

JAPAN INTERNATIONAL COOPERATION AGENCY
COMMUNICATION AND WORKS DEPARTMENT
GOVERNMENT OF NORTH WEST FRONTIER PROVINCE
THE ISLAMIC REPUBLIC OF PAKISTAN

**BASIC DESIGN REPORT
ON
THE PROJECT
FOR
CONSTRUCTION OF BRIDGES
IN NORTH WEST FRONTIER PROVINCE
OF
THE ISLAMIC REPUBLIC OF PAKISTAN**

MARCH 1993

NIPPON KOEI CO.,LTD.

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PREFACE

In response to a request from the Government of the Islamic Republic of Pakistan, the Government of Japan decided to conduct a basic design study on the Project for Construction of Bridges in the North West Frontier Province and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Pakistan two survey teams; the first was headed by Mr. Takeo Kai, Development Specialist in the field of Civil Engineering, Institute for International Cooperation, JICA and constituted by members of Nippon Koei Co., Ltd. from July 14 to August 21, 1992, and the second headed by Mr. Rikiya Iizuka, Deputy Manager of Sakaide Office of the 2nd Operation Bureau, Honshu-Shikoku Bridge Authority and constituted by members of Nippon Koei Co., Ltd. from October 20 to November 27, 1992.

The teams held discussions with the officials concerned of the Government of Pakistan as well as the Government of North West Frontier Province of Pakistan and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Pakistan in order to discuss a draft report, and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the the Islamic Republic of Pakistan as well as the Government of North West Frontier Province of Pakistan for their close cooperation extended to the teams.

March 1992



Kensuke Yanagiya
President

Japan International Cooperation Agency

March 22, 1993

Mr. Kensuke Yanagiya
President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

Dear Sir,

We are pleased to submit to you the basic design study report on the Project for Construction of Bridges in North West Frontier Province in the Islamic Republic of Pakistan.

This study has been made by Nippon Koei Co., Ltd., based on a contract with JICA, from July 8, 1992 to March 22, 1993. Throughout the study, we have taken into full consideration the present situation in Pakistan, and have planned the most appropriate project in the scheme of Japan's Grant Aid.

We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, the Ministry of Foreign Affairs, Ministry of Construction and Embassy of Pakistan in Japan. We also wish to express our deep gratitude to the officials concerned of Communication and Works Department of the Government of North West Frontier Province, Economic Affairs Division of the Government of the Islamic Republic of Pakistan, JICA Pakistan Office, Embassy of Japan in Pakistan for their cooperation and assistance during our study.

At last, we hope that this report will be effectively used for the promotion of the project.










Very truly yours,



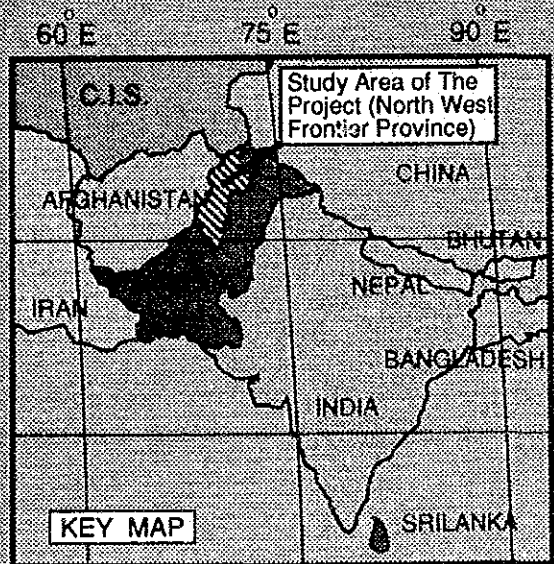
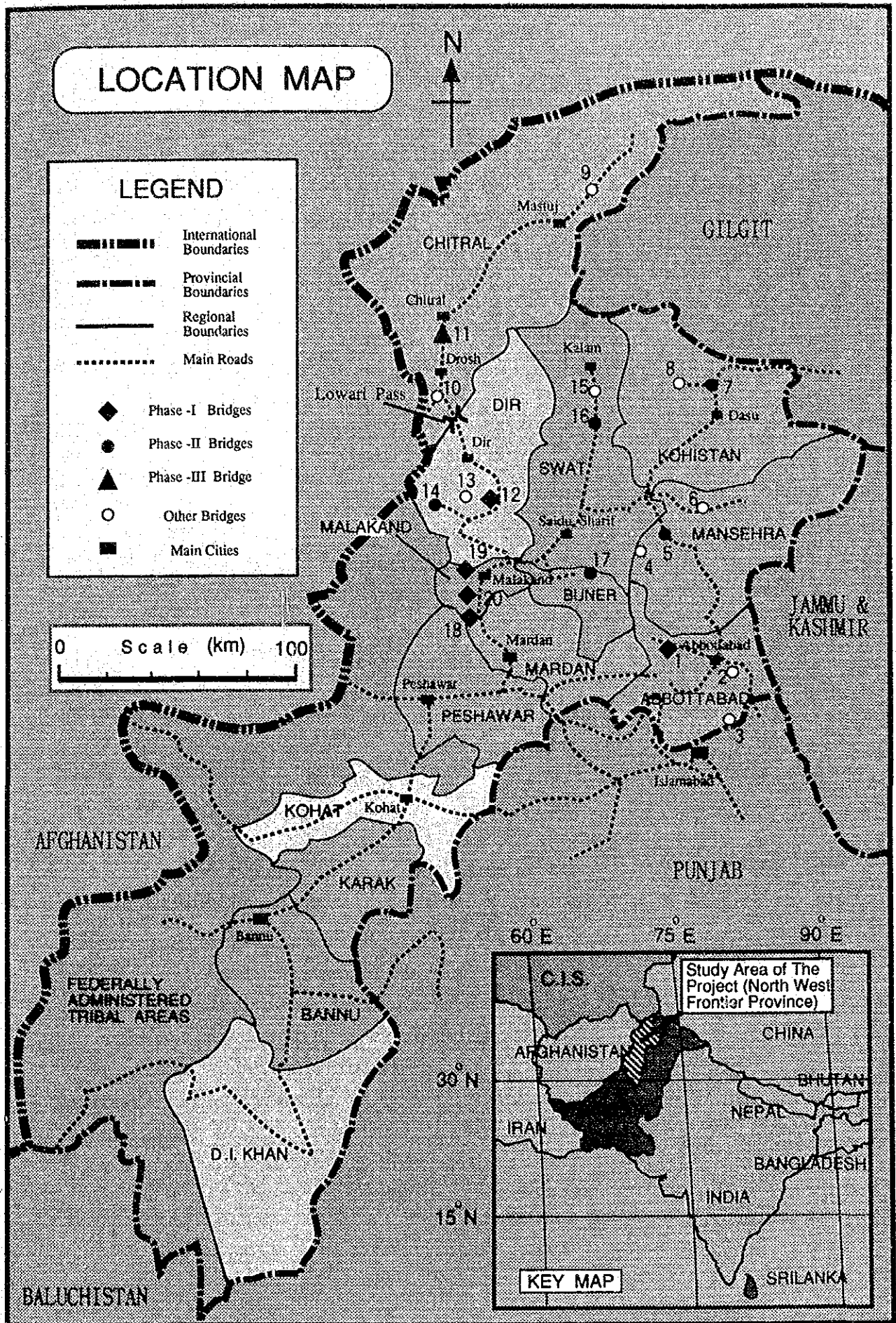
Hisashi Oshima
Project Leader
Basic Design Study Team on
The Project for Construction of Bridges in
North West Frontier Province
Hisashi
Nippon Koei Co., Ltd.

LOCATION MAP

LEGEND

-  International Boundaries
-  Provincial Boundaries
-  Regional Boundaries
-  Main Roads
-  Phase -I Bridges
-  Phase -II Bridges
-  Phase -III Bridge
-  Other Bridges
-  Main Cities

0 Scale (km) 100



SUMMARY

The Islamic Republic of Pakistan is at present enforcing the 7th 5-year National Development Program (1988/89 – 1993/94) under the long term Program (Perspective Plan: 1988-2003) with the aim of attaining 2 large goals; the economic independence and the eradication of poverty by the year 2003. For the fulfillment of its aim, emphasis is focused on the development of the Transportation and Communication sectors, especially the development of the road network system.

The North West Frontier Province (NWFP) is bordered with Afghanistan to the west and north, inhabited with a population of 19 million in an area of approximately 107,000 km², and is a mountainous area where the economy relies mainly on agriculture and forestry.

The regional development of the Province is largely delayed and backwards compared to the other Provinces due to its large number of valleys and rivers crossing the land and separating the regions.

Furthermore, since traffic by vehicles are difficult and sometimes not possible because the bridges crossing rivers in the valleys are made of suspension type wooden structured bridges with very narrow width, transport of goods are carried out manually and by donkeys. Due to the above situation, there are problems in the transport of products to the market and vice versa, the transport of commodities to the population in the region.

The Pakistani Government, in its effort to enhance the regional development and thereby raise the quality of livelihood of its inhabitants in the Province, is considering the construction Program of constructing 200 bridges. However, considering the Program from the Governmental view-point, the rehabilitation and improvement of the main cargo transport roads would become their primary urgency, and as a result, since the budget allocation has been mainly placed in the rehabilitation of the main roads in its 7th 5-year road rehabilitation program, sufficient budget has not been allocated for the rehabilitation of bridges on the regional roads.

Considering the above background situation, the Pakistani Government requested to the Government of Japan for the construction of 7 bridges in the 7 districts of Abbottabad, Mansehra, Kohistan, Chitral, Dir, Swat and Malakand under the Grant Aid Cooperation.

The Government of Japan having made the decision to execute the implementation of the basic design study, JICA despatched to Pakistan a preliminary investigation team from February 10 to February 25, 1992, two basic design study teams from July 14 to August 21 and October 20 to November 27, 1992, and a study team to explain the Draft Final Report from March 8 to March 18, 1993.

As the result of study, the study team confirmed that the operational organization is the Communication and Works Department (C & W Dept.) of the North West Frontier Province (NWFP) and that this Project aims to facilitate the transport of products to the market and vice versa transport of commodities to the population in the region where no vehicle transport bridge exists at present, by way of constructing bridges.

The study team confirmed to add 13 more bridges to the 7 previously requested bridges totaling 20 bridges with a total length of 2,106m to be the object of project. The study team further confirmed on the present conditions of the proposed bridge sites of the 20 requested bridges through discussions with government agencies of the Islamic Republic of Pakistan, site investigations of each bridge site, collecting data and information and examination of the traffic volume, and finally performed the priority ranking of the construction for each of the 20 bridges in consideration of emergency necessities of construction.

Subsequently, the study team carried out investigations for each of the 20 bridges, such as examination of the natural conditions, examinations of the Project operation system, confirmation of the ability for maintenance management, examination on the Project implementation system, and the adequacy of the Project and its influential effect of the construction of bridges.

Based on the above result, this Project had been mutually agreed that the below mentioned 11 bridges would be considered for construction.

As a result of the study, it is recommended that the construction of the 11 bridges be implemented in 3 phases. Phase I project includes the subject bridges not only categorized in high priorities but also advantageous in prompt mobilization owing to the geographical situation that the sites are close to Islamabad or Peshawar. Phase II project includes the rest of the high priority bridges excluded from Phase I except one bridge of which completion would require more than one year. Phase III is to construct one bridge.

Configuration of bridges and associated facilities is as follows:

	Bridge Name & Site	Bridge Length	Clear Width
Phase I	Br. No.1, Narlai Bridge, Abbottabad District	125 m	4.0 m (1 lane)
	Br. No.12, Khal Bridge, Dir District	88 m	4.0 m (1 lane)
	Br. No.18, Jahazoon Dak Bridge, Malakand Agency	75 m	4.0 m (1 lane)
	Br. No.19, Totakan Bridge, Malakand Agency	108 m	4.0 m (1 lane)
	Br. No.20, Sakhakot Bridge, Malakand Agency	75 m	4.0 m (1 lane)
Phase II	Br. No.5, Pashorai Bridge, Mansehra District	75 m	4.0 m (1 lane)
	Br. No.7, Panipa Bridge, Kohistan District	180 m	4.0 m (1 lane)
	Br. No.14, Bukari Khawar Bridge, Dir District	50 m (2@25 m Bridge)	4.0 m (1 lane)
	Br. No.16, Kaidon Bridge, Swat District	44 m	4.0 m (1 lane)
	Br. No.17, Peer Baba Bridge, Buner District (Buner was separated from Swat in 1990)	50 m	4.0 m (1 lane)
Phase III	Br. No.11, Choni Bridge, Chitral District	90 m	7.0 m (2 lanes)

The period to implement each Phase I and Phase II project is scheduled for 3.5 month from detailed design and preparing of tender document to tendering. After examination of the tender, contract will be concluded and construction will be started. Each construction period is about 12 months.

The period to implement Phase III project is scheduled for 3.0 month from detailed design and preparing of tender document to tendering. After examination of the tender, contract will be concluded and construction will be started. The construction period is about 21 month including the period of interruption work in the winter season.

The benefit recipient population and the anticipated total traffic volume by the Project (11 bridges) would be as follows:

	Benefit Recipient Population	Traffic volume (no./day)
Present condition (1990)	493,000	2,890
Future expectation (2010)	741,000	6,720

The secondary significance would be assumed as follows:

- The problem of the missing link in the traffic network would be dissolved and the traffic efficiency promoted, thus contributing to the regional economic development.
- At the present, agricultural produces and lumber were liable to become damaged and degraded due to the unloading and reloading operation process together with the weight limitation, but with the construction of bridges, the degradation of the above products would be avoided and contribution to the regional industry would be promoted.
- Regional public service, such as improvement of service relating to medical, educational and rescue services at times of disaster would be promoted, thus contributing to the stabilization of public welfare.

The NWFP has numerous places requiring construction of bridges due to its steep mountains and rapid current rivers, and as for the type of bridges, it needs such bridges as suspension bridges requiring advanced technology in the structure.

Taking the above enumerated significance and effectiveness into consideration, the implementation of the subject project through the cooperation of the Japan's Grant Aid Program would be most meaningful and thus its early implementation would be most desirable.

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CHAPTER 1

INTRODUCTION

CHAPTER 1 INTRODUCTION

The Islamic Republic of Pakistan requested to the Government of Japan on November 5, 1991 for the construction of 7 bridges in the 7 districts of Abbottabad, Mansehra, Kohistan, Chitral, Dir, Swat and Malakand in the North West Frontier Province (NWFP) under the Grant Aid Cooperation.

The Government of Japan having made the decision to execute a preliminary investigation based on the request made by the Government of the Islamic Republic of Pakistan despatched a preliminary investigation team headed by Mr. Takeo Kai, Civil Engineering Development Specialist, Institute for International Cooperation, JICA, from February 10 to February 25, 1992.

As a result of the discussions held between the 2 parties, minutes of discussions had been exchanged between the 2 parties with the substance to add 13 more bridges to the 7 previously requested bridges totaling 20 bridges with a total length of 2,106 m.

The Government of Japan having decided to follow up with the implementation of the basic design study, JICA despatched to Pakistan a basic design study team headed by Mr. Takeo Kai, Civil Engineering Development Specialist, Institute for International Cooperation, JICA, from July 14 to August 21, 1992.

The object of this basic design study is to understand the background and the detail substances of the request made by the Government of the Islamic Republic of Pakistan and to examine the influential effect into the economy and its adequacy as a Grant Aid Project, and to execute the preliminary design of the Bridge considered to be the most adequate and essential for this Project.

The basic design study team conducted hearings from the related government agencies of the Islamic Republic of Pakistan regarding the present conditions of the proposed bridge sites of the 20 requested bridges, held discussions and collected data and information in order to fully understand the substance of the request and further confirmed the substance through the site investigations of each bridge site and examination of the traffic volume, and finally performed the priority ranking of the construction for each of the 20 bridges.

Based on the above result, the Study Team exchanged minutes of discussions with the Government of the Islamic Republic of Pakistan. It had been mutually agreed in the meeting that the below mentioned 5 bridges considered to require immediate construction will be included in the Phase I Project.

- No.1 Narlai Bridge (Pind Gali road), Abbottabad District
- No.12 Khal Bridge (NCC road km 135), Dir District
- No.18 Jahazoon Dak Bridge, Malakand Agency
- No.19 Totakan Bridge (Totakan - Kamala road), Malakand Agency
- No.20 Sakhakot Bridge, Malakand Agency

Subsequently, the following site investigation had been undertaken on the above 5 bridges determined for the Phase I Project.

- For the purpose of examining the technical adequacy of the Project, investigation of the natural geographical conditions of the project site, sub soil condition, and geographical features were examined.
- The construction situation and the related rules and regulations of the Islamic Republic of Pakistan on the construction execution method practiced at the local sites which are required for the estimation of construction cost and the planning of the construction work schedule were examined.
- Examination of implementation program and project operation system for the Project were carried out.
- The existing bridge maintenance operation system of the NWFP and confirmation of its ability were examined.
- Confirmation on the extent of works to be burdened by the Government of the NWFP and examination on the project operation system.
- Examination on the adequacy of the Project as the Grant Aid Cooperation and its influential effect in case the Project is executed were carried out.

Based on the result of the above examination, JICA prepared an Interim Report comprising of the substance of the basic design for the 5 bridges to be included in the Phase I Project.

Moreover, JICA despatched a study team to the site headed by Mr. Rikiya Iizuka, Deputy Manager of Sakaide Office of the 2nd Operation Bureau, Honshu-Shikoku Bridge Authority from October 20 to November 27, 1992, and held discussions with the Pakistan Government officials and exchanged minutes of discussions regarding the basic design study result for the 5 bridges in the Phase I Project, and the Phase II Project (selection of 6 bridges contemplated to be included in the Phase II Project) which is expected to be

subsequently implemented. In this minutes, an agreement was made on the selection of the following 6 bridges to be included in the Phase II Project.

- No.5 Pashorai Bridge (Pashorai - Ughas Banda road), Mansehra District
- No.7 Panipa Bridge (Kandia Valley road), Kohistan District
- No.11 Choni Bridge (NCC - Chitral Town road), Chitral District
- No.14 Bukari Khawar Bridge (Samar Bagh - Shahi road), Dir District
- No.16 Kaidon Bridge (Kaidon - Goornai road), Swat District
- No.17 Peer Baba Bridge (Peer Baba - Malakpur road), Buner District

The Study Team carried out investigation on the 6 bridge sites included in the Phase II Project similar to that executed for the Phase I Project, such as the examination of the natural conditions, examinations of the Project operation system, confirmation of the ability for maintenance management, examination on the Project implementation system, and the adequacy of the Project as the Grant Aid Cooperation and its influential effect.

JICA prepared a Draft Final Report based on the above study result and substance of the interim report previously prepared and submitted. Of the 6 bridges included in the Phase II Project, No.11 Choni Bridge which has a special condition where the construction would be limited to only a certain period in the year were proposed to be separated from Phase II Project and scheduled in the Phase III Project.

JICA despatched a Final Report (Draft) Study Team headed by Mr. Rikiya Iizuka, deputy manager of the 2 nd Operation Bureau, Honshu-Shikoku Bridge Authority, to explain the report to Pakistan side from March 8 to March 17, 1993. After the contents of the report were verified and agreed upon by the parties, minutes containing the basic agreements between the parties were signed and exchanged.

This report contains results of the basic design study. The list of Study Team Members, survey itinerary and visited parties, and minutes are attached in the appendices. Boring logs of the subsoil investigation are attached as well.

CHAPTER 2

BACKGROUND OF THE PROJECT

CHAPTER 2 BACKGROUND OF THE PROJECT

2.1 Outline of the North West Frontier Province

2.1.1 General Outline

The NWFP is bordered with Afghanistan to the west and north, inhabited with a population of 19 million in an area of approximately 107,000 km², and is a mountainous area where the economy relies mainly on agriculture and forestry.

The provincial administration is divided into two separate administration; the sector under the direct administration of the Province and the sector under the Federal Government administration.

The regional development of the Province is largely delayed and backwards compared to the other Provinces due to its large number of valleys and rivers crossing the land and separating the regions.

Especially, the development of roads are delayed due to restrictions rendered from its mountainous geographical features, resulting in having an extraordinarily low figure of 0.2 km/km² of road length on the average within the Province. Furthermore, since traffic by vehicles are difficult and sometimes not possible because the bridges crossing rivers in the valleys are made of suspension type wooden structured bridges with very narrow width, transport of goods are carried out manually and by donkeys.

Due to the above situation, there are problems in the transport of products to the market and vice versa, the transport of commodities to the population in the region.

2.1.2 Administration

The organization of the governmental body in the North West Frontier Province is mandated by the Governor as the chief administrator but its activities are centered on the province council and the virtual chief executive of the Administration is the Chief Minister. The organization of the administrative body under the Chief Minister includes the following fifteen (15) departments.

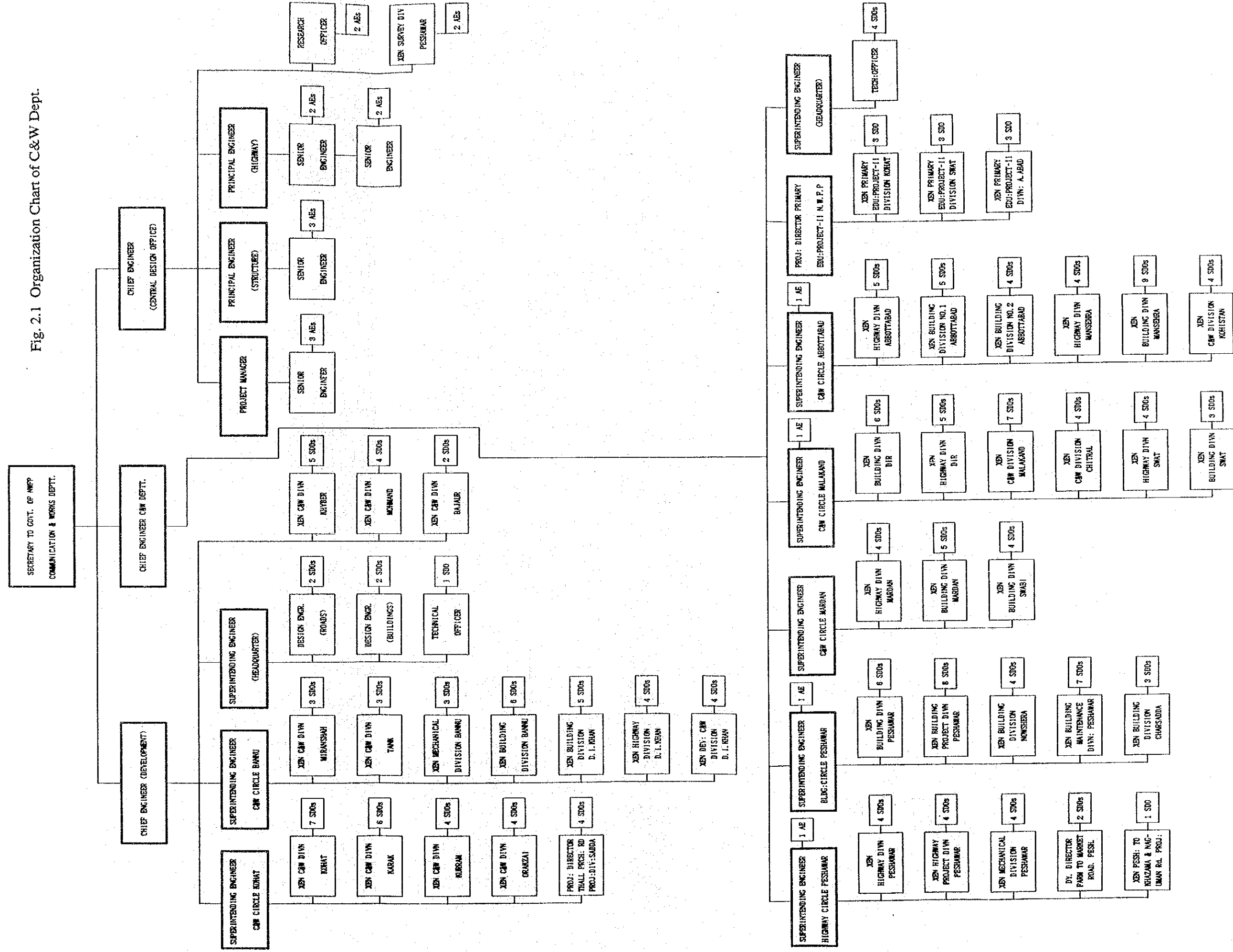
- 1) Service and General Administration Dept.
- 2) Finance Dept.
- 3) Education Dept.
- 4) Food, Agriculture, Livestock and Cooperation Dept.
- 5) Communication and Works Dept.

- 6) Forest, Fishery and Wildlife Dept.
- 7) Health, Social Welfare and Population Dept.
- 8) Home and Tribal Affairs Dept.
- 9) Industries, Commerce, Labour, Mineral Development and Transport Dept.
- 10) Information, Sports, Culture and Tourism Dept.
- 11) Irrigation and Public Health Engineering Dept.
- 12) Law Dept.
- 13) Local Government, Election and Rural Development Dept.
- 14) Planning, Environment and Development Dept.
- 15) Zakat and Ushr Dept.

Minister is the head of each Department while the Secretary who is assistant to the Minister will perform all the practical administrative affairs. Under the departments, there are Divisions, Sections, and Sub-sections where the administrative affairs are administered in compliance with the rules and regulations for each of the respective Provinces. Each of the Departments maintains a close coordination with the corresponding Departments in the Federal Government Ministry other than prosecuting the Province's own administrative activities, especially regarding the compilation of budget and implementation of major provincial projects, for which the advises and approval of the Federal Government would become necessary.

Bridge construction projects as in this particular investigation works will be handled by the Communication and Works (C&W) Dept. The organization of the C&W Dept. is as shown in Fig. 2.1.

Fig 2.1 Organization Chart of C&W Dept.



XEN : Executive Engineer
 AE : Assistant Engineer
 SDO : Sub-Divisional Officer

2.1.3 Budget

The road project budget of the C&W Dept. in the past 5 years (1987/88 ~ 1991/92) are as shown in the following Table 2-1.

Table 2-1 The Road Project Budget of NWFP

Year	Maintenance Management cost (million rupee)	Construction cost (million rupee)
1987 ~ 1988	205.2	332.0
1988 ~ 1989	218.3	281.9
1989 ~ 1990	139.3	262.0
1990 ~ 1991	171.7	305.0
1991 ~ 1992	160.1	459.4

(Source: C&W Dept. NWFP, 1993)

Note: Budget related to roads are for the actual project cost and does not include indirect costs. FATA is also excluded.

2.2 Outline of the Transportation Sector

2.2.1 General Outline of Transportation

The transportation system of the whole Pakistan is as follows.

- Road : 118,450 km (1985 statistic)
- Railroad : 8,775 km
- Airport : 36 nos.

More than 85% of the overland transportation in the NWFP is carried by the national roads and the main trunk roads (provincial roads), and motorcars form the main means of transportation. There is also the national railway comprising of 230 km of wide gauge rails in the northern region of Peshawar and 290 km of narrow gauge rails in the southern region. Also there is an air transport service of PIA for travel between Peshawar and Chitral, D. I. Khan, and the tourist site of Saidu & Sharif.

2.2.2 Project Implementation Situation

The road network in Pakistan has been strenuously developed in the 90 years or so since the late 19th century during the period of English mandatory and therefore

the national network of the main trunk line had already been formationed when Pakistan had become independent from India in the year 1947. The trafficable road by motorcar at the time was a mere 8,500 km and were in a poor state as a means of transportation.

Due to the rapid development of the road transportation system since the 1960's, the construction of motor-ways have been promoted in a very quick pace. At the present, there is a total of 12,200 km of completed provincial roads including 842 km of national roads and main trunk roads. However, there are problems regarding the quality of the roads, such as, the insufficiency of the road width and the standard of quality of pavements and also that part of the trunk roads do not have sufficient capacities due to the recent rapid increase in traffic volume and the increase in heavy duty trucks. Also, the situation regarding the missing link in the road network system and the access to the remote areas are still far inadequate and insufficient.

2.2.3 Existing Situation of Bridges

The regional development of the Province is largely delayed and backwards compared to the other Provinces due to its large number of valleys and rivers crossing the land and separating the regions.

Especially, in the northern part of the Province, the situation of north-south direction roads is better than the situation of east-west direction roads due to the geographical features that rivers and mountains run in the north-south direction.

In the local areas where steep mountain roads run pararell to the rivers, once transportation is closed due to the winter snow collapse of road slops in the rainy season, or increase of water in rivers, it is not an unuseal case that the area would become isolated due to the very few numbers of bridges and the lack of alternative detour routes available.

Although very few, there are bridges crossing rivers in the valleys which are made of suspension type wooden structured bridges with very narrow width, where transport of goods are carried out manually and by donkeys.

2.3 Development Program

2.3.1 National Development Program

The 7th 5-year program (July 1, 1988 ~ June 30, 1993) was announced on July 19, 1988. The main Target of the 7th 5-year program is as indicated below.

Economical aim	Average yearly GDP growth rate	6.5%
	Average yearly GNP growth rate	6.3%
	Average yearly Agricultural growth rate	4.7%
	Average yearly Manufacturing Industry	8.1%
	Average yearly Export Manufacturing Industry	9.1%
	Average yearly Import Manufacturing Industry	4.5%
Political aim	Establishment of new employment	
	Development of human resources (Education, vocational training)	
	Improvement of transportation & medical public services (Essential area in traffic and transportation sector : NWFP & Baluchistan province)	
	Improvement of foreign dependence practice	
	Introduction of private capital	
	Repression of inflation	
	Improvement of international payments	
	Curtailment of financial deficit	

For the fulfillment of its aim, emphasis is focused on the development of the Transportation and Communication sectors, especially the development of the road network system. Further, the 7th 5-year program adopts the development of the NWFP and Baluchistan Provinces as its primary policy. This Project is scheduled to be implemented in accordance with the 7th 5-year program.

2.3.2 Priority Programs of the Transportation Sector

In the area of road improvement, the 5-year program has been planned with emphasis focused on the NWFP and the Baluchistan Provinces where development is comparatively backwards, which is based on the long term program of "Perspective Plan : 1988 ~ 2003" that the Pakistan Government prepared with the aim of attaining 2 large goals; the economic independence and the eradication of poverty by the year 2003.

2.3.3 Relation between the Similar Development Programs and the International Organ Aid Program

The NWFP has prepared the "20 year Master Plan from Farm to Market Roads" program with the cooperation fund from ADB and they are forwarding the road improvement based on this program.

However, the bridges subjected to this preliminary design investigation are being constructed with the C&W funds only and are not receiving any aid from any foreign government nor any international agencies.

The forementioned ADB financial program "Farm to Market Roads" is used for the improvement of gravel surfaced roads to asphalt surfacing and not for the construction of bridges.

The "Farm to Market Roads" program is already in the stage of construction with the phase I stage already completed and is now progressing with the Phase II stage.

This program is being enforced under the initiative of ADB but OECF Japan has also completed the SAPROF investigation with the intention of providing aid fund.

2.4 The Circumstances and Substance of Request for the Project

2.4.1 The Circumstances of the Request

The Pakistani Government, in its effort to enhance the regional development and thereby raise the quality of livelihood of its inhabitants in the Province, is considering the construction Program of constructing 200 bridges including 52 bridges under the direct administration of the Government and 148 bridges under the Provincial administration. However, considering the Program from the Governmental view-point, the rehabilitation and improvement of the main cargo transport roads would become their primary urgency, and as a result, since the budget allocation has been mainly placed in the rehabilitation of the main roads in its 7th 5-year road rehabilitation program, sufficient budget has not been allocated for the rehabilitation of bridges on the regional roads.

Therefore, the Pakistani Government, in order to enhance the development of the subject Province which is far backward and delayed in comparison with the overall National Development, has made a request to the Government of Japan for a Grant Aid for the construction of vehicle transport bridges in the northern districts within the subject Province considered to be the most urgently required which was selected from the above mentioned Construction Program for 200 Bridges in the NWFP.

2.4.2 The Substance of the Request

The subject bridges requested for construction at this time are located in the Hazzara and Malakand Agencies and is inclusive of the following 20 bridges shown in Table 2-2.

Table 2-2 List of Requestd Bridges

Bridge No.	Bridge name	Bridge type	Bridge length (m)	District
(Bridge in Hazzara Agency)				
Br. No. 1	Narlai	Suspension	70.0	Abbottabad
" 2	Desal	"	60.0	"
" 3	Kuniar Kass	Composite Truss	250.0	"
" 4	Shagai	Suspension	70.0	Mansehra
" 5	Pashorai	"	67.0	"
" 6	Jabrai	"	185.0	"
" 7	Panipa	"	175.0	Kohistan
" 8	Jajshoe	"	54.0	"
(Bridge in Malakand Agency)				
Br. No. 9	Darband	Suspension	170.0	Chitral
" 10	Naggar	"	70.0	"
" 11	Choni	Composite Truss	70.0	"
" 12	Khal	Suspension	100.0	Dir
" 13	Haya Serai	"	135.0	"
" 14	Bukari Khawar	"	150.0	"
" 15	Mankial	"	120.0	Swat
" 16	Kaidon	Steel girder	40.0	"
" 17	Peer Baba	"	50.0	Buner
" 18	Jahazoon Dak	"	60.0	Malakand
" 19	Totakan	"	60.0	"
" 20	Sakhakot	Suspension	150.0	"
Total		20 Bridges	2,106.0 m	

Note) The above No. 3 Kuniar Kass bridge is indicated to have a length of 250 m, but according to our investigation, it only has about 20 m length. The only bridges with a span of about 250 m would be bridges over the Jhelum river. The bridge over the Jhelum river will be bridges linking the NWFP and Jammu & Kashmir (disputed area) which is excluded from the intended study area.

Further, the estimated construction cost at the time of request by the Pakistan Government was 2,900 million yen for 7 bridges.

The rough location map and photos for the requested 20 bridges are as shown in the appendix-5.

CHAPTER 3

SELECTION OF THE SUBJECT BRIDGES

CHAPTER 3 SELECTION OF THE SUBJECT BRIDGES

3.1 Ranking of Priorities

3.1.1 Items of Consideration for Ranking Priorities and Method of Ranking

(1) Items of consideration

Within the 20 requested bridges, site investigation-related reference had been selected by the following method with the aim of selecting bridges requiring new construction.

[A: Condition of existing road and bridge]

A-1 Condition of existing bridge:

whether new construction is deemed necessary from the points of structural and traffic volume.

A-2 Condition of approach roads to the new bridge:

whether there is any existing approach road to the bridge capable of vehicle traffic.

[B: Effective result by the new bridge construction to the road network]

B-1 Access by vehicle would become possible.

B-2 All weather road link will be made possible.

B-3 The disconnection to the existing road network would be dissolved and improvement of the road network would be attained.

[C: Effect of the new bridge to the public welfare]

C-1 whether emergency rescue activities at time of disaster would be facilitated.

C-2 whether access to schools and hospitals would be made possible throughout the year.

[D: Effect of the new bridge to the economic activities]

D-1 Effect to agriculture.

D-2 Effect to forestry.

D-3 Effect to development of mineral resources.

D-4 Influence to future development programs.

[E: Adequacy of applying the Japanese Grant Aid]

E-1 There is no problem in land acquisition.

E-4 To be limited to bridge requiring Japanese bridge technology.

(2) Method of applying priorities

The method adopted for applying priorities in the preliminary design investigation is as explained hereinafter. The summary is shown in Fig. 3.1 in a flow-chart.

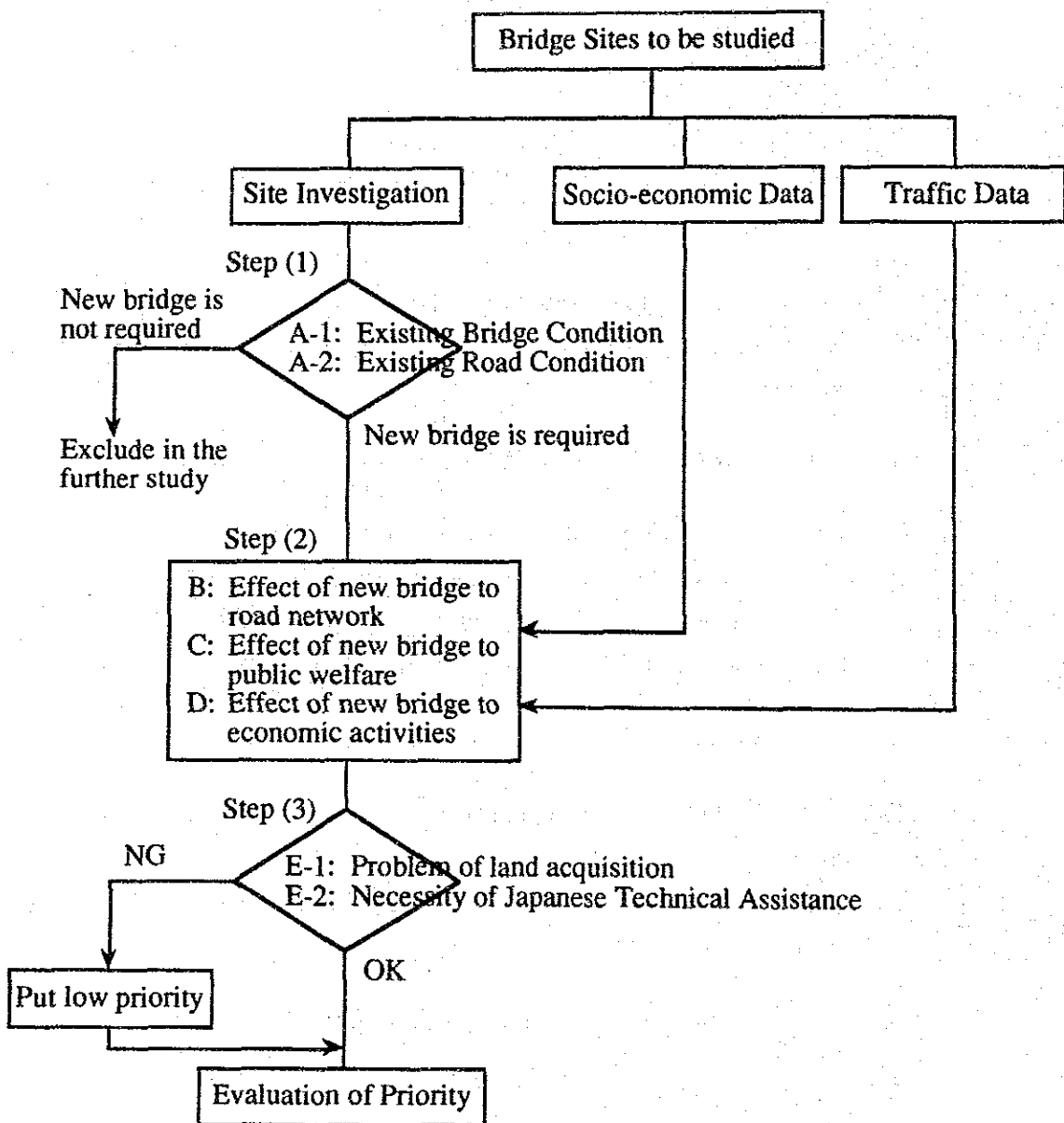


Fig 3.1 Working Flow for Ranking Priorities

3.1.2 Step (1) Examination of Existing Bridge and Road Conditions

(1) A-1: Examination of Existing Bridge Condition

The No. 6 Jabrai Bridge in Mansehra District is constructed of concrete arch structure and as regards its safety viewed from the points of structural and traffic capacity (carriage width), it has been judged that there is no urgent necessity to reconstruct a new bridge for the time being. Therefore, the subject bridge was eliminated from further study.

(2) A-2: Examination of Existing Road Condition

As a result of site investigation, it was found that the 3 bridges, the No. 2 Desal Bridge in the Abbottabad District, the No. 4 Shagai Bridge in the Mansehra District and the No. 9 Darband Bridge in the Chitral District could not at the moment be linked to any vehicle traffic road. It has been judged that since the above facts do not meet the basic principle in the selection of bridges for the subject project, that one of the factors in the aim of this Project lies in the construction of bridges capable of vehicle traffic, the above mentioned 3 bridges were eliminated from further consideration.

For example, the existing conditions of the subject 3 bridge sites are as follows:

- No. 2 Desal Bridge site

There is a suspension bridge (very old and dilapidated) in Desal on the Abbottabad ~ Murree road but it is merely continued to a pathway (mule track) at the opposite bank. Even the nearest village is situated several km away and considering the hilly geographical features and rock exposing geological features, it has been judged that the time required for the construction of the access road would be more than the time required for the construction of the bridge itself.

- No. 4 Shagai Bridge site

On the side of Mansehra, the Thakot ~ Darband road is now under construction running along the left bank of the Indus river. This road is deemed to be made possible for vehicle traffic in the very near future but there is no vehicle traffic access road in the opposite Swat side bank. Should the bridge be constructed, an access road of more than 10 km would

become necessary and it is judged that the construction of a new bridge is not considered imminent.

- No. 9 Darband Bridge site

The Darband bridge site (not the same Darband referred in the forementioned No. 4 Bridge) which is located in the hinterland of Mastuj, which is also in the hinterland of Chitral has no vehicular trafficable access road at the present.

Under the present condition, it was judged that even the transportation of construction materials would not be possible.

3.1.3 Step (2) Examination of Effects in Relation to Traffic Network, Public Welfare and Economic Aspects

Refer to Table 3-1 "Necessity and Effect of Bridge Installation".

3.1.4 Step (3) The Appropriateness of Grant Aid from Japan

(1) Item E-1: Problem of land acquisition

As a result of informations collected from the local inhabitants, in the case of No. 15 Mankial Bridge (Swat District), the site is located in a narrow valley. Since the mountain slope on the right bank poses a dangerous possibility of mountain slide, the inhabitants have built their residents in a very limited small area. It was therefore considered that the land acquisition and compensation including the relocation of the inhabitants would entail a very difficult problem and therefore the priority ranking of the bridge was lowered.

(2) Item E-2: Whether or not the Japanese bridge technology would be necessary

As a result of site investigation at the No. 3 Kuniar Kass Bridge site (Abbottabad District), it was found that the water depth is quite shallow and a small scale bridge of about 20 m or a box culvert would be sufficient. Therefore, the priority ranking for their bridge has been lowered.

Table 3-1 Necessity and Effect of Bridge Installation

Bridge No. & Name	Location	Type & Scale	Beneficial Population (thousands)	Future Traffic (veh/day)	Necessity & Effect of New Bridge Construction		Evaluation of Bridge Importance (relative appraisal)	
					Necessity from Viewpoint of Road Network	Impacts on Citizen Welfare		
Br. No. 1 (Narai Bridge, Abbottabad)	N 34 11 E 72 58	PC girders bridge Length: 25m X4 spans + 25m X1 span	Present: 200 Future: 300	Less than 500	Forces the route of Abbottabad~Haripur~Narai~Mansehra~Abbottabad. Accesses right bank to Haripur by reducing travel distance by 85-km.	Improves access to medical care by accessing the nearest hospital in Haripur to residents on opposite river bank. Supports rescue operations. Improves access to medical care by accessing the nearest hospital in Muree to residents on opposite river bank. Supports rescue operations.	Expands agricultural market sphere, reduces damage to produce during transportation, encourages more cash crop production. Provides transportation for agricultural produce (especially wheat and corn) for crops throughout the year. Reduces transportation time of produce to markets.	⊙
Br. No. 3 (Nunar Lass Bridge, Abbottabad)	N 33 58 E 73 27	PC girders bridge Length: 25m X2 spans	Present: 30 Future: 45	Less than 500	Links Mandia Valley on right bank of Indus River to Karakoram Highway. Provides a substitute route for Karakoram Highway.	Supports rescue operations. Improves access to medical care for Kadnia residents by accessing the nearest rural health center in Dasu.	Reduces transportation time for produce and improves efficiency. Supports timber industry. Supports plans for hydraulic resource development.	○
Br. No. 5 (Pashori Bridge, Mansehra)	N 34 42 E 72 59	PC girders bridge Length: 25m X2 spans	Present: 50 Future: 75	Less than 500	Links Mandia Valley on right bank of Indus River to Karakoram Highway. Provides a short-cut between northern Kohistan and Swat (future project).	Supports rescue operations. Improves access to medical care for Kadnia residents by accessing the nearest rural health center in Dasu.	Reduces transport time for produce and improves efficiency. Supports timber industry. Supports plans for hydraulic resource development.	⊙
Br. No. 7 (Panipa Bridge, Kohistan)	N 35 25 E 73 12	Suspension bridge Length: 180m	Present: 30 Future: 45	Less than 500	Links Mandia Valley on right bank of Indus River to Karakoram Highway. Provides a short-cut between northern Kohistan and Swat, together with Br. No. 7. Lifeline function	Supports rescue operations. Improves access to medical care for Kadnia residents by accessing the nearest rural health center in Dasu.	Reduces transport time for produce and improves efficiency. Supports timber industry. Supports plans for hydraulic resource development.	⊙
Br. No. 8 (Ajshoe Bridge, Kohistan)	N 35 27 E 73 03	PC girders bridge Length: 25m X3 spans	Present: 30 Future: 45	Less than 500	Links Mandia Valley on right bank of Indus River to Karakoram Highway. Provides a short-cut between northern Kohistan and Swat, together with Br. No. 7. Lifeline function	Supports rescue operations. Improves access to medical care for Kadnia residents by accessing the nearest rural health center in Dasu.	Reduces transport time for produce and improves efficiency. Supports timber industry. Supports plans for hydraulic resource development.	⊙
Br. No. 10 (Nagar Bridge, Chitral)	N 35 09 E 71 44	Suspension bridge Length: 150m	Present: 10 Future: 15	Less than 500	Links right bank of Chitral River to NCC Road. Provides a substitute route for NCC Road. Existing 3 bridges fit for small automobiles between Borsh~Nagar.	Supports rescue operations. Supports educational services.	Reduces transport time for produce and improves efficiency. Time & improves efficiency for transporting minerals & timber.	⊙
Br. No. 11 (Choni Bridge, Chitral)	N 35 09 E 71 44	Suspension bridge Length: 100m	Present: 15 Future: 23	2000~4000	Provides a substitute route for NCC Road, which often washed out in the rainy season. Reduces of traffic congestion in Chitral City.	Supports rescue operations.	Stimulates transport industry by rearranging road network in Chitral.	⊙
Br. No. 12 (Khal Bridge, Dir)	N 34 54 N 34 11	Steel plate girders bridge Length: 44m X2 spans	Present: 40 Future: 60	Less than 500	Links Khai to NCC Road (5,000 pedestrians a day via it). Forms the route of Timargara~NCC Road~Khai~Timargara. Reduces distance to Timargara.	Supports educational services by making it easier for students residing on right bank to go to school on opposite bank of the Panjkora River. Accesses medical care.	Expands cash crop production by providing larger market. Reduces transport time for produce.	⊙
Br. No. 13 (Jaya Serai Bridge, Dir)	N 34 55 E 71 50	PC girders bridge Length: 25m X3 spans	Present: 50 Future: 75	Less than 500	Links Timargara to Bha Serai. Forms the route of Timargara~Jaya Serai~Lal Qila~Saarabagh~Timargara & Timargara~Bha Serai~Khai~Timargara. Aids in the better handling of regional traffics.	Improves access to medical care by accessing the nearest hospital in Timargara.	Expands agricultural market sphere, reduces damage to produce during transportation, encourages more cash crop production.	○
Br. No. 14 (Bukari Khawar Bridge, Dir)	N 34 59 E 71 40	PC girders bridge Length: 25m X4 spans + 25m X1 span	Present: 50 Future: 75	500~1000	Forms the route of Timargara~Munda Serai~Bonda~Lal Qila~Jaya Serai~Timargara. Strengthens traffic functions of intercity roads.	Improves access to medical care by accessing hospitals in Saarabagh.	Expands agricultural market sphere, reduces damage to produce during transportation, encourages more cash crop production.	⊙
Br. No. 15 (Mankhal Bridge, Swat)	N 35 20 E 72 37	Steel plate girders bridge Length: 50m	Present: 10 Future: 12	Less than 500	Links Mankhal to trunk road. Provides a lifeline since there is no substitute route.	Supports rescue operations. Improves access to medical care.	Improves efficiency & stability of agricultural produce transportation.	○
Br. No. 16 (Batdon Bridge, Swat)	N 35 15 E 72 35	Steel plate girders bridge Length: 50m	Present: 6 Future: 9	Less than 500	Links left bank to the trunk road on right bank. Provides a lifeline since there is no substitute route.	Supports rescue operations. Improves access to medical care.	Improves efficiency & stability of agricultural produce transportation.	○
Br. No. 17 (Peer Baba Bridge, Buner)	N 34 37 E 72 27	PC girders bridge Length: 25m X3 spans	Present: 15 Future: 23	Less than 500	Forms the route of Jemar~Peerbaba~Bagar~Jemar. Provides a substitute route for the trunk road which is often damaged and impassable.	Supports educational services. Improves access to medical care by accessing schools & hospitals.	Improves efficiency & stability of agricultural produce transportation.	⊙
Br. No. 18 (Jahazoon Dak Bridge, Malakand Agency)	N 34 26 E 71 53	PC girders bridge Length: 25m X3 spans	Present: 22 Future: 33	Less than 500	Links Jahazoon Dak to NCC Road. Reduces by 20km the trip to Takht Bhai.	Improves access to medical care by accessing hospitals in Takht Bhai.	Stabilizes transportation of sugar cane, the main farm product, to Takht Bhai. Stimulates expansion of cash crop production for close big markets, of Peshawar.	⊙
Br. No. 19 (Totakan Bridge, Malakand Agency)	N 34 38 E 71 48	Suspension bridge Length: 80m	Present: 35 Future: 42	Less than 500	Forms the ladder pattern road-network of Kolang~Chakdara~Bathela~Kolang. Assists in the distribution regional traffic. Reduces by 30km trip to Malakand.	Improves access to medical care by accessing hospitals in Malakand.	Reduces transport time & improves efficiency of crops distribution by employing heavy trucks.	⊙
Br. No. 20 (Sakhakot Bridge, Malakand Agency)	N 34 27 E 71 54	PC girders bridge Length: 25m X3 spans	Present: 30 Future: 45	Less than 500	Links Sakhakot to NCC Road. Forms the route of Takht Bhai~(NCC Road)~Sakhakot~(Jahazoon Dak Road)~Takht Bhai. Provides functions of a city road by accessing the Sakhakot Village to Bazaar along NCC Road.	Improves access to educational services by accessing the Sakhakot Village to schools in Bazaar. Improves access to medical care by accessing hospitals in Takht Bhai.	Stimulates expansion of cash crops by reducing transport time and improving efficiency of crops distribution by employing heavy trucks.	⊙

Notes: ⊙ Very Important
○ Quite Important
△ Important

3.1.5 Priority Ranking

The result of the above examinations are shown in Table 3-1 "Necessity and Effect of Bridge Installation". The investigation team has finalized the priority ranking as shown in Table 3-2 below.

Table 3-2 Priority Ranking of Bridge Installation

Priority ranking	Bridge No.	Bridge name	District
(1)	No. 7	Panipa	Kohistan
(2)	No. 11	Choni	Chitral
(3)	No. 1	Narlai	Abbottabad
(4)	No. 12	Khal	Dir
(5)	No. 20	Sakhakot	Malakand
(6)	No. 18	Jahazoon Dak	Malakand
(7)	No. 19	Totakan	Malakand
(8)	No. 14	Bukari Khawar	Dir
(9)	No. 17	Peer Baba	Buner
(10)	No. 16	Kaidon	Swat
(11)	No. 5	Pashorai	Mansehra
(12)	No. 13	Haya Serai	Dir
(13)	No. 15	Mankial	Swat
(14)	No. 3	Kuniar Kass	Abbottabad
(15)	No. 8	Jajshoe	Kohistan
(16)	No. 10	Naggar	Chitral

(Prepared by Investigation Team)

Priority ranking (1) ~ (11) : Bridge construction is deemed necessary from the short term view

Priority ranking (12) ~ (13) : Reconstruction of bridge is deemed necessary from the medium term view

Priority ranking (14) ~ (16) : Bridge construction is deemed necessary from the long term view

3.2 Selection of Bridges

3.2.1 Selection of Bridges for Preliminary Designing

The bridges construction required in the short and medium range will be included in the basic design.

The bridges to be included will be the bridge priority ranking (1) ~ (11) shown in Table 3-2 and will be as shown in Table 3-3 when shown in the numerical order of the Bridge No.

Table 3-3 Bridges Subject to Preliminary Design

Bridge No.	Bridge name	Related road	River	Agency
No. 1	Narlai	Pind Gali	Siran R.	Abbottabad
No. 5	Pashorai	Pashorai-Ughas Banda	Nandia Khawar	Mansehra
No. 7	Panipa	Kandia Valley	Indus R.	Kohistan
No. 11	Choni	NCC-Chitral Town	Chitral R.	Chitral
No. 12	Khal	NCC, Km - 135	Panjpora R.	Dir
No. 14	Bukari Khawar	Sanar Bagh - Shahi	Nullah Bukari	Dir
No. 16	Kaidon	Kaidon - Goornai	Swat R.	Swat
No. 17	Peer Baba	Peer Baba - Malakpur	Malakpur Khawar	Buner
No. 18	Jahazoon Dak	Jahazoon Dak - Ghawar Killey	Sakhakot R.	Malakand
No. 19	Totakan	Totakan - Kamala	Swat R.	Malakand
No. 20	Sakhakot	Sakhakot Village	Sakhakot R.	Malakand

(Prepared by : Study Team)

3.2.2 Consideration on Implementation Method and Selection of Bridges subject to construction

(1) Consideration on Implementation Method

The substance of considerations in case of constructing bridges are as indicated below.

- Efficient project implementation cannot be expected due to the bridge sites being spread out in a vast area requiring not only large numbers of heavy equipments and labor forces but also a large number of supervisors. It is therefore necessary to divide it into packages in order to attain efficiency in construction.

- There are sites where snowfall occurs and the construction periods would be limited. In the case of No.11 Choni bridge, the trunk road (NCC road) would be closed due to snowfall at the Lowari Pass for 6 months between December to May. Since the Chitral district would become isolated during this period, construction work would become impossible.

- The Government of NWFP has no previous experience in the Japanese Grant Aid Cooperation. It is therefore expected that there is apt to be delay in the simple

procedures and these may be difficulties in completing the project in a simple year if many bridges are involved in one package.

(2) Phase Division and Subject Bridges

Judging from the above considerations, it is proposed to construct 11 Bridges according to priorities. It will be detailed in the implementation program layed out in section 6 of chapter 6 but the summary will be as follows.

(i) Phase I Project (5 bridges)

Phase I project includes the following 5 bridges where it is relatively easy to transport materials and equipments from the capital of Islamabad or the provincial capital of NWFP Peshawar.

- No.1 Narai Bridge
- No.12 Khal Bridge
- No.18 Jahazoon Dak Bridge
- No.19 Totakan Bridge
- No.20 Sakhakot Bridge

(ii) Phase II Project (5 bridges)

Phase II project includes the following 5 bridges which are expected to require sometime to transport the materials and equipment.

- No.5 Pashorai Bridge
- No.7 Panipa Bridge
- No.14 Bukari Bridge
- No.16 Kaidon Bridge
- No.17 Peer Baba Bridge

(iii) Phase III Project (1 bridge)

Construction of the subject bridge cannot be expected during the winter season with heavy rainfall and cannot be completed within a single year contract.

- No.11 Choni Bridge

CHAPTER 4

OUTLINE OF THE STUDY AREA

CHAPTER 4 OUTLINE OF THE STUDY AREA

4.1 General Condition of the Investigation Subject-Area

4.1.1 General Condition

The NWFP is one of the four Provinces making up the Islamic Republic of Pakistan, situated in lat. $31^{\circ} \sim 37^{\circ}$ N and long. $69^{\circ} \sim 74^{\circ}$ E, and as can be seen in the name of the Province, it is situated in the north western region of Pakistan. To the north, it is bordered with Hunza at the Karakoram mountains of the Himalayan mountain system, and to the west, it is bordered with Afghanistan at the Hinzukushi mountains. The northern part of the Province is covered with mountainous area while the whole region is divided and separated by the Indus river flowing in the north-south direction in the eastern most region, the Kabul river flowing in the east-west direction in the central region and also its tributaries, which is the reason why the development of their province is delayed and backward.

The climate in the NWFP is very much diversified due to its length in the north-south direction. It can be roughly divided into four climatic regions; the northern region where the climate is very changeable with heavy snowfall during the winters, the eastern region where precipitation is relatively high with a warm climate, the central region where it is warm but with low precipitation, and the southern region where it is dry with low precipitation.

Peshawar, the capital city of NWFP is situated in the central region with an annual precipitation of 230 mm and an annual average temperature of about 23°C .

4.1.2 Population

The population trend of the districts under the provincial administration will be as shown in Table 4-1. The following may be conceived from the table.

- That the population in the NWFP excluding FATA was approx. 15 million in the year 1990, of which 12.61 million (84%) were living in the rural region.
- That the increasing rate of population in the NWFP excluding FATA was 1.34 during the 9 years between 1981 ~ 1990. Comparing the increase rate between the rural and the urban region, the urban region shows an increase of 1.42 while the rural region shows only 1.33 which indicates a population movement to the urban region.

Regarding the increasing rate of population within the 7 Districts where the construction of bridges had been requested (the Swat District had been separated into Swat District and Buner District in the year 1990 but in the table, Buner District is included in the former Swat district), although the increase rate is above the average for Malakand District, Dir District and the Swat District which are located in the central region of the NWFP, the increase rate is below average in the Abbottabad District, Mansehra District and the Chitral District which are not located in the central region. Moreover the Kohistan District shows a rapid increase in population but this is due to the great improvement in the traffic conditions by the establishment of the Karakoram Highway in 1978.

Table 4-1 Population Trend in NWFP

	1981 (1,000)			1990 (1,000)			Ratio 1990/1981		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Peshawar	869	1,437	2,307	1,590	1,505	3,095	1.830	1.047	1.342
Mardan	227	1,283	1,520	296	1,633	1,929	1.304	1.263	1.269
Kohat	124	391	515	186	497	683	1.500	1.747	1.326
Karak	14	238	252	21	314	335	1.500	1.319	1.329
Bannu	62	655	747	70	842	912	1.129	1.285	1.272
D.I.Khan	118	525	643	156	723	879	1.322	1.377	1.367
Abbottabad	156	1,022	1,178	296	1,130	1,426	1.897	1.106	1.211
Mansehra	38	1,036	1,074	51	1,255	1,306	1.342	1.211	1.216
Kohistan	-	481	481	-	1,153	1,153	-	2.397	2.397
Dir	-	779	779	-	1,158	1,158	-	1.487	1.487
Swat	91	1,158	1,249	220	1,550	1,770	2.418	1.339	1.417
Chitral	-	211	211	-	281	281	-	1.332	1.332
Malakand	-	261	261	-	370	370	-	1.418	1.418
N.W.F.P.	1,688	9,496	11,184	2,402	12,608	15,010	1.423	1.328	1.342

Source: N.W.F.P. DEVELOPMENT STATISTICS, BUREAU OF STATISTICS

4.1.3 The Society in General

(1) Race

Population is made up of various race and tribes; it may be largely divided into the Panjab of Indo-Arian origin and the Patan and the Baruchiw of the Iran origin.

In the NWFP, the population is mostly made up of Patan, the same tribe as the people living near the eastern border of Afghanistan and their tribal kinship being so strong, they seldom have inter-marriage with other tribes.

(2) Religion

As can be conceived from the historical evidence of having been separated and winning independence from India where the main religion is Hindu, the Pakistani state religion is Islam (Sunni sect.) where 96 % of the population is Islam, 3 % is Christian, 1 % is Hindu and a few of Buddhist and Parsi.

The proportion of Islam in the NWFP is still higher and the commandment is much more severe than the other Provinces.

(3) Language

The Pakistani language is Urdu and the writing characters are the same Morpheme as that of the Arabic character.

However, Pushtu is mainly used in the NWFP. Moreover, in Pakistan English is also being used as the official language beside Urdu.

(4) Education

In the NWFP, just as in the case of the other provinces, education is being emphasized at all levels and in all fields for the development of human resources. The literacy rate in the year 1981 was quite low with a provincial average rate of 16.7 % which is considered due to the high percentage of the rural population, while that of the female maintained an average of 6.5 % (according to 1989 statistics, the average of all Pakistan was 26.2 %).

Especially, the literacy rate of the rural districts within the province (1981) was 13.2 % (male ~ 21.7 %, female ~ 3.8 %) which is only about one-half and quite low compared to the 26.2 % in average for all Pakistan.

The districts where the construction of bridges are proposed at this stage are mostly located in the rural area and therefore repletion of education, especially the repletion of elementary education is considered to be necessary.

In the elementary education of the subject province, the rate of attendance is below 43 % due to the high percentage (20 %) of drop outs.

As a result, the percentage of applicants for higher education is only 5.1 % and low but recently there seems to be an indication of improvement. As regards the advanced professional educational institution, there are four such institutions in Peshawar, the capital, i.e., the University of Peshawar, the Peshawar Technical Institute, the Agricultural University of Peshawar and the University of Gomal.

(5) Medical Treatment

The medical institutions in the NWFP (excepting FATA) comprises of 118 numbers of hospitals, 373 numbers of dispensaries, 64 numbers of rural health post, 476 numbers of basic health units (as of January 1, 1986). There are 3.1 doctors for every 10,000 persons and is much more advanced than the neighboring developing countries.

However, in the remote and secluded rural areas as the districts where the construction of bridges are now being proposed, medical facilities are very severe notwithstanding the efforts devoted by the Pakistan government and the provincial government, and moreover, even where medical facilities are provided, access to the facilities is impeded by lack of transportation with trafficable roads cut by mountains and rivers and presents a most difficult situation.

4.1.4 Economy

(1) General Conditions

The economy of the NWFP relies mainly on its primary industry of agriculture, forestry and mining. The manufacturing industry is concentrated in the provincial capital of Peshawar and its surrounding nearby cities of Nowshera, Mardan and Abbottabad. Other small scale processing industries using agricultural products are scattered around the local cities.

The conditions of each of the industries are as follows.

(2) Agricultural Industry

Comprising more than 35 % of the GRDP and with more than 60 % of its population being engaged in agriculture, it is the main industry of the NWFP. The main products are wheat, rice, corn, sugar cane, tobacco and cotton. The statistics of 1985/86 ~ 1989/91 shows that the production of wheat, corn and

sugar cane increased at an annual rate of 2 ~ 5 % indicating a favorable increase while cotton, rice and barley tended to decrease.

The strengthening of nurturing the agricultural sector is one of the priority policies of the NWFP government, and it is providing subsidies for fertilizers, irrigation facilities, improvement of plant breeding and introduction of tractors.

The 8 districts where the construction of bridges were requested are the main producing region of wheat, corn, rice and barley within the NWFP.

Especially the Swat District (including Buner District) alone respectively produces 16.1 %, 25.5 % and 18.9 % of wheat, corn and rice totally produced in the Province. The Dir District also produces 25.7 % of rice and 19.6 % of barley of the provincial total product. Comparing the cultivation area per 1,000 agricultural population in each of the subject districts, it was found that except for Swat District (including Buner District) and Malakand Agency, they were smaller than the provincial average of 1.41 km²/1,000 P.

As for forestry, an annual volume of 180,000 m³ of lumber is being produced mainly from Kohistan, Chitral and the mountain region of Dir District.

(3) Mining Industry

The NWFP produces various kinds of mineral products but within the subject districts where the construction bridges are contemplated, the Chitral District produces 100 % of the antimony produced in the NWFP, the Swat District produces porcelain clay, feldspar and the Abbottabad District produces marble, crystal magnasite and soapstone, and Mansehra District produces feldspar.

(4) Manufacturing Industry

Although the NWFP is positively implementing the acceleration policy of establishing the manufacturing industry, the arrangement of manufacturing infrastructures is far from sufficient to permeate throughout the province and is only concentrated around the capital city of Peshawar in the vicinity of national road 5 and in the Abbottabad District. As to the type of manufacturing industry, the refinery, paper, pulp, and glass manufacturing industry which requires large amount of investment are not sufficiently

developed as yet. Only such products which are made of agricultural products and textile products are mainly to be seen.

As regards the districts where the construction of bridges are contemplated, the Abbottabad District has many manufacturing industries with advanced mechanization due to the influence of the large scale industrial complex in its vicinity and the Swat district is very active in the processing industry. As for the rest of the 6 districts, it is mostly limited to the domestic industry products.

4.1.5 Transportation Conditions

(1) Condition of Traffic Bridges

As previously explained, the NWFP is largely divided into 2 regions - the region under the direct administration of the Provincial Government and the region under FATA which is directly administered by the Federal Government. The area now under discussion for the bridge construction is the 8 districts within the area under the direct administration of the provincial government. The past transition of provincial road length for each of the 7 districts (under C&W administration) and the recent road density (1980/90) will be as shown in Table 4-2, and the transition of road length when shown in graph form will be as shown in Fig. 4.1. In these tables, figures of the Buner District are included in the Swat District.

The expansion rate of provincial road length is quite high with 5 % per annum and the road density of provincial road when calculated independently would be 0.12 km/km². However, the road density inclusive of all roads in the northern-most region of Kohistan District and Chitral District is conspicuously low with only 0.05 km² and 0.08 km/km² respectively.

The municipal roads which are the equivalent to the city roads in Peshawar, Nowshera and Abbottabad cities is under the administration of the city administration and the road length is more than 390 km (including 271 km of paved road) as of the fiscal year 1983/84.

There is only one truckable access road leading to Chitral District crossing over the Lowari Pass over the NCC road (provincial road) from Dir District. However, since the road would be closed for 6 months (December - May) during the winter season due to heavy snowfall, the only detour road available to and from the surrounding Districts during this time would be a Jeepable road via the neighboring Afghanistan thru Peshawar.

As regards the situation of bridges in the northern region of the Province, as the mountains and rivers are running in the north-south direction, bridges are comparatively provided in the north-southern direction, but it is extremely inefficient in the east-west direction. Therefore, although being the regional trunk road, the roads in the mountainous region are liable to be closed due to the inadequate inter-linkage between the roads due to snowfalls in the winter time and landslide and river flooding during the rainy season parallel to river. Once the road are closed due to the above mentioned natural disasters, it is quite a normal case for the region to be completely isolated for several months due to the few bridges crossing the river and the lack of detour road in the vicinity.

(2) Transportation

The transportation proportions of the passenger transportation and cargo transportation in the road transportation of all the transportation within the NWFP is assumed to be more than 85 %.

This proportion is expected to further increase with the increase of passenger and cargo transportation demand and the increase in trip length.

Passenger transportation is divided into the public and private sectors. In the public transportation, the NWFP Road Transportation Board is in charge of the transportation service within the cities and between each of the cities. Thus, public bus transportation covers only 35 % of the bus transportation and the majority of the bus transportation is serviced by the private sector. The passenger transportation which is facilitated by the private sector, includes taxis, motor rikishas, horse carriages other than the bus transportation which serve as an important transportation means of the public. Large buses carrying about 70 passengers and small buses carrying about 15~ 30 passengers are generally being used.

The public organ responsible for the cargo transportation is undertaken by the NLC (National Logistic Cell) which covers a 5 % proportion of the total cargo transportation volume. The other 95 % of cargo transportation is covered by the private sector using large and small type trucks, pick-ups and wagon cars and as in the case of passenger transportation, it is required to acquire license from the transportation department (Transport Division, Dept. of Industries, Commerce, Labour, Mineral Development and Transport) of the Provincial Government.

The registered number of vehicles in NWFP in 1989 was more than 220,000 (= 13 nos. per 1,000 persons) including 2 wheel vehicles (70,000) and tractors. The registered number of vehicles during the 2 years (late 1987 ~ late 1989) had been as shown in Table 4-3.

It is increasing in a rapid rate yearly; the yearly increase rate of vehicles inclusive of all types were 18 %.

Especially, the increase rate of 2 wheel vehicles, sedans, taxis and tractors were nearly 20 % and as for busses and mini-buses, the increase were incredibly high with 24 % and 59 % respectively.

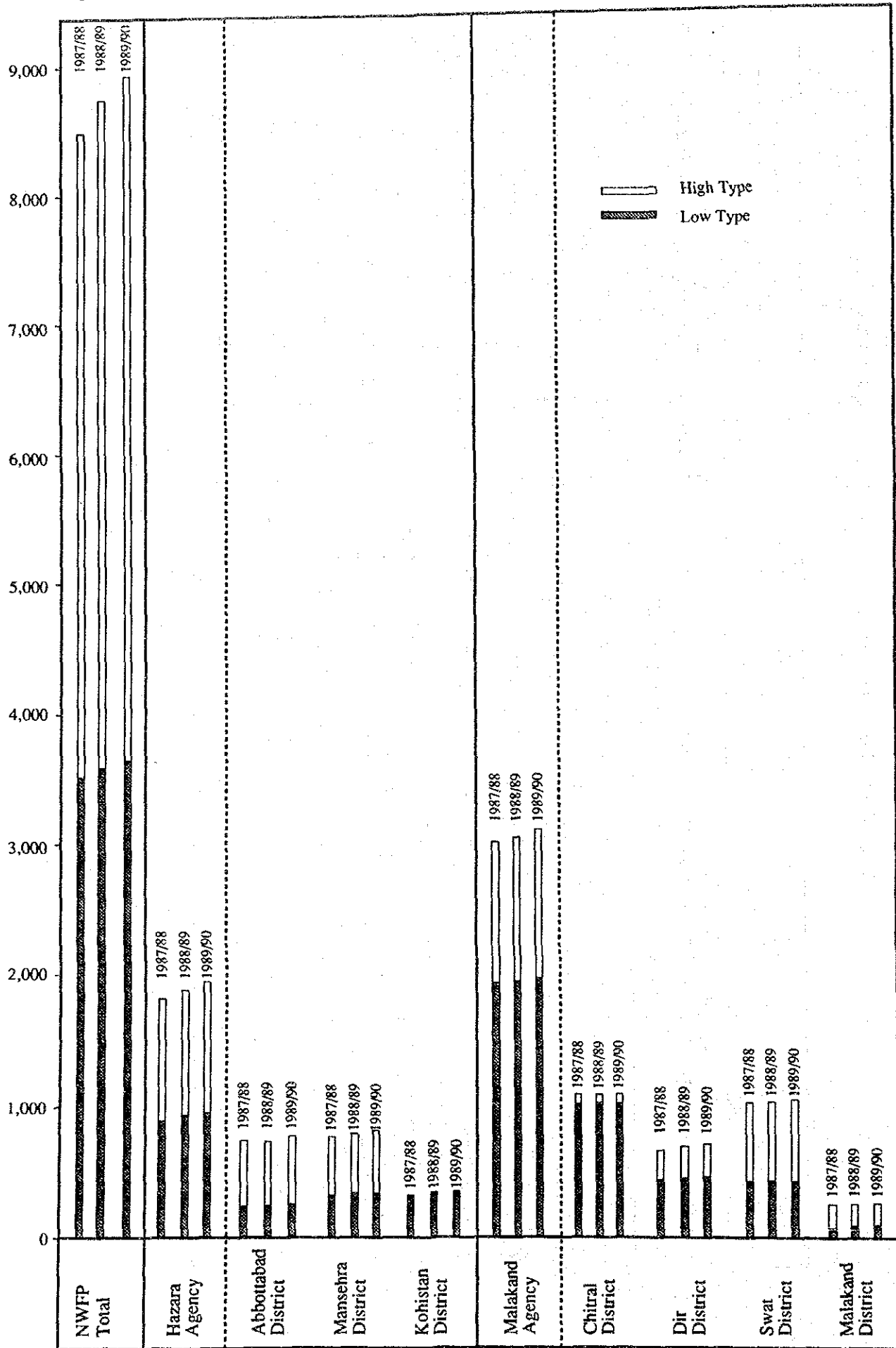
This phenomenon is due to the increase in the cargo transportation need and the demand for passenger transportation means.

Table 4-2 Change of Road Length and the Road Density under the Subject Regions

	Yearly Provincial Road Length (km)										Road Density (1989/90)			
	1987/88			1988/89			1989/90				Population (1000 P)	Area (km ²)	Road Density vs Population (km/1000P)	Road Density vs Area (km/km ²)
	High Type	Low Type	Total	High Type	Low Type	Total	High Type	Low Type	Total					
NWFP Total	4,993.64	3,511.15	8,504.79	5,148.99	3,586.15	8,735.04	5,283.99	3,647.45	8,931.45	15,842	74,521	0.56	0.12	
[Hazara Agency]	933.13	883.18	1,861.31	967.38	927.68	1,895.06	988.58	955.43	1,944.01	3,869	17,103	0.50	0.11	
1) Abbottabad District	498.77	231.21	729.98	514.77	245.21	756.98	528.77	260.21	788.98	1,674	3,565	0.47	0.22	
2) Mansehra District	434.36	326.52	760.88	452.61	341.52	794.13	459.81	341.52	801.33	1,528	5,957	0.52	0.13	
3) Kohistan District	-	325.45	325.45	-	340.95	340.95	-	353.70	353.70	666	7,581	0.53	0.05	
[Malakand Agency]	1,081.45	1,939.03	3,020.48	1,100.95	1,957.53	3,058.48	1,143.00	1,975.09	3,118.09	3,536	29,872	0.88	0.10	
1) Chitral District	82.03	1,003.60	1,085.63	82.03	1,008.10	1,090.13	87.53	1,009.66	1,097.19	300	14,850	3.66	0.07	
2) Dir District	222.21	435.94	658.15	236.24	447.94	684.18	246.24	459.94	706.18	1,100	5,282	0.64	0.13	
3) Swat District	598.15	422.20	1,020.35	603.65	422.20	1,025.85	627.20	422.20	1,049.40	1,766	8,788	0.59	0.12	
4) Malakand Agency	179.03	77.29	256.32	179.03	79.29	258.32	182.03	83.29	265.32	370	952	0.72	0.28	

(Source: C & W Dept., NWFP, 1990)

Fig. 4.1 Change of Road Length and Road Density under the Subject Regions



The registered number for each separate type of vehicle in the regions of the proposed bridge construction is shown in Table 4-3. When seen from the total number of vehicles, the Abbottabad District has an overwhelmingly large number of vehicles in comparison to its population and area which shows the degree of motorization in the district.

When seen from the number of family owned cars, while the average within the Province is 4.9 vehicles per 1,000 persons, the Abbottabad District has 5.5, the Mansehra District 2.8, the Chitral district 0.6, the Dir District 2.5, and the Swat District (including Buner) plus the Malakand District together have 3.3 vehicles per 1,000 persons.

Table 4-3 No. of Vehicles in the Construction Proposed Area (1989)

Province Agency District	Type of Vehicle										Total
	2 wheel	Sedan Jeep	Taxi	Bus	Mini- van	Private Truck	Public Truck	Tractor	Rick- sha	Others	
NWFP Total	49,834	71,102	12,676	12,203	49,834	744	27,244	22,385	6,290	47,561	222,397
[Hazara Agency]	2,997	13,444	3,659	1,330	2,997	141	2,529	1,479	-	20	29,332
1) Abbottabad District	2,519	9,201	2,818	1,061	2,519	120	2,160	918	-	-	21,024
2) Mansehra District	477	4,243	841	269	477	21	369	561	-	20	8,308
3) Kohistan District	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A
[Malakand Agency]	3,027	7,764	2,076	1,969	1,421	36	990	2,930	587	-	20,800
1) Chitral District	166	165	367	4	105	3	11	67	-	-	888
2) Dir District	686	2,749	270	1,607	253	-	276	1,175	-	-	7,016
3) Swat and Malakand District	2,175	4,850	1,439	358	1,063	33	703	1,688	587	-	12,896

(Source: NWFP Government)

4.2 Characteristics of Proposed Bridge Sites

Conditions and circumstances of the selected 11 bridges for basic design are discussed below:

4.2.1 Present and Future Status of the Region

(1) No.1 Narlai Bridge

(a) Status of existing bridge

The existing bridge is 1 meter in width and can only be used by pedestrians or livestock. In addition, it is rather decrepit and obsolete. Therefore, it is highly urgent that a new bridge be considered.

(b) Status of river

Since the Siran River has a broad basin, its discharge is quite large. Furthermore, the topography of this area also causes the river to sometimes overflow its banks.

(c) Population benefiting from the new bridge

Present (1990)	:	200 thousand people
Future (2010)	:	300 thousand people

(d) Vehicular traffic

Present (1990)	:	None		
Future (2010)	:	Passenger car, bus,		
		pick-up trucks	:	about 200 vehicles/day
		Truck	:	about 200 vehicles/day
		<hr/>		
		Total	:	about 400 vehicles/day

(e) Status of road network and the future role of the new bridge

A road from Abbottabad to Haripur is being built on the left bank of the Siran River, while on the right bank a paved road runs from Mansehra to Lassana Wab (a town at the boundary of the Abbottabad District and Mansehra District). From Lassana Wab it is about 14 km to the bridge site via a jeepable gravel road. The bridge will link the Abbottabad ~ Haripur and Mansehra ~ Lassana Wab roads, connecting both sides of

the river one hour away by car from the capital Islamabad. The bridge site is 33 km north of Haripur. However, since the existing bridge cannot handle automobiles, vehicle on the right bank of the river that wants to go to Haripur has to take a detour through Mansehra. The distance of the detour is about 118 km, or almost 85 km longer than the route via the bridge. By constructing a bridge fit for automobiles, a ring road linking up Abbottabad ~ Haripur ~ Narlai ~ Mansehra ~ Abbottabad will be made possible.

(f) Impacts from bridge

(i) Impacts on social welfare

At present, there is no hospital in the benefiting area. If a new bridge is built here, people residing on the right bank of Siran River can go to the nearest hospital in Haripur. Therefore, the bridge will play an important role in making hospital services more accessible.

ii) Economic impacts

The benefiting area has about 200 square km of cultivated land. The main agriculture products are wheat, rice, sugar cane and beans. This area is near Abbottabad, an administrative and agricultural distribution center, and Haripur, an industrial city. It is also adjacent to Islamabad, the capital of Pakistan. The accessibility of this area will be improved by constructing a new bridge fit for automobiles. In this case, the market sphere of crops would be expanded and new farm products (cash crops) could be introduced.

Minerals are also in abundance in this area, which produces marble, soapstone and magnesite. Because the existing bridge cannot be used by motor vehicles, extracted ore on the right bank has to be transported to the Taxila industrial area by taking the detour route of Mansehra ~ Abbottabad. A bridge could reduce transportation time as well as stimulate activities in this area.

Commuting from the right bank of Siran River to the Haripur industrial area located 30 km to the south will also be possible when a new bridge is constructed. This would enable the

Haripur industrial area to make use of the surplus labor on the right bank of the Siran River and to enhance its industrial activities.

(2) No.5 Pashorai Bridge

(a) Status of existing bridge

A pedestrian suspension bridge exists about 1.5 km upstream from the proposed bridge site. Wooden members of this suspension bridge are seriously decayed.

(b) River condition

The Nandia Khawar is a relatively small river having an average width of approximately 40 m. Since the riverbed slope is steep, a large number of boulders and stones are observed in the riverbed.

(c) Population benefiting from the new bridge

Present (1990)	:	50,000
Future (2010)	:	75,000

(d) Vehicular traffic

Present (1990)	:	None
Future (2010)	:	Sedan, bus, pick-up etc. : about 300 vehicle/day
	:	Truck : about 70 vehicle/day
<hr/>		
Total	:	about 370 vehicle/day

(e) Road network and the future role of the new bridge

- Area on the left bank of the Nandia Khawar will be directly connected with KKH (N-35).
- KKH passes steep mountaneous areas and therefore landslides occur very often caused by rainfall.
- KKH passes steep mountainous areas and is likely to be closed by landslides during the rainy season. Therefore, detour road network which leads to the opposite bank side of KKH will be made available if the new bridge is constructed.

(f) Impacts from the new bridge

(i) Social welfare

- New bridge will facilitate the emergency rescue.

(ii) Economic impacts

- The new bridge can provide time and vehicular operation cost savings for transporting agricultural products such as wheat, rice, maize, vegetable etc.

(3) No.7 Panipa Bridge

(a) Status of existing bridge

The existing bridge is a pedestrian suspension bridge with relatively new wooden decks. The Kandia Valley which occupies the right bank of the Indus River produces timber logs and agricultural products. These forestry and agricultural products are firstly transported from the valley to the open space near the existing bridge tower on the right bank. And then they are unloaded to be shifted to small tracker, and then hawling on the suspension bridge to a similar space on the left bank. After that, they are loaded to another truck toward the markets. In this regard, the timber log is mostly cut to small sizes due to restriction in transportation over the Indus River.

(b) River Condition

The proposed new bridge is located in the downstream of the confluence of the Indus and Kandia rivers. The Indus River flows a large volume of water throughout the year, and the mean velocity is about 3.0 m/sec or more.

(c) Population benefiting from the new bridge

Present (1990) : Approximately 30,000

Future (2010) : Approximately 45,000

(d) Vehicular traffic

Present (1990) :	Pick-up, tractor, mini-bus	: about 200 vehicles/day
Future (2010) :	Sedan, bus, pick-up, tractor etc.	: about 200 vehicles/day
	Truck etc.	: about 400 vehicles/day
<hr/>		
	Total	: about 600 vehicles/day

(e) Road network and the future role of the new bridge

- This new bridge will provide a new life-line to the Kandia Valley by way of connecting the valley directly with KKH.
- The northern part of Kohistan district will be connected directly with the northern part of Swat district.

Accordingly, an east-west link road will be completed if this new bridge is constructed.

(f) Impacts from the new bridge

(i) Social welfare

- Facilitate emergency rescues activities
- Since no hospital nor health post exists in Kandia Valley, people in the valley will be possible to use the health post located at Dasu.

(ii) Economic impacts

- Impacts to agriculture
Transportation cost and time for exporting the agricultural products will be remarkably saved.
- Strengthening of forestry industry.
- Future development program of hydropower and other hydro potentiality.

(4) No.11 Choni Bridge

(a) Present status of existing bridge

This bridge facilitate a direct connection between the NCC Road and the southern part of Chitral town. Chitral town is located on the right bank of the Chitral River while the NCC Road passes on the left bank. At present, Chew Bridge, which is a prestressed concrete type bridge completed in 1980, carries vehicles from the NCC Road to Chitral Town. Chew Bridge is located at the northern tip of Chitral town where the width of the river is narrow.

The existing Choni Bridge is located at the southern tip of the town. The existing bridge is a suspension type bridge with wooden stiffening truss which is seriously decayed. The existing bridge is a 99 m long bridge with a carriageway width of 2.0 m.

As for the access road to the northern Chew Bridge, there is a land slide prone stretch along the NCC Road.

This stretch might cause road block once land slide occurs. In this regard, construction of a new bridge at Choni is very essential.

(b) River Condition

The proposed bridge would cross over the Chitral River which is a tributary of the Kabul River flowing into NWFP from Afganistan. River discharge is very large and the construction of piers in water is deemed to be very difficult.

(c) Population Benefiting from the new bridge

Present (1990) : approx. 15,000

Future (2010) : approx. 23,000

Since Chitral town is one of the attractive tourism spots in Pakistan, a large number of foreign tourists such as Japanese and Europeans visit there.

(d) Vehicular traffic

Present (1990) : Mini-bus, pick-up, sedan etc. :
about 1,200 vehicles/day

Future (2010) : Truck, tractor, bus, pick-up, sedan etc. :
about 2,250 vehicles/day

(e) Road network and the future role of the new bridge

- Acts as a detour when traffic blocks occur on NCC Road during the rainy season.
- Relief and dispersal of traffic congestion in Chitral town (cf. future volume is estimated at 2,000 ~ 4,000 vehicles/day, which figure is the largest among the requested 20 bridge sites.)
- Many villages are located on the right bank side of the Chitral River towards down-stream.

People in such villages will be able to access easily to the NCC Road via the new Choni Bridge which is located at the southern tip of Chitral town while the existing Chew bridge is at the northern tip of the town.

(f) Impacts from the new bridge

(i) Social welfare

- Support to emergency rescue activities and other public services.
- Relief of people's fear that Chitral town be isolated in case of traffic blocks on the NCC road during rainy season.

(ii) Economic impacts

- Strengthening of activities in transportation industries by way of improving the existing road network.

(5) No.12 Khal Bridge

(a) Status of existing bridge

The existing bridge is 2.7 meters wide and can only be used by pedestrians, livestock and small vehicles. In addition, it is rather obsolete. Therefore, it is highly urgent that a new bridge be considered. At present, approximately 5 thousand people cross the existing bridge everyday, with a big bazaar located along the NCC Road on the left bank of the Panjkora River and Khal on the right bank.

(b) River condition

The water level of the Panjkora River is about 5 meters higher than its river bed and the flow is fast.

(c) Population benefiting from new bridge

Present	(1990)	:	40 thousand people
Future	(2010)	:	60 thousand people

(d) Traffic

Present	(1990)	:		:	about 100 vehicles/day
Future	(2010)	:	Passenger car, bus,		
			pick-up trucks	:	about 350 vehicles/day
			Truck, tractor	:	about 50 vehicles/day
			Total	:	about 400 vehicles/day

(e) Road network and the future role of the new bridge

The NCC Road runs along the left bank of the Panjkora River, while on the right bank there is a gravel road that runs almost in parallel. The roads are linked by the above-mentioned existing bridge. Khal, the bridge site, is 16 km south of Timargara, the center of administration and commerce for Dir District. Since the existing bridge can be used only by small vehicles, medium- and large-size vehicles going from Khal to Timargara have to use the gravel road on the right bank. This is 15 km and 1.5 hours longer in distance and time, respectively, than the route via the bridge and the NCC road.

By constructing a bridge fit for medium and large-size vehicles, a road network linking Timargara ~ Khal ~ Haya Serai ~ Timargara will be possible for these types of vehicles.

(f) Impacts from bridge

(i) Impacts on Citizen's Welfare

Primary schools are located along the NCC Road. Students who reside on the right bank of the river go to school via the existing bridge. However, the bridge is decrepit and dangerous. Also, the wooden structure of the bridge requires frequent maintenance. Therefore, a new bridge built of long-lasting materials would have a positive effect on both students and other residents.

At present, there is neither a hospital nor clinic in the benefiting area. A new bridge would make it easier for people on the right bank of Panjkora River to go to the hospital in Timargara.

(ii) Economic impacts

The benefiting area has about 16 square km of cultivated land. The main agricultural products are wheat, rice, and sugar cane. Vegetables such as onions and green beans, as well as fruits like oranges and apples, are produced on the left bank along the NCC Road. Production of cash crops has begun to increase in recent years. Because the benefiting area is near Timargara, the center for administration, commerce, and distribution of agricultural produce for Dir District, a new bridge would encourage an expansion in cash crop production that would raise the farmer's income.

There are many shops for selling produce, transportation companies, and restaurants at the bazaar along the NCC Road. A new bridge connecting Khal to these facilities would improve the market access of agricultural produce and enhance the existing distribution network.

(6) No.14 Bukari Khawar Bridge

(a) Status of existing bridge

Samar Bagh ~ Shahi Road crosses the Nullah Bukari River at km 23 of the road, near Bukari Khawar Village about 23 km north-west of Timargara city. The Nullah Bukari River consists of two river channels and about 180 m wide sand bars developed in between these channels. At present, no bridge exists there and trucks and buses crosses the riverbeds. However, light vehicles can hardly pass these riverbeds even in the dry season.

(b) River condition

The Nullah Bukari River flows in two river channels from the upstream far away from the proposed bridge site. In a normal case, water levels of the channels are quite low and heavy vehicles can pass the riverbeds. However, the Nullah Bukari River has strong current and flows riverbed materials like stone once flood takes place. In such flood time, vehicle can no longer cross the river.

(c) Population benefiting from the new bridge

Present (1990) : approx. 50,000

Future (2010) : approx. 75,000

(d) Vehicular traffic

Present (1990) : Truck, 4-wheel-drive-car, tractor, bus :
about 650 vehicles/day

Future (2010) : Truck, bus, sedan, pick-up etc. :
about 950 vehicles/day

(e) Road network and the future role of the new bridge

If the proposed bridge is completed, circumferential road link Timargara ~ Munda ~ Samar Bagh ~ Banda ~ Lal Qila ~ Haya Serai ~ Timargara would serve effectively to the people. At Munda, a trunk road starts toward Peshawar so that traffic dispersal and optimum distribution of traffic would be achieved. As the access road to the bridge, Samar Bagh ~ Shahi Road has a characteristic of trunk road of

the area, construction of the proposed bridge would strengthen the function of the road as a trunk road.

(f) Impacts from the new bridge

(i) Social welfare

- Support to medical services

The beneficial area would be connected with Samar Bagh where hospital exists.

(ii) Economic impacts

- Impacts to agriculture

The beneficial area is located relatively close to the core city Timargara and the transit city of Munda toward Peshawar. In this regard, stable supply of agricultural products to the markets would be achieved. Decrease in bruises of fruits and change to commercial base products from planting of conventional crops would be expected as well. Accordingly, completion of the proposed bridge would be able to strengthen the agriculture in the area.

(7) No. 16 Kaidon Bridge

(a) Present status of the existing bridge

The proposed bridge is located at km 1 of Kaidon ~ Goornai Road, about 60 km away from Saidu. The existing bridge was built about 30 years ago. The existing bridge is a 40 m long wooden bridge with the floor supported by timber cantilever and steel ropes. The existing bridge is decayed seriously.

(b) River condition

The proposed bridge site is located at upstream of the Swat River and velocity of water current is very rapid. Exposure of boulders are observed at the both riverbanks and the river course seems to be stable. Water is transparent and its quality is very good for drinking.

(c) Population benefiting from the new bridge

Present (1990) : approx. 6,000

Future (2010) : approx. 9,000

(d) Vehicular traffic

Present (1990) : Pick-up, tractor etc. : about 90 vehicles/day

Future (2010) : Truck, bus, sedan etc. : about 300 vehicles/day

(e) Road network and the role of the new bridge

- The new bridge would connect the villages on the left bank of the Swat River with the trunk road of Khawaza Khela ~ Kalam Road. Kaidon ~ Goornai Road is the only road in the left bank side providing access to other places such as Saidu Sharif, Peshawar etc. Therefore, the new bridge would be a life-line for the villagers on the left bank side of the Swat River.

- Kaidon ~ Goornai Road would be connected with Kandia Valley Road (Kohistan, refer to No.7 Panipa Bridge). Thus, the significance of this No.16 Kaidon Bridge would be enhanced.

(f) Impacts from the new bridge

(i) Social welfare

- Support to the rescue and evacuation of people on emergency cases

(ii) Economic impacts

- Impacts to agriculture

The new bridge can facilitate stable and efficient transportation of agricultural products on the left bank villages of the Swat River.

(8) No.17 Peer Baba Bridge

(a) Present status of the existing bridges

There are two existing bridges near the proposed new bridge site:

- The pedestrian suspension bridge is seriously decayed and can no longer carry any load.
- A new concrete bridge is now under construction by local participation. This new bridge is being built in order to temporarily solve the local people's demand. All the structural elements are made up of temporary ones (refer to Memorandum).

(b) River conditions

As the river bed slope is very gentle, flow velocity is relatively low and sandy materials are deposited in the river bed.

(c) Population benefiting from the new bridge

Present (1990) : approx. 15,000

Future (2010) : approx. 23,000

(d) Vehicular traffic

Present (1990) : Truck, bus, tractor, 4-wheel-drive :
about 250 vehicles/day

Future (2010) : Truck, bus, sedan, pick-up etc. :
about 500 vehicles/day

(e) Road network and the role of the new bridge

- The new bridge would complete the circumferential road link of Jewar ~ Peer Baba ~ Dagar ~ Jewar.
- There is another road, the Jewar ~ Dagar, which is a land slide prone road during the rainy season. Therefore the circumferential road can be utilized as a detour road of the Jewar ~ Dagar Road.

(f) Impacts from the new bridge

(i) Social welfare

- Support toward educational services

People living in Malakpur, where no school exists, can use the new bridge to commute to the school in Peer Baba.

- Support to medical services

There is no hospital and health post in the influenced area, and therefore the completion of the new bridge would facilitate the public services of the hospital at Malakand.

(ii) Economic impacts

- Impacts to agriculture

The new bridge can facilitate stable and efficient transportation of agricultural products.

(9) No.18 Jahazoon Dak Bridge

(a) Status of existing bridge

The existing bridge is a steel concrete beam bridge with 3 m in width and 60.8 m in length. It is capable of handling light weight vehicular traffic. However, since the bridge is low in height, it will be submerged under water about 50 centimeters during the flood.

(b) River conditions

The Sakhakot River has a small basin and the discharge is normally small. However, due to the topographical factors, the discharge can be large at times.

(c) Population benefiting from new bridge

Present (1990) : 22 thousand people
Future (2010) : 33 thousand people

(d) Vehicular traffic

Present (1990) : Almost all are pick-up trucks : about 200 vehicles/day

Future (2010) : Passenger car, bus,
pick-up trucks : about 350 vehicles/day
Truck : about 50 vehicles/day
Total : about 400 vehicles/day

(e) Road network and future role of new bridge

The Jahazoon Dak ~ Ghawar road, which links up with the NCC Road, runs from the left bank of Sakhakot River to Jahazoon on the right bank. The new bridge would therefore play an important role in this route.

Takht Bhai is about 18 kilometers south of the benefiting area. It is an important transportation center connected by trunk roads and railways with Peshawar (the provincial capital) and Mardan and Nowshera (well developed industrial area). It is a city that developed around a railway station. It is also a city that represents the Gandara art and the ruins of ancient Buddhist temples can still be seen. Its main industries are transportation and tourism. The distance from Jahazoon to Takht Bhai by the NCC Road without using the proposed bridge is 40 kilometers. This will become only 18 kilometers, or a reduction of about 20 kilometers, by using the new bridge.

By constructing the new bridge, a ring road linking up Takht Bhai ~ Jahazoon Dak ~ Takht Bhai would become possible. In addition, the bridge would also act as a substitute for the NCC Road when it is unusable.

(f) Impacts from the new bridge

(i) Impacts on social welfare

At present, there is no hospital in the benefiting area and no medical clinic on either the right or left bank. Therefore, the new bridge would have a positive effect on improving access to medical care by accessing the right bank of the Siran River to Takht Bhai where there are hospitals.

(ii) Economic impacts

The benefiting area has about 70 km² of cultivated land and produces sugar cane as its main agricultural product. The sugar cane is transported to a factory in Takht Bhai. The new bridge will cut down the distance to Takht Bhai and improve transport efficiency, as well as provide a stable route for transporting sugar cane even during the rainy season. In addition to sugar cane, corn, wheat, and onions are also grown in this area, and there is a move towards increasing the production of cash crops. The benefiting area is very close to Peshawar, Nowshera and Mardan cities with large economy and populations. Therefore, the bridge will encourage this area to make full use of these geographically close and attractive markets to expand its cash crop production, which will raise the overall income of the area.

(10) No.19 Totakan Bridge

(a) Status of existing bridge

The existing bridge is a wooden floor type pedestrian bridge, but can be used by light weight vehicles. It is 64 meters in length.

(b) River conditions

Of the 5 bridges in Phase I, this bridge will straddle the Swat River, the biggest of the rivers to be crossed. Its basin covers more than a half of Swat District and has a large discharge and rapid flow.

(c) Population benefiting from the new bridge

Present (1990) : 35 thousand people

Future (2010) : 53 thousand people

(d) Vehicular traffic

Present (1990) : : about 50 vehicles/day

Future (2010) : Passenger car, bus,

pick-up trucks : about 15 vehicles/day

Truck : about 50 vehicles/day

Total : about 200 vehicles/day

(e) Road network and future role of the new bridge

The Batkhela ~ Totakan road, which branches from the NCC Road at Batkhela's Malakand Agency, runs on the left bank of Swat river, while on the right bank the Chakdarra ~ Kolanga road runs parallel to the river. The two roads will be connected by the new bridge.

There is a bridge for motor vehicles that crosses the Swat River at Chakdarra, 20 km upstream and east of the new bridge site. By constructing the new bridge, the two roads between Chakdarra and Totakan on the left and right banks could supplement each other, and form a useful network. Then, it would be possible to manipulate regional traffic and to use the roads to substitute for each other when one of them is impassable for some reason.

(f) Impacts from bridge

(i) Impacts on social welfare

At present, there is neither a hospital in the benefiting area nor a medical clinic on the right or left banks of the Swat River. The proposed bridge would provide access to the people residing on the right bank to the nearest hospital in Malakand.

(ii) Economic impacts

The benefiting area produces wheat, rice, corn and sugar cane as its main farm products, but it is in a remote area far from a big market. However, with heavy trucks being available and reductions in transportation time achievable by construction of the new bridge, distribution of the area's agricultural produce to markets would be improved.

(11) No.20 Sakhakot Bridge

(a) Status of existing bridge

The existing bridge is a 43 m long reinforced concrete slab bridge. At present, 6 thousand people per day, many livestock and light weight vehicles cross the existing bridge. It is considered a very urgent matter to build a new bridge since the existing one is severely dilapidated and, moreover, will become totally submerged during floods.

(b) Status of river

The existing bridge site is located at the upstream of Br. No. 18 (Jahazoon Dak Bridge). The width of the river is narrow and rocks are visible in the valley. The Sakhakot River normally has a small discharge, but, it also bursts out a large discharge at times.

(c) Population benefiting from new bridge

Present (1990) : 30 thousand people

Future (2010) : 45 thousand people

(d) Vehicular traffic

Present (1990) : : about 150 vehicles/day

Future (2010) : Passenger car, bus,
pick-up trucks : about 450 vehicles/day

Truck : about 50 vehicles/day

Total : about 500 vehicles/day

(e) Road network and the future role of the new bridge

Sakhakot Village road separates from the NCC Road, a trunk road in the NWFP. It crosses the river from the left to the right bank via the bridge. It is a vital road that links Sakhakot Village to Sakhakot Bazaar and also supports the access to public facilities in this area.

Takht Bhai is about 22 kilometers south of the benefiting area. It is an important transportation center, connected by trunk roads and railways with Peshawar (the provincial capital) and Mardan and Nowshera (well developed industrial areas). It is a city that developed around the railway station. It is a city that represents the ruins of ancient Buddhist temples of Gandhara art, and also where transportation and tourism are the main industries. The distance from the benefiting area to Takht Bhai without utilizing the planned bridge is 50 kilometers. However, it will be 22 kilometers, a reduction of about 30 kilometers when the planned bridge is utilized. (the same impacts as Br. No. 18)

By constructing the new bridge, a ring road linking up Takht Bhai ~ (NCC Road) ~ Sakhakot ~ (Jahazoon Dak ~ Gawar road) ~ Takht Bhai would become possible. In addition, the bridge would also act as a

substitute for the NCC Road when it is damaged. (the same impacts as Br. No. 18)

(f) Impacts from bridge

(i) Impacts on social welfare

The bridge plays an important role in supporting the primary education, because education facilities are found in Sakhakot Village and Sakhakot Bazaar.

At present, there is neither hospital nor rural health center on either the right or left bank in the benefiting area. Therefore, the new bridge would have a positive effect on improving medical care by accessing the right bank of the Siran River to Takht Bhai where there are hospitals.

(ii) Economic impacts

The benefiting area have about 40 square km of cultivable land. As Jahazoon Dak (the benefiting area of Br. No. 18), it's main agriculture products are wheat, sugar cane and many other crops. The benefiting area is near Peshawar and Nowshera, a large consumption area. Therefore, the bridge will encourage this area to make full use of these geographically close and attractive markets to expand its cash crop production, which will raise the overall income of the area.

There are many transportation enterprises that deal with farm products and consumption goods at Sakhakot Bazaar along the NCC Road. The new bridge will directly link Sakhakot to the NCC road. Therefore, the bridge will improve the market access of agriculture products and enhance the existing distribution network.

4.2.2 Topography of Proposed Bridge Sites

Longitudes, latitudes and altitudes of the 11 bridges are listed in Table 4-4.

Table 4-4 Lat., Long. & Altitude of 11 Bridges

Bridge Name	Latitude	Longitude	Altitude	River Name
No.1 Narlai Bridge	34°11' N	72°58' E	620 m	Siran R.
No.5 Pashorai Bridge	34°42' N	72°59' E	880 m	Nandia Khawar
No.7 Panipa Bridge	35°25' N	73°12' E	990 m	Indus R.
No.11 Choni Bridge	35°09' N	71°44' E	1,450 m	Chitral R.
No.12 Khal Bridge	34°54' N	71°59' E	930 m	Panjhora R.
No.14 Bukari Khawar Bridge	34°59' N	71°40' E	1,140 m	Nulla Bukari
No.16 Kaidon Bridge	35°15' N	72°35' E	1,530 m	Swat R.
No.17 Peer Baba Bridge	34°37' N	72°27' E	810 m	Malakpur Khawar
No.18 Jahazoon Dak Bridge	34°26' N	71°53' E	450 m	Sakhakot R.
No.19 Totakan Bridge	34°38' N	71°48' E	660 m	Swat R.
No.20 Sakhakot Bridge	34°27' N	71°54' E	480 m	Sakhakot R.

Notes) - Latitude and Longitude: based on GPS
 - Altitude: based on altimeter

General features of the respective bridge sites are outlined as follows:

(1) No.1 Narlai Bridge

The topography of the area is shown in Fig. 4.2. The characteristics of the topography are not similar in the upper and lower streams, where L is the dividing point in the Siran river. Limestone distribution is bulging out towards the Siran river at point L. The lower stream beyond L has a width of about 50 m, and its cross section can be described as V shaped valley. The main features of the lower stream are the steep slope and the upper terrace (T1). In contrast to this, the upper stream from L has a width of 230 m including a flood plain. The cross section here is wider and has a gentle slope. Characteristic is the lower terrace (T2) and a fan.

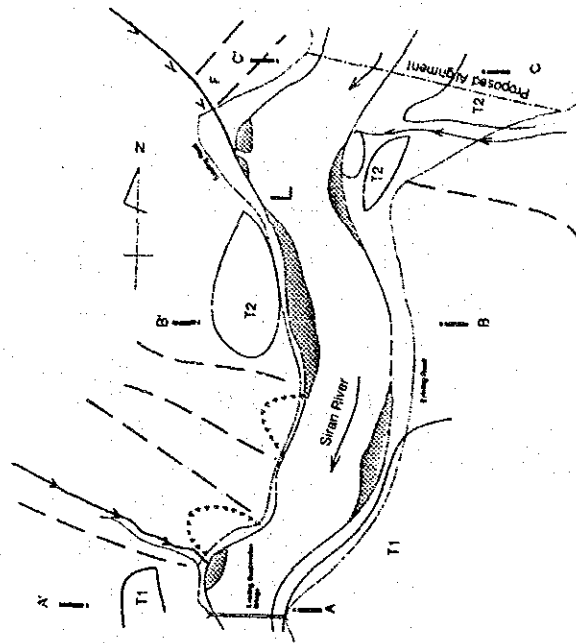


Fig. 4.2 Topography of Bridge No.1

Slope along the lower stream of the Siran river from the L is steep and rocky. The gradient is about 45-50 degrees. Vegetation on the slope is shrubby. In ravine slopes, rock debris are deposited, and gradual creeping can be found. Two terraces (T1, T2) can be found along the lower stream of Siran river. The upper terrace is located on the right bank with a height of 20-25 m from the river-bed. The long terrace is 8-10 m from the river-bed and located in the same side of the river. The neck point of the erosion front of the river is recognized by the Pind Gali road surface (Refers to Fig. 4.3(a), (b)). Existing bridge is located in the rocky slope about 3-4 m downwards from the Pind Gali road.

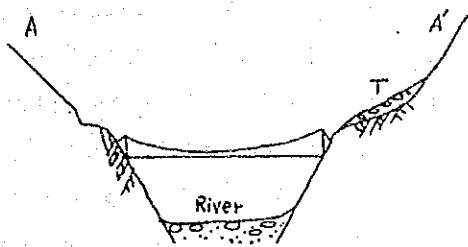


Fig.4.3(a)

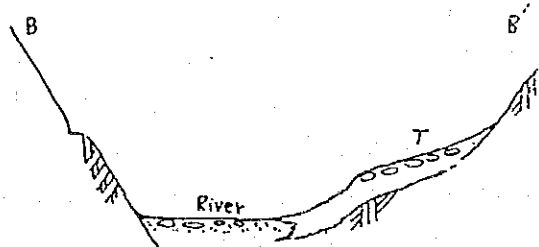


Fig.4.3(b)

The upper stream from L has a gentle slope. The right bank of the Siran river shows characteristic of a terrace and the left bank is fan. The height of the terrace from the Siran river bed is about 5 m, and the height of the surface is equivalent to T2 of the lower stream from the L. Fan is formed by a sub-stream of Siran river, which has a stream length of 1.6 km and watershed area of about 1.0 km². Two tall trees and shrubby vegetation can be found in this area. Therefore, it can be estimated that this fan is comparatively secure. The fan is about 3 m from the Siran river bed and has an inclination of about 3.5% towards the river. Soil deposit around L is confined to a smaller area due to erosion control works resulting a well established sedimentary plain. The new bridge is planned to be constructed about 100 m away from L in the upper stream where the width of the river is about 60 m. Both sides of the bridge is located on the above said river terrace and fan.

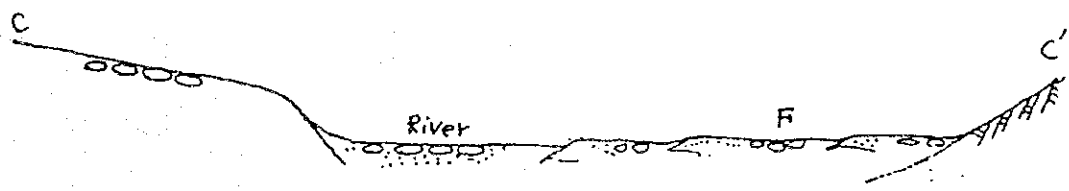


Fig. 4.4

(2) No.5 Pashorai Bridge

This site is located 15 km to the south-west of Thakot bridge on the KKH and at km -171 on the KKH. The Nandia Khawar river at this site has a width of 100 m and flows meandering to the north with terraced geographical features on the left bank and mountainous geographical features on the right bank. The terraced geographical features on the left bank forms a low (L), medium (M) and high (H) terrace. The low and medium terrace forms a crescent shaped curve caused by erosion of the Nandia Khawar River. The elevation height of the terrace is about 12 m for the high terrace and about 5 m for the medium and low terraces. The high terrace has an elevation of about 30 m from the water level of the Nandia Khawar River. The characteristic feature is that the medium terrace has a slope of approximately 3~5 degrees. The right bank side forms a steep slope of about 40 degrees extending from the mountainous region to a high terrace and sloping down to the river. The KKH is located on the right bank of the Nandia Khawar River running along the midway of the mountain side slope and the slope from the highway down to the river side has a steep inclination of about 40 degrees. At the present, there are only bridges for use by pedestrians and the new bridge is proposed to be constructed at the elevation of the low terrace on the left bank at the location where the low terrace is projecting out to the east.

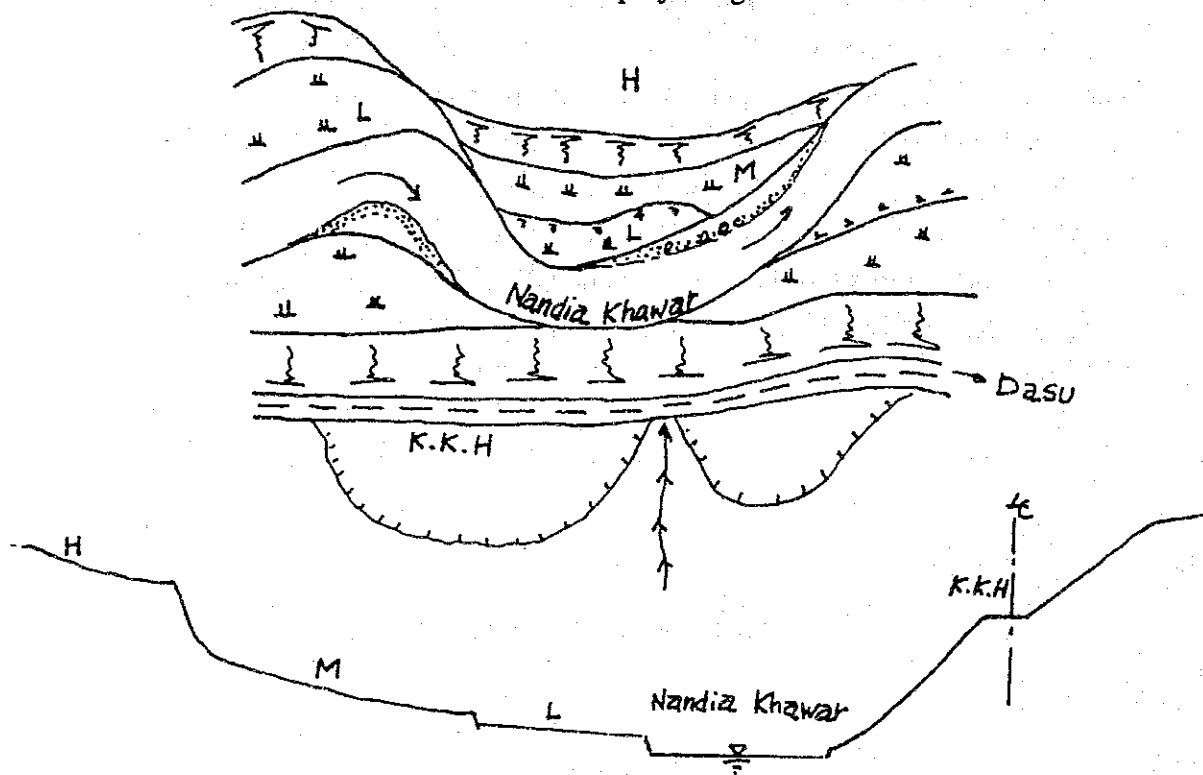


Fig. 4.5 General Geographical Features of No.5 Pashorai Bridge

(3) No.7 Panipa Bridge

This site is located about 18 km north from Nasce on the KKH at the confluence of the Kandia River and the Indus River. The KKH at this site runs along the left bank of the Indus River. The Kandia Valley Road runs along the Indus River after crossing the KKH, makes a U-turn and approaches the existing suspension bridge, cross the 175 m Indus River and runs along the right bank of the river towards Karang. The geographical features at this site is characterized by the V-shaped configuration of the rock bed formed by the corrosion caused by the Indus River. The left bank forms a steep slope of about 30~40 degrees and the face of the slope is thinly covered by a coat of weathered rock debris produced on the rock slope surface above the KKH. As there is no sign of any vegetation over the weathered rock debris, it may be considered to be due to the cause of creeping phenomenon. The river bank of the Indus River below the Kandia Valley Road shows exposure of the rock surface caused by erosion during the long years. The right bank forms a steep slope of about 70 degrees of rock surface. From about 50 m above the Kandia Valley Road, the steep slope transforms to a gentle slope, and there are weathered rock debris accumulated on the slope. Further, there are weathered rock debris accumulated along the Kandia Valley Road on the right bank of the Indus River produced from the mountain side. The new bridge is proposed to be constructed about 30 m downstream from the existing bridge site.

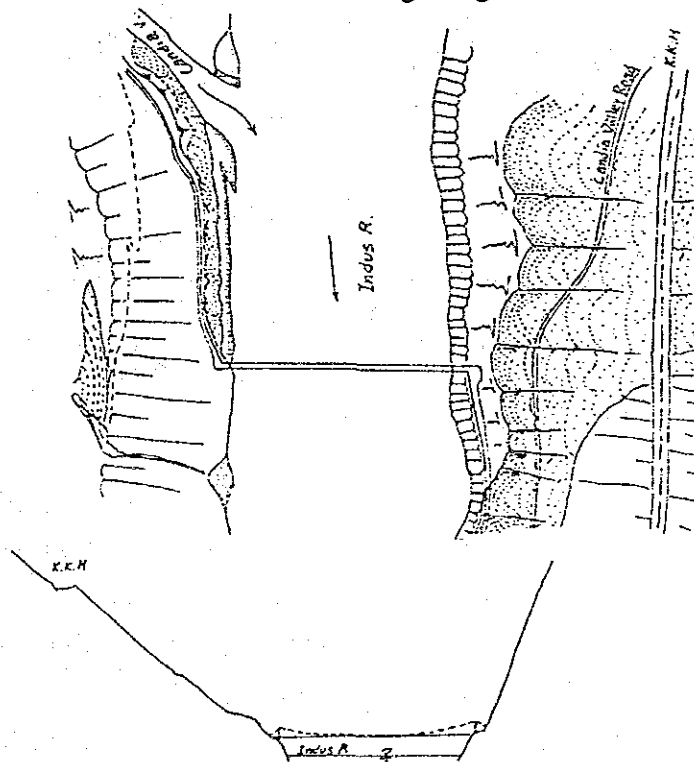


Fig. 4.6 General Geographical Features of No.7 Panipa Bridge

(4) No.11 Choni Bridge

This site is located in the vicinity of Chitral Scout, south of the Chitral City, and about a 100 m to the south of the confluence of Chitral River and Mohlen Gole Nullah. The Chitral river at this site has a width of about 100 m. The geographical features in this region can be characterized by the terraced topography (T) formed by the Chitral River and the fan-shaped topography (F) formed by the Mohlen Gole Nullah. The left bank of the Chitral River is formed by a vast area of terraces. These terraces continue from near the NCC road to the Chitral River and have a width of about 300 m. There are also villages on the terraces. On the right bank of the Chitral River, there is the fan-shaped Mohlen Gole Nullah which forms a gentle sloped plain. The Mohlen Gole Nullah is flooded several times a year and therefore new accumulation of sand and gravel can be witnessed over the fan-shaped ground. The new bridge site is located about 40 m upstream of the existing bridge connecting the right bank terrace and the extreme southern end of the fan-shaped Nullah.

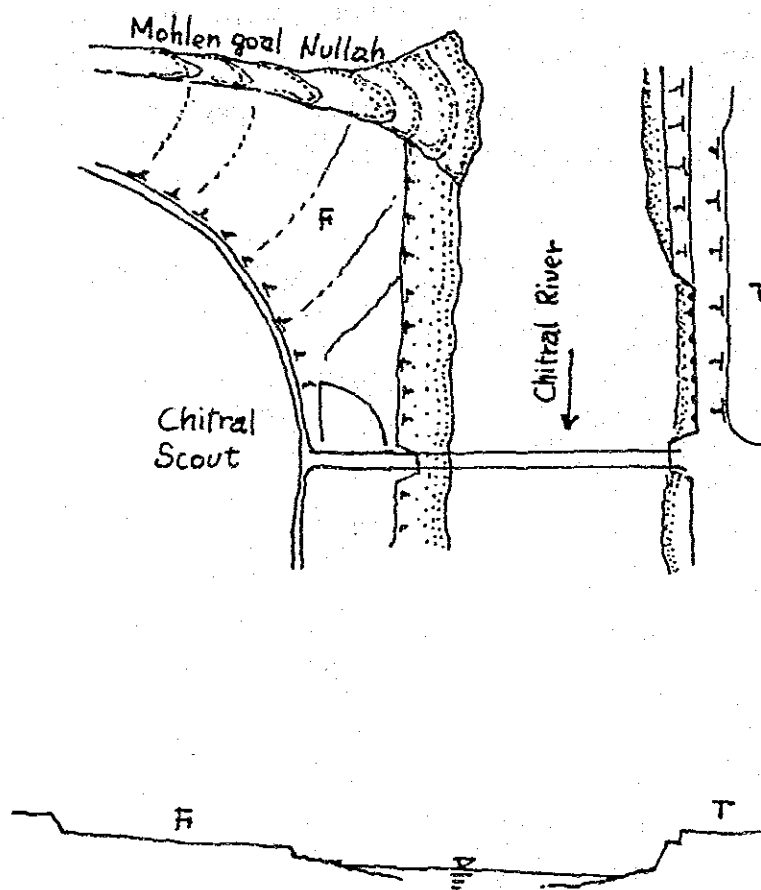


Fig. 4.7 General Geographical Features of Choni Bridge

(5) No.12 Khal Bridge

The Panjkora river originates from 40 km north of Kalkot, and merge with two other rivers at 10 km north-west of Gandigar. One of these river flows from Lowari Pass and, the other from Binshal. The river runs through Gandigar, Wari and changes its course at about 3 km to Khal. With this turn it expands its width and the extent of the flood plain.

The existing bridge which is required to be replaced is situated near Khal where the width of the Panjkora is about 80 m, and the flood plain extends more than 500 m. The proposed bridge is planned to be constructed about 200 m downstream from the existing bridge. The proposed construction site and the geographical characteristics are shown in Fig. 4.8. The existing river terrace and the flood plain are the main topographical features of the proposed site.

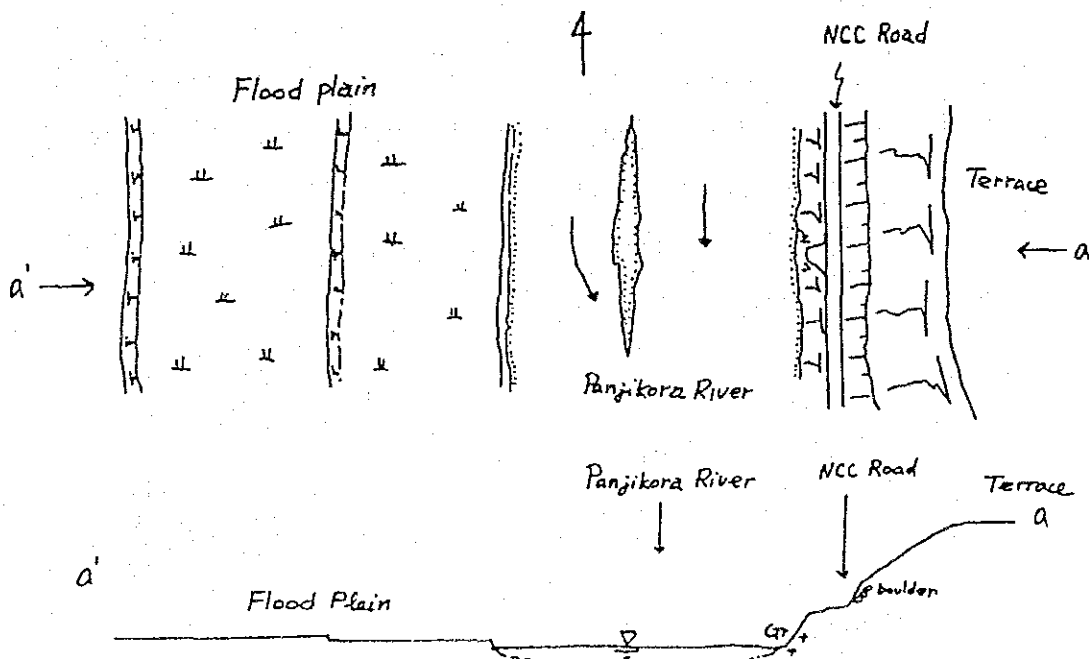


Fig. 4.8 Topography at Bridge No.12

The flood plain is virtually flat and consists of very flat areas with 1-2 m difference in height. These are actively used as crop lands. The Panjkora flows in the south-west direction at the east end of the flood plain. A mountain is situated at the west end of the flood plain where the slope from the plain to the summit is gentle. Granite can be found in this mountainous area. Inhabitants of the area are concentrated on the hill slope where large numbers of houses have been built. At the east end of the flood plain, the river terrace extends to about 300-400 m. The terrace is about 30 m, above

the river bed and used as housing area of the people. The NCC road is passing through the terrace slope, which is about 5~10 m above the river bed and runs along the Panjkora river. The bridge will be built at a height where it would be usable even during a flood.

(6) No.14 Bukari Khawar Bridge

This site is located about 23 km north-east of Timarpara. The Nullah Bukari River at this site has a width of about 200 m. However, at the present, the water flows only near the river embankment at both ends as shown in the sketch below. The geographical features at this site forms a terraced topography (T) on both banks of the river and has an elevation of about 15 m from the Nullah Bukari river level. The Nullah Bukari River is being fully utilized for land use taking advantage of the large width of the river. The Samar Bagh – Shahi road detours around the cultivated area in a U-shape in order to secure the cross section slope of the road as shown in the sketch below. The new bridges will be constructed over the 2 water ways at both ends of the river by utilizing the terrace and the cultivated river bed.

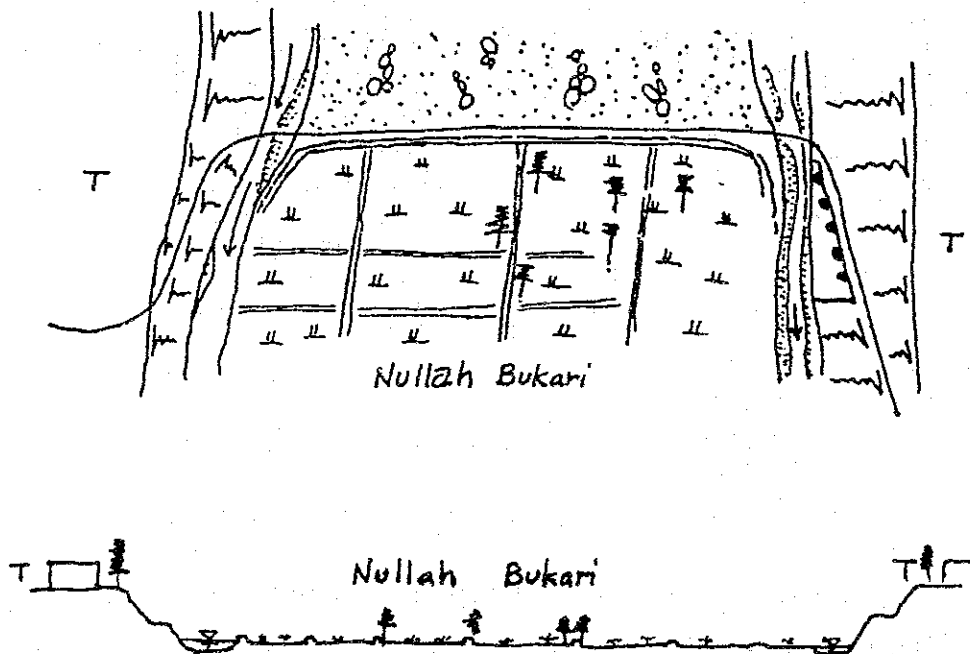


Fig. 4.9 General Geographical Features of the No.14 Bukari Khawar Bridge

(7) No.16 Kaidon Bridge

This site is located about 16 km north of Madyan. The Swat River at this site runs south in a straight line and the Bahrain Kalam Road runs on the right bank of the Swat River. The geographical features of this site is characterized by the terraced terrain on the right bank and the land slide terrain on the left bank. The terraced terrain lies about 12 m above the Bahrain Kalam Road, and forms an oblong shape with a width of about 100 m and length of about 500 m. Weathered rock debris are seen accumulated over the terrace, produces from the mountainous slope on the east. The land slide terrain (L.S) on the left bank comprises a large area with a width of about 300 m and depth of about 200 m. This land slide is a land slide of weathered rock forming a plateau when viewed from the geographical feature and although there are slight signs of partial collapsing of rocks at the end portion, it is deemed to be stabilized as a whole. The Kaidon-Goonai Road branches off from the Bahrain Kalam Road at Kaidon, crosses the Swat River and runs through the midst of the land slide area forming a large curve. The present bridge crosses the Swat River about 1-2 m below the elevation of the Bahrain Kalam Road. Therefore, the footing of the bridge is located at the north end of the land slide portion on the left bank and the terrace end on the right bank of the river. The new bridge is proposed a little upstream of the existing bridge.

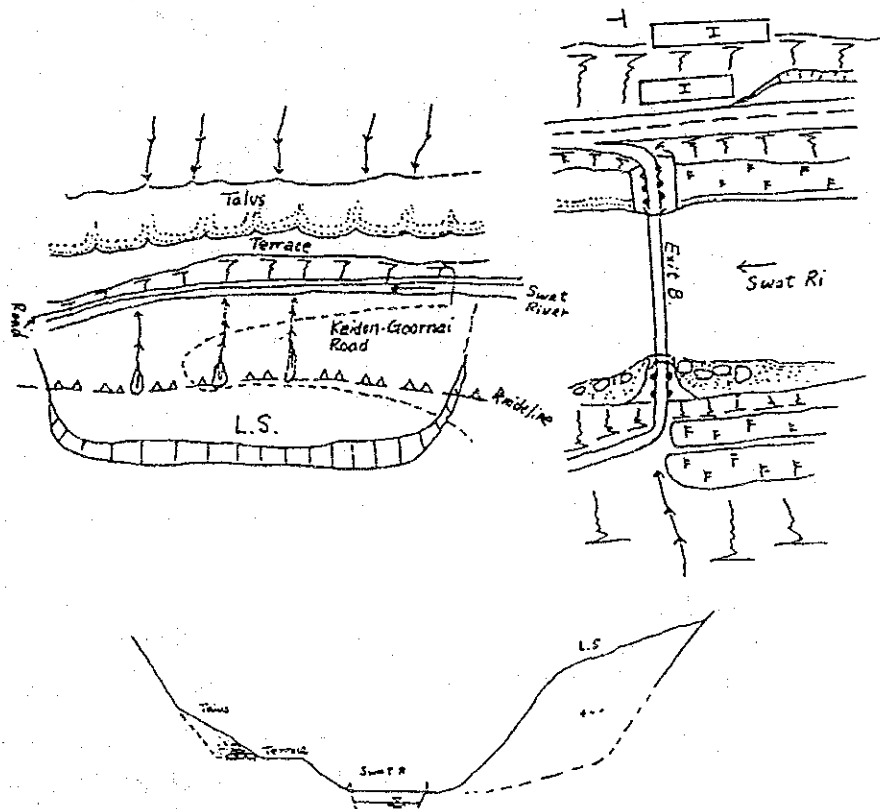


Fig. 4.10 General Geographical Features of the No.16 Kaidon Bridge

(8) No.17 Peer Baba Bridge

This site is located about 40 km north-west of Saidu. Here the Malakpur Khawar River largely curves to the east and there is a residential area on the right bank and cultivated farm area on the left bank. The geographical feature of this site is divided into two separate areas by the Malakpur Khawar River; the right bank being of terraced terrain and the left bank of flooded plain. Therefore, the Malakpur Khawar River is obliged to flow on the east side of the river (the terrace side). The terraced terrain gently slopes toward the north and the elevation difference with the flooded plain is about 3 m. At the present, there is only a pedestrian bridge in the region. The Peer Baba Malakpur Road crosses the Malakpur Khawar river diagonally as shown in the sketch below. The new bridge will be constructed at the same location where the Peer Baba Malakpur Road crosses the river directly.

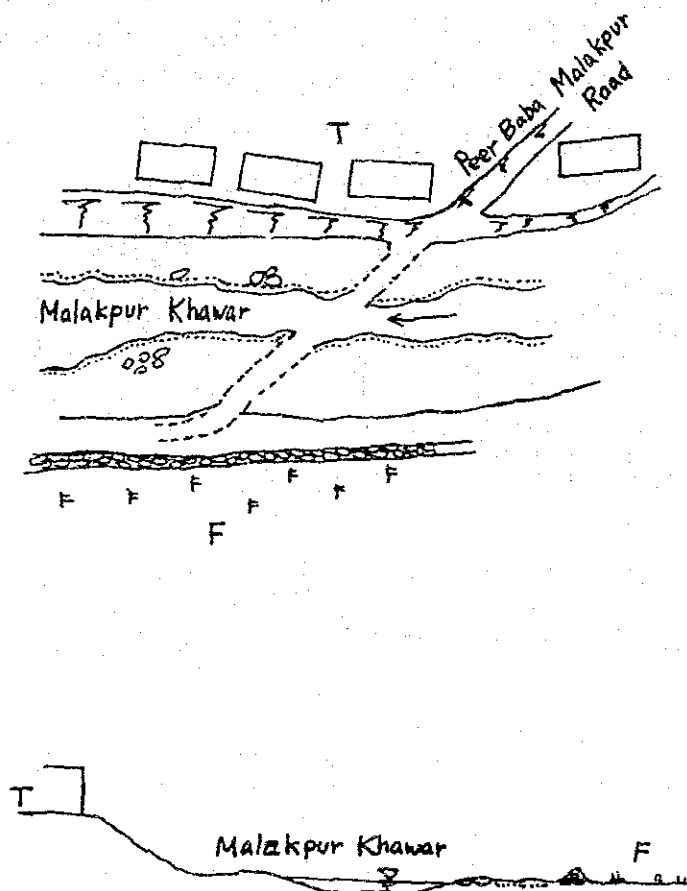


Fig. 4.11 General Geographical Features of the No.17 Peer Baba Bridge