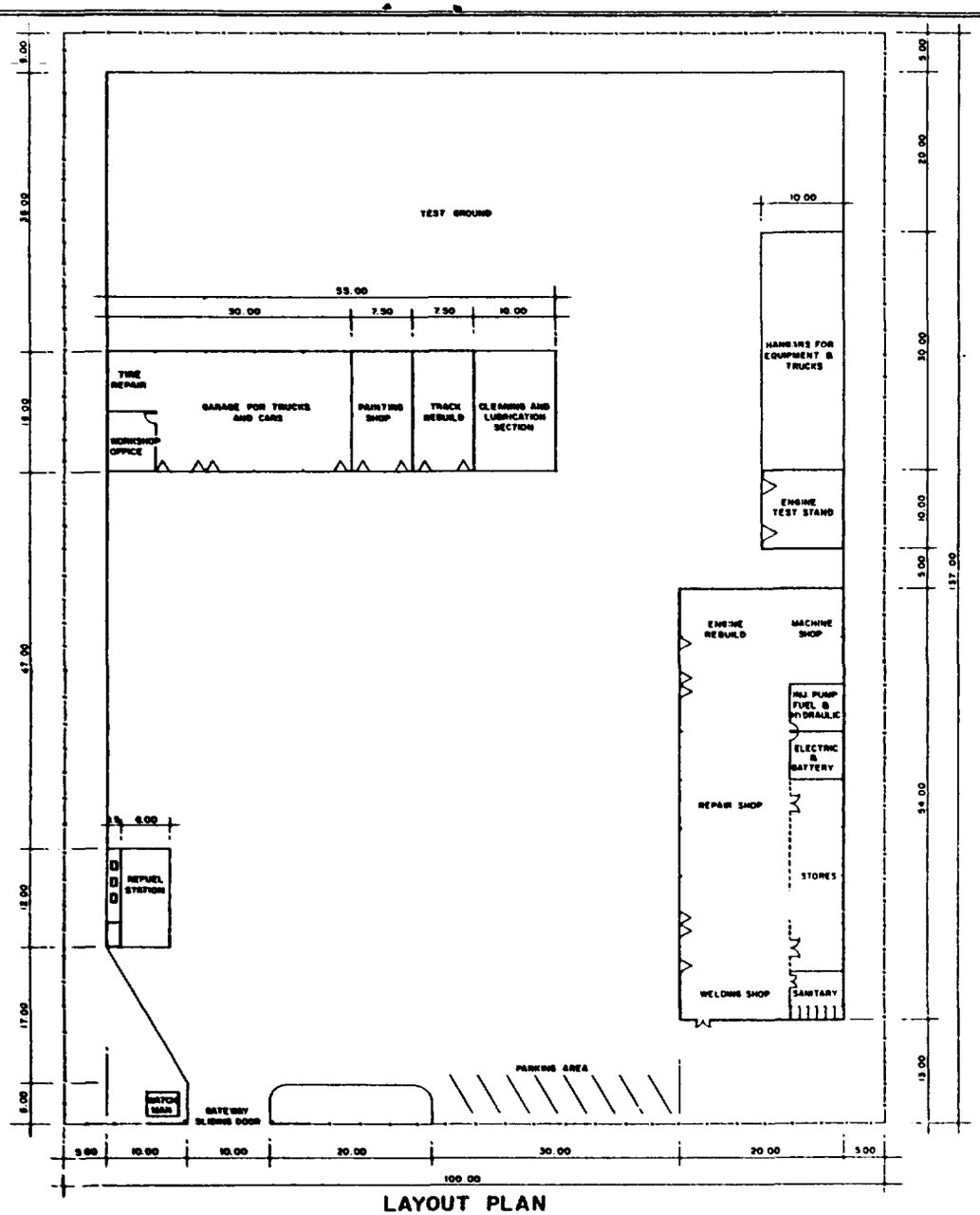
POST TITLE	Mechanical Engineer (Expert in fabrication of spare parts)
DURATION	Two years, with possibility of extension
DATE REQUIRED	As soon as possible, but not later than ...
DUTY STATION	
PURPOSE OF PROJECT	The Government of Pakistan is initiating a comprehensive programme for repair and rehabilitation of heavy road-building and automotive equipment. Realizing the crucial demand for spare parts, the Government will involve in its programme the manufacture, as far as possible, of spare parts, not only to save foreign exchange for importation but also to ensure an uninterrupted supply.
DUTIES	The expert will assist the Government in the preparation and implementation of the programme, notably:

(i) to assist in surveying and identifying the spare part requirements and in setting up spare part list, determining those that can be manufactured by domestic industries, and to assist in the acquisition of those that have yet to be imported.

(ii) to assist in undertaking practical experiments and research, casting, machining, heat treatment and hardening, and

(iii) to advice local manufacturers of spare parts and arrange for obtaining technical assistance and support and, if necessary and possible, licences from developed countries.

QUALIFICATIONS	Mechanical Engineer with broad background and experience in fabrication of spare parts, notably for heavy earth-moving, road-building and automotive equipment. University degree.
LANGUAGE	English fluently
BACKGROUND INFORMATION	In its accelerated programme of expanding activities in construction and reconstruction of roads and highways, and the implementation of its infrastructure programme, Pakistan has an increasing demand for heavy construction and transport equipment. Large amounts of foreign exchange are spent for their acquisition but considerable losses of valuable machinery accrue due to inadequacy of repair and maintenance facilities and inadequately trained personnel. The repair and rehabilitation of the equipment is extensively hampered due to the lack of spare parts. The project follows a UNIDO survey and it is in line with its recommendations.



LAYOUT PLAN
SCALE 1 : 300

ANNEX V

BASIC EQUIPMENT

ENGINE REBUILD

1 CRANKSHAFT GRINDING MACHINE
2 CYLINDER BLOCK AND HEAD GRINDING MACHINE
3 CYLINDER BORING AND HONING MACHINE
4 VALVE RECONDITIONING DEVICES
5 STEEL SPRY EQUIPMENT FOR CRANKSHAFT BEARINGS
6 ENGINE TEST STAND WITH DYNAMOMETER

MACHINE SHOP

7 MILLING MACHINE
8 SHAPER
9 HEAVY LATHE
10 LIGHT LATHE
11 DRILL DRESS
12 BENCH DRILL
13 GRINDER
14 HYDRAULIC PRESS
15 WORKBENCHES WITH DRAWERS AND VISES

TRACK RECONDITIONING

16 SUBMERGED ARC WELDING MACHINE
17 DOUBLE END TRACK HYDRAULIC PRESS
18 SUBMERGED WELDING MACHINE FOR TRACK ROLLER AND IDLERS
19 HYDRAULIC PRESS FOR ROLLER AND IDLER BUSHINGS

GENERAL EQUIPMENT

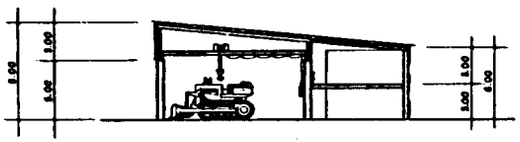
20 RAMPS IN BEAM STEEL CONSTRUCTION
21 STEAM CLEANER
22 HIGH PRESSURE WASHING INSTALLATION
23 COMPRESSED AIR LUBRICATION EQUIPMENT
24 OIL CHANGE FACILITIES VIA HOSE REELS
25 TYRE REPAIR EQUIPMENT
26 BRAKE DRUM TURNING AND GRINDING EQUIPMENT
27 BRAKE LINING REVETING AND GRINDING MACHINE
28 BATTERY CHARGER
29 UNIVERSAL ELECTRIC TEST BENCH
30 ELECTRIC WELDING GENERATOR
31 SUBMERGED ARC WELDING DEVICES
32 AUTOGENOUS WELDING EQUIPMENT
33 FORGE
34 AIR COMPRESSOR
35 INJECTION PUMP REPAIR FACILITIES AND TEST BENCH
36 WORKSHOP CRANE 5000 Kg
37 HYDRAULIC LIFTING DEVICES

MOBILE EQUIPMENT

38 LOW - BED SEMI - TRAILER 40 TON WITH THREE - AXLE TRACTION UNIT
39 BREAKDOWN TRUCK WITH HYDRAULIC ROTARY CRANE
40 FIELD SERVICE JEEP
41 LUBRICATION TRUCK
42 MOTOR AMBULANCE
43 INSPECTION JEEPS
44 ELECTRIC GENERATOR

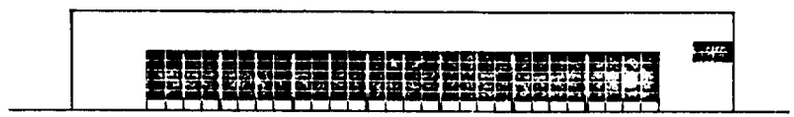
Tentative Layout for Technical Equipment Center

ANNEX V

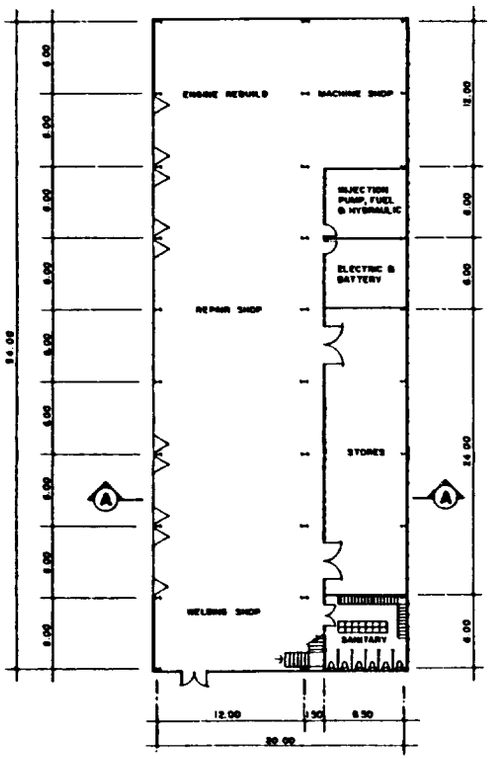


SECTION A – A
SCALE 1 : 200

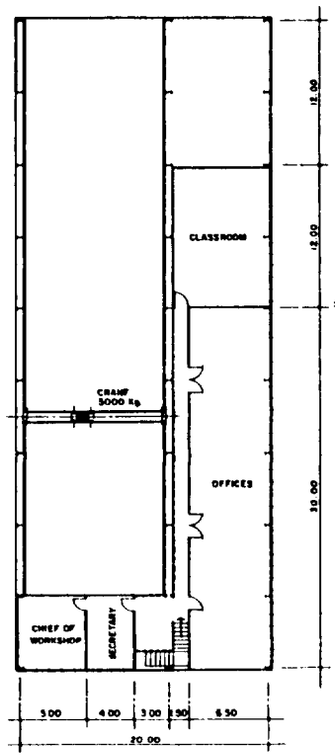
SIDE ELEVATION
SCALE 1 : 200



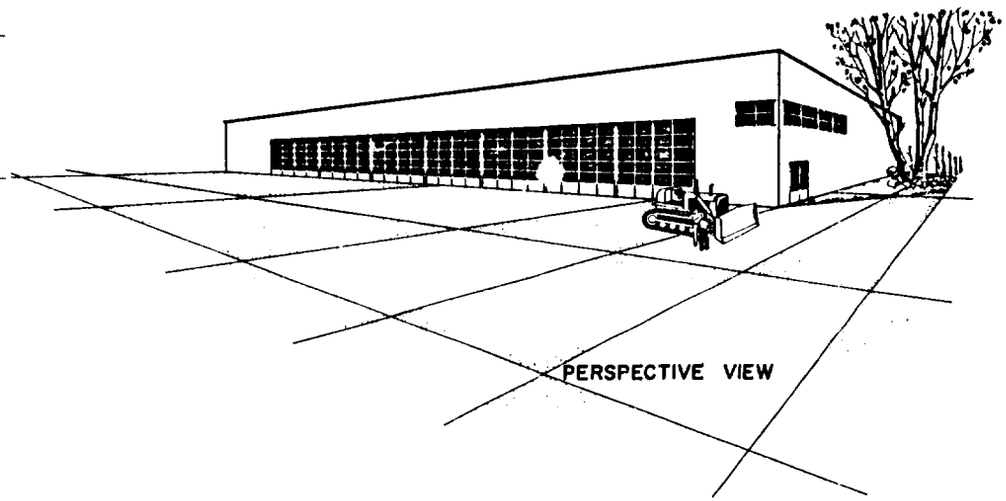
FRONT ELEVATION
SCALE 1 : 200



GROUND FLOOR PLAN
SCALE 1 : 200



FIRST FLOOR PLAN
SCALE 1 : 200



PERSPECTIVE VIEW

Tentative Layout for Technical Equipment Center