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INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT
INTERNATIONAL DEVELOPMENT ASSOCIATION

APPRAISAL OF A
HIGHWAY ENGINEERING PROJECT
WEST PAKISTAN

August 9, 1966

Projects Department
CURRENCY EQUIVALENTS

US $1 = PRs 4.76
PRs 1 = US $0.21
PRs 1,000,000 = US $210,000

Fiscal Years

July 1               June 30

Units

British
APPRAISAL OF A
HIGHWAY ENGINEERING PROJECT
WEST PAKISTAN

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TABLE: Estimated Cost of Engineering Services

MAP: West Pakistan (IBRD 1610 R)

This report is based on the findings of missions to West Pakistan composed of Messrs. Hogg and Young, in December 1964 and of Mr. Kaden in July/August 1965 and June 1966.
APPRAISAL OF A
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WEST PAKISTAN

SUMMARY

i. The Government of Pakistan, on behalf of the Government of West Pakistan, has applied for an IDA Credit to assist in financing the services of consultants to complete the detailed engineering of two major roads, including bridges, with a view to their construction soon thereafter. These services include, among others, site investigations, topographic surveys, detailed designs, the preparation of bill of quantities, bidding documents, schedules of construction work and cost estimates.

ii. The project roads are as follows:

Lahore-Sheikhupura-Lyallpur -- 83 miles
Sheikhupura-Sargodha-Khushab -- 109 miles

iii. The engineering services would be carried out over a period of about 15 months. The estimated total cost, including contingencies, is about US$ 1.7 million. It is proposed that IDA should finance 60% of the total cost or approximately US$ 1.0 million equivalent; this would cover the foreign exchange component of the project, estimated at 42%, and a portion of the local cost. The Communications and Works Department of the West Pakistan Government would be the executing authority.

iv. Traffic over the full length on the Lahore-Sheikhupura-Lyallpur road on completion of its construction is expected to exceed 1,000 vehicles per day, while that on the Sheikhupura-Sargodha-Khushab road is anticipated to vary between 500-1,000 according to sections. On the basis of presently estimated savings to road users it appears that the expected rate of return on the construction of these projects should be well in excess of 12%.

v. The project provides a suitable basis for an IDA Credit of US$ 1.0 million equivalent. The proposed term of the Credit is 10 years including a two-year period of grace. It is contemplated that in the event that either IDA or the Bank should subsequently assist in the financing of the two project roads, the engineering credit would be refunded from the proceeds of such subsequent credit or loan.
APPRAISAL OF A
HIGHWAY ENGINEERING PROJECT
WEST PAKISTAN

1. BACKGROUND

1.1 The Government of Pakistan has requested a credit from the International Development Association to help finance the costs of engineering for a project in West Pakistan involving the construction of two new highways, one between Lahore, Sheikhupura and Lyallpur and the other between Sheikhupura, Sargodha and Khushab (see map). An IDA mission consisting of Mr. V. W. Hogg (Economist) and Mr. H. Young (Engineer) first examined the possibilities of the project in December 1964. The purpose of their visit was to review a feasibility study of the project prepared by a firm of U.S. consultants engaged by the Government of West Pakistan. After further work on the preparation of the project by the Communications and Works Department, subsequent visits were made by Mr. Kaden (Engineer) in July/August 1965 and in June 1966. As a consequence of these visits it is now proposed that IDA assist in the financing of the detailed engineering of these two roads through an engineering credit amounting to US$ 1.0 million equivalent.

Lahore-Lyallpur Road

1.2 Lahore, the capital of West Pakistan, is a city of over one million people. Lyallpur, with a population of half a million people, is becoming a major industrial center. Existing road communications between the two cities are below standard and involve high vehicle operating costs.

1.3 At present, two roads connect these cities. The older, or south road which is 87 miles long, follows the alignment of a historical trade route that was first surfaced as a single-lane road during the early 1930's. Because of a shortage of funds at that time and the small volume of motorized traffic, the extremely bad alignment of this road was not improved. By the early 1950's the rapid growth of Lyallpur had generated sufficient traffic to justify the construction of a new two-lane road from Sheikhupura, some 20 miles west of Lahore, to Lyallpur. This second route was also built to low standards. It passed through waterlogged and flooded areas, but again shortage of funds prevented any serious attempt to overcome these conditions. With the steady increase in the volume of traffic and the use of heavier and faster vehicles its physical condition has deteriorated.
Faced with the need for a modern, all-weather link between Lahore and Lyallpur, the Government of West Pakistan (GOWP) invited the U.S. consulting firm of Louis Berger, Inc., to carry out a feasibility study and preliminary engineering. After investigation, the consultants rejected the possibility of upgrading either of the existing roads and proposed a new alignment, located between the two existing routes, primarily on the grounds of its shorter distance. At the request of the Association, however, the GOWP and its general consultants (Howard, Needles and Tamendorf - U.S.), who are being financed under IDA Credit 51h-PAK, undertook a complete review of the alignment proposed and of other alternatives.

This review led to a modified alignment, with a 4-lane highway for a distance of 18 miles between Lahore and Sheikhupura and two lanes for the remaining distance to Lyallpur. The estimated construction cost of this highway (83 miles) is about US$ 20 million equivalent. This would be about 15% less than the solution originally proposed, taking into account the fact that the first section of 18 miles would be common to the Lahore-Sheikhupura-Sargodha-Khushab road (described below). This cost estimate prepared by the GOWP and its general consultants, on the basis of the original study, has been reviewed by the Association and found satisfactory. The costs are high mainly because i) high embankments are necessary in the waterlogged terrain through which the road passes; ii) a large number of structures is required to cross the numerous main canals and their distributaries in the area; and iii) little use can be made of the existing road which, in large part, will be left to bullock and other animal-drawn cart traffic.

Lahore-Sheikhupura-Sargodha-Khushab Road

This road, which extends to Bannu, an important town on the west of the Indus River, is located in the area of the historic trade routes between Afghanistan and the Indian subcontinent. As mentioned, the first section of this road - from Lahore to Sheikhupura (18 miles) - would also be a part of the new road between Lahore and Lyallpur. From Sheikhupura a new highway would go to Sargodha, a town with a population of some 150,000 people and the largest agricultural market in the area. The present road connection between Sheikhupura and Sargodha is partly one-lane, without suitable river crossings, and does not provide adequate facilities for economical all-weather transport. The route proposed would be about 21 miles shorter than the diversion via Chiniot, which has to be used at times.

Beyond Sargodha the existing road to Khushab, a regional market with a population of about 25,000, is in better condition. The growing traffic from the northern and western areas of Pakistan to the Lyallpur/Lahore area, however, requires that the new highway be extended to Khushab, where the main roads from the west and the north join.

Two main bridges, one crossing the Chenab River and the other the Jhelum River, are required on this route. These will be designed by the relevant Department of the GOWP, which is already performing the same services satisfactorily for similar types of bridges under Credit 51h-PAK. Following
present practice, the Department's design will be reviewed later by consultants.

1.9 On the basis of the feasibility study and preliminary engineering prepared by Louis Berger, the construction of the Sheikhupura-Sargodha-Khushab road (109 miles, including the bridges across the Chenab and the Jhelum River) would cost about US$ 26 million.

Economic Justification

1.10 One important benefit of the project is an expected increase in the quantity and quality of agricultural production. Output of perishables, in particular, is expected to grow because of the rapidly rising demand in the many large urban markets in the Punjab area. Another expected benefit is a reduction in total distribution costs by the earlier release of funds tied up in the transit and warehousing of agricultural and manufactured goods and a reduction in transport costs. This is anticipated to lead to a fall in production costs thereby increasing the purchasing power of existing consumers and bringing potential consumers into the market. The project will also aid the competitive position of Pakistan exports originating from the areas served. The savings to road users, assuming no traffic growth after the first year of opening of the roads, discounted over their economic life, are presently estimated to produce economic returns well in excess of 12% and justify proceeding to final engineering at this time.

1.11 The design standards envisaged for the roads are appropriate to the traffic volumes expected. Terminal-to-terminal traffic on the Lahore-Lyallpur road, for example, is forecast to be about 1,000 vehicles per day in the year after the opening of the road. Higher volumes are expected on intermediate sections because of shorter distance traffic, and on the first 18-mile section between Lahore and Sheikhupura, which is common to both project roads, because of traffic between Lahore, Sargodha and the west. On the Sheikhupura-Sargodha-Khushab road traffic, at its opening, is expected to vary between 500-1,000 vehicles per day according to sections. Over the past decade, vehicle registrations in the area have been increasing at an average rate of about 11% p.a., with sales of motor fuel averaging 18% p.a. The consultants forecast a long-term traffic growth rate averaging about 8% p.a. on the project roads. Although this may be a little high, traffic growth at even half this rate would raise the expected economic returns above 15%.

1.12 While the present unusually high proportion of commercial vehicles (60-80%, according to section) can be expected to decline, it is anticipated that such vehicles will continue to form a substantial part of future traffic. The project roads are not directly competitive with existing rail lines in the area, which are circuitous branch lines. Inland water transport is negligible and can be ignored.
1.13 The highway network of West Pakistan is at present administered by the Department of Communications and Works. General consultants, engaged under Credit 54-PAK, are assisting the Government to reorganize and improve this Department. They have already formulated several recommendations, including the separation of highway operations (including bridges) from other activities; the centralization of the planning, design, and supervision of construction of major highway projects in the head office; the organization of traffic counts and origin and destination surveys; and improved administrative arrangements for contractor's working conditions. The Government is gradually taking measures to implement some of these recommendations; others may still remain as conditions for a later construction credit if they have not been satisfactorily implemented by that time.

2. THE ENGINEERING PROJECT

2.1 The project consists of consultants' services to complete the detailed engineering (including the preparation of designs, cost estimates and bidding documents) for construction of the Lahore-Sheikhupura-Lyallpur and Sheikhupura-Sargodha-Khushab roads; the design, preparation of bidding documents and cost estimates by the GOWP's Communications and Works Department of two main bridges crossing the Chenab and Jhelum rivers, and the review of these designs, documents and estimates by consultants. The project is expected to take about 15 months.

2.2 On the Association's advice the GOWP has entered into draft contractual arrangements with two foreign consulting firms and their respective Pakistani associates: Sir William Halcrow and Partners (U.K.) in association with Incorporated Consulting Engineers for services on the Lahore-Sheikhupura-Lyallpur road and with Pacific Consultants (Japan) in association with Zafar and Associates for the Sheikhupura-Sargodha-Khushab road. The consultants are fully responsible for the execution of the contract. The draft contracts and the priced proposals of the consultants have been reviewed and found satisfactory to the Association. On the granting of an IDA Credit the GOWP would sign the contracts with the consultants so that work could begin immediately thereafter. The GOWP has not yet decided which consulting firm will be responsible for reviewing the design of the two bridges, but since the bridges are on the road Sheikhupura-Sargodha-Khushab it has indicated that it will give first consideration to the firm selected to provide the engineering services on this road.

2.3 The services to be provided by the consultants and the tasks to be undertaken by the GOWP during the period prior to issuing invitations to bid for construction are as follows:
1. Roads

a) By Consultants (Detailed Design and Engineering Services):

(i) Site investigations, final alignment, hydraulic aspects of waterways, soils, etc.;

(ii) topographic surveys;

(iii) detailed design of the new highways, of relocated or new access roads, and structures;

(iv) right-of-way plans for the new highways and associated access roads;

(v) specifications, bills of quantities and all other bidding documents;

(vi) cost estimates and schedules of construction work; and

(vii) preparation of a supplementary report covering the revised scope of work and the revised technical and economic justification.

b) By GOWP:

(i) Initiation of the acquisition of such land and access thereto as is required for the orderly and economical execution of the construction work; and

(ii) prequalification of contractors (with the assistance of the consultants).

2. Bridges

a) By GOWP:

(i) Site investigations, hydraulic aspects of the waterways, soils, etc.;

(ii) topographic surveys;

(iii) detailed design of the foundations, the bridge structures and the river training works;

(iv) specifications, bills of quantities and all other bidding documents; and

(v) cost estimates and schedules of construction work;
(vi) initiation of the acquisition of such land and access thereto as is required for the orderly and economic execution of the construction work; and

(vii) prequalification of contractors with the assistance of the consultants (b) below.

b) By Consultants:

(i) Review of structural computations, designs, cost estimates, with appropriate recommendations, and the preparation of bidding documents.

2.4 The total cost of the project is estimated at US$ 1,660,000 equivalent. This cost excludes taxes but includes US$ 63,000 equivalent of costs for services performed by the GOWP and contingencies of about 15% (Table). Since the cost estimate is based mainly on priced proposals from the consultants referred to in para. 2.2 above and partly on the GOWP's estimate on the basis of similar work in connection with Credit 54-PAK, the contingencies provision is acceptable. The foreign exchange component of the project, on the basis of the priced proposals, is estimated to be 42%. Figures for similar recent engineering work in Pakistan have varied between 40%-60%. The proposed Credit of US$ 1.0 million equivalent would represent approximately 60% of the project's cost and would be applied to the payment in full of the foreign exchange costs and to a portion of the local currency costs. The GOWP would finance the remaining 40% of the total cost.

2.5 The executing authority for the project would be the Communications and Works Department, assisted by the general consultants.

2.6 Under the West Pakistan Tolls on Roads and Bridges Ordinance, 1962, the GOWP has the power to levy tolls on the use of any public road or bridge. So far the use of tolls has been restricted to specific bridges, but it has decided that on the Karachi-Hyderabad road, which is being built under Credit 54-PAK, tolls will be collected. It has informed the Association that it intends that the roads in this project will also be designated as toll facilities. Provision has been made in the cost estimates for the small additional amount of design work that this entails. The economic return is unlikely to be greatly affected by the collection of reasonable tolls because of the great distance and other savings offered by the project roads as compared with alternative routes.

2.7 The GOWP has given an assurance that during the design and engineering phase of this project it would initiate proceedings to acquire and obtain entry to such land as is necessary to ensure that the ultimate construction works take place in a timely and economical manner.

2.8 The use of an engineering credit in this case will enable any subsequent loan or credit for construction of the roads to be based on detailed engineering and more accurate cost estimates. The cost estimates will also be able to reflect the experience gained in contracting for the
Karachi-Hyderabad road which is to be the first major highway, with modern design standards, being built in West Pakistan by foreign contractors. A review of the economic justification on the basis of the detailed cost estimates will be possible and is provided for in the project. While the engineering is being prepared work on acquiring right-of-way will proceed. Thus, should a loan or credit be made subsequently for the construction work, disbursements could be made with a minimum of delay.

2.9 Appraisal for such a construction loan or a credit for the two highways could take place as soon as the detailed cost estimates and the revised economic justification have been prepared. On the basis of the provisional work schedule it is envisaged that the third quarter of 1967 may be an appropriate time for the consideration of such a construction loan or credit. In the event of such a loan or credit being made it is contemplated that it would also provide for refunding the proposed engineering credit.

3. RECOMMENDATION

3.1 The proposed project, which provides for the preparation of designs, cost estimates and other engineering services for the subsequent construction of two new major highways and bridges in West Pakistan has been well investigated and planned. A satisfactory economic justification for the works can be expected.

3.2 The GOWP has given assurances that it will engage the services of consultants, acceptable to the Association and on terms satisfactory to the Association, who will be responsible for the provision of the engineering services provided for in the project.

3.3 The GOWP has also given assurances that it will immediately take all necessary steps to acquire and obtain entry on to such land as is necessary for the orderly and economical execution of the construction works.

3.4 It has also given an assurance that it will provide on a timely basis all such local funds as are required for the satisfactory execution of the project, which is anticipated to take 15 months.

3.5 The project forms a suitable basis for an Engineering Credit of US$ 1.0 million equivalent. The proposed term of the Credit is 10 years including a two-year period of grace.

August 9, 1966
## ESTIMATED COST OF ENGINEERING SERVICES

*(excluding taxes)*

(US$ '000 equivalent)

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<tr>
<th>No. of Item</th>
<th>Project Item</th>
<th>Required Services</th>
<th>Performed By</th>
<th>Basis of Estimate</th>
<th>Total Cost</th>
<th>Local Currency</th>
<th>Foreign Exchange</th>
</tr>
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<tbody>
<tr>
<td>1.</td>
<td>Lahore-Sheikhupura-Lyallpur Road (63 miles)</td>
<td>Final design, preparation of cost estimate, bidding documents, etc. and revision of technical and economic justification.</td>
<td>Consultants (128 expatriate man-months and 8/3 Pakistani man-months)</td>
<td>Lump sum of consultant's priced proposal</td>
<td>564</td>
<td>380</td>
<td>284 (43%)</td>
</tr>
<tr>
<td>2.</td>
<td>Sheikhpura-Sargodha-Khushab Road (109 miles)</td>
<td>(a) Final design, preparation of cost estimate, bidding documents, etc. and revision of technical and economic justification but excluding bridges over Chenab and Jhelum rivers.</td>
<td>Consultants (127 expatriate man-months and 825 Pakistani man-months)</td>
<td>Lump sum of consultant's priced proposal</td>
<td>669</td>
<td>395</td>
<td>274 (41%)</td>
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<tr>
<td></td>
<td></td>
<td>(b) Final design and preparation of bidding documents for bridges across Chenab and Jhelum rivers.</td>
<td>GOWP</td>
<td>GOWP's estimated lump sum</td>
<td>63</td>
<td>57</td>
<td>6 (10%)</td>
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<td>(c) Review of (b) above.</td>
<td>Consultants</td>
<td>GOWP's estimated lump sum</td>
<td>40</td>
<td>4</td>
<td>36 (90%)</td>
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**Table:**

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<th>Description</th>
<th>Total Cost</th>
<th>Local Currency</th>
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<tr>
<td>Sub-total</td>
<td>1,436</td>
<td>836</td>
<td>600 (42%)</td>
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<td>Contingencies (approximately 15%)</td>
<td>224</td>
<td>130</td>
<td>94 (52%)</td>
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<td><strong>Total</strong></td>
<td><strong>1,560</strong></td>
<td><strong>966</strong></td>
<td><strong>694 (42%)</strong></td>
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<td><strong>Total (with 50% Association participation)</strong>*</td>
<td><strong>1,660</strong></td>
<td><strong>660</strong></td>
<td><strong>1,000 (50%)</strong></td>
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