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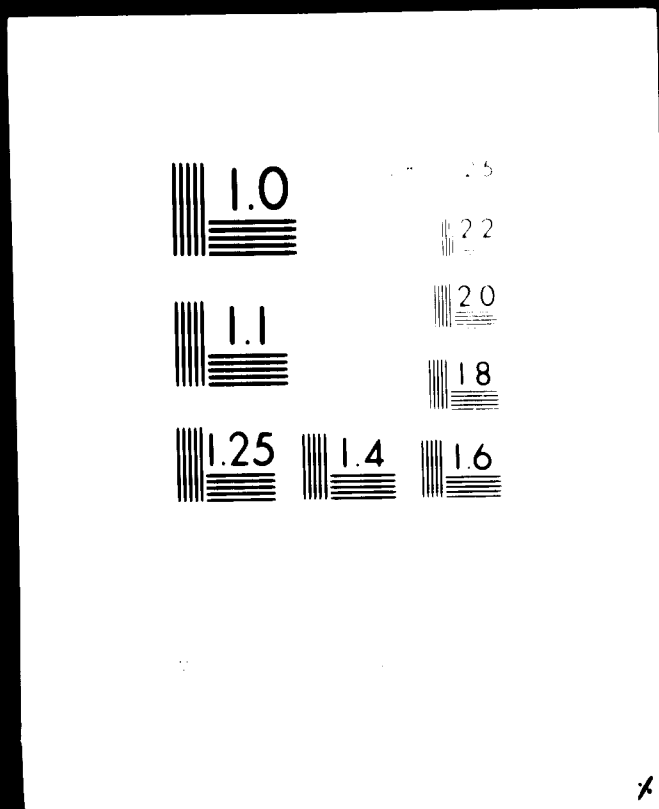
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CONFIDENTIAL

March 1969

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANISATION

REPORT

on

REPAIR AND MAINTENANCE OF INDUSTRIAL PLANT

in

PAKISTAN

UNIDO CONTRACT NO. 69/1

UNIDO REQUISITION NO. SIS 69/500 dated 3rd January 1969

MCLELLAN AND PARTNERS
WESTMINSTER S W 1

REPORT ON MAINTENANCE AND REPAIR OF INDUSTRIAL EQUIPMENT IN PAKISTAN

ABSTRACT OF REPORT

The Report surveys the repair and maintenance facilities for industrial plant in Pakistan.

It concludes that lack of proper spares, combined in some cases with inadequate planned maintenance, is resulting in unnecessary deterioration in the condition of plant and vehicles in factories, public utilities and electrical distribution networks and that there is a lack of practical experience in junior supervisory staff in repair and maintenance organisations.

It suggests means of increasing the local production of spares manufactured to the necessary standards, of improving the experience of staff and outlines a programme for implementing its recommendations.

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANISATION
REPORT
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INTRODUCTION

a. Scope of Report and Summary of Findings

This Report covers the repair and maintenance of industrial equipment in Pakistan. It is based on a sample survey of 71 factories and public utilities and on discussions at 24 meetings with Government officials and representatives of Industry.

Factories include those in the cement, chemical, engineering, iron and steel, jute, oil refinery, paper, sugar and textile industries and public utilities, road and water transport, docks, electrical generation and distribution.

The Report is one of several on repair and maintenance in developing countries being prepared for the United Nations Industrial Development Corporation to enable them to choose which countries need most assistance in this field and to help in drawing up a long term policy for assistance.

To ensure uniformity in the several Reports, Sections 1 to 6 inclusive have the paragraphs numbered and headed in accordance with UNIDO instructions.

The Report reviews the industries in the survey giving an indication of the numbers of firms and their importance, the prevailing conditions of repair and maintenance and the availability of skilled personnel. Its main findings are:-

Except in a few cases workshops are well equipped and adequate but due to restrictions on the free import of spare parts cannot obtain sufficient proprietary items. Unless these restrictions are lifted facilities for local manufacture to adequate specifications should be provided

In many cases graduate engineers and junior supervisory staff do not have sufficient practical experience

Generally systems of planned maintenance are practised but need improvement

Early attention should be given to the Water and Power Development Authority electrical distribution network

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otherwise further power failures will result and to the Government fertiliser factory at Fenchuganj to prevent a major plant shutdown.

The Report then gives recommendations which are summarised in Section 7.g covering additional facilities required for local manufacture of spares, the training of graduate engineers and other staff and improvements in planned maintenance procedures.

It then outlines a suggested programme for the implementation of its recommendations and concludes with a summary.

b. Itinerary of Survey Team

The survey team from McLellan and Partners, London, left England on 6th January 1969, spent the following day at UNIDO headquarters in Vienna and arrived in Karachi on 8th January. On 10th January they met officials of the Central Government in Islamabad and the programme for the survey was agreed. Approximately 4 weeks were spent in West Pakistan with a similar period in East Pakistan and on 6th March the team returned to Islamabad for a final meeting with the Central Government.

On 7th March they visited the Pakistan Standards Institute in Karachi and left Pakistan that night to return to England.

A diary showing all the visits and meetings is given Appendix A. Due to local circumstances some omissions had to be made from the agreed programme but these did not prevent the team obtaining the information needed.

c. Statistics

Pakistan consists of two provinces, the East and the West, which are separated by over 1,000 miles. It became independent in 1947 and the last census in 1961 gave the areas of the East and West as 55,126 square miles and 310,403 square miles and the populations as 50.8 M and 42.8 M respectively.

d. Geography and Climate

East Pakistan is formed round the delta of the River Jamuna, large areas of which are flooded during the monsoon. West Pakistan is mountainous to its north and west but in the southern part there are large deserts through which the River Indus flows irrigating the banks.

The climate of East Pakistan is humid with a very high rainfall which favours the jute plant but West Pakistan is dry and arid. Climatic conditions are given in Appendix B.

e. Economy

In 1947 both East and West Pakistan were principally agricultural communities with little industry in comparison with the present day. In 1952 the Pakistan Industrial Development Corporation was established to give particular attention to the basic industries of cement, chemicals, engineering, fertiliser, iron and steel, jute, paper, sugar and textiles, and since then the annual gross national product has increased from \$6,200 M

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to an estimated \$13,000 M.

f. Units

Throughout the Report the metric system of measurement is used and money values are given in American dollars at the rate of exchange ruling at the relevant time.

SECTION 1 - IMPORTANT INDUSTRIES

CEMENT FACTORIES

(a) Number of firms of reasonable size and the type and volume of manufacture

There are 8 cement works in West Pakistan and one in East of which 2 and 1 respectively were included in the itinerary but the latter visit had to be cancelled because of a General Strike. Particulars of the plant were obtained from the East Pakistan Industrial Development Corporation. The Works seen make cement from local limestone and have rated outputs of 250,000 and 300,000 tonnes pa.

(b) Age of firms etc

The works at Chattak in East Pakistan are 30 years old and although some of the West Pakistan mills were in production in 1949, the 1947 output amounted only to 300,000 tonnes.

A new plant at Hyderabad is under construction but its completion has been delayed and a plant at Bogra to produce 675,000 tonnes pa by 1977 is being considered but has not yet been approved.

At Chittagong a new clinker grinding and packing plant having a capacity of 150,000 tonnes pa is under construction.

(c) Importance and impact on the national economy

Although production of cement in Pakistan rose from 1.1 M tonnes in 1957 to 2.1 M tonnes in 1967/68, imports for the nine months ending March 1968 were valued at \$2.2 M.

All grey cement is consumed in Pakistan.

(d) Importance in the field of export

A small quantity of white cement is exported.

(e) Type, age and condition of equipment

All kilns in Pakistan are of the horizontal rotary type and with the exception of the old kiln at Chattak and one at Daud Khel, those seen are of the best modern design. Most other kilns are understood to be less than 10 years old.

Apart from one kiln at Daud Khel, which is of unusual design and troublesome, plant is as well maintained as the difficulty of obtaining replacement parts and instruments allows.

CHEMICAL PLANTS

(a) Number of firms of reasonable size and the type and volume of manufacture

There are 7 factories in West Pakistan and 1 in East Pakistan making

commercial and industrial chemicals of which 4 and 1 respectively were visited. The rated outputs of the works range from 30 to 60 tonnes/day and total production of chemicals for 1967/68 was:-

Soda Ash	44,000 tonnes
Caustic Soda	24,000 "
Sulphuric Acid	31,000 "
Chlorine Gas	4,600 "

(b) Age of firms etc

The chemical industry has few plants more than 10 years old.

(c) Importance and impact on the national economy

Imports for the nine months to March 1968 were:-

	<u>Value of Imports</u> <u>£000's</u>
Sulphur	400
Organic chemicals	4,000
Inorganic chemicals	3,400
Mineral tar and crude chemicals	465
Synthetic organic dyestuffs	6,150
Dyeing and tanning extracts	950
Pigments, paints and varnishes	1,670
Medical and pharmaceutical products	11,000
Soaps and polishing preparations	770
Explosives	286
Plastic materials	4,950
Miscellaneous chemicals	12,500
Chemical - materials	82,500
Manufactured minerals	<u>1,100</u>
Total	<u>130,141</u>

(d) Importance in the field of exports

Exports help the balance of payments situation and for the nine

months to March 1968 were -

	<u>Value of Exports</u> <u>£000's</u>
Organic chemicals	920
Inorganic chemicals	50
Dyeing and tanning extracts	1
Pigments, paints and varnishes	770
Soaps and polishing preparations	1,650
Medical and pharmaceutical products	825
Plastic materials	26
Miscellaneous chemicals	410
Chemical - materials	4,850
Manufactured minerals	12
Crude minerals	<u>300</u>
Total	<u>9,814</u>

(e) Type, age and condition of equipment

The plants seen were up to 20 years old. Some of the more modern ones have automatic process control and product packing.

Generally the equipment is in good condition but great difficulty is experienced in obtaining the correct spares, particularly for the automatic equipment in which use of incorrect parts sometimes causes damage and loss of production.

EARTH-MOVING, ROAD AND WATER TRANSPORT

(a) Number of firms of reasonable size and the type and volume of work

This group includes Public Road Transport Corporations, Government Earth-Moving and Repair Organisations, Docks and Port Trusts, Farm Tractor Repair Organisations and all mobile equipment fitted with diesel engines as a prime mover.

Approximate numbers of equipment handled include:-

West Pakistan Water & Power Development Authority (Machinery Pool Organisation)	6,000 vehicles
East Pakistan Water & Power Development Authority (Mechanical Equipment Organisation)	1,500 vehicles
East Pakistan Water & Power Development Authority (Dredger Organisation)	165 craft
East Pakistan Roads & Highways Department	270 vehicles
East Pakistan Road Transport Commission	400 vehicles

West Pakistan Road Transport Commission	3,300 vehicles
West Pakistan Port Trust	70 craft
East Pakistan Port Trust	50 craft 100 vehicles
Agricultural Department Tractor Station, Comilla	15 tractors

(b) Age of organisations etc

The Port Trusts date from 1892 and most other organisations were formed after 1947.

(c) Importance and impact on the national economy

An efficient internal transport service is an obvious need in a developing country.

Value of imports for the year ending March 1968 was \$25 M of which road vehicles accounted for \$23 M and ships and boats for the balance.

(d) Importance in the field of exports

In this group of service organisations the two most directly affecting exports are the two main exporting ports of Karachi and Khulna.

(e) Type, age and condition of equipment

The boats of the older organisations were originally driven by steam and later by low speed diesels and maintenance needed few imported spares.

All new craft, in common with the equipment of the other organisations, are now fitted with high speed diesel engines and maintenance requires parts which are not yet manufactured satisfactorily in Pakistan. Consequently all organisations are finding difficulty in servicing engines and much mobile equipment is standing idle and deteriorating.

ENGINEERING INDUSTRIES

(a) Number of firms of reasonable size and the type and volume of manufacture

There are 39 engineering works of reasonable size in West Pakistan and 19 in East Pakistan, of which 15 and 7 respectively were seen. They cover a wide range of manufacture from simple machine tools to small diesel engines, high pressure vessels and broad looms for the textile industry.

No figures are available for the total output but the largest machine tool factory at Landhi has a planned annual output valued at \$21 M and a general engineering workshop in the Chittagong area produced 350 tonnes of manufactured equipment in 1968.

(b) Age of firms etc

The oldest works seen were those of the Chittagong Port Trust started in 1896. Several of the original machines are still in good working order and a large gap-bed lathe with a faceplate for carrying work 1.7 m in diameter remains one of the largest lathes in Pakistan.

Most of the other works are not more than 15 years old and contain machine tools from all the major manufacturing countries.

(c) Importance and impact on the national economy

Importance of engineering industries in assisting the economy of the developing country is obvious as until they can be built up basic machines must be imported.

(d) Importance in the field of export

Exports in the nine months ending March 1968 were negligible.

(e) Type, age and condition of equipment

With the exception of Chittagong Port Trust machine tools generally throughout the engineering industry are less than 20 years old and include all types normally used.

Few works take adequate precautions against dusty conditions common in West Pakistan and in the East examples were seen of lack of protection of mobile machines against the weather. However, the need to keep machines clean and working surfaces well oiled is obviously appreciated and the condition of equipment is generally good.

FERTILISER FACTORIES

(a) Number of firms of reasonable size and type and the volume of manufacture

There are three factories in West Pakistan and one in the East, all of which were seen.

Designed annual outputs are:-

	<u>Tonnes</u>
Superphosphate	15,000
Ammonium Sulphate	53,000
Ammonium Nitrate	105,000
Urea	108,000

(b) Age of firms etc

The Pakistan Industrial Development Corporation built 2 factories in 1954 and 2 in 1962 to produce agricultural fertilisers from natural resources. The two latest factories use the natural gas discovered about 15 years ago

A second urea factory is being built in East Pakistan to produce 340,000 tonnes/pa.

(c) Importance and impact on national economy

The value of imported fertilisers for the nine months to March 1968 was \$31 M and so the provision of the second urea factory is important as is the attainment of full output from the existing factories.

The main effect of fertiliser factories on the national economy is to reduce imports and improve productivity of the soil.

(d) Importance in the field of export

No fertilisers are exported as demand exceeds local supply.

(e) Type, age and condition of equipment

The plants are of modern design and the original installations have been extended.

The high process pressures required and the corrosive nature of the intermediate products require a high standard of repair and maintenance to maintain full output. This is not always being achieved mainly due to delays inherent in the indenting system which causes a lack of spares.

The condition of the plant is generally deteriorating.

IRON AND STEEL WORKS

(a) Number of firms of reasonable size and the type and volume of manufacture

The only steelmaking plant is at Chittagong and has an annual finished output of 110,000 tonnes.

There are several rerolling mills using imported billets and 3 with annual outputs varying from 20,000 tonnes to 80,000 tonnes were visited.

(b) Age of firms etc

The Chittagong Steel Works was built in 1966 and the rerolling mills visited dated from 1950.

A new steelmaking plant is proposed for Karachi and an iron and steelmaking plant for Kalabagh.

(c) Importance and impact on the national economy

The value of imports of iron and steel for the nine months to March 1968 was \$37 M.

The importance of the steelmaking industry is to reduce the total value of imports by producing finished steel sections from inexpensive imported raw materials and local scrap.

(d) Importance in the field of export

Exports of iron and steel for the nine months to March 1968 were valued at \$55,000.

(e) Type, age and condition of equipment

The plant at the Chittagong steelworks is of modern Japanese manufacture. Maintenance is still being carried out under the maker's supervision.

Each of the rerolling mills seen has added further mills since the original were built. They are of the simple cross-country type manufactured locally using imported rolls and main drive motors. The reheating furnaces are also made locally.

JUTE MILLS

(a) Number of firms of reasonable size and the type and volume of manufacture

All the 40 mills in the country are in East Pakistan and three were visited, having rated outputs of 9,000, 28,000 and 31,000 tonnes/pa.

They produce sacking, hessian and carpet backing and have from 375 to 1,000 normal looms and 20 to 30 broad looms.

(b) Age of firms etc

There were only 3 jute mills in 1952, 14 in 1958 and 29 in 1967. Although the demand for traditional jute sacking is decreasing, this is offset by the increasing demand for carpet backing and to produce this, broad looms either 4.3 m or 5.4 m wide are being installed.

(c) Importance and impact on national economy

The total output of manufactured jute has risen steadily from 55,000 tonnes in 1954 to 500,000 tonnes in 1967/68.

(d) Importance in the field of export

All jute production is exported and for the nine months ending March 1968 was valued at \$137 M.

(e) Type, age and condition of equipment

All the equipment is of modern design and nearly all British although Italian and Japanese machines have recently been imported.

The standard of maintenance varied as did the condition of the plant in the 3 mills seen.

OIL REFINERIES

(a) Number of firms of reasonable size and the type and volume of manufacture

There are 3 refineries in Pakistan of which only the one at Karachi was seen. Products include naphtha, kerosene, diesel fuels, liquid petroleum gas, furnace oil and lubricating oils. Actual or potential production figures are not available.

(b) Age of firms etc

The Karachi plant was built in 1962.

(c) Importance and impact on the national economy

The importance of the oil industry is to reduce imports of refined products.

(d) Importance in the field of export

Exports of petroleum products for the nine months to March 1968 were valued at \$4.8 M.

(e) Type, age and condition of equipment

The Karachi refinery has modern plant and an excellent system of preventive maintenance. The equipment is still operating efficiently and this has largely been achieved by accurate long term forecasting of future spares requirements.

PAPER MILLS

(a) Number of firms of reasonable size and the type and volume of manufacture

There are 3 mills in West Pakistan and 2 in East Pakistan, of which the itinerary included visits to 2 and 1 respectively. They manufacture writing paper, packing board and newsprint and the annual rated outputs are:-

	<u>Tornes</u>
Board	16,000
Packing Board and Paper	24,000
Newsprint	53,000

(b) Age of firms etc

The 2 mills in East Pakistan were built in 1956 and 1959 and the latest one in West Pakistan in 1968.

One factory has recently added a machine to make cigarette paper but was experiencing difficulty in finding a suitable raw material.

To increase the quantity of raw materials available for the paper making industry the use of crushed sugar cane from which sugar has been extracted is being considered. At present this is used to fire sugar mill boilers, which would then be converted to oil or gas firing.

(c) Importance and impact on national economy

The industry cannot produce sufficient to meet local requirements, the consumption of which is steadily rising and imports of paper and board for the nine months ending March 1968 were valued at \$62 M.

(d) Importance in the field of export

A very small percentage of special papers and paper board are exported. For the eight months ending February 1968 these were valued at \$420,000.

(e) Type, age and condition of equipment

All paper and hardboard mills are of the modern high speed continuous type.

Generally, plant is well maintained and production is kept to a high level, but at Khulna newsprint malle, the new Canadian machine which incorporates many new mechanical and electrical devices has serious maintenance problems.

POWER STATIONS

(a) Number of Stations of reasonable size and their output

The Water and Power Development Authority have 10 power stations in East Pakistan and 20 in West. Of these approximately 13 are hydro-electric and 17 thermal stations burning natural gas or oil. In addition there are the power stations of the Pakistan Industrial Development Corporation and of individual works.

The Water and Power Development Authority stations have capacities up to 260 MW whilst those of other stations generally varied from 3 MW to 36 MW.

In 1947 the Water and Power Development Authority generating capacity was 12 MW for East Pakistan and 72 MW for West, but by 1968 this has increased to 240 MW and 560 MW respectively.

(b) Age of Stations etc

All major power stations are less than 20 years old.

Power station plant generally has been imported under foreign aid and, as it is from many sources, a central holding of common spares is not practicable.

The output of the hydro-electric stations is limited in summer which is the peak period of demand due to the extensive use of tube wells for irrigation purposes.

A Grid system was completed in West Pakistan in 1965 and in East Pakistan the two existing systems will be interconnected in 1970 by a line across the River Jamuna.

(c) Importance and impact on the national economy

Power consumption both in East and West Pakistan is increasing at the high rate of 30% pa. It is obvious that an efficient power supply and distribution system is essential to the economy of a developing country as it is in practice the only source of power for its manufacturing industries.

(d) Importance in the field of export

No electric power is exported from Pakistan.

(e) Type, age and condition of equipment

In most of the major thermal stations the generators are driven by steam turbines with water tube boilers fired by oil or natural gas. Some gas turbine stations for taking peak loads have recently been installed.

Both in the Water and Power Development Authority and in the larger private stations the equipment is modern.

Except for the Karnafuli hydro-electric station at Kaptai, which has overcome its teething troubles, all the other stations visited had major problems which are restricting output. These include rotor vibration, boiler and superheater tube fractures and heat exchanger leaks. There is serious shortage of spares for burner controls, boiler instruments and feed pumps, and this is interfering with the execution of plant maintenance programmes.

Owing to the lack of staff experienced in the overhaul of heavy machinery and major rotating plant, both sectors of the industry now call on the makers for major overhauls and servicing. There are, however, complaints that the standard of workmanship is deteriorating.

SUGAR FACTORIES

(a) Number of firms of reasonable size and the type and volume of manufacture

There are 10 factories in East Pakistan and 14 in the West of which our survey included 1 and 3 respectively. The daily rated outputs of the factories varies from 1,500 tonnes to 5,500 tonnes and in all cases was limited by the supply of cane or beet.

(b) Age of firms etc

The 3 mills seen in West Pakistan were built in 1949, 1956 and 1959. In 1959 there were 6 mills operating in West and 8 in East Pakistan.

(c) Importance and impact on national economy

The sugar industry produces essential food from local raw materials.

In 1967/68 output was 416,000 tonnes valued at \$137 M, of this approximately 95,000 tonnes was produced in East Pakistan, which is insufficient for local needs.

(d) Importance in the field of export

Pakistan does not export sugar in any quantity.

(e) Type, age and condition of equipment

The oldest mill, commissioned in 1934, is in East Pakistan, and some spares are still obtainable from the original makers. Twenty steam engines provide power for the main and ancillary drives.

The more modern factories are in West Pakistan, half of which are less than 10 years old, but the factories in the itinerary were the older ones.

In general equipment is reasonably well maintained, particularly where there are experienced managers. Spares are difficult to obtain and local manufacture not always satisfactory, sometimes so much so that production is reduced even though the sugar season lasts not more than six months and for the rest of the year the plant is available for repair.

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TEXTILE MILLS

(a) Number of firms of reasonable size with the type and volume of manufacture

There are 47 mills in East Pakistan and 97 in West Pakistan of which 1 and 8 respectively were visited.

These had from 12,500 spindles and 200 looms to 65,000 spindles and 1,350 looms.

Their products are mainly finished cotton cloth, sometimes dyed and printed and occasionally mixed with synthetic fibres to produce special fabrics. Output in 1967/68 was 710 M metres of cloth and 154,000 tonnes of yarn.

(b) Age of firms etc

All the mills visited were built between 1951 and 1954 when there were 71 in operation and so just over half of the present total were built later than those seen. Age did not appear to be the main factor in determining output and both well and indifferently managed mills were seen.

(c) Importance and impact on national economy

Since Independence the textile industry has developed rapidly and is now the second largest in the country. It supplies clothing for the majority of the inhabitants, uses indigenous raw materials and so greatly assists the balance of payments situation.

From 1952 to 1967 annual imports of textiles were reduced in value from \$132 M to \$3 M, whilst exports rose from \$150,000 to \$59 M respectively.

(d) Importance in the field of export

In the third quarter of 1968 exports of finished cotton and textiles were valued at \$29 M and textile yarn and thread at \$16 M. Raw cotton is exported in large quantities and so there is still a considerable source of raw materials for the expansion of this industry.

(e) Type, age and condition of equipment

The majority of mills including all those seen were built after 1947. The buildings and equipment are generally well laid out and compare favourably with new factories overseas.

The majority of plant seen is Japanese but there are British and German spinning machines and a few looms have been made in Pakistan.

Spinning frames are usually of modern design with spindles running in ball bearings, but one Japanese machine seen has plain spindle bearings which reduces output and increases maintenance.

Looms are of the non-automatic, semi-automatic and fully automatic types.

Some carding machines are fitted with modern high speed cross roll type accessories which increase output up to eight times that of earlier types.

Generally, equipment is modern in comparison with that of European textile factories, and should therefore be in better condition but this is often not so.

GROUPS OF SMALL FIRMS

(a) Number of groups and articles produced

In some areas of West Pakistan there are groups of small factories all manufacturing the same range of product, eg surgical instruments and sporting goods at Sialkot, vehicle spares at Gujranwala and cutlery at Islamabad.

(b) Age of firms etc

The ages of the firms vary considerably.

At Sialkot, which it was not possible to visit because of a curfew, the Government has established a Common Facility Centre to provide the necessary stainless steel and other raw materials.

(c) Importance and impact on the national economy

These groups of factories should be regarded as important in view of their potential export capacity.

(d) Importance in the field of exports

Although no figures are available for individual groups, Pakistan exported sports goods etc in the third quarter of 1968 to the value of \$1.6 M and scientific and medical instruments and apparatus to the value of \$600,000.

(e) Age, type and condition of equipment in the various firms

Most of the items are hand-made in the small workshops and there are comparatively few machine tools or heat treatment facilities.

SECTION 2 - EXISTING REPAIR AND MAINTENANCE PHYSICAL FACILITIES

a. Survey of Existing Repair and Maintenance Facilities in Different Factories and in the Country as a Whole

(i) In the Cement, Chemical, Fertiliser, Jute, Paper, Sugar and Textile Factories visited, all have repair and maintenance sections, generally with adequate workshop facilities. All operate a system of planned maintenance but the plan and its implementation is, in practically all cases, open to improvement, particularly in the case of Government Fertiliser factories.

(ii) The only Oil Refinery visited has good workshop facilities and an excellent system of planned maintenance.

(iii) The workshops of the Re-rolling Mills have the essential equipment and the maintenance procedures cover daily requirements. Overhauls are carried out during extended periods when the mills are awaiting billets. The Chittagong Steel Mill has good workshops but although a system of planned maintenance is in operation it is understood breakdowns, possibly from other causes, are frequent.

(iv) The Earth-Moving, Road and Water Transport industries have adequate workshops except for the Road Transport Corporation at Dacca and the Roads and Highways Department at Chittagong which are dealt with later in this report. Although planned maintenance procedures exist, as in similar industries throughout the world, they are usually difficult to implement and Pakistan is no exception.

(v) Engineering manufacturing industries generally use production plant as maintenance workshops and as so often happens in this industry the standard of plant maintenance could be considerably improved.

(vi) All Power Stations have small workshops sufficient for minor repairs. Apart from routine daily maintenance, repair work is planned for annual shutdowns but these programmes are often disrupted by plant breakdowns caused by delays inherent in the spares indenting system.

(vii) Groups of small firms do not have the same facilities as the major industries mentioned and consequently standards of maintenance tend to be lower. Methods of improvement are dealt with later in this report.

(viii) Generally, except in groups of small firms, there are responsible managers in charge of repair and maintenance facilities and the main difficulty to be overcome is the lack of spares and of trained supervisors.

(ix) The Pakistan Industrial Technical Advisory Centres offer an advisory and consulting service in specialised engineering techniques and workshop practice generally. More information is given in Appendix C.

b. Survey of Centralised Repair Shops

(i) Central Government Repair Shops The only ones included in the itinerary were the workshops of the Pakistan Industrial Technical Advisory Centres at Lahore and Dacca which can design and make precision parts including

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jigs and dies for private industry. Their workshop equipment is in excellent condition and they have a modern materials laboratory.

They will only undertake work carried out on a cost plus basis and for which the correct materials are available. Each centre works two shifts daily with forty skilled men per shift.

(ii) Repair Shops in the Public Sector of Industry in West Pakistan
The Machinery Pool Organisation of the Water and Power Development Authority have four Central Workshops at Lyallpur, Sukkur - which is being extended - Kashmir and Jamshoro. All the workshops are kept busy manufacturing and rebuilding parts for the 6,500 items of earth-moving, transport and miscellaneous equipment in the Authority. Work is generally of a high standard but additional inspection and testing would assist.

The Agricultural Development Corporation, which was not included in the itinerary, have workshops maintaining their fleet of farm tractors. It is understood that a separate United Nations team are carrying out an agricultural survey which will include these workshops.

The West Pakistan Road Transport Corporation maintain a fleet of 3,300 vehicles in West Pakistan. At Lahore maintenance facilities are barely adequate but a new engine overhaul department with crank shaft grinder and fuel injector service equipment is now being installed. The quality of work done is not very high and the Corporation is handicapped by lack of revenue as the maximum bus fares fixed by the Government in 1945 are no longer economic.

(iii) Repair Shops in the Public Sector of Industry in East Pakistan
The East Pakistan Road Transport Corporation operate 400 buses with depots in each city. The central depot at Dacca has modern machine tools including crank shaft grinders. The quality of the work is generally poor due to lack of spare parts, lack of trained fitters and congestion. As in West Pakistan the bus fares are uneconomic.

The Roads and Highways Department Central Depot at Chittagong repair and maintain about 270 items of road-making equipment. Workshops facilities are most inadequate and there is even a shortage of hand tools. There are no facilities for reboring engines or regrinding crank shafts and engine overhauls generally consist of replacing damaged parts with less worn ones from similar vehicles. As a result the wastage rate of equipment is very high.

The Mechanical Equipment Organisation of the East Pakistan Water and Power Development Authority have major workshops at Dacca, Feni, Bogra and Bheramara and it is planned to have a further two by 1970. They maintain their fleet of about 1,500 items of earth-moving equipment, lorries etc and generally the workshops facilities are adequate and the standard of work good.

The Dredger Organisation of the East Pakistan Water and Power Development Authority at Narayanganj service 165 vessels operating throughout Pakistan. Machinery, although 15 years old, is maintained in good condition and they have no difficulty in making parts for, and maintaining, the older slow speed diesel engines.

(iv) Centralised Repair Shops in the Private Sector No centralised repair shops in the private sector were included in the itinerary, but General

Motors maintain adequate workshops at Lahore and Karachi where complete overhauls of Bedford trucks and lorries can be undertaken. It is understood that similar facilities are provided by other mobile equipment manufacturers operating in Pakistan.

c. Availability of Spare Parts and Restrictions on their Import

(i) Delays caused by foreign exchange regulations procedure restrict the only spares readily available on the open market to those for which there is a steady demand such as popular vehicle parts, small ball bearings, vee belts etc.

Other parts such as proprietary items for special purpose machinery take a considerable time to obtain.

(ii) Regulations currently divide imports into the following:-

The Free List comprises items to be imported by means of aid or barter trading and sources of procurement are specified for most items. The list includes important industrial imports such as iron and steel, dyes and chemicals, drugs and medicines and copper. Manufactured items on the list include fractional low lift pumps, marine diesel engines, tools and workshop equipment. Letters of Credit for the import of items on the Free List may be opened at will and without a licence by registered industrial consumers, resident nationals of Pakistan and Pakistan owned business houses.

Items on the Licensable List are licensed largely on a past performance basis and importers are granted licences proportionately to their imports in the previous period.

The Bonus List specifies those items which may be imported by way of the Export Bonus Scheme. Under this scheme Pakistani exporters of non-traditional goods receive vouchers for a specified percentage of their foreign exchange earnings. These bonus vouchers carry an entitlement to import licences for items on the Bonus List. The vouchers are freely transferable and may be sold; they currently attract a premium of 190% above their face value, thus making imports financed by this means very costly. Nevertheless, they are widely used when there remains no other means.

The Cash-cum-Bonus List contains items for which a licence will be issued on the surrender of 50% bonus vouchers and 50% cash.

Banned Items Items not included in any of the above lists may not be imported. Manufacturing firms in Pakistan whose products are passed by the Pakistan Standards Institution can apply to have the import of competing products banned.

(iii) A large number of industrial imports have recently been transferred from the Licensable List to the Cash-cum-Bonus List.

Import licences other than those acquired through the Export Bonus or Cash-cum-Bonus schemes are neither negotiable nor transferable and all imports other than those for the Public Sector or under the Free List must be covered by a valid import licence

The items on the various lists are reviewed every six months and cover a six month shipping period. Licences not taken up during the shipping period elapse.

d. Availability of Spare Parts Manufacturing Facilities

(i) Cement Factories import half their spare parts including grinding balls.

(ii) Chemical and Fertiliser Plants and Oil Refineries A high proportion of the pumps, motors, valves and instruments must still be imported as they are made of special materials. All plants seen had large workshops for manufacture of parts and work seen was generally of a high standard.

(iii) Earth-Moving, Road and Water Transport The principal workshops making parts for earth-moving and transport are given in Section 2.b under Centralised Repair Shops.

Local manufacture of these parts is at present less than 10% of total requirements. Efforts are being made to increase this and the West Pakistan Water and Power Development Authority are hoping to make 40% when their new workshop at Sukkur is in production.

They have tried to encourage local manufacturers to make spares for them but have had little success due to the specialist nature of the work.

(iv) Engineering Firms Specialising in the Manufacture of Spare Parts A list of these firms is included in Appendix D. Firms who manufacture under licence agreements have to maintain standards but the quality of other locally made parts is usually inferior to the imported.

Items made under licence include pistons, liners, piston rings etc but the makers have great difficulty in getting the right raw materials. With the large variety of parts the consequent small batch production may mean that local costs are up to ten times those of the imported parts they are replacing

Unscrupulous firms who are not manufacturing under licence will pack sub-standard items in original makers' new cartons.

(v) Jute Mills make over 70% of their replacement parts which are well made but as they are often of the wrong material replacement is frequent.

Mills still need to import shuttles, spindles, ball bearings, picking sticks, trumpets and pins

(vi) Paper Factories Less than half the spares needed can be made in Pakistan. Parts that still have to be imported are rubber covered rollers, ball and roller bearings and instruments

(vii) Steel Industry Rerolling Mills can make all their own parts

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except rolls which they buy rough turned and finish.

Chittagong Steel Mills' annual Free List entitlement does not cover their requirement of refractory bricks and they have to make many other parts often from unsuitable materials. Ingot moulds are made satisfactorily by Khulna Shipyard Workshops.

(viii) Sugar Factories get over 70% of their parts made in their own workshops or elsewhere in Pakistan. As most parts are of cast iron the quality is generally adequate although larger castings often have blow holes. Locally made roll shells, cane cutting knives etc have comparatively short lives.

(ix) Textile Mills make between 50% and 70% of their spare parts requirements in their own workshops. They are usually copied from originals as drawings are not held and sometimes a worn part is used as a pattern. The life of such parts is further shortened as they are often made from poor quality or incorrect raw materials.

Ball and roller bearings, rings, ring travellers, spindles, combing plates, carding flex and rubber covered calender rolls are still imported.

e. Availability of Organised Adequate Stores

(i) Public Sector Workshops have large, well organised stores but these are hardly adequate for the wide range of equipment serviced.

(ii) Private Sector In general manufacturers' agents in Pakistan do not carry spares for the products they handle.

The only exceptions seen were the agents for Bedford Trucks, Massey Ferguson 135 Tractors and Ford cars.

Because of this individual works have to build up their own stocks by direct imports. These stores are generally well organised but have insufficient stocks.

Many fast moving parts are imported by small private traders operating in all the main towns but it is difficult and time consuming to obtain parts from them.

SECTION 3 - PREVAILING CONDITIONS AND REPAIR AND
MAINTENANCE ACTIVITIES AND DIAGNOSIS

a. Present Repair and Maintenance Facilities

In general workshop facilities are adequate but work is severely hampered by lack of imported spares. Except as mentioned below loss of production from this cause is not serious as Pakistani maintenance staff are adept at fabricating make-shift parts to keep equipment running. These parts do not last as long as ones made to the original makers' specification.

b. Industries where Repair and Maintenance Problems are Particularly Acute

(i) Cement Industry At the Maple Leaf Cement Works, Daud Khel, No. 2 kiln is giving considerable trouble due to poor design and the use of inferior materials during manufacture. It appears unlikely that the plant will ever give its rated output for any long period however much is spent on maintenance.

In both cement works seen maintenance was made difficult by lack of spares made from the right materials. For example, stainless steel kiln exhaust fan blades were replaced by ones made from mild steel and this entailed frequent interruptions of production to change worn blades.

There was also a lack of replacement process control instruments for which no repair service exists locally.

(ii) Earth-Moving, Road and Water Transport With modern high speed diesel engines lack of precision spare parts is a major problem. With the very small clearances and special materials required, such parts as fuel injection equipment, crank shafts, cam shafts etc cannot be made satisfactorily in Pakistan.

(iii) Fertiliser Plants Of the four Government Fertiliser Plants seen all have difficulty in obtaining spare parts within a reasonable time. This appears to be due to procedural difficulties in that orders for imported parts from organisations in the public sector of industry have to go through several departments. Consequently the interval between an indent being raised and the receipt of the parts can be two years or more. At the Multan and Fenchuganj factories production loss during 1968 was 20% and 50% respectively of the rated output. It was not possible to diagnose the causes of this during the survey but the situation is serious and needs immediate investigation.

(iv) Paper Mills The new Canadian paper-making machine at Khulna News Print Factory which was installed in 1965 has not yet overcome its teething troubles. Loss of production last year was twelve days and the cause appears to be lack of senior maintenance staff with experience of this type of machine.

(v) Power Generation and Distribution There is in most generating stations a shortage of supervisory staff with experience in the maintenance and repair of modern thermal stations and of the forward indenting procedure needed to obtain spares in time.

The Water and Power Development Authority electrical distribution system has a serious problem of repair and maintenance and in all areas except Karachi the loss of industrial production due to local power failures is about 7%. There is an urgent need for new equipment and for spares to maintain the existing distribution system but only about 50% of the money required annually is made available. In Karachi, which has an independent distribution system, power failures are rare.

(vi) Textile Mills In many mills badly made shuttles disintegrate and break other parts of the loom. Loom parts made of cast instead of malleable iron break and often cause further damage.

c. Factors Affecting the Adequacy of Repair and Maintenance Facilities

The main factors are given below. The most important one is considered to be lack of foreign spares or of the materials to make them. It is difficult to assess the relevant importance of the others which may vary with individual works but in all cases it is considered that they have considerable influence.

(i) Lack of foreign proprietary spares or of special materials such as alloy steels, synthetic rubber and plastics, which could be used for their local manufacture.

(ii) Shortage of trained junior supervisory staff and the very wide educational and technical gap between engineers and craftsmen, many of whom lack the basic knowledge of the operating principles of the plant, particularly diesel engines, on which they are working. This lack of the necessary close supervision often results in a very low standard of repair and maintenance.

(iii) Limited planned maintenance systems in most sections of industry.

(iv) Few engineers with University degrees have yet acquired the necessary practical experience which fits them for responsible posts in industry or electrical distribution.

(v) Craftsmen are usually illiterate and have often learnt their trade from their fathers with consequent inheritance of out-dated and often poor techniques. Once they have learnt how to do a particular job they will do it well but they do not have the necessary technical background to enable them to undertake a new one without instruction. Consequently, when they attempt repair work on equipment with which they are not familiar, it takes an unduly long time, it is often unsatisfactory and wastes material.

d. Standardisation

(i) Although many attempts have been made to introduce standard makes and types of equipment in various areas, due to trade loans and barter agreements this has rarely been possible. These agreements usually require Pakistan to purchase from countries to which she exports and which vary from year to year.

(ii) Lack of standardisation means that more capital needs to be tied up in a wider variety of spares than would be necessary if it were practised. As the capital available is normally limited a shortage of spares results and plant may stand idle for periods up to two years.

e. Repair Organisations in the Private and Public Sectors of Industry

(i) Apart from manufacturers' agents providing facilities for the repair and maintenance of their principals' plant there are no private institutions dealing with repair and maintenance.

(ii) Central Government workshops are dealt with in paragraph 2b and in addition the Government provides facilities for the repair and maintenance of plant at the following:-

Karachi Shipyard makes castings principally for the cement, sugar and textile industries and they have extensive machine shops and fabricating facilities to handle work up to 20 tonnes in weight. Castings over 3 tonnes in weight cannot be cast in one pour and this results in lack of homogeneity. They are prepared to manufacture single items but are very busy and there is usually a long delay.

West Pakistan Industrial Development Corporation, Machine Tool Factory, Landi is primarily a manufacturing plant and is prepared to make spares only if the order is large. Their prices are high and they are not busy as local demand is met by small private manufacturers who produce an inferior but cheaper product.

West Pakistan Industrial Development Corporation Heavy Machinery Complex at Taxila was not included in the itinerary but it is understood the machine shop is being built to accommodate 130 machine tools now on order and valued at \$1.5 M.

West Pakistan Industrial Development Corporation Pak-American Fertiliser Plant at Daud Khel has a large and comprehensive workshop and undertakes repairs for other projects in the area.

West Pakistan Industrial Development Corporation Fertiliser Plant at Multan has workshops more than adequate for its own needs and the management are willing to discuss making greater use of this facility by carrying out work for other factories.

The Ordnance Factory at Wah was not included in our itinerary but we understand it is very well equipped and takes in work from private industry.

The East and West Pakistan Railway Workshops were not included in the itinerary but are understood to be extensive and well equipped.

f. Government Policies

(i) Import Regulations Current regulations have been explained in Section 2c. The effect of these is to increase the cost of spares and raw materials which cannot be obtained on the Free or Licensable Lists.

Items are placed on the Banned List when a local firm satisfies the Pakistan Standards Institution they can manufacture to a satisfactory specification. This gives rise to two difficulties:-

The Pakistan Standards Institution have insufficient engineers to make adequate checks on the standards of these locally manufactured parts. Consequently there is a tendency for standards of both the materials and workmanship to fall

Differing interpretations as to which items are on the Banned List leads to delays in Customs clearance.

(ii) Capacity Tax The Government, concerned at the fall in production in the textile and cement industries over the last few years, imposed a Capacity Tax based on the output capacity of each factory.

Textile mills now tend to employ better qualified staff to increase the output per loom and dismantle the less efficient non-automatic looms.

In the cement industry there is now a tendency to keep kilns operating instead of shutting them down for planned maintenance. This must eventually result in loss of output.

SECTION 4 - PERSONNEL

a. Availability of Skilled Personnel

(1) The situation in the various grades is:-

Engineering Management - As in all countries the level of management skill varies. If this can be judged by the ability to run plant above its rated production, there is in some factories in Pakistan a very high degree both of skill and experience.

Few graduate engineers have acquired the necessary practical experience and training to fit them for senior posts in Industry and many do not appear to wish to obtain it or even realise it is necessary.

Supervisors - In the context of this report the term Supervisor refers to junior management who are the link between the engineers and the workmen.

There appears to be an adequate supply of diploma holders from Technical Colleges but many do not have the practical experience needed for the supervision of skilled workmen.

Skilled Workmen - There are shortages of skilled men such as pipe fitters, general fitters, machinists, tool makers, instrument mechanics, pressure vessel welders etc, generally.

The only area where this is not so is Karachi where higher wages draw them from the rest of West Pakistan.

Draughtsmen - are everywhere very scarce.

(ii) There are, as far as is known, no courses dealing specifically with repair and maintenance but Appendix E gives the numbers of students qualifying in engineering trades from various training establishments.

b. Availability of Training Facilities

(1) Government Sponsored Training Facilities These are also listed in Appendix E and include:-

Polytechnic Institutes - Financed by Provincial Governments. Boys of at least 16 years who have completed their schooling can do an eighteen month to two year course leading to a trade certificate or a three year course leading to a diploma.

Technical Training Centres - There are five Technical Training Centres in West Pakistan and three in East Pakistan. These are in addition to the German-Pakistan Technical Training Centre at Dacca and the Marine Diesel Training Centre at Narayanganj.

Centres are financed by Provincial Governments and come under the control of the Directorates of Labour. Boys who have completed their schooling do eighteen months to two year courses and receive trade certificates.

It is understood from the International Labour Organisation Manpower Planning Project that the shortage of teachers at Technical Training Centres is severe, many have only just completed their own training and lack practical experience of the work they are attempting to teach. This applies particularly to East Pakistan.

Vocational Training Institutes - There are at present 17 in East Pakistan and boys receive a trade certificate on passing out. Institutes are financed by Provincial Governments and come under the control of the Director of Technical Education.

Small Industries Corporation - This has 30 Centres and is financed by Provincial Governments. Its principal function is to teach handicrafts but the Light Engineering Service Centre at Gujranwala takes in eight school leavers per year and gives a three year course in machine shop practice, welding, pattern making and electroplating.

A similar Centre has been started at Chittagong but it is understood completion is delayed due to lack of finance.

Pakistan Industrial Technical Assistance Centres - Details of training facilities are given in Appendices C and E.

(ii) Private Facilities The Swedish-Pakistan Institute of Technology at Kaptai has an annual intake of 88 and offers two year trade courses. These may be followed by a third year leading to a diploma in Electrical Installation and Maintenance Technology, Industrial Wood Technology, Machine Shop Technology or Automobile Technology.

Other private Institutes running on similar lines include the Pakistan-Dutch and Pakistan-American.

The Syllabuses of courses at private Institutes vary considerably and the Government is trying to standardise and rationalise the various courses.

(iii) Inplant Training The Apprentice Ordinance directs that firms employing 50 or more shall have not less than 20% apprentices for whom proper instruction should be provided.

It came into operation in West Pakistan in 1965 and in East Pakistan in 1968 but has never been enforced and as a large proportion of the labour force is with firms employing 10 or less, it is not very effective.

(iv) General It is said standards of training in private Institutes are higher than in Government sponsored ones and this may be due to the much higher rates paid to instructors.

There were complaints from industry that boys who had been to the Institutes do not wish to make use of the skills they have acquired.

c. Availability of Potential Trainees

The situation in the various grades is:-

Supervisors - There is no shortage of educated boys who wish to train as supervisors

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Skilled Workmen - There is no shortage of boys wishing to become skilled workmen as is shown by the large response to advertised training courses.

From brief discussions held with the Training Department of the International Labour Organisation Manpower Planning Project it appears the standard of teaching in Elementary Schools is low because teachers are usually unqualified and poorly paid.

In consequence the standard of education of many potential skilled men is below that required and they are not all able to take proper advantage of the training facilities.

Draughtsmen - There appears to be a shortage of applicants for training.

SECTION 5 - FUTURE POLICY

a. Summary of Repair and Maintenance Needs

The main needs are given below. The most important are the first three in the order given.

It is difficult to assess the relative importance of the others as they will vary with individual works and organisations but in all cases it is considered they are items to which immediate attention must be given.

- (i) In the Government fertiliser factory at Fenchuganj maintenance engineers must be appointed with authority to obtain immediately spares needed to prevent a major plant shut-down.
- (ii) The Water and Power Development Authority needs more money and staff to repair and maintain the electrical distribution networks.
- (iii) Reinforcement of the advisory and consulting staffs is needed at Pakistan Industrial Technical Assistance Centres.
- (iv) Forecasts of future requirements of spares for all plant in all industries should be made.
- (v) The provision of sufficient spare parts made to the dimensions and of the materials specified by the original manufacturers is essential.
- (vi) Planned maintenance systems need improvement for all plant in all industries.
- (vii) Adequate practical training for graduate engineers and supervisors and much higher standards of education and training for skilled workmen is required.
- (viii) Additional courses are required for training fitters and supervisors in the repair and maintenance of high speed diesel engines.
- (ix) Courses are needed for training instrument mechanics from suitable men such as watchmakers, silversmiths etc.
- (x) An expert familiar with the particular problems arising on the new Canadian paper-making machine at Khulna Newsprint Mills is required for a period of up to twelve months.
- (xi) Assistance is needed at the Govt. Fertiliser Factory, Multan, in putting into operation planned maintenance systems, forecasting and obtaining spares.
- (xii) Standardisation of plant and vehicles should be practised within individual factories and Govt. organisations.

b. Recommendations for Improving Existing Workshops and Services

The foreign exchange situation hampers the import of original

makers spares in sufficient quantities and so more must be made locally. To do this not only must the correct raw materials be provided but workshop facilities must be improved.

(i) Factory Workshops In general these are adequate for existing needs but in remote areas provision of case hardening facilities for small manufactured parts should be provided where required.

(ii) Spare Parts Manufacturing Workshops All workshops manufacturing spares should have heat treatment, machine shop and testing facilities sufficient to ensure that they can comply with the original manufacturers specification.

Depending upon the item being manufactured this may mean providing muffle furnaces, cyaniding and carburising equipment, precision grinding, hardness testers, size gauges, balancing machines etc.

(iii) Centralised Workshops The Water and Power Development Authority workshops seem lack adequate quality control and inspection equipment and this should be provided.

The Road Transport Commission workshops at Dacca need more space to house their new machine tools. To increase efficiency the existing workshops and stores should be used exclusively for the overhaul of sub-assemblies eg engines, axles, gearboxes etc. Additional mechanical handling equipment is needed.

The Road Transport Commission workshops at Lahore need lubricating bays with either hydraulic lifts or pits and pressure greasing equipment etc for routine service of vehicles.

The Road and Highways Central Depot at Chittagong has adequate site and buildings but needs completely equipping with facilities to undertake the overhaul and servicing of its vehicles and plant.

(iv) Other Workshops At Karachi Shipyard the foundry needs improving to allow continuous pouring of castings over 3 tons in weight.

(v) The PITAC Consultancy and Advisory Section should be expanded to provide a wider service to Industry both in the public and private sector and give advice on planned maintenance, workshop stores procedure and organisation, steam generation, high speed diesel engines and electrical maintenance.

Engineers of this section should pay regular visits to all factories and power stations etc and should submit confidential reports to the management giving comments on present conditions and constructive criticism for improvement.

(vi) Pakistan Standards Institution To provide adequate inspection and standards for locally manufactured spare parts the staff of the Pakistan Standards Institution should be reinforced with experienced engineers.

c. Recommendations on the Establishment of New Facilities

(i) Central Workshops The Road Transport Commission Workshops at Dacca need a new body repair workshop with facilities for replacing sub-assemblies recommended in the sub-assembly shop already recommended (see 5b (iii)).

It is not considered that any other new central workshops are necessary.

(ii) Common Facilities Centres It is recommended that these are set up wherever there are large groups of small firms needing assistance such as in Karachi, Peshawar, Chittagong, Rawalpindi etc.

(iii) Repair and Maintenance Programmes All factories should have up to date inventories of all plant held. These inventories should be arranged in sections so that similar items are grouped together.

From the inventory a planned preventive maintenance programme should be prepared.

d. Recommendations on Improving Existing Stores and the Establishment of New Ones

(i) Existing Stores The stores section of the Roads and Highways workshops at Chittagong needs to be enlarged and properly organised.

(ii) New Stores In both East and West Pakistan a new central store for the specific purpose of providing adequate and ready supplies of special materials such as tool and alloy steels, synthetic rubbers, plastics etc, should be built to enable spares to be manufactured locally to original makers specifications.

To encourage local manufacture of spares it is recommended that the cost of materials from these stores is based on cif costs plus a small handling charge. Otherwise the cost of locally produced spares may exceed the cost of similar imported items.

e. Required Training with Establishment of Priorities

(i) Engineers and Supervisors The acquisition of sufficient practical training and experience to enable engineers and supervisors to assume responsible posts in Industry is made difficult by the prevailing attitude in Pakistan which regards manual labour as being the lot of the uneducated. In the case of supervisors the remedy may be, whilst insisting on present standards of education, to accept for training at Polytechnics only candidates who are skilled tradesmen. The course for training as supervisor would then consist of further specialised practical instruction with some related theory and the elements of management, job costing etc.

The practical training of engineers is more difficult. Only a minority of Pakistani graduates are prepared to do it. In many cases practical training overseas has proved to be of great value but it is not a complete answer as conditions overseas vary from those in Pakistan. Whilst sandwich courses, ie a five year course of which the second and fourth are spent doing manual work in Industry and the first, third and fifth at University would help, it is difficult to see a satisfactory solution to the problem until the present attitude to manual work changes. This is perhaps a case where sociologists rather than engineers are better qualified to provide a solution.

(ii) Skilled Workmen It is considered that existing training facilities should be improved by providing properly trained and experienced

instructors rather than by increasing the number of establishments. It is understood that the International Labour Organisation who have investigated the problem extensively also came to this conclusion.

It is recommended that the provisions of the Apprentice Ordinance should be enforced but initially too much insistence should not be put on the training of the full percentage legislated for. Training given under this Ordinance should be supplemented by evening classes.

(iii) General Further courses for both supervisors and workmen specialising in the maintenance and repair of small high speed diesel engines should be started.

To improve the standards of workmen the establishment of PITAC Training Centres at Karachi and Chittagong, similar to the one at Lahore, is recommended. To avoid interference in training, production work should only be undertaken to suit the needs of the training programme and not as a service to Industry.

f. Recommendations on the Establishment of Spare Parts Storage Systems

(i) Plant Inventories recommended in 5c (iii) should, in conjunction with spare parts lists, be used for establishing initial holdings of spare parts in factory stores.

These holdings should allow for the period it may take to obtain spares after indenting and should be revised at least annually.

Interchangeable parts in different sections of stores should be cross referenced.

(ii) The Special Materials Stores recommended in 5d (ii) should have lists prepared showing if other materials can be used when the first choice is not available.

g. Recommendations on the Establishment of Spare Parts Manufacturing Facilities

Before any additional facilities are provided existing workshops should be improved as recommended in 5b (ii) and utilised to greater extent, if necessary by the introduction of shift working.

h. Role that can be Played by Developed Countries and Mother Factories

(i) Help in the Establishment of Special Material Stores Provision by developed countries of initial stocks for the stores recommended in 5d (ii) would be of assistance.

(ii) Central Repair Workshops The additional equipment recommended in 5b (iii) and 5c (i) could be provided by developed countries.

(iii) Help in Organising Repair and Maintenance in Different Factories The staff recommended in 5b (v) for the expansion of the PITAC consultancy and advisory service can, until sufficient experienced Pakistani engineers are available, best be provided by developed countries.

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(iv) Help in Establishing Spare Parts Manufacturing Facilities The additional equipment required to implement the recommendations in 5b (ii) and 5c (ii) could be provided by developed countries.

(v) Supply of Staff to Advise on Repair and Maintenance Problems Generally Staff for the following could be provided by developed countries:-

Government fertiliser factories at Fenchuganj
and Multan (see 5a (i) and 5a (xi))

The Water and Power Development Authority
electrical distribution network (see 5a (ii))

Khulna Newsprint Mill paper machinery
(see 5a (x)).

SECTION 6 - SUGGESTED PROGRAMME OF IMPLEMENTATION
OF RECOMMENDATIONS

- (i) The following suggestions on the programme for implementing recommendations set out in Section 5 are generally in order of relative importance but where suggestions can be carried out without preliminary work the date given is related to the probable availability of staff rather than to the importance of the work - eg Khulna Newsprint factory.
- (ii) The provision of money for the Water and Power Development Authority electrical distribution networks and additional staff for maintenance of these networks and for the maintenance of the Government fertiliser factory at Fenchuganj are most important and action to provide them should be taken now.
- (iii) Immediate approval should be sought for reinforcement of the consultancy and advisory staff of the Pakistan Industrial Technical Assistance Centres as it is considered that implementation of all other recommendations except 5a (vii), 5a (x), 5a (xi) and 5a (xii) could best be carried out under the auspices of this body. The necessary staff should begin to arrive in Pakistan during September 1969 and recruitment should be complete by March 1970.
- Among the first tasks to be undertaken by PITAC should be advice on the setting up of the special materials stores and the initiation of complete factory plant inventories in the fertiliser, power distribution and generation, textile and cement industries.
- (iv) Plans to implement standardisation of plant and vehicles particularly in the public utilities should be drawn up this year and put into effect as soon as possible.
- (v) An expert to advise on the solution of the troubles now being experienced in the Khulna Newsprint factory should arrive by July 1969.
- (vi) The staff recommended in 5a (i) for the Fenchuganj fertiliser factory should, when their work there is complete, be seconded to PITAC to assist in similar work at the Multan and other fertiliser factories.
- (vii) The practical training of engineers, supervisors and workmen should be investigated by the Central Government with a view to implementing the suggestions made in this report.

SECTION 7 - SUMMARY

a. General

This Report and its recommendations are based on a sample survey of factories covering the main industries in Pakistan and on information given at meetings with Government officials and representatives of private Industry. Although it was only possible to visit a small proportion of all the factories, in all those seen, the problems of repair and maintenance in both large and small works in all industries were remarkably similar.

Although in the Report recommendations have been made for assistance to specific installations, there may be others equally important requiring similar attention which were not brought to light because the particular factories were not visited.

In all industries there are interruptions to power supplies caused by inadequate Water and Power Development Authority electrical distribution networks but in many cases there is no overall loss of production due to seasonal shortages of raw materials and other causes.

b. Existing Workshops

In the public utilities sector the Water and Power Development Authority have adequate power station workshops and the central workshops of its Machinery Pool Organisation were generally well equipped and turned out work of high standard but additional testing and inspection equipment would be an advantage. Their Mechanical Equipment Organisations and Dredger Organisation workshops are adequate and produce good standards of work. The workshops and maintenance facilities of the Road Transport Commissions in both East and West Pakistan and of the Roads and Highways Department in Chittagong are not up to the standard needed. Other workshop facilities in the public utilities sector of Industry include Karachi Shipyard which makes castings and has extensive machine shops and fabricating facilities.

The Central Government workshops of the Pakistan Industrial Technical Assistance Centres at Lahore and Dacca are well equipped with machine tools and a modern materials testing laboratory. They assist private Industry in making dies and tools.

No central workshop was visited in the private sector but General Motors maintain workshops at Lahore and Karachi for the complete overhaul of Bedford vehicles.

c. Existing Stores

Most factories and other organisations had adequate spare parts storage facilities but insufficient stocks of imported proprietary spares or raw materials such as alloy steels and synthetic rubbers from which to make parts. These shortages are due to import regulations which result in long delays in obtaining spares, lack of complete plant inventories which can be used for long term forecasting of spares requirements and lack of standardisation which means a wider variety of spares is needed.

d. Availability of Experienced Staff

The acquisition of sufficient practical training and experience to enable graduate engineers, and staff in junior supervisory positions to assume responsible posts in Industry is made very difficult by the prevailing attitude in Pakistan which regards manual labour as being the lot of the uneducated. In all areas except Karachi there are shortages of skilled men and everywhere draughtsmen are very difficult to find. The training of supervisors and craftsmen is hindered by shortage of teaching staff particularly at Technical Training Colleges where many have only just completed their own training and lack practical experience in the subjects they teach. This is particularly applicable to East Pakistan.

e. Existing Maintenance Procedures

Systems of planned maintenance are in operation in all factories and public utilities though in most cases both the plan and its method of implementation are open to considerable improvement. In the case of the Government Fertiliser Factory at Fenchuganj and the Water and Power Development Authority electrical distribution networks immediate action is required.

The main cause of unsatisfactory maintenance is the difficulty of obtaining foreign proprietary spares or suitable materials from which to make them locally.

Pakistani workmen are adept at making spares but when these are from the wrong materials the subsequent rate of wear is accelerated, production of the machine in which they are fitted may be reduced and other damage result. Typical examples of this occur in the textile industry where locally made shuttles disintegrate and other loom parts made of grey cast iron instead of malleable iron break causing further damage.

f. Import of Spares

There are two ways of obtaining foreign parts, either to abandon or relax the import regulations or to provide facilities for making locally parts to original makers specifications. In this Report it has been assumed that the first course will not be acceptable as a long term solution and recommendations providing for the second are made, but owing to the comparatively small quantities needed costs of local production may be greater than the costs of identical spares mass produced overseas.

In the Government sector of Industry there appear to be procedural delays and as orders for imported parts have to go through several departments the interval between the indent being raised and the receipt of the parts can be two years or more.

g. Recommendations

The recommendations of this Report fall broadly into three categories covering facilities required for local manufacture of spares, the training of graduate engineers and other staff and improvements in planned maintenance procedures:-

- (i) Recommendations for increasing the local manufacture of spares at

present imported include the establishment in both East and West Pakistan of special materials stores which would provide adequate and ready supplies of materials such as alloy steels, synthetic rubbers and plastics etc; the improvement of existing workshop facilities rather than the establishment of new and increasing the staff of the Pakistan Standards Institution.

(ii) For the practical training of engineers it is suggested that sandwich courses in which the first, third and fifth years are spent at University and the second and fourth obtaining practical experience in Industry would help as would overseas training.

For supervisors it is recommended that instead of school leavers, skilled tradesmen should be recruited for training at Polytechnics where they would be given further specialised practical instruction with some related theory and the elements of management and job costing etc.

For skilled men it is recommended that the standards of training should be improved by raising the standards of instructors and that special courses should be provided for diesel engine fitters and instrument mechanics. It is also recommended that the provisions of the Apprentice Ordinance are enforced and that apprentice training should be supplemented by evening classes.

It is felt that the view widely held in many countries that manual work is only to be done by the uneducated must be changed and that the means by which it is to be changed is a problem for the sociologist rather than the engineer.

(iii) For improving the standards of maintenance this Report recommends the consultancy and advisory section of the Pakistan Industrial Technical Advisory Centre should be used as the principal agent. The section should be financed to provide a wider service to Industry both in the public and private sectors and give advice on planned maintenance, workshop stores procedure and organisation, steam generation, high speed diesel engines and electrical maintenance.

Engineers from it should pay regular visits to all factories and public utilities and make confidential reports to the management giving comments on present conditions and constructive criticisms for improvements.

h. Programme

The Report suggests ways in which help in implementing its recommendations could be given by developed countries and outlines a programme which includes as first priorities the giving of immediate help to the Government Fertiliser Factory at Fenchuganj, the Water and Power Development Authority electrical distribution departments and the reinforcement of the consultancy and advisory staff of the Pakistan Industrial Technical Assistance Centres.

APPENDIX A

Diary of Survey Team

<u>Date</u>	<u>Town</u>	<u>Engagement</u>
7th Jan	Vienna	UNIDO Headquarters
8th "	Karachi	General Investment Promotion and Supplies Dept
" "	"	West Pakistan Industrial Development Corporation
" "	"	General Iron & Steelworks Ltd
" "	"	Star Textile Mills Ltd
9th "	"	Pakistan Industrial Credit and Investment Corporation
10th "	Islamabad	Central Govt: Ministry of Industries and Natural Resources
11th "	Lawrencepur	Lawrencepur Woollen Mills Ltd
13th "	Nowshera	Ferozsons Laboratories Ltd
" "	"	Adamjee Paper and Board Mills Ltd
14th "	Charsadda	Charsadda Sugar Mill Ltd
" "	Mardan	Premier Sugar Mill Ltd
15th "	Peshawar	Nishat Textile Mill Ltd
" "	Nowshera	Colony Sarhad Textile Mill Ltd
16th "	Daud Khel	UNIDO Inter-Regional Adviser
17th "	"	Maple Leaf Cement Works Ltd
" "	"	Pak-American Fertilizers Ltd
20th "	Lahore	Provincial Govt: Director Industries and Commerce
" "	"	West Pakistan Water and Power Development Authority Headquarters
" "	"	Packages Ltd
" "	"	Pakistan Industrial Technical Assistance Centre
21st "	"	Road Transport Corporation
" "	"	Zulsham Engineering Works Ltd
22nd "	"	Batala Engineering Co (Pakistan) Ltd
" "	"	Pak-Electronics Ltd
23rd "	Lyallpur	West Pakistan Water and Power Development Authority Power Station
" "	"	West Pakistan Water and Power Development Authority Machinery Pool Organisation Workshop
" "	"	West Pakistan Industrial Development Corporation Fertilisers
" "	"	Crescent Sugar Mills Ltd

APPENDIX A (Continued)

<u>Date</u>	<u>Town</u>	<u>Engagement</u>
24th Jan	Multan	West Pakistan Industrial Development Corporation Fertiliser Plant
" "	"	West Pakistan Water and Power Development Authority Natural Gas Power Station
25th "	Kala Shah Kaku	Koh-i-noor Rayon Plant Ltd
" "	"	Koh-i-noor Chemical Plant Ltd
" "	"	Koh-i-noor Engineering Ltd
27th "	Gujranwala	Light Engineering Services Centre
" "	"	Crescent and Star Industrial Co. Ltd
" "	Lahore	Pakistan Cycle Industrial Co-op Society Ltd
28th "	"	Curfew all day
29th "	"	Rana Motors Ltd
" "	"	Electrical Eqpt Manufacturing Co. Ltd
" "	"	Curfew after 2 pm
30th "	"	West Pakistan Water and Power Development Authority - Northern Area Electrical Distribution
" "	"	Rana Tractors & Equipment Ltd
" "	"	Curfew after 2 pm
31st "	"	K.S.B. Pumps Ltd
" "	"	Curfew after 2 pm
1st Feb	"	Longmans Mills Ltd
" "	"	Curfew after 2 pm
3rd "	Landhi	Steel Co. of Pakistan Ltd
" "	Karachi	Lakhany Silk and Cotton Mills Ltd
4th "	"	Valika Cement Ltd
" "	"	Valika Chemical Ltd
" "	"	Pakistan Refinery Ltd
5th "	"	West Pakistan Industrial Development Corporation Headquarters (Heavy Engineering)
" "	"	Central Govt - Additional Director of Industries and Natural Resources
" "	"	Karachi Shipyard and Engineering Works Ltd
" "	Landhi	Dawood Cotton Mills Ltd
6th "	Karachi	Ghandhara Industries Ltd
" "	"	Bawany Violin Textile Mills Ltd
7th "	Landhi	West Pakistan Industrial Development Corporation Machine Tool Factory

APPENDIX A (Continued)

<u>Date</u>	<u>Town</u>	<u>Engagement</u>
7th Feb	Karachi	United Nations Development Project - Manpower Planning Project
" "	"	Allwin Engineering Industries Ltd
" "	Landhi	Fazal Shafiq Textile Mills Ltd
8th "	Karachi	Wazir Ali Engineering Ltd
" "	"	Pak Chemicals Ltd
10th "	"	Karachi Port Trust
" "	"	Pakistan Industrial Credit and Investment Corporation
11th "	Dacca	Provincial Government - Ministry of Industries and Commerce
" "	"	East Pakistan Industrial Development Corporation
" "	"	East Pakistan Water and Power Development Authority
" "	Tongi	Nishat Jute Mill Ltd
12th "	Dacca	East Pakistan Road Transport Corporation
" "	"	Pakistan Industrial Technical Assistance Centre
13th "	"	Water and Power Development Authority - Machinery Equipment Organisation
" "	Narayanganj	Water and Power Development Authority - Dredger Organisation
" "	Dacca	Kohinoor Chemicals
14th "	"	Hartal (General Strike)
15th "	"	Latif Bawany Jute Mills Ltd
" "	Tongi	Engineering Industries Ltd
17th "	Kaptai	Karnafuli Hydro-Electric Station
" "	"	East Pakistan Water and Power Development Authority - Machinery Equipment Organisation
" "	Chanderghona	Karnafuli Paper and Rayon Mills Ltd
18th "	Chittagong	Chittagong Port Trust
" "	Pahartoli	Ispahani Marshall Ltd (Engineering)
" "	"	Pahartoli Textile Mills Ltd
19th "	Chittagong	Hartal (General Strike)
20th "	"	Roads and Highways Dept
" "	"	Elahee Bukhsh & Co. Ltd
" "	"	Amin Jute Mills Ltd

APPENDIX A (Continued)

Date	Town	Engagement
21st Feb	Chittagong	Hartal (General Strike)
22nd "	"	East Pakistan Industrial Development Corporation Steel Mills
" "	"	Forest Development Corporation
24th "	Dacca	Rahim Eng Co Ltd
25th "	"	Mirpur Ceramic Ltd
26th "	Gopalpur	North Bengal Sugar Mills Ltd
27th "	Dacca	Idul Azha (National Holiday)
28th "	"	" " " "
1st March	Khulna	Khulna Ship Yard (East Pakistan Industrial Development Corporation)
" "	"	Khulna Newsprint (East Pakistan Industrial Development Corporation)
3rd "	Sylhet	Fenchuganj Fertiliser Plant (East Pakistan Industrial Development Corporation)
4th "	Dacca	Hartal (General Strike)
5th "	"	East Pakistan Provincial Govt: Education Dept
" "	"	East Pakistan Industrial Development Corporation Headquarters (Cement)
6th "	Islamabad	Central Govt - Ministry of Industries and Natural Resources
7th "	Karachi	Pakistan Standards Institution.

APPENDIX B

Climatic Conditions in Pakistan

CITY	ELEVATION Metres above sea level	MINIMUM Temp °C (Dry Bulb)	MAXIMUM Temp	
			°C (Dry Bulb)	°C (Wet Bulb)
BOGRA	18	+5	38	29
CHITTAGONG	13	+7	37	29
COMILLA	8	+8	37	29
DACCA	7	+7	42	30
DINAJPUR	34	+4	43	29
HARIPUR	500	0	44	25
HYDERABAD	28	-1	50	29
ISLAMABAD	550	-2	47	28
JACOBABAD	52	-4	53	29
KALAT	780	-12	48	28
KARACHI	21	0	48	29
KHULNA	5	+7	42	29
LAHORE	200	-2	48	29
MULTAN	115	-2	50	28
MYMENSINGH	13	+6	41	29
NARAYANGANJ	8	+6	42	30
PESHAWAR	330	-3	48	29
QUETTA	1,450	-17	41	22
RANGPUR	32	+7	42	29
RAWALPINDI	470	-4	48	27
SUKKUR	62	-4	48	29
SYLHET	32	+9	41	31

APPENDIX C

Pakistan Industrial Technical Assistance Centre (PITAC)

PITAC is an autonomous agency sponsored by the Central Government and administered by a Governing Body under the chairmanship of the Secretary, Ministry of Industries and Natural Resources. It was set up, in collaboration with the United States Agency for International Development, to improve the productivity of industry in Pakistan.

The headquarters is in Lahore with a branch in Dacca and an advisory office in Karachi.

Its objectives are to provide facilities for training, design and manufacture and finishing processes together with industrial advisory, consulting and technical information services.

It is intended that men trained at PITAC will, in their turn, train others in the technical schools and factories.

For the manufacture and finishing process there is a permanent staff of skilled craftsmen but trainees are used wherever possible.

The work done is of a high standard and a stock of alloy steels is held.

Training

PITAC take tradesmen from industry and for a \$100 fee give them 12-week courses to improve their skill and demonstrate modern procedures. Courses include:-

Design of machines, fixtures, jigs, dies, moulds, tools and gauges etc.

Advanced Machine Shop practice

Tool and Die Shop practice

Ferrous and non-ferrous foundry work

Pattern making

Heat treatment

Welding

Die and free forging

Sheet metal fabrication

Anodising, electro, zinc, nickel and silverplating.

In addition, students from technical and trade schools are given courses in:-

Inspection and quality control

Draughting and drawing interpretation

APPENDIX C (Continued)

Maintenance and repairs
Industrial engineering
Industrial management

Design, Manufacturing and Finishing Processes

PITAC advertise this service at charges that barely cover costs of materials and labour. It is used by public and private industries who lack the necessary facilities or skills.

Work undertaken covers:-

Design Only

Foundry cupolas, ceramic furnaces and roll pass designs for merchant steel sections

Design and Manufacture

Precision dies, jigs, fixtures, gauges and tools
Machinery components
Foundry patterns
Ferrous, non-ferrous, alloy and malleable castings
Machine tools including lathes, planers, millers, gear cutters and grinders etc

Finishing Processes

Heat treatment and electro-plating

Industrial, Advisory and Consulting Services

A staff of foreign experts and Pakistani Engineers is available to give advice in the following:-

Process selection	Manning and production scheduling
Machinery and equipment selection	Material handling
Plant layout	Assembly line techniques
Material specification	Inspection and quality control
Organisation	Workshop practice
Supervision	Simplification, specialisation and standardisation

Processes in which specialist advice is available include:-

Ceramics, glass and refractory engineering
Chemical and electrical engineering

APPENDIX C (Continued)

Foundry practice

Steel rolling, heat treatment, electro-plating,
sheet metal fabrication, forging techniques,
welding etc.

Technical Information Service

PITAC have libraries in all three offices and a stock of films is carried; shows are arranged in the main industrial centres.

From time to time seminars and group discussions are organised in the main centres to which industrialists, managers, technicians and experts are invited.

General

PITAC training courses are not filled as management seems reluctant to lose key personnel for three months.

Training programmes sometimes appear to interfere with the production work and vice versa.

There is an unsatisfied demand for training courses in the Karachi and Chittagong areas.

APPENDIX DList of Engineering Firms Manufacturing Spare PartsWest Pakistan

<u>Name of Firm</u>	<u>Location</u>	<u>Present Manufacturing Activities</u>
Pakistan Industrial Technical Assistance Centre	Lahore	Press Tools, Special Purpose Machines, Jigs, Fixtures etc
Alwis Zulshan Industries Ltd	Lahore	Diesel Engines, Printing Machinery, Spares etc
Pakistan Cycle Industrial Co-operative Society Ltd	Lahore	Cycles
Batala Engineering Co. (Pakistan) Limited	Lahore	Electric Motors, Pumps, Cycles, Storage Tanks, Building Structures, Plant Equipment Items, Hydraulic Structures
Abdul Majid & Sons Ltd	Lahore	Diesel Engines
Crown Engineering Works	Lahore	Lathes, Gear Hobbing, Drilling Machines etc
Ittefaq Foundry & Workshop Limited	Lahore	Diesel Engines, Centrifugal Pumps, Lathes, Shaping Machines, Road Rollers etc
Pakistan Western Railway Workshop	Lahore	Wagons, Coaches, Springs, Rail Cars etc
Atta and Brothers	Lahore	Inlet and Outlet Valves
M.Mohd. Hussain & Sons	Lahore	Diesel Engines
S.Mohd. Din & Sons Ltd	Lahore	Electric Fans, Motors, Water Coolers etc

APPENDIX D (Continued)

<u>Name of Firm</u>	<u>Location</u>	<u>Present Manufacturing Activities</u>
Pakistan Industrial Chains Ltd	Karachi	Cycle and Motor Cycle Chains, Industrial and Lifting Chains, Free Wheels
Singer Industries (Pakistan) Ltd	Karachi	Singer Sewing Machines and parts
R.R. Steel Industries	Lahore	Auto parts
National Spring Manufacturing Company	Lahore	"
M. Shah Mohammad & Sons, Automobile Engineers	Multan	"
M. Ghulam Mustafa & Sons	Lahore	"
Suleman & Company	Lahore	"
Envoy Limited	Lahore	"
Sunrays Industries	Lahore	"
Alam Brothers	Hyderabad	"
Ghulam Hussain Co. Ltd.	Lahore	"
Punjab Motor Workshop	Karachi	"
Nisaco Motor Parts Industries	Karachi	"
Universal Distributing Agencies	Karachi	"
Haroon Industries Ltd	Karachi	"
Mascot Industrial Corporation	Karachi	"
Deen Engineers	Lahore	"

APPENDIX D (Continued)

Name of Firm	Location	Present Manufacturing Activities
KSB Pumps Co. Ltd	Wah	Centrifugal Pumps, Deepwell Turbine Pumps
Sind Chemical & General Industries Ltd	Hyderabad	Auto Parts, Centrifugal Pumps and parts, Tractor parts
Ali Automobiles Ltd	Karachi	Cars, Truck bodies, Scooters, Tractors etc
Ghandara Industries Ltd	Karachi	Cars, Truck bodies, Vans, Refrigerators etc
Wazir Ali Engineering Ltd	Karachi	Scooters and their parts eg Gears etc
Kandawala Industries Ltd	Karachi	Jeep Assembly, Auto parts eg Radiators and Miscellaneous Sheet Metal work
Sind Cottage Industries	Karachi	Sprayers, Foot Pumps etc
Atlas Autos Limited	Karachi	Honda Motor Cycles and other metal parts
Allwin Engineering Industries Ltd	Karachi	Auto parts eg Pistons, Valves and Rings, Spring (Laminated) Track components, Radiators, Castings etc
Karachi Shipyard & Engineering Works Ltd	Karachi	Heavy type steel fabrication, Sugar Mills equipment, CI, Steel Castings, Shipbuilding, Ship repairs etc

APPENDIX D (Continued)

<u>Name of Firm</u>	<u>Location</u>	<u>Present Manufacturing Activities</u>
Climax Engineering Company Limited	Gujranwala	Electric Fans, Motors, Transformers, Pumps etc
Anwar Industries Ltd	Gujranwala	Electric Fans. Brass Fittings for sanitary purposes etc
H. Fazel Din & Sons	Sialkot	Planers for Wood, Drilling Machines, Augers etc
Faizi Industries Ltd	Gujranwala	Switchgear etc
Govt. Metal Industrial	Sialkot	The Centre is established for metal industry in Sialkot and surrounding areas
National Metal Works Ltd	Gujrat	Electric Fans, Motors
Metal Engineering Corp. Ltd	Wazirabad	Auto spares eg Tie Rod ends, King Pins, Shackle Pins etc
Khawari & Company	Wazirabad	Cutlery, Surgical Instruments, Tubular Furniture etc
Water & Power Development Authority MPO	Lyallpur	Primarily Maintenance Shop, have facilities to manufacture: Brushes, Shafts, Axles for Heavy Construction Equipment
Lyallpur Motor Company	Lyallpur	Track Rollers, Shafts, Track Pins and Bushing, Pistons etc
Shaigan Electric & Engineering Co. Ltd	Islamabad	Spark Plugs, Miscellaneous Sheet Metal and Wood Works

APPENDIX D (Continued)

East Pakistan

<u>Name of Firm</u>	<u>Location</u>	<u>Present Manufacturing Activities</u>
Dockyard & Engineering Works Limited	Narayanganj	Shipbuilding and General Engineering
National Iron Foundry & Engineering Works	Khulna	Sugar Cane Crushers, Tubewell Pump and Accessories
Meghna Engineering Works	Chittagong	Lathes, Agricultural Implements
Haleem Engineering Works Ltd	Chittagong	Agricultural Implements, Tubewell Pump and Accessories
Metal Industries	Dacca	Springs, Sheet Metal Works
United Engineers	Sylhet	Auto Spares, Tea Machinery and Spares
Eastern Engineering Works	Chittagong	Auto Spares, Huller Knives
Pak Motor Engineering and Workshop	Chittagong	Diesel Pistons, Liners
Model Engineering Works	Dacca	Repairs of Various Machines, Auto Pistons, Valves, Guides
Pakistan Flotilla Company Limited	Narayanganj	Barges, Tugs and repairing jobs
Dacca Engineering Works	Dacca	Propeller, Pistons, Bobbin Carriers
The Fakhri Industries Works	Chittagong	Water Tanks, Signal Arms for Railway, Conduit Pipe, CI Castings
Chalna Engineering Works	Kushtia	CI Cistern, Water Pumps, Pulleys
Mohammadi Iron & Steel Works	Chittagong	Steel and Brass Casting, Rolls, Gear Machine parts

APPENDIX D (Continued)

<u>Name of Firm</u>	<u>Location</u>	<u>Present Manufacturing Activities</u>
The Comilla Mohajir Co-operative	Comilla	Agricultural Implements, Heavy Castings
Atlas Epak Ltd	Dacca	Motor Cycles and Miscellaneous Sheet Metal Works
Metalex Corporation Ltd	Dacca	Electric Fans Spares
Ispahani Marshall Limited, Engineering Works	Chittagong	Textile Mills Spares, Tea Machines Spares, Oil Tanks, Tar Boilers, Road Rollers
Galfara Habib Ltd	Chittagong	Jute Mill, Machinery
Engineering Industries Ltd	Tongi	Parts for Jute Textile, Cigarettes, Tea Garden and Miscellaneous

APPENDIX E

Numbers of Students Qualifying in Engineering Trades
from various Training Establishments

Numbers completing 12 week courses at the Pakistan Industrial
Technical Assistance Centres

<u>Financial Year</u>	<u>Centres</u>	<u>No.</u>
1962-63	Lahore	20
1963-64	"	112
1964-65	"	130
1965-66	Lahore and Dacca	215
1966-67	"	281
1967-68	"	237
		<hr/>
		995
		<hr/>

Technical Training Centres in East Pakistan administered by the
Directorate of Labour

In East Pakistan there are TTCs at Dacca, Chittagong and Rajshahi

The Marine Diesel Training Centre, Narayanganj and the German
Pakistan Technical Training Centre.

Vocational Training Institutes in East Pakistan administered by the
Directorate of Technical Education

There are 17 Vocational Training Institutes in East Pakistan and
5 more are being started shortly. It is hoped to have 35 operating by 1970
with a total annual intake of 8,000.

At present the annual intake, including those doing evening courses
at the Polytechnics, is 3,280.

The Vocational Training Institutes teach any two of the following
subjects, one of which is usually Farm Mechanical:-

- Woodworking
- Foundry
- Pattern making
- Electrical
- Farm Mechanical
- Auto Diesel
- Machinist

APPENDIX E (Continued)

Numbers of Places in Technical Training Centres in West Pakistan under Directorate of Labour Welfare

NAMES OF CENTRES	MECHANICAL GROUP											ELECTRICAL GROUP				MISCELLANEOUS			TOTALS	
	Draughtsmen	I.C. Engine Artificers	Machinist	Centre Lathes	Bench Fitters	Fitter Millwrights	Welders	Sheet Metal Worker	Moulders	Auto Mechanic	Diesel Mechanic	Blacksmith	Electricians	Radio Mechanics	Refrigeration and Air Conditioning	Electroplater	Pattern Makers	Plumber		Other Trades
Karachi Evening Classes	40	-	120	20	30	-	30	-	20	50	-	-	40	-	30	-	20	-	70	450
	25	-	30	20	-	50	-	-	-	35	-	-	40	20	-	-	-	-	-	200
Gulberg	12	24	24	24	72	-	24	-	12	-	-	44	-	-	-	12	-	-	48	336
Waghalpura	32	-	24	24	96	-	48	-	-	16	16	64	-	-	-	-	-	32	-	352
Feshawar	24	-	12	24	48	-	24	-	24	12	12	48	24	24	-	-	24	24	48	348
Multan	24	-	24	48	24	-	48	-	-	48	-	48	24	24	-	-	-	24	48	384

New Technical Training Centres (Not yet operating)

Hyderabad	40	-	24	24	-	64	24	-	16	32	32	-	32	-	-	-	-	16	56	360
Rawalpindi	15	-	12	15	15	-	12	-	-	16	-	-	15	10	-	-	-	15	75	200
Multan	30	-	20	30	75	-	20	20	20	50	-	10	50	20	-	-	-	-	155	500

Karachi TMC also train 50 Instructors

APPENDIX E (Continued)

Numbers of Students who qualified from the Polytechnic Institutes
in the Northern Area of West Pakistan in 1968

	Civil	Electrical	Radio and Electronics	Foundry and Pattern- making	Automobile Engineering	Air Conditioning and Refrigeration	Welding and Metallurgy	Mechanical	Machine Shop	Total
Lahore	40	80	40	-	40	40	-	80	-	360
Rawalpindi	40	80	40	40	40	40	40	80	40	480
Rasul	200	-	-	-	-	-	-	-	-	200
Sialkot	40	40	-	-	40	-	-	40	-	160
Peshawar	40	40	-	-	-	-	-	40	-	120
Bahawalpur	40	40	-	-	-	-	-	40	-	120
Multan	-	40	-	-	-	-	-	40	-	80

Total 1520

Total passes in 1966 were 1280
Total passes in 1967 were 1240

Information on Polytechnics in the Karachi area was not obtained

APPENDIX F

Bibliography

<u>Publication</u>	<u>Publisher</u>
Monthly Statistical Bulletins	Manager of Publications, Karachi
Monthly Foreign Trade Statistics of Pakistan	Manager of Publications, Karachi
Pakistan Basic Facts	Ministry of Information and Broadcasting
The Concept of Pakistan	Associated Printers Ltd, Dacca
Decade of Development East Pakistan Water and Power Development Authority	Public Relations East Pakistan Water and Power Development Authority
Decade of Progress in Technical Education in East Pakistan	Directorate of Technical Education, East Pakistan
Pakistan Machine Tool Factory)
Cement Industry in Pakistan)
Fertiliser Projects) West Pakistan Industrial Development Corporation Printing Press, Karachi
West Pakistan Industrial Development Corporation Annual Reports)
Technical Assistance to Industries) PITAC Fisco Press Lahore
We help you to reduce waste)
Milestone	East Pakistan Road Transport Corporation Public Relations Dept
Activities of Karachi Shipyard	Karachi Shipyard & Engineering Works Ltd
Karachi Port Trust Year Book	Karachi Port Trust
10 years of Pakistan Industrial Credit and Investment Corporation Ltd)
An introduction to Pakistan Industrial Credit and Investment Corporation Ltd) State Bank of Pakistan Printing Press, Karachi
Pakistan Industrial Credit and Investment Corporation Ltd Annual Reports)
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ORGANISATION**

REPAIR AND MAINTENANCE OF INDUSTRIAL PLANT IN PAKISTAN

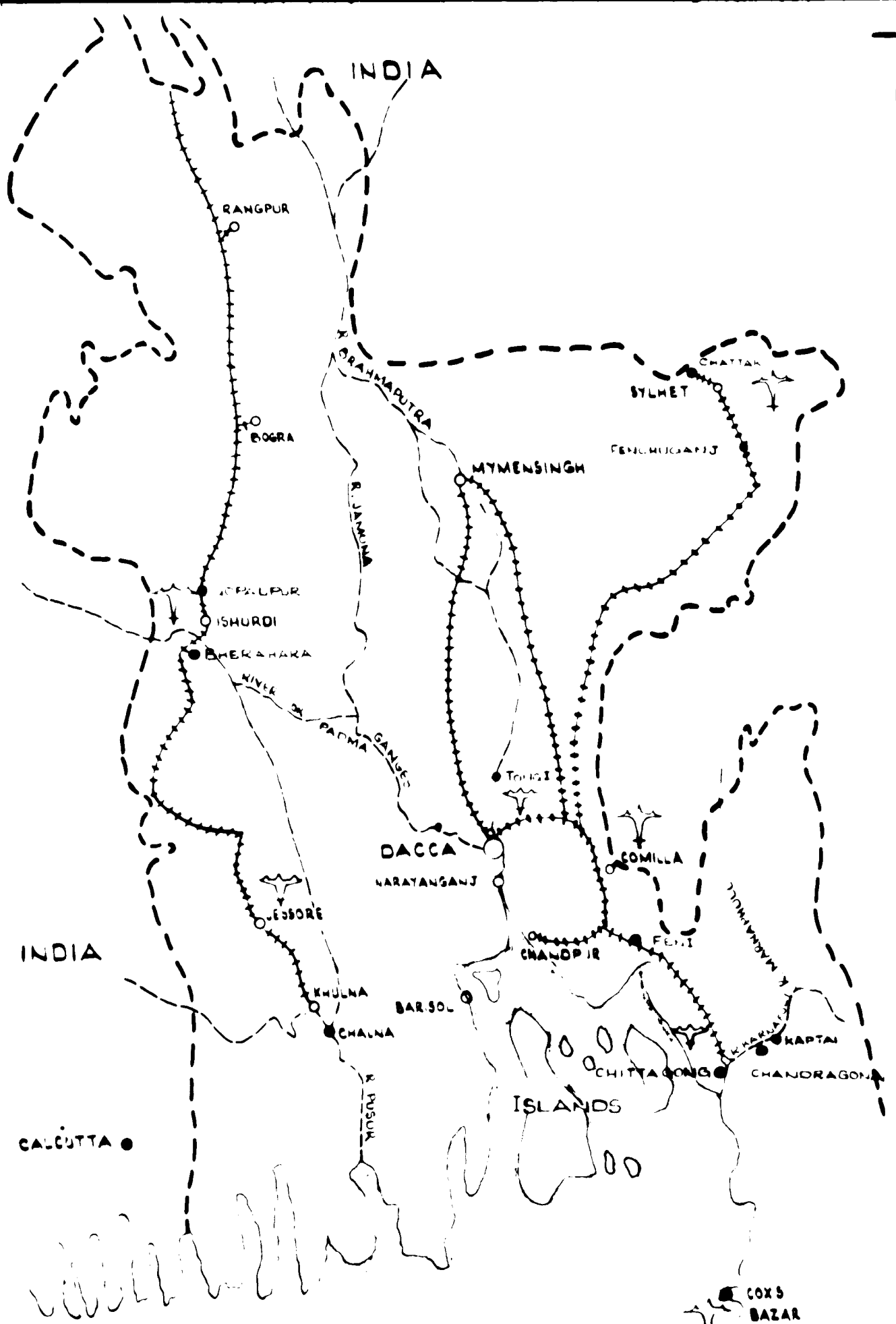
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NT IN PAKISTAN



RIVERS
 INTERNATIONAL BOUNDARY
 RAILWAYS
 AIRPORTS

MAP OF EAST PAKISTAN

APPENDIX G.

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INTERNATIONAL BOUNDARIES - - - - -

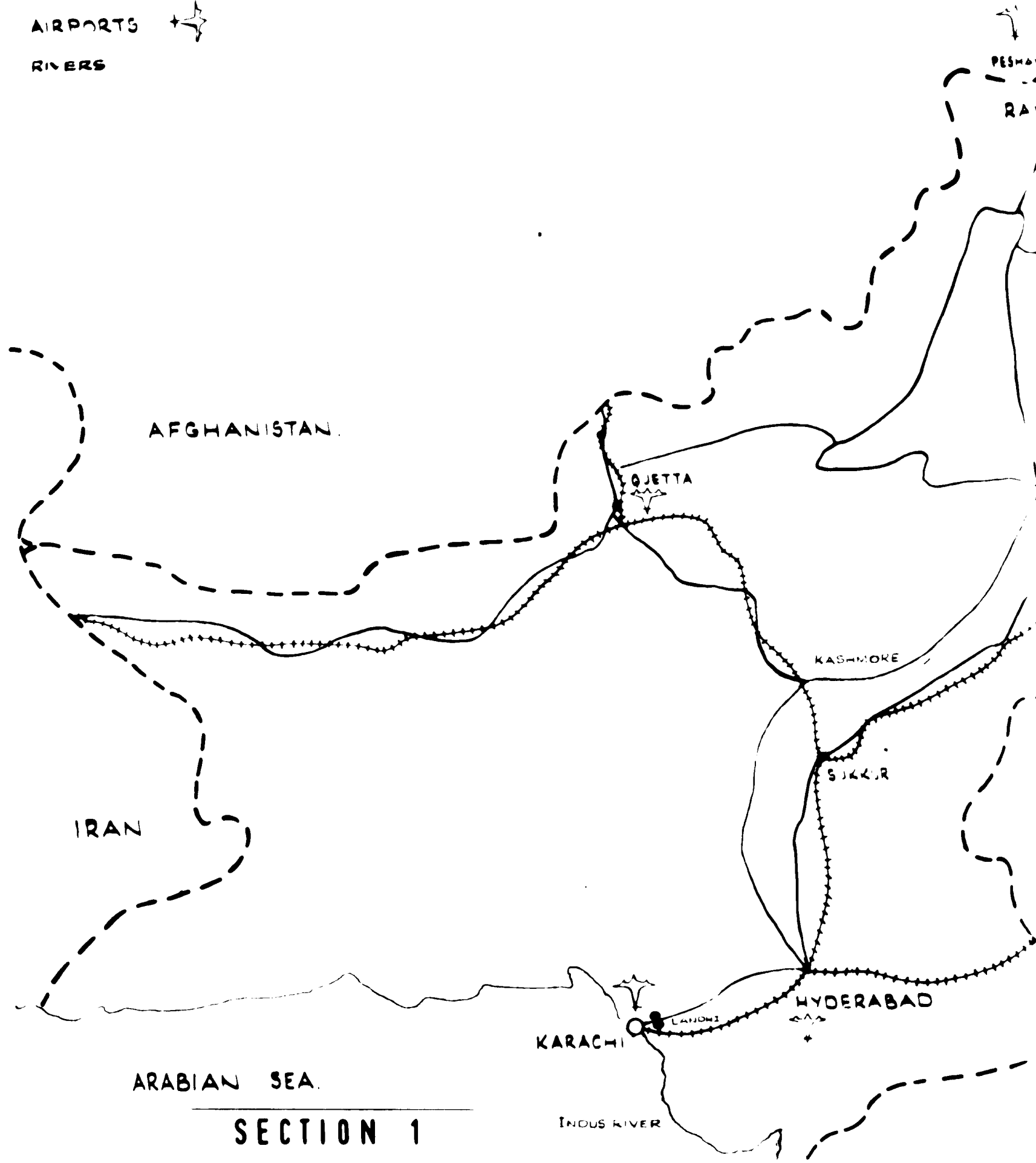
BOUNDARY OF JAMMU & KASHMIR - - - - - BOUNDARY DISPUTED

MAIN ROADS - - - - -

RAILWAYS + + + + +

AIRPORTS ✦

RIVERS



SECTION 1

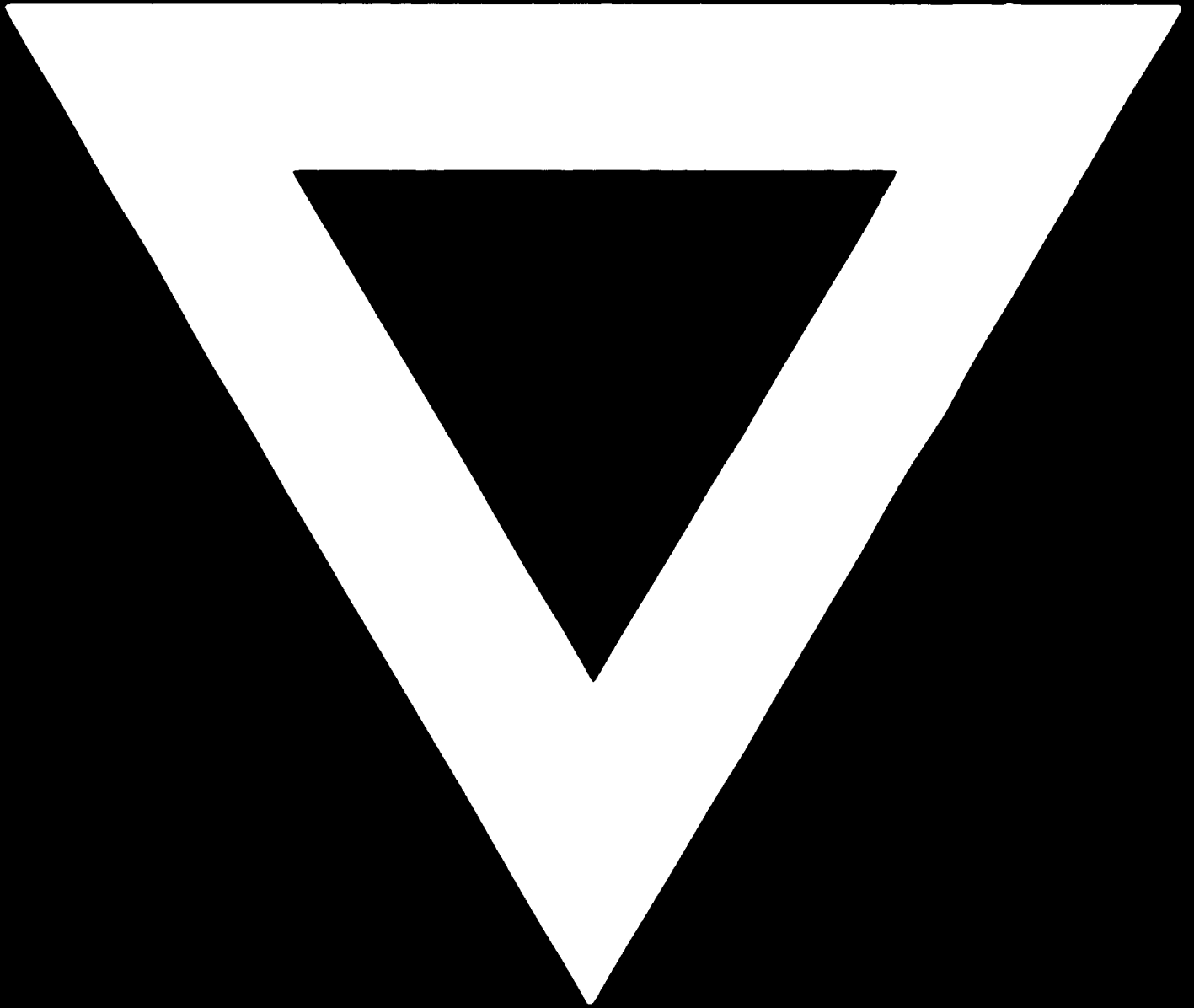
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