PD-ABD-234

PAKISTAN
RURAL ROADS PROJECT
(391-0480)

REPORT ON

RECURRENT MAINTENANCE COSTS
INSTITUTIONAL ANALYSIS
FINANCIAL RESOURCES ANALYSIS

PREPARED UNDER

IQC PDC-0000-I-12-3082-00
WORK ORDER NO. (12)

TO

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
AND
MINISTRY OF LOCAL GOVERNMENT AND RURAL DEVELOPMENT

BY

LOUIS BERGER INTERNATIONAL INC.,
EAST ORANGE, NEW JERSEY, U.S.A.
AND
ISLAMABAD, PAKISTAN

MARCH 1985

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Islamabad

March 25, 1985

Agency for International Development,
USAID Mission to Pakistan,
Islamabad,
Pakistan.

Attention: Mr. Alejandro Sundermann,
Chief, Office of Engineering

Re: Rural Roads Project Paper -
Interim Report (Project No. 391-0480)

Dear Mr. Sundermann:

It is with pleasure that we submit this final version of the report, which has been prepared under IQC PDC-0000-1-12-3082, Work Order No. 12, dated Dec. 13, 1984.

This Final Report reflects the comments on the Preliminary report presented at the review meeting on March 10 and those contained in your memorandum of the same date.

We are indebted to the many officials in Islamabad, the provinces and the districts with whom we have conferred, especially to those in the Ministry of Local Government and Rural Development and in USAID. They all gave their time generously and were most cooperative.

We trust that you will find this report fully satisfactory.

Sincerely yours,

F. Heywood Marsh

F. Heywood Marsh
Team Leader

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GLOSSARY

AADT	Average Annual Daily Traffic on a road
AASHTO	American Association of State Highway and Transportation Officials
AD	Assistant Director
ADT	Average Daily Traffic on a road
ADB	Asian Development Bank
ADP	Annual Development Program. These are one-year public sector development programs prepared by both the federal and provincial governments.
AID	See USAID
Bajri	Aggregate (stone or brick)
Beldar	Laborer
Billion	One thousand million. Written 1,000,000,000
btk	Billion ton-kilometres
C&W	Provincial Department of Communications and Works
CBU	Completely Built Up (imported vehicle ready for the road)
CED	Central Excise Duty
CDWP	Central Development Working Party
CKD	Completely Knocked Down (imported vehicle in kit form to be assembled in Pakistan)
Consultant	"The Consultant" refers to Louis Berger International, Inc.
Crore	A term meaning 100 lakhs or 10 million. Written 1,00,00,000
Commissioner	The administrative/executive head of a Division

Current Fiscal Year	In this report, the 1984-85 Fiscal Year
DBST	Double Bituminous Surface Treatment
Deputy Commissioner (DC)	The administrative/executive head of a District, now becoming more of an advisory position
DHV	Design Hourly Volume. The volume of traffic for which a road is designed
District	A geographical sub-division, headed by a deputy commissioner. Several districts form a division
District Council	A locally elected government body controlling the district. In recent years, the Chairman of the District Council has assumed many of the former responsibilities of the Deputy Commissioner
Division	A sub-unit of a province containing several districts
EAD	Economic Affairs Division
ECNEC	Executive Committee of the National Economic Council
ESA	Equivalent Standard Axles
FATA	Federally Administered Tribal Areas
FBS	Federal Bureau of Statistics
Federal	Applying to the Central Government in Islamabad
FEC	Foreign Exchange Component (Currency)
FRREC	Federal Rural Roads and Engineering Cell. The technical organization of the Ministry of Local Government and Rural Development responsible for rural roads, water supply and allied matters.
Fiscal Year (FY)	The Government of Pakistan's Fiscal Year is from July 1 of one year to June 30 of the next, and is designated by showing both years, e.g. 1983-84

GOP	Government of Pakistan
HSD	High Speed Diesel (fuel)
Katcha Road	An unpaved (earth) road
Lakh	One hundred thousand, written 1,00,000
LDC	Lower Division Clerk
LGRD	Local Government and Rural Development. A ministry in the federal government; a department in each provincial government except Baluchistan.
LGRDA	Local Government, Rural Development and Agrovilles. The name of the LGRD department in Baluchistan
MES	Military Engineering Services
Metalled	Paved with bituminous or asphalt carpet surface. Also called "Pacca"
Metric System	Pakistan is converting to the metric system. Most distances are measured in kilometres (km), and mileposts along most roads have been replaced by kilometre markers. However, dimensions such as widths of road are still given in feet and thicknesses of pavement courses in inches. This report follows this current practice
MC	Municipal Committee
MV	Motor Vehicle
NEC	National Economic Council
NHB	National Highway Board
NLC	National Logistics Cell
NTRC	National Transport Research Centre
NWFP	North West Frontier Province
P & D	Planning & Development Departments in the provincial governments

Pacca road	A metalled or paved road
Paved	A road surfaced with bituminous treatment or asphalt carpet
PC-1	A GOP document defining the requirements for a development project
Petrol	Gasoline
PID	Project Identification document (USAID)
POL	Petroleum, Oil and Lubricants
Province	One of the four major self-governing regions of Pakistan
Rupees (Rs)	The Pakistani monetary unit. In March 1985, Rs 16.0 = US$ 1.00
RDP	Rural Development Program. The district council block grants program in provinces other than NWFP
RWP	Rural Works Program, the district council block grants program in NWFP
SCUG	Sind Council Unified Grades
SDO	Sub-Divisional Officer
Shingle (road)	A gravel, stone or brick surfaced road, without blacktopping
Taluka	A sub-division of a district in Sind, equivalent to a tehsil
TBST	Triple Bituminous Surface Treatment
USAID	United States Agency for International Development
Union Council	The smallest elective unit of government
VOC	Vehicle Operating Costs
Zila	District

Chapter 1

INTRODUCTION

1.1 GEOGRAPHIC BACKGROUND

The Islamic Republic of Pakistan covers a land area of approximately 307,000 square miles (796,000 square kilometres). It has a varied topography, consisting of the Indus basin in the central part of the country with the Hindu Kush and Himalayas to the north, arid mountains and plateaus to the southwest and the Thar desert to the southeast (Figure 1.1*).

Figure 1.2 clearly shows the low rainfall (less than five inches) in the hot deserts of Baluchistan, increasing towards the north with the wet zone (over 30 inches annually) being where the first ranges of mountains occur. The headwaters of the major rivers of Pakistan lie in this mountainous area.

The country is a federation of four provinces (Punjab, Sind, North West Frontier Province, and Baluchistan), Azad Jammu and Kashmir, the Northern Areas, seven Federally Administered Tribal Areas (FATA) and the Federal Territory of Islamabad.

The basic political unit is the Union Council, there being 3,416 in the four provinces. Members of these councils are elected by the population of the country's 45,000 villages. The next larger unit is the District which, for many purposes, is the basic administrative unit. There are a total of 87 districts and agencies, of which 72 are in the four provinces:

-	Punjab	27 districts,	2,241	union councils
-	Sind	15 "	561	"
-	NWFP	13 "	438	"
-	Baluchistan	17 "	176	"

The provinces and districts are shown in Figure 1.3. Although this map was revised in the last two or three years, some new districts that have come into being are not shown. These are:-

Sind	Karachi district is now divided into:	Karachi West
		Karachi East
		Karachi South

* Figures 1.1 through 1.4 have been extracted from Oxford Atlas for Pakistan (Ref 1). A list of references is contained in Appendix 1.1.

NWFP	Kohat district is now divided into:	Kohat Karak
Baluchistan	Sibi district is now divided into:	Sibi Dera Bugti

Figure 1.4 shows the principal rail, road and air links in the country.

There are about 95 million persons in the country, with some 70% residing in the rural areas. Table 1.1 shows the 1981 population figures for the four provinces.

Table 1.1

POPULATION AND AREA BY PROVINCE

	Area (km^2)	Population (000's)	Pop. Density (Persons/km^2)
Punjab	206,251	47,292	229
Sind	140,914	19,029	135
NWFP	74,521	11,061	148
Baluchistan	347,190	4,332	12

Source: 1981 census figures, as quoted in Pakistan Statistical Yearbook, 1984 (Ref. 2)

The same source shows the total population of Pakistan, according to the 1981 census, as 84,253,644, with an estimated population at 1 July 1983 of 90,480,030, indicating a growth rate in excess of 3% a year.

Appendix 1.2 shows the urban and rural populations in each district.

1.2 THE AGREEMENT

This report was prepared under an agreement between the United States Agency for International Development and Louis Berger International, Inc. (the Consultant). The basic contract was IQC No.PDC-0000-I-12-3082-00, Work Order No. (12). The title of the task to be performed under this Work Order was Project Design Fund - Rural Roads Project Paper - Interim Report (Project No. 391-0470) (Ref. 3).

The Project Paper referred to in the work order is for a proposed program of maintenance assistance to the Government of Pakistan. It is anticipated that a sum of $40 million will be expended over a period of, tentatively, four years. Most of this money will be for equipment purchase and actual maintenance operations with the remainder allocated to institutional strengthening, training, administration etc. The Project Identification Document (PID) (Ref. 4) tentatively recommends that the program cover nine districts. Hereinafter this program will be referred to as the "AID Project"

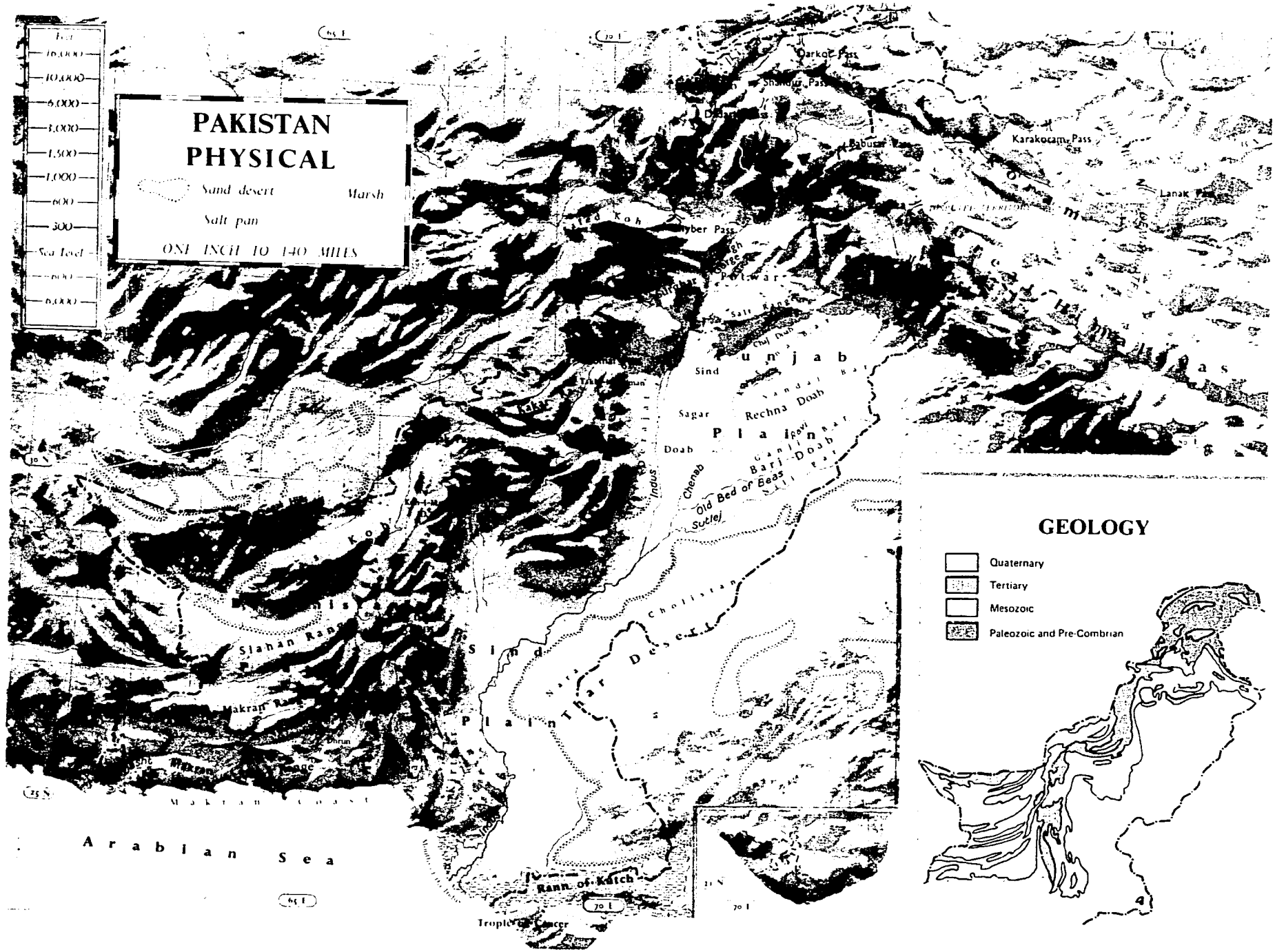
PAKISTAN
PHYSICAL
Sand desert
Marsh
Salt pan
ONE INCH TO 140 MILES
Feet
10,000
6,000
3,000
1,500
1,000
600
300
Sea level
Karakoram Pass
Lanak Pass
Khyber Pass
Sind
Sagar Doab
Rechna Doab
Bari Doab
Old Bed of Beas
Sutlej
Chenab
Indus
Cholistan
Thar Desert
Sind Plain
Siahan Range
Makran Range
Makran Coast
Arabian Sea
Rann of Kutch
Tropic of Cancer
GEOLOGY
Quaternary
Tertiary
Mesozoic
Paleozoic and Pre-Cambrian

Figure 1.1

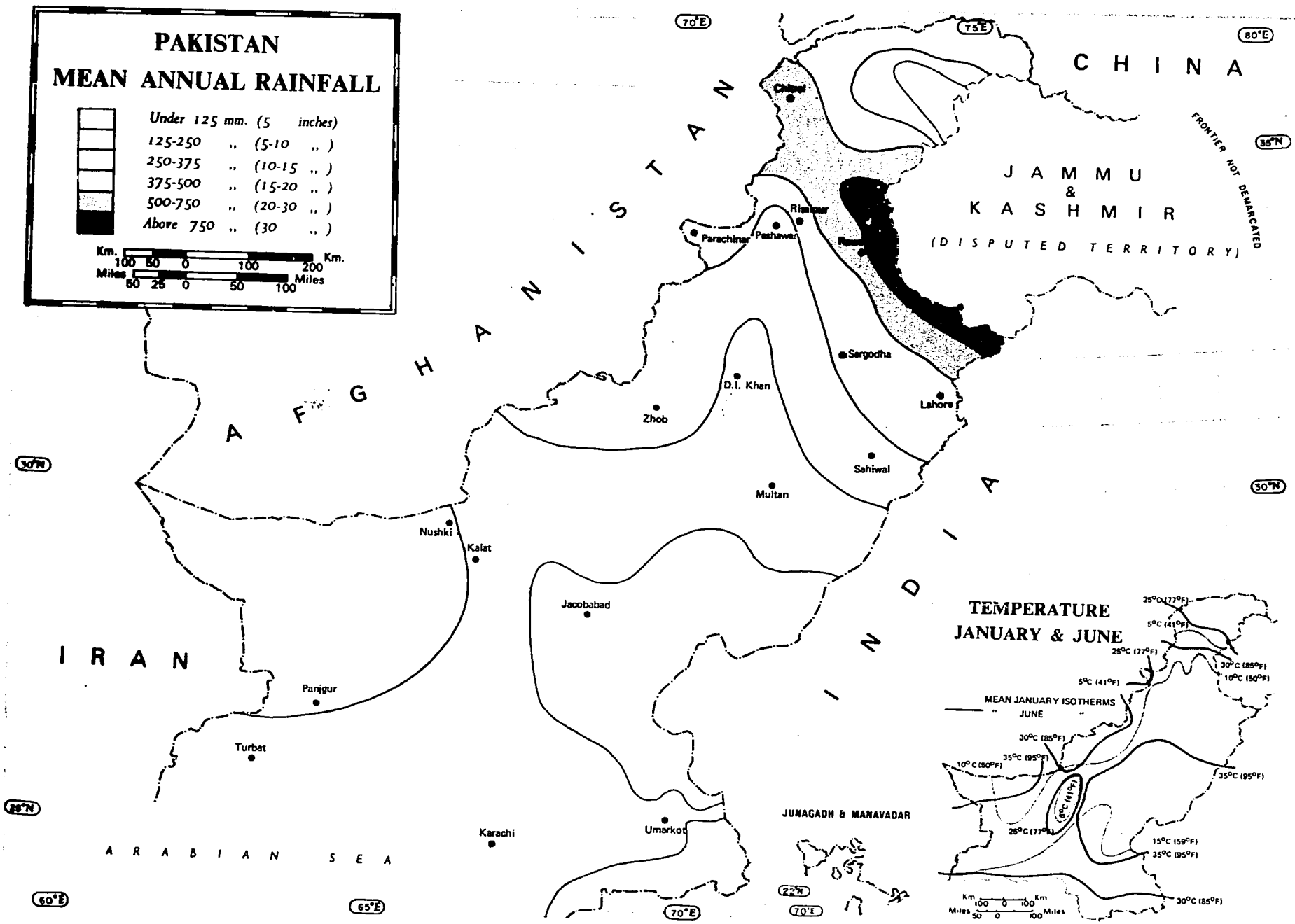

Figure 1.2

1-4

-4-

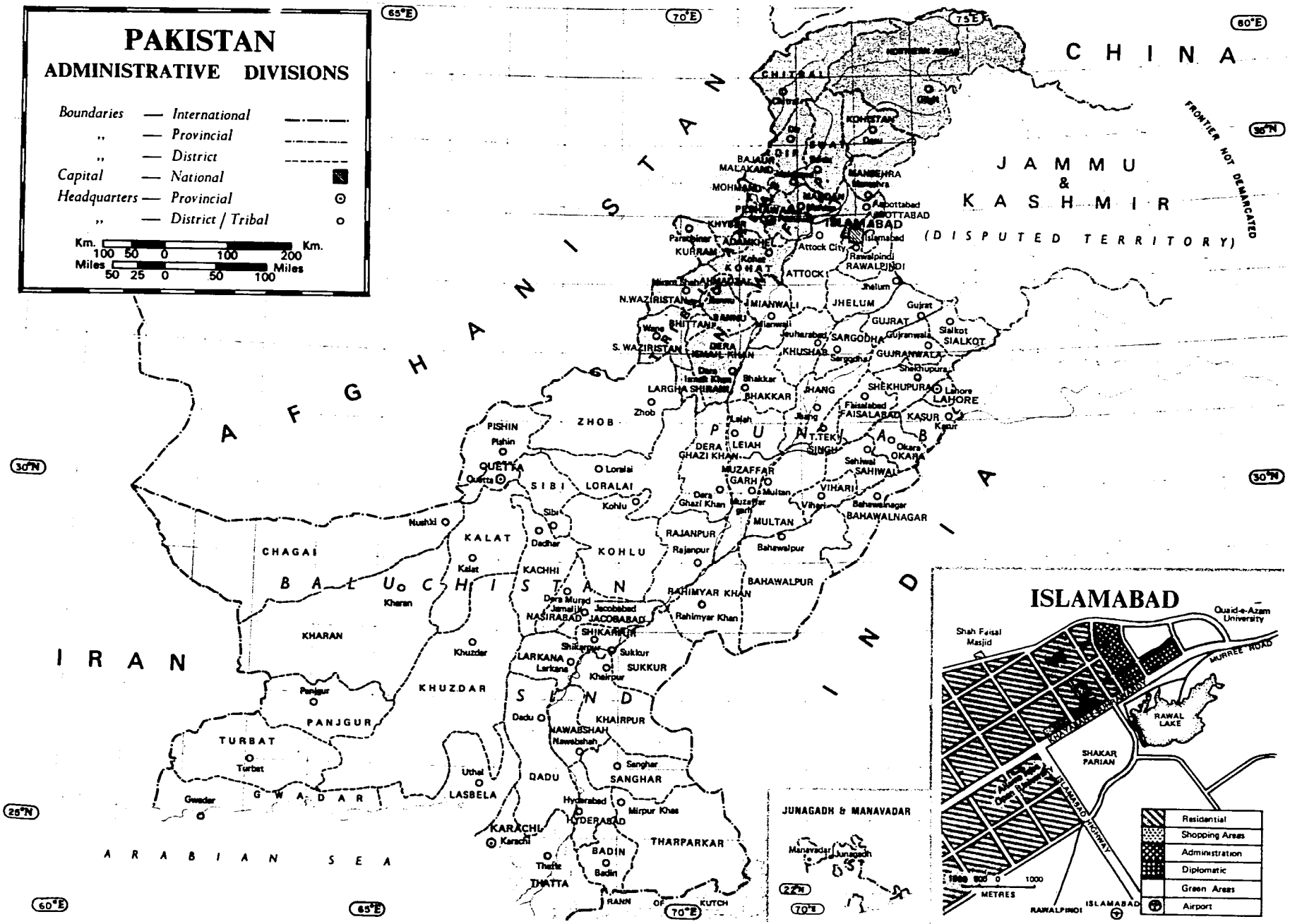
PAKISTAN
ADMINISTRATIVE DIVISIONS
Boundaries — International
,, — Provincial
,, — District
Capital — National
Headquarters — Provincial
,, — District / Tribal
Km. 100 50 0 100 200 Km.
Miles 50 25 0 50 100 Miles
CHINA
JAMMU & KASHMIR
(DISPUTED TERRITORY)
FRONTIER NOT DEMARCATED
AFGHANISTAN
IRAN
INDIA
ARABIAN SEA
ISLAMABAD
RAWALPINDI
ATTOCK
JHELUM
GUJRAT
SIALKOT
SARGODHA
KHUSHAB
MIANWALI
BHAKKAR
JHANG
SHEKHUPURA
LAHORE
FAISALABAD
KASUR
OKARA
SAHIWAL
VEHARI
BAHAWALNAGAR
MULTAN
BAHAWALPUR
RAHIMYAR KHAN
DERA GHAZI KHAN
MUZAFFAR GARH
RAJANPUR
LEIAH
TOBA TEK SINGH
ZHOB
PISHIN
QUETTA
SIBI
LORALAI
KOHLU
KALAT
CHAGAI
KHARAN
KHUZDAR
PANJGUR
TURBAT
GWADAR
LASBELA
KACHHI
JACOBABAD
SHIKARPUR
SUKKUR
KHAIRPUR
NAWABSHAH
SANGHAR
QADU
HYDERABAD
BADIN
THARPARKAR
KARACHI
THATTA
RANN OF KUTCH
BALUCHISTAN
SIND
PUNJAB
KOHISTAN
MANSEHRA
ABBOTTABAD
KOHAT
BANNU
DERA ISMAIL KHAN
S. WAZIRISTAN
N. WAZIRISTAN
JUNAGADH & MANAVADAR
Manavadar
Junagadh
ISLAMABAD
Shah Faisal Masjid
Quaid-e-Azam University
MURREE ROAD
RAWAL LAKE
SHAKAR PARIAN
ISLAMABAD HIGHWAY
METRES
RAWALPINDI
Residential
Shopping Areas
Administration
Diplomatic
Green Areas
Airport

Figure 1.3

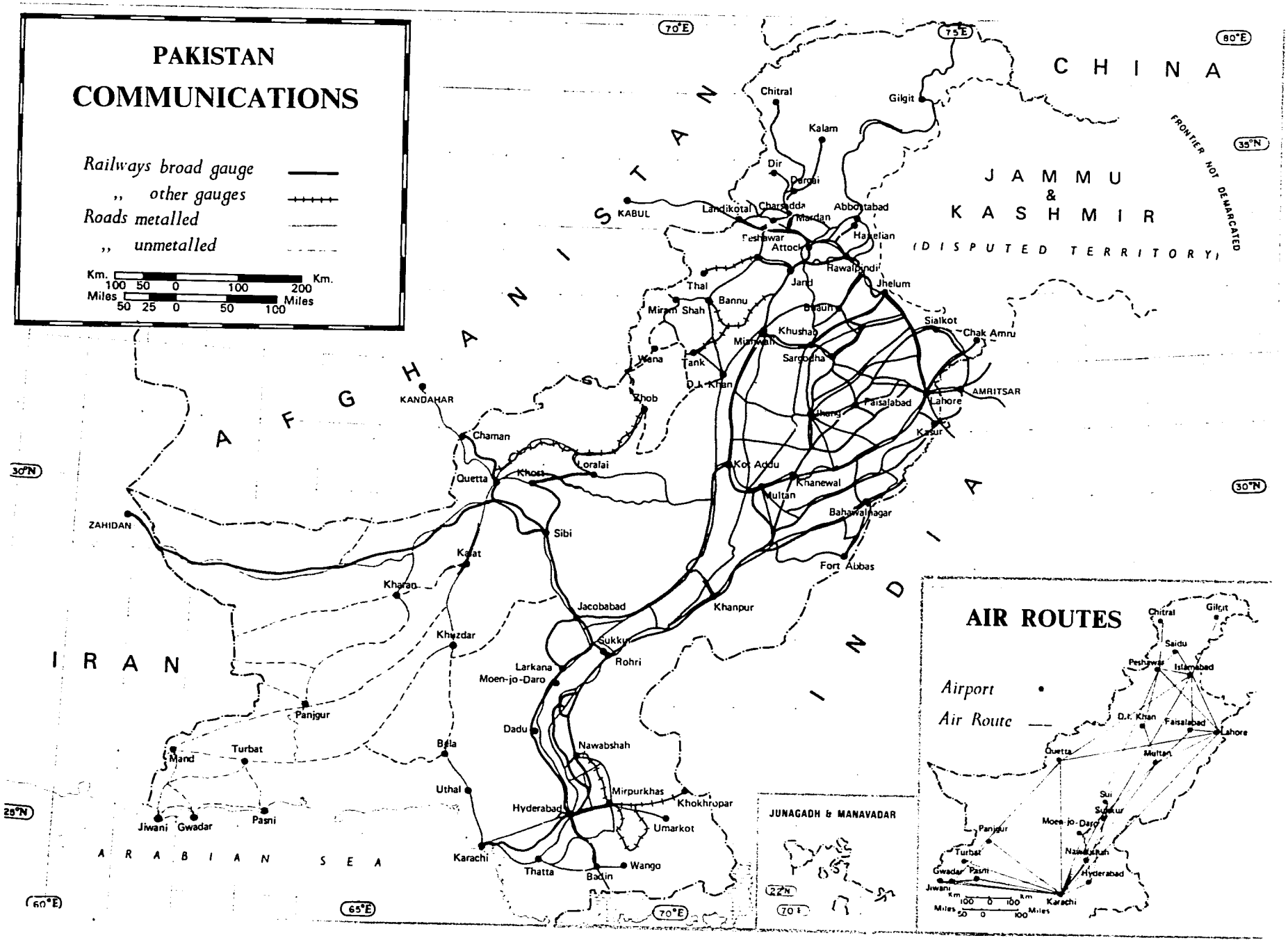
PAKISTAN
COMMUNICATIONS
Railways broad gauge
,, other gauges
Roads metalled
,, unmetalled
Km. 100 50 0 100 200 Km.
Miles 50 25 0 50 100 Miles
CHINA
JAMMU & KASHMIR
(DISPUTED TERRITORY)
FRONTIER NOT DEMARCATED
AFGHANISTAN
IRAN
INDIA
ARABIAN SEA
KABUL
KANDAHAR
ZAHIDAN
Chitral
Gilgit
Kalam
Dir
Dargai
Landikotal
Charsadda
Mardan
Peshawar
Attock
Abbottabad
Haripur
Rawalpindi
Jhelum
Jand
Thal
Bannu
Mirian Shah
Wana
Tank
D.I. Khan
Zhob
Bhaun
Khushab
Mianwali
Sargodha
Sialkot
Chak Amru
AMRITSAR
Lahore
Faisalabad
Jhang
Kasur
Chaman
Quetta
Khost
Loralai
Kot Addu
Multan
Khanewal
Bahawalnagar
Fort Abbas
Sibi
Kalat
Kharan
Khanpur
Jacobabad
Khuzdar
Sukkur
Rohri
Larkana
Moen-jo-Daro
Panjgur
Dadu
Nawabshah
Bela
Turbat
Mand
Uthal
Mirpurkhas
Khokhropar
Hyderabad
Umarkot
Jiwani
Gwadar
Pasni
Karachi
Thatta
Badin
Wango
60°E
65°E
70°E
75°E
80°E
35°N
30°N
25°N
JUNAGADH & MANAVADAR
22°N
70°E
AIR ROUTES
Airport
Air Route
Chitral
Gilgit
Saidu
Peshawar
Islamabad
D.I. Khan
Faisalabad
Lahore
Quetta
Multan
Sui
Sukkur
Moen-jo-Daro
Panjgur
Turbat
Nawabshah
Gwadar
Pasni
Hyderabad
Jiwani
Karachi
Km 100 0 100 Km
Miles 50 0 100 Miles

Figure 1.4

1.2.1 Summary of the Terms of Reference

Article III - Statement of Work of the Work Order (Ref. 3) states, in part:

"The contractor shall provide a team of three consultants consisting of an institutional/public administration specialist; budget analyst and engineer who shall perform the following tasks:

1. Prepare estimates of the annual recurrent costs of maintaining in Pakistan the existing District road network for the design life. These estimates must be based on costs per kilometer for different types of roads under varying conditions. Typical sample(s) of the 84 districts should be studied to obtain data for the estimates.

2. Prepare estimates of the need for reconstruction in order to put the roads into a maintainable condition.

3. Prepare estimates of the financial resources that are available for road construction and maintenance and an analysis of revenue sources that could be collected at District level.

4. Describe and analyze the capability and capacity of institutions at the District level responsible for the construction and maintenance of roads and their relationship with institutions at the Division, Province and Federal levels. Identify Federal, Provincial, Divisional and District institutional relationships, authority and capacity for rural road development including maintenance. Outline the typical basic administrative structure for rural roads construction and maintenance with an analysis of equipment, manpower and training needs for improved operations.

5. Prepare preliminary assessment of Federal, Provincial and District changes needed to improve rural roads maintenance.

6. Describe annual flow of funds from Federal and Provincial administrative levels down to the District level for rural roads development, with an analysis of timeliness of availability of funds".

Article IV calls for the submittal of four copies of the draft report and 20 copies of the final report, which is to be submitted by March 31, 1985.

1.2.2 Clarification of the Terms of Reference

In a meeting on January 7, 1985 between AID and the Consultant, it was agreed that, for a number of reasons, work on the study would be confined to the four provinces, thus excluding the Tribal areas and other extra-provincial territories. As noted in section 1.1 there are 72 districts in the four provinces. All references in this report are, therefore, limited to the four provinces, unless specifically stated otherwise.

Although it is not specifically mentioned in the work order, AID requested the Consultant to make suggestions on how to select the nine districts for the Proposed AID Program.

In an exchange of memoranda dated Feb 6 and 11, it was agreed that:

- due to a dearth of information, country-wide totals for maintenance and rehabilitation will be indicative only.

- life cycle costs will be on a financial basis. However, one example will be presented showing the economic effects of vehicle operating costs.

1.3 ORGANIZATION OF THE REPORT

The report is organized on the decimal system of chapter headings and subheadings.

The convention used in listing the provinces is that used in many publications, that is, in descending order of population, i.e. Punjab, Sind, NWFP and Baluchistan.

After the conventional letter of transmittal and tables of contents, a glossary explains the abbreviations and terms used in the report.

Chapter 1. A brief description of Pakistan is followed by a section on the work order that constitutes the agreement between AID and the Consultant for this study and report. The Terms of Reference are summarized for convenience. The chapter closes with a section on the procedures adopted, including a listing of the officials visited.

Chapters 2, 3 and 4 contain the body of the report. Chapter 2 covers road maintenance. First, the nation's road system is described. The next section discusses the present maintenance practices. The chapter concludes with a summary of the field investigations conducted by the Consultant.

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In Chapter 3, the institutional aspects of road maintenance are examined at the federal, provincial and district levels. There is a description of the responsibilities and activities of each relevant visit, usually accompanied by an organization chart.

Chapter 4 discusses the financial arrangements for road maintenance, tracing the flow from the federal government through the provincial governments to the district councils. The receipts of each level of government are identified.

In Chapter 5, the unit costs are developed for maintenance, rehabilitation and betterments. Seven combinations of surface widths and types have been selected as being typical of the great majority of district roads. Life cycle costs for the various alternative combinations of rehabilitation and maintenance are presented.

Chapter 6 contains the analysis of the findings of the study. Separate sections deal with the institutional, technical and financial aspects.

Chapter 7 contains the conclusions of the study and the recommendations for future policy and action.

An executive summary was considered. In a multi-volume report, such a summary is virtually essential. In a comparatively short one volume report an executive summary is not so essential, and was discarded in favor of presenting the reader with the logical sequence of background-investigations -analyses-conclusions-recommendations.

Following the final chapter are the appendices. These contain material that either is too extensive to incorporate in a chapter or else is inappropriate in the text, such as the first appendix, which is a list of references.

Appendices are also numbered with a decimal system, the first digit indicates the chapter to which the appendix refers, and the second digits are numbered sequentially for that chapter's appendices.

1.4 PROCEDURES ADOPTED

Team Leader F. Heywood Marsh, PE, arrived in Islamabad on January 7, 1985. Principal Highway Engineer John H. Whipple, PE, and Budget Analyst Richard J. Wyatt arrived on January 10.

The team was provided office space in the building occupied by the Federal Rural Roads and Engineering Cell of the Ministry of Local Government and Rural Development. The Project Director for the Ministry was Colonel Raza Hussein Shah.

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A considerable amount of literature was researched, including AID documents, statistical reports, budgets, inventories of roads, and material from many other sources. Where appropriate, reference is made to source material in this report.

Although the literature research was rewarding up to a certain point, it was found highly desirable to talk with a wide range of officials in order to understand better the magnitude of the maintenance task at the district level.

In the first place, those authorities in Islamabad concerned with road development were interviewed. The provincial capitals were considered vital for the collection of data.

It was essential to visit some of the districts, not only to talk with the people who actually manage and conduct the maintenance of roads, but to inspect a small sample of these roads in order to appreciate some of the problems and difficulties facing government. There was some discussion with AID and MLGRD as to which districts to visit. It was agreed that a reasonable sample would be eight - two in each province. The ministry requested the provinces to submit lists of primarily districts, may be five or six in each province. It was agreed that the selection of the districts to be sampled shall be determined as follows:-

- they should be selected from the province's lists of "priority" districts.
- the two districts in each province should have different characteristics e.g. flat and hilly; lightly and densety populated; suburban and rural.
- the selection should not be influenced by the need to choose nine districts for the proposed AID program.

The Consultant's proposed schedule of visits was presented to AID and FRREC on January 14.

Unfortunately, there was one unusual factor that was not considered as it was not realized that it would have such an effect on this program of interviews. The Government of Pakistan called for elections to the National Assembly on February 25 and for the provincial assemblies on February 28. Preparation for these elections involved a substantial amount of extra work throughout the governmental structure and there were difficulties in arranging all the meetings that the Consultant requested.

The Consultant actually visited three provincial headquarters and six districts, with at least one being in each province. The Consultant believes the completion of the full schedule requested by the Consultant would have provided a better base for the conclusion reached.

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In each of the districts visited, an effort was made to inspect as many "typical" kilometres of its network as possible within the time constraints of the study. On these field trips the project engineer was accompanied by either the district engineer or his designee. Of primary interest were the characteristics of road width, surface type and condition, drainage effectiveness and materials availability. Data concerning the amount of recent routine and periodic maintenance attention were recorded. The purpose was to ascertain as clear a picture as possible of the rehabilitation needs required to bring the roads up to a maintainable standard and the reasons therefore.

The information gathered in this manner served, in part, for the technical analyses in developing country-wide, per-kilometre unit costs (see chapter 5).

The following sections list the principal officials and others interviewed. In most cases, these persons had senior members of their staff present.

1.4.1 Islamabad

- Ministry of Local Government and Rural Development
  The Minister

  Joint Secretary, Rural Development Wing

  Project Director, Federal Rural Roads and Engineering Cell

- Ministry of Planning and Development
  National Transport Research Centre
  Rural Roads Consultant

  Assistant Chief of Statistics

- Central Board of Revenue
  2nd Secretary, Customs and Excise

- Ministry of Communications
  Director General, National Highway Board

1.4.2 Punjab

- Finance Department, Province of Punjab
  Vehicle Registration Dept, Islamabad

  Excise and Taxation Officer

1.4.2.1 Rawalpindi District

On February 8, the team visited Rawalpindi district offices and met with:

- District Council Chairman
- Chief Officer
- District Engineer

An inspection of selected roads followed the meeting.

1.4.2.2 Jhelum District

The team visited Jhelum district offices on February 8 and met with:

- Chief Officer of the district
- District Engineer

This meeting was followed by an inspection of typical metalled and katcha roads.

1.4.3. Sind

On February 20, the following provincial officials were interviewed:

- Director General, Design, Department of Communications and Works
- Director, Technical, Rural Development, Department of LGRD

1.4.3.1 Jacobabad District

The following district officials were interviewed on February 18

- Chief Officer
- District Engineer
- Accounts Officer

An inspection of a brick soled road was conducted the next day.

1.4.3.2 Sukkur District

The Consultant met with district personnel on February 19

- Chief Officer
- District Engineer
- SDO'S

Following the meeting, a typical katcha road was examined.

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1.4.4 North West Frontier Province

On January 21, the following officials of the NWFP provincial government were interviewed by members of the team:

- Additional Chief Secretary, Planning and Development
- Director General, Department of Local Government and Rural Development
- Chief Engineer, Department of Communications and Works

1.4.4.1 Abbottabad District

The team visited Abbottabad on February 3 and met with:

- Assistant Director, Department of Local Government and Rural Development
- District Engineer, Abbottabad District

An inspection of a typical gravel mountain road followed the meeting.

1.4.5 Baluchistan

On a visit to Quetta on February 17, the team met with

- Chief, Section of Planning and Development, Department of Planning and Development

1.4.5.1 Pishin District

On February 17, the team met with

- District Commissioner
- Assistant Director, LGRDA
- Chief Officer
- District Engineer

Following the meeting, an existing katcha road and a new shingle road were examined.

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Chapter 2

ROAD MAINTENANCE INVESTIGATION

This chapter describes the nation-wide road networks, with special attention paid to the district roads, and then cites and comments on the current road maintenance practices.

2.1 DESCRIPTION OF ROAD SYSTEM

Pakistan's network of roads is composed of four general categories: national, provincial, district and others. The latter comprises the roads assigned to the municipalities; the FATA roads, those of Azad Kashmir and the northern areas; canal roads (about 1,100 km open to the public); and roads developed by the military, forestry and agriculture departments, etc.

2.1.1 The Network, Nation-wide

The 1980 figures from NTRC (Ref. 5) for national and provincial roads, broken down by province and type, and expressed in kilometres, are as follows:

PROVINCE	UNPAVED	PAVED	TOTAL
Punjab	172	11,583	11,755
Sind	1,975	5,997	7,972
NWFP	3,700	3,543	7,243
Baluchistan	8,841	3,019	11,860
Totals	14,688	24,142	38,830

Roads under the jurisdiction of the district councils, broken down in the same manner and expressed in kilometres, have the following totals:

PROVINCE	UNPAVED	PAVED	TOTAL
Punjab	16,823	3,856	20,679
Sind	13,172	193	13,365
NWFP	3,871	178	4,049
Baluchistan	4,596	99	4,695
Totals	38,462	4,326	42,788

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Roads under the jurisdiction of the municipalities, broken down in the same manner and expressed in kilometres, have the following totals:

PROVINCE	UNPAVED	PAVED	TOTAL
Punjab	606	3,854	4,460
Sind	304	3,253	3,557
NWFP	78	199	277
Baluchistan	85	560	560
Totals	1,073	8,165	9,238

In the "others" category, there are the following totals:

FATA	1,967	1,956	3,923
Azad Kashmir	1,653	826	2,479
Northern Areas	2,288	0	2,288
Canal Roads (1)	1,127	0	1,127
Totals	7,035	2,782	9,817

(1) Canal roads open to the public only

Country Totals	61,258	39,415	100,673

These totals do not include an estimated 7,000 kms of roads under military jurisdiction or canal roads not open to the public.

2.1.2 Roads Covered in This Study

Table 2.1, "ROAD LENGTHS UNDER MAINTENANCE RESPONSIBILITY OF DISTRICT COUNCILS," gives detailed data on lengths of roads by type and pavement width, for each province, division and district. The information comes from the NTRC publication, "Transport Bulletin (Supplementary No. 1)," dated November 1981 (Ref. 5), and represents the situation as of the end of 1980. The total district network is made up of earthen roads (81%), gravel roads (11%) and paved roads (8%). Of the latter, 92% are narrow (up to 12 feet in paved width, and usually only ten feet), constructed on an 18-to-24-foot formation.

More current (1983) information is available from the same source (NTRC); however, when comparing these later figures with those for 1980, many become suspect. The higher credibility given to the 1980 data stems from the fact that they are recorded in conjunction with similar information from previous years (usually from 1970). However, even with this background, some figures are obviously incorrect. For example, the recorded 1970 data for Gujranwala District indicates a total of 11.27 kilometres (6.44 earthen, 4.83 paved). In 1974 the total was 4.83

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Table 2.1
ROAD LENGTH UNDER MAINTENANCE
RESPONSIBILITY OF DISTRICT COUNCILS
YEAR 1980
(IN ROUNDED KILOMETRES)

PROVINCE / DIVISION / DISTRICT	LOW TYPE			HIGH TYPE					
	EARTH	GRAVEL	TOTALS	UP to 12'-0"	12'-1" to 18'-0"	18'-1" to 24'-0"	24'-1" to 30'-0"	30'-1" to 36'-0"	TOTALS
PUNJAB									
RAWALPINDI									
ATTOCK	1450	0	1450	121	0	0	0	0	121
RAWALPINDI	722	11	733	95	0	0	0	0	95
JHELUM	1025	0	1025	383	0	0	0	0	383
SARGODHA									
MIANWALI	812	0	812	122	0	0	0	0	122
BHAKKAR	0	0	0	0	0	0	0	0	0
KHUSHAB	0	0	0	0	0	0	0	0	0
SARAGODHA	1347	0	1347	348	0	0	0	0	348
GUJRANWALA									
GUJRAT	534	166	700	194	0	0	0	0	194
GUJRANWALA	6	0	6	8	0	0	0	0	8
SIALKOT	799	79	878	0	0	0	0	0	0
FAISALABAD									
JHANG	582	164	746	0	0	0	0	0	0
FAISALABAD	976	2	978	697	49	0	0	0	746
T.T. SINGH (1)	0	0	0	0	0	0	0	0	0
LAHORE									
SHEIKHUPURA	281	24	305	108	0	17	0	0	125
LAHORE	77	94	171	31	0	0	0	0	31
KASUR	544	24	568	30	0	17	0	102	149
OKARA	0	0	0	0	0	0	0	0	0
MULTAN									
MULTAN	1531	75	1606	312	0	0	0	0	312
SAHIWAL	2175	0	2175	163	0	0	0	0	163
VEHARI	326	62	388	73	0	0	0	0	73
D.G. KHAN									
D.G. KHAN	696	0	696	39	0	0	0	0	39
LEIAH	0	0	0	0	0	0	0	0	0
MUZAFFAR GARH	574	30	604	94	5	0	0	0	99
RAJANPUR	0	0	0	0	0	0	0	0	0
BAHAWALPUR									
RAHIM YAR KHAN	369	120	489	40	0	0	0	0	40
BAHAWALPUR	459	106	565	97	0	0	0	0	97
BAHAWALNAGER	580	24	604	31	0	0	0	0	31
(PROVINCE SUB-TOTAL)	15865	981	16846	2986	54	34	0	102	3176

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Table 2.1
ROAD LENGTH UNDER MAINTENANCE
RESPONSIBILITY OF DISTRICT COUNCILS
YEAR 1980
(IN ROUNDED KILOMETRES)
(Continued)

PROVINCE	DIVISION	DISTRICT	LOW TYPE EARTH	LOW TYPE GRAVEL	LOW TYPE TOTALS		HIGH TYPE UP to 12'-0"	HIGH TYPE 12'-1" to 18'-0"	HIGH TYPE 18'-1" to 24'-0"	HIGH TYPE 24'-1" to 30'-0"	HIGH TYPE 30'-1" to 36'-0"	HIGH TYPE TOTALS
SIND												
	SUKKUR											
		JACOBABAD	1157	0	1157		0	0	0	0	0	0
		LARKANA	640	40	680		9	0	0	0	0	9
		SHIKARPUR	404	14	418		5	0	0	0	0	5
		SUKKUR	1500	64	1564		25	0	0	0	0	25
		KHAIRPUR	600	26	626		7	0	0	0	0	7
		NAWABSHAH	1086	20	1106		36	0	0	0	0	36
	HYDERABAD											
		BADU	1474	0	1474		19	0	0	0	0	19
		HYDERABAD	459	0	459		0	48	0	0	0	48
		SANGHAR	1802	49	1851		26	0	0	0	0	26
		THATTA	198	0	198		6	0	0	0	0	6
		BADIN	566	0	566		0	0	0	0	0	0
		THARPARKAR	3066	8	3074		13	0	0	0	0	13
	KARACHI											
		KARACHI EAST (2)	243	0	243		94	0	0	0	0	94
		KARACHI WEST (2)			0							
		KARACHI SOUTH (2)			0							
	(PROVINCE SUB-TOTAL)		13195	221	13416		40	48	0	0	0	288
N.W.F.P.												
	MALAKAND											
		CHITRAL	239	0	239		0	0	0	0	0	0
		DIR	103	1	104		6	0	0	0	0	6
		SWAT	0	0	0		0	0	0	0	0	0
	HAZARA											
		MANSEHRA	493	19	512		0	0	0	0	0	0
		ABBOTTABAD	979	3	982		6	0	0	0	0	6
	PESHAWER											
		PESHAWER	166	325	491		45	0	0	0	0	45
		MARDAN	211	206	417		52	0	0	0	0	52
	KOHAT											
		KOHAT	154	89	243		23	0	0	0	0	23
		KARAK	0	0	0		0	0	0	0	0	0
	D.I. KHAN											
		BANNU	250	190	440		0	34	0	0	0	34
		D.I. KHAN	272	10	282		14	0	0	0	0	14
	(PROVINCE SUB-TOTAL)		2867	843	3710	0	146	34	0	0	0	180

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Table 2.1
ROAD LENGTH UNDER MAINTENANCE
RESPONSIBILITY OF DISTRICT COUNCILS
YEAR 1980
(IN ROUNDED KILOMETRES)
(Continued)

PROVINCE / DIVISION / DISTRICT	LOW TYPE EARTH	LOW TYPE GRAVEL	LOW TYPE TOTALS	HIGH TYPE UP to 12'-0"	HIGH TYPE 12'-1" to 18'-0"	HIGH TYPE 18'-1" to 24'-0"	HIGH TYPE 24'-1" to 30'-0"	HIGH TYPE 30'-1" to 36'-0"	HIGH TYPE TOTALS
BALUCHISTAN									
QUETTA									
PISHIN	165	93	258	3	0	0	0	0	3
ZHOB	57	69	126	0	0	0	0	0	0
QUETTA	0	189	189	3	0	0	0	0	3
LORALAI	374	11	385	0	0	0	0	0	0
CHAGAI	690	24	714	10	0	0	0	0	10
SIBI									
SIBI	306	164	470	0	0	0	0	0	0
KACHHI	406	67	473	4	0	0	0	0	4
KOHLU	0	0	0	0	0	0	0	0	0
NASIRABAD	102	0	102	0	8	0	0	0	8
DERA BUGTI	0	0	0	0	0	0	0	0	0
KALAT									
KALAT	9	626	635	0	13	0	1	0	14
KHARAN	0	579	579	47	6	0	0	0	53
KHUZDAR	100	578	678	0	3	0	0	0	3
LASBELA	0	0	0	0	0	0	0	0	0
MEKRAN									
PANJGUR	0	0	0	0	0	0	0	0	0
TURBET	0	0	0	0	0	0	0	0	0
GWADAR	0	0	0	0	0	0	0	0	0
(PROVINCE SUB-TOTALS)	2209	2400	4609	67	30	0	1	0	98
TOTALS.....	34136	4445	38581	3439	166	34	1	102	3742
% OF TOTAL BY TYPE	88	12		92	4	1	0	3	
% OF TOTAL IN COUNTRY	81	11	92	8	0	0	0	0	8

(1): The divisions and districts are listed as they are now (1985); where no figures are shown for a district, that district did not exist as such in 1980.

(2): The division of Karachi now has three districts; however, the kilometers indicated are for the division as a whole (not broken down by district); also, these specific data are for 1983, not 1980.

SOURCE: NTRC-74, TRANSPORT BULLETIN (SUPPLEMENTARY NO. 1), NOVEMBER, 1981

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kilometres (3.22 earthen, 1.61 paved); in the years 1977 through 1979, the earthen roads "disappeared" while the paved totals were recorded as 1.61, 3.22 and 3.22 respectively. In reality, the district probably has several hundred kilometres of roads. This example is not typical; however, it does point out that there are inaccuracies in the recorded data, and to attempt to extract trends in types of construction from these numbers would be a suspect exercise at best.

Table 2.1, then, merely gives the reader a fairly reliable basis from which to judge the magnitude of the current network. One could estimate that perhaps the 1980 total kilometres will have increased by 10% (by 1986), that the accent for the immediate past five years has been on the paving of earth and gravel roads (other than new construction) with little attention being paid to upgrading from earth to gravel.

It should also be pointed out that the classification of "Gravel" roads would indicate to most that these roads have been engineered. In the majority of cases this is not true; many of these roads are merely at-grade tracks which have been given a thin coating of uncompacted, uncrushed riverbed gravel.

Drainage on these at-grade, earth and gravel roads is almost non-existent, with only a few isolated masonry culverts in the sharpest of ravines evident. Drainage structures on the engineered gravel roads and the paved system is more in evidence, but still lacking. In road sections which experience flooding every year, there are very few low-water crossings (i.e., the paving of the riverbed itself in order to allow traffic to pass during periods of low water).

2.2 PRESENT MAINTENANCE PRACTICES

Present road maintenance practices in Pakistan are mostly limited to the periodic activity of resurfacing paved roads and the emergency activity of removing material and reopening roads in the aftermath of slides and flooding; however, some minor work is also being accomplished by work-gangs in the repair of shoulders, minor patching and in the cleaning and repair of drainage structures. The bulk of available funds and effort is going toward non-maintenance-oriented works, including the paving of earthen or gravel roads and even new construction.

2.2.1 National & Provincial Roads

All national and provincial roads fall under the maintenance responsibility of the provincial department of Communications & Works (C&W). For national roads (all paved) the National Highway Board (NHB) has defined 13 maintenance activities:

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Routine:	Repair of potholes Repair of structures Repair of shoulders Repair of roadside drains Repair of retaining walls Repair/replacement of kilometre stones Painting and posting road signs Whitewashing boundary pillars Maintenance of tools & plant/workshop Maintenance of railway crossings/rest houses
Periodic:	Resurfacing (single, double or triple bituminous treatment)
Emergency:	Clearing of slide and flood debris Clearing of snow

In actual practice, only the periodic and emergency work are being accomplished with any degree of consistency. The resurfacing work is primarily done under contract since the provinces are not equipped to handle it themselves. The emergency work required following slides, flooding, etc. is done on a force account basis, but not without the help of the agricultural departments which are needed to supply the low-bed tractor-trailers to transport the provincial equipment to the site. The provinces do have permanently-employed work-gangs (usually five or six, with each made up of a mate and four or five unskilled laborers), and they will, if funds allow, hire day-labor to augment this small force. However, these gangs are equipped with only the most rudimentary hand tools and the quality and production of work are therefore very low. Shoulder repair, for example, is composed of merely spreading material (and usually just side borrow) to bring the shoulders up to grade. With no compaction equipment on site (and poor materials) this work accomplishes very little. The rollers owned by the provinces could be used for this work; however, most of these units are rented out to the contractors doing the resurfacing work and even if units were available, none of the provincial C&W departments have adequate transport equipment to get them to the site.

The resurfacing program for national roads, with a goal of accomplishing 20% per year (i.e., all roads to be resurfaced every five years), cannot keep up with the deterioration rate, and the condition of the network can only worsen unless more effort is made. Also, the current pattern of using bituminous treatment for resurfacing must be held suspect, particularly on the more heavily trafficked roads. National Route 5, which carries such a large volume of traffic and is subjected to a high percentage of very heavy loads, should be investigated for the advisability of overlaying with asphalt concrete instead of merely bituminous treatment. The latter adds very little strength to the pavement, even with the currently-used, three-layer approach. The initial cost of asphalt concrete would be higher, but the recurrent costs would be considerably lower, and the initial construction investment in the road would be better protected.

The provincial networks, also maintained by the C&W departments, currently receive even less attention than the national system. There are just not sufficient funding and other resources available.

2.2.2 District Roads

As a rule, the district councils have the maintenance responsibility for all district roads; they have a construction responsibility also, though in practice LGRD does the work in some provinces. All do some betterment work. Most districts have a few pieces of heavy equipment, usually in the form of dozers, rollers, asphalt heaters and the occasional motor grader. The dozers are used for widening mountain roads (betterments) and for clearing flood and slide debris; the rollers and asphalt heaters are rented to contractors for resurfacing with bituminous treatment; and the occasional motor grader is used for the blading of gravel surfaces. (One district visited has a small asphalt batch plant -- 1-1/2 tph -- which is leased to contractors for asphalt concrete overlays.) As do the provinces, the districts use work gangs (of the same average make-up of personnel and hand tools); however, only a few have permanent gangs -- most use day-labor, not having sufficient funding to maintain a permanent staff. However, the normal and basic complement of motor graders, front-end loaders, loader/backhoes, dump trucks, water tankers, low-boys, fuel trucks, light vibratory rollers, etc. is clearly lacking. Neither do the districts have any minor equipment, such as small, hand-operated asphalt sprayers or vibrating plate compactors (for spot sealing of cracked paved surfaces), or jack hammers or tamper-compactors (for pothole patching of paved and unpaved surfaces).

On the mechanical side, no district visited had the means to do any more than the most rudimentary servicing of equipment; there were no repair facilities at district headquarters. Operators, it was said, could change oil, oil filters and grease, and perhaps make some minor repairs; other than that, all repair work, and general servicing, had to be taken to the agricultural departments' shops or the private sector. One district had a five-year contract for the maintenance of their equipment. The (Revised) P.C. 1 PROFORMA, "Procurement of Machinery for the Construction and Improvement of Farm-To-Market Roads in Pakistan (Umbrella Project)" (Ref. 6), prepared by the Ministry of Local Government and Rural Development, dated June, 1983, lists 118 governmental agency workshops (predominately of the agricultural departments), nation-wide, which are available to maintain and repair equipment. This scheme has been partially implemented. The private sector, of course, would add to this list.

Due to the lack of resources, road maintenance in the districts means only the periodic work necessary to rebuild pavements which have been allowed to deteriorate, the emergency effort required after floods, slides and heavy snows, and the few laborers who attempt to attend to shoulders and drainage.

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There is no management system applied wherein work activities are programmed, scheduled, accomplished and reported upon. Without such a system, there is no control over maintenance work and no basis from which to develop future resource needs (i.e., budget requests). The district engineers are all aware that not enough attention is being paid to normal routine maintenance, and all agreed that if they had more equipment and funding, much more of this work would be done. However, available funds are presently being aimed at betterments and rehabilitation, not maintenance, and before routine maintenance procedures are fully installed and carried out, there must be a basic change in the premise, or philosophy, that this periodic rehabilitation approach is economically the lowest-cost solution. This change may not be easily adopted, and surely not "over night."

2.3 SUMMARY OF FIELD INVESTIGATIONS

As indicated in Chapter 1, the Consultant's team visited numerous offices of the federal, provincial and district governments. Data collected during these visits and from other sources has been summarized in sections 2.1 and 2.2. This section presents some of the more detailed engineering-related information that was gathered. The Consultant feels that these data, although only a sampling, do provide a useful insight to the road construction and maintenance situation in Pakistan.

2.3.1 Federal

2.3.1.1 National Highway Board

The National Highway system consists of six numbered routes totalling 4,893 km. N-5, Karachi to Peshawar, reportedly carries 50% of the road traffic in the entire country. Currently, road and rail freight is about 25 and 7.5 billion tonne-km (btk) respectively. The projected figures for 2000 the year are 85 and 12 btk.

Any road connecting two provinces may be declared a National Highway, but there are no plans for the immediate expansion of the system.

It was observed that the Pakistani-manufactured Bedford trucks should be produced with three axles to distribute the heavy loads they carry. It was also observed that front-end, wheeled loaders would, in many cases, be of more value to road building and maintenance operations than tracked, or even wheeled, bulldozers.

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2.3.2 Provincial

2.3.2.1 Sind

As of June, 1984, the provincial system comprised approximately 7,500 km of metalled and 68 km of shingle roads. Some 200 to 250 km of new roads are constructed annually.

In the current fiscal year, Rs 300 million is budgeted for construction and improvements. There is a separate allocation of Rs 90 million for maintenance. This is based on Rs 10,000 per mile per 10 foot width of pavement, but the demand is more like Rs 15,000 to 18,000, and the government has been requested to raise the allocation.

Minor maintenance, such as pothole repair, is performed by permanent gangs. Major works are performed by contractors. The executive engineers handle all contracts, including payments.

Geometric design is performed in-house. Class I roads are designed for 100-120 km/h and rural roads for 80 km/h. Structures are designed to class AA, 70-ton loadings. This is currently being compared with American standards to determine which is the more severe.

Compaction of the top two feet of fills under the pavement is to 95-100% of Modified AASHTO (Laboratory). Below that, the compaction is 80-85%, except in water logged areas, where 95-100% is used throughout.

The largest haul distance for road stone is 160 km. Stabilized lime has been used with some success, and its use may increase. Roads built with lime two and three years ago are performing satisfactorily.

A new road, for 50 AADT, would have six inches of crushed stone on a six-inch shingle/gravel layer. Finishing is triple bituminous surface treatment (TBST). Asphalt concrete is not used.

2.3.2.2 NWFP

The province has 8,103 km in its road system, none of which is earth.

Construction costs about Rs 500,000 per km in flat country and one million in hilly country. Maintenance of blacktop is Rs 12,000/km/year, including resurfacing every five years.

Crushed limestone or screened river shingle is used. There is a central materials laboratory in Peshawar which can handle a variety of tests, including the Los Angeles Abrasion test, and there are three field laboratories to perform sieve analyses, compaction tests etc.

Standards are as follows:-

AADT 100	Gravel
100-500	12' paved
500-1500	20' "
1500-3000	24' "
3000-7000	24' asphalt carpet, 10 cm thick
7000	Dual carriage-way

Thin-wheeled bullock carts are prohibited in the province. The police have the authority to break the wheels of any such cart using the roads.

2.3.3 Districts

2.3.3.1 Rawalpindi (Punjab)

The district council is responsible for 245 km of metalled and 510 km of katcha roads. 12 km of metalled roads are constructed annually.

The Engineering Branch staff is comprised of the district engineer, four sub-engineers, one surveyor and clerical personnel.

Equipment for road works:

Road rollers	6
Tar boilers	12
Asphalt Batch Plant	1

(There are no departmental transporters, as such, to transfer the rollers from job to job).

The existing metalled roads have been, for the most part, built to the following specifications:

- Subbase course: Compacted shingle with 30% sand mixture, 4" thick
- Bitumen surfacing per 100 square feet:
  - First coat: 35 lbs bitumen and 4.0 CF bajri, nominal size 3/4"
  - Second coat: 18 lbs bitumen and 2.0 CF bajri, nominal size 1/2"
  - Third coat: 14 lbs bitumen and 1.5 CF bajri, nominal size 1/4"

Experience in the district is that roads built to the above specification have a short life (start breaking up in three years). Cold weather may be a contributing factor. The following specification is now used for metalled roads and is showing good results.

- 24'

- Premix, 1-1/2" thick carpet, per 100 SF:

Bajri, 1/2" Max.	10.58 CF
Stone dust	4.56 "
Sand (Herro river)	4.50 "
Bitumen	108.07 lbs

Heated in mixer to 350 to 400°C
Laid on road, min. temp. of 200°C
Cost for 1 km (presumably 10 feet width) is Rs 175,000

A Rs 1,750,000 contract is underway for maintaining 45 km of 20 roads, including resurfacing plus some pothole patching and shoulder work.

The Consultant was shown three sample roads:

- a katcha road, described as "typical," was no more than two wheel tracks, at grade, across the fields. This is virtually unmaintainable, except to fill in puddles.

- a metalled road that was being overlaid. The 4" course of stone that had been placed so far had a considerable amount of 4" stone in it, which, clearly, is much too large for a 4" course. 2" to 2-1/2" should be the maximum.

- a road with about 40-50 AADT that had recently been resurfaced with the hot mix carpet specified above. The texture was very uneven, which indicates poor mixing and/or separation in dumping and spreading.

Consultant's comments:

From examining these three roads, the conclusion may be drawn that, although there is basically nothing wrong with either specification (in fact, the hot mix carpet is very ambitious for a low volume road, but could prove to be a least cost solution), the execution of the actual work in one case did not follow the specification and in the other could be a matter of not adhering to the specification, poor workmanship, or both.

2.3.3.2 Jhelum (Punjab)

The district road system consists of 440 km of metalled and 1010 km of katcha roads. There are no shingle roads.

Katcha roads are usually on about a two-foot high embankment with a 22' - 24' formation. The district is not building any katcha roads, only maintaining the existing ones.

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The district engineer has three sub-engineers to assist him in road works. His equipment consists of:

Road rollers	4
Tractors with blade, cultivator and trolly (50-60 HP)	3
Tar boilers	6
Pick-up truck, Ford	1

There is one 68-km road under construction, including earthwork, small culverts, retaining walls (culvert headwalls?), subbase, base, and TBST. The average cost is Rs 500,000 per kilometre.

No premix is used in this district.

A typical 8' span culvert, 4' to 6' high, with masonry walls and reinforced concrete top slab would cost Rs 60,000 to 70,000 and take six weeks to build.

Aggregate hauls average from 8 to 40 km.

The Consultant was taken to examine a metalled road. The edges were ravelling badly, partly due to the pavement being only ten feet wide but more due to the shoulders not being brought up to grade and compacted.

2.3.3.3 Jacobabad (Sind)

The road system consists of

1,500 km katcha	18'-22' formation
20 km metalled	10'-12' paved
3 km brick paved	12' paved

New katcha roads are built up to a 3-foot height on a 20-foot formation. They are compacted by traffic (the district has no road building equipment); some water is used when readily available.

Each of the 80 beldars (laborers) is assigned three miles of katcha road to maintain. He does this work for the first 20 days of the month. In the next ten days, he works in a gang of five or six, wherever needed. Their tools are pick and shovels, they do not even have any hand rammers.

The Consultant was taken to examine a recently-built brick road. Bricks were laid on edge, on a six-inch layer of sand. Sand is then spread over the surface to fill in the cracks. The section is 12' of brick plus shoulders, which again will be traffic-compacted. The road has no crown or camber (a condition that seems quite common in the country). Land was provided by the landowners. There is one culvert. The road, about 3.2 km, cost Rs 600,000.

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The district considers a layer of brick, 4-1/2", to be equal to 6" of compacted stone. Brick in place cost Rs 250 per 100 SF; 6" stone is "three times the price."

2.3.3.4 Sukkur (Sind)

The district has about 2,000 km of katcha roads, 68 km brick paved and 34 km metalled. By June 1985 these totals are expected to be increased by 200, 40/50, and 4/5 km respectively.

Equipment consists of two tractors with trollies. In addition, in early February, 1985, they took delivery of the first elements of equipment being supplied by the machinery procurement scheme (Ref. 6), namely:

One Caterpillar D7G bulldozer with ripper, (200-220 HP)
Two Komatsu bulldozers, D50A-17 (100-110 HP)
Two Komatsu motor graders, GD 505A-2, articulated, (120-130 HP)

This machinery will be maintained in a depot by one mechanical engineer and two sub-engineers who will shortly be posted to the district. The operators will be district employees and be trained by the agricultural workshop staff.

Beldars are responsible for two-to-four miles each. They receive Rs 500 a month, plus two uniforms, laundry allowance and pension at age 60.

There are sufficient quarries in Sukkur district.

The district personnel stated that, in Tharparker District, which is desert, bitumen and sand are premixed to form a 9" asphalt carpet.

Brick surfaces are not laid until six to nine months after the embankment has been constructed so as to allow for settlement.

Approximate costs per kilometre for complete roads, including culverts are:

Katcha	Rs 40,000
Brick	Rs 300,000
Metalled	Rs 1,000,000 to 1,200,000, 12' wide

The Consultant visited a katcha road near Sukkur. This was built five years ago on a 3' embankment with about a 14' formation. The side steps are grassed and stable. The surface is dusty and somewhat uneven, but the condition is generally good. The cost in 1980, for two km, was Rs 70,000. It took one month to construct, using farm tractors with blades.

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2.3.3.5 Abbottabad (NWFP)

District equipment includes:

Bulldozers, D6/7 size	3
Motor Grader	1
Roller	1

"Internal" hourly rental rates for those items is Rs 450, 245 and 100 respectively

The Consultant was shown a mountain road that had recently been improved by widening. It was notched into the face of a cliff. The surface was the natural earth and gravel over the bedrock.

2.3.3.6 Pishin (Baluchistan)

The district has about 2,000 km of katcha roads. As the local material is very stony, these are more like gravel roads than earthen ones.

The only equipment is a motor grader. As the budget for roads is about Rs 500/km/year, about the only work that can be done is to grade each road two or three times a year, as well as repairing any storm damage.

The Consultant viewed an existing katcha road. The stony material provides a reasonably good surface, and, presumably, few repairs are needed. The Consultant also saw a new stone road under construction, this consisted of crushed stone laid on the existing gravel.

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Chapter 3

INSTITUTIONAL INVESTIGATION

3.1 INTRODUCTION

3.1.1 Procedure

At each level of government, those ministries, departments and other organizations concerned with rural roads were identified. In most cases, an organization chart is shown for the, say, department, with the units involved in roads being shown in some detail and the other branches in outline only.

The level of detail shown for each government organization varies considerably, depending upon which agency was visited and the amount of information gathered at the interview. Where information collected was repetitious, it has not normally been included. For example, largely for this reason, the data presented for Jhelum district is much less detailed than for Rawalpindi.

It will be noticed that organization and procedures do differ somewhat among provinces and even among districts within the same province.

The Consultant is indebted to references (7) and (8) for much of the background information presented in this chapter.

3.2 FEDERAL

3.2.1 Ministry of Local Government and Rural Development

Rural road development in Pakistan is, at the Federal level, administered by the Ministry of Local Government and Rural Development (LGRD), which was established in 1976.

Its functions are best summarized in a circular issued by the ministry on 18th June, 1984, which states, in part and with minor editing:

"RULES OF BUSINESS

"Functions of the Ministry of Local Government and Local Government ... are as under:-

1. Federal functions pertaining to local government institutions in areas other than Cantonments including:-

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(a) promotion of local government institutions;
(b) planning and coordination;
(c) grants-in-aid; and
(d) International aspects including liaison with community development and local government institutions in other countries.

2. Integrated Rural Development Programme - policy, guidance, follow-up action, coordination, foreign assistance and evaluation.

"Functions of the Ministry, which (have) remained under consideration for some time and are being proposed for inclusion in the Rules of Business, are as under:-

1. Federal functions pertaining to Local Government Institutions in areas other than Cantonments, including:-

   (a) Promotion of Local Government Institutions;
   (b) Planning and Coordination;
   (c) Grant-in-aid;
   (d) International aspects including liaison with community development and local government institutions in other countries.
   (e) Research and evaluation of functions of Local Government Institutions;
   (f) Legislation on Local Government for the Federal Area;
   (g) Local Government extension training.

2. Rural Development including infrasturcture work:-

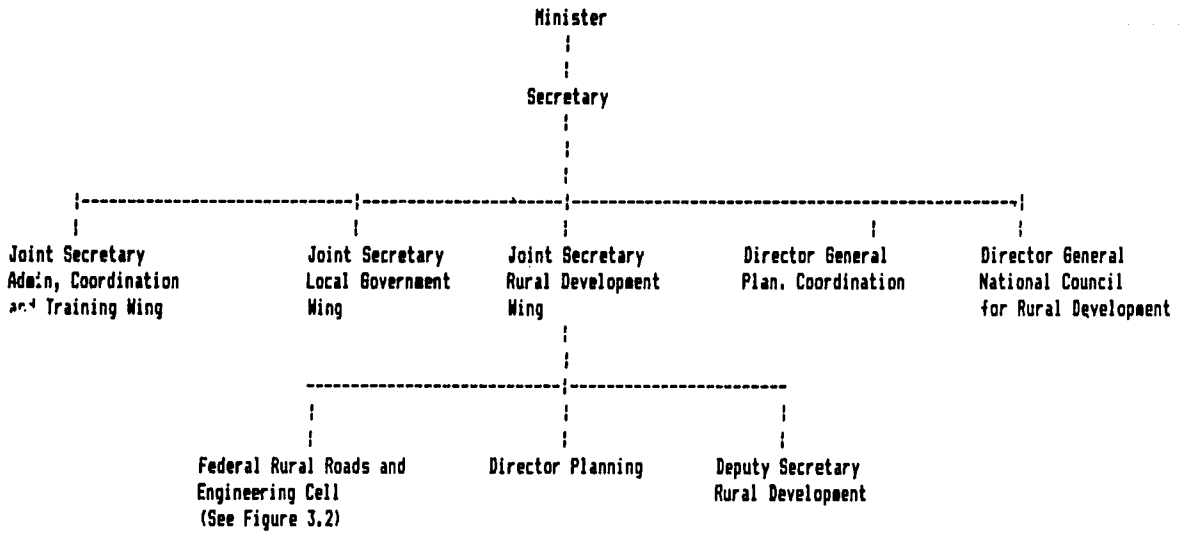
   (a) National Policy and guidance for undertaking the rural development programme;
   (b) Coordination with Provincial Governments and Federal Agencies regarding implementation of programme, that is, programming, assignment of priorities, periodical evaluation, monitoring etc.
   (c) Preparation of overall Five Year and Annual Plans for rural development.
   (d) Field and Laboratory research on problems facing the rural development.
   (e) Negotiations and liaison with Foreign Agencies and donor countries through Economic Affairs Division for arranging technical and project assistance;
   (f) Programme of work related to rural development, including schools, rural health centres, rural electrification, rural roads, rural water supply and sanitation.

3. National Centre for Rural Development. "

An outline organization chart of the ministry is presented in Figure 3.1.

Figure 3.1

MINISTRY OF LOCAL GOVERNMENT AND RURAL DEVELOPMENT



FRREC reports direct to Secretary for all projects (through Joint Secretary RDW where need to be)

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3.2.1.1 Federal Rural Roads and Engineering Cell

Under the Rural Development Wing of the ministry is the Federal Rural Roads and Engineering Cell (FRREC). See Figure 3.2. All road activity in the Ministry passes through this Cell.

The FRREC was established in 1978. The cell's present responsibilities are:

- the provision of technical guidance to rural road execution agencies, namely the Provincial Departments of LGRD and the District Councils
- the monitoring and evaluation of rural road programs
- the formulation of technical publications and manuals to advance technical knowledge down to all levels of government
- the coordination of any special development program on behalf of the Ministry of LGRD
- the formulation of various development projects for foreign donor assisted financing and coordination of all foreign financing.

To date, the FRREC has written four manuals that have been published by the National Transport Research Centre. These are:

- Manual of Maintenance of Low Volume Unpaved Rural Roads - January, 1983
- Manual of Stage Construction of Rural Roads - January, 1983
- Manual of Road Construction Engineering - January, 1983
- Manual of Vibratory Compaction - March, 1984

A fifth manual on standards for district roads is being prepared.

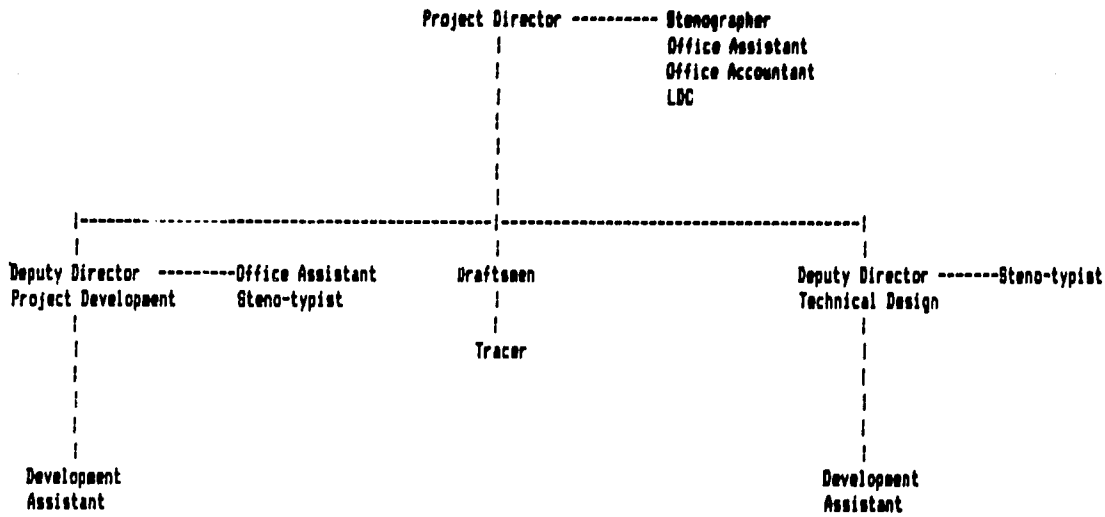
It must be noted that, at this writing (March 1985) neither of the Deputy Directors shown in Fig. 3.2 had actually joined the FRREC, so that the Project Director was the only technical person in the organization.

As of the date of this report, a PC-1 form is being prepared that will greatly expand the staff capabilities and responsibilities of FRREC. The contents of the PC-1 have not been finalized, therefore all that follows in the next four paragraphs must be considered as tentative and unofficial.

Figure 3.3 shows the proposed organization. Tentative responsibilities for each technical branch are:

Figure 3.2

FEDERAL RURAL ROADS & ENGINEERING CELL
(authorized as of January, 1985)



Messengers, Drivers etc. not shown

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Figure 3.3

FEDERAL RURAL ROADS & ENGINEERING CELL
(Tentative proposed organization effective July, 1985)

Project Director

- Stenographer - 1
- Office Assistant - 1
- Account Assistant - 1
- U.D.C - 1
- Driver - 1
- N/Qasid - 1

Deputy Director (Projects)	Deputy Director Design & Consultancy	Deputy Director Research & Development & Training	Deputy Director Administration
Assistant Director (Project Formulation) - 1	Assistant Director	Assistant Director (Monitoring & Evaluation)	
Assistant Director (Project Implementation) - 1			Section Officer (Admin)
Development Assistant - 2	Development Assistant - 1	Development Assistant (R&D)	Office Assistant Accountant L.D.C Stenotypist Driver - 1 Naib Qasid - 1 Chowkidar - 1
	Librarian Technical - 1	Development Assistant (Training)	
Stenotypist Driver - 1 Helper - 1 Naib Qasid - 1	Stenotypist Driver - 1 Helper - 1 Naib Qasid - 1	Stenotypist - 1 Helper - 1 Naib Qasid - 1	

- Projects (essentially field oriented)

  - Scope of districts' programs versus funding available
  - Direction of funding from federal level
  - Sample implementation schemes; e.g. a one kilometre pilot project (province would assist in design)

- Design and Construction (Islamabad)

  - Principally concerned with donor projects
  - Preparation of design standards
  - Design of problem-area roads referred by districts/provinces
  - Design of any new projects developed by FRREC

- Research & Development and Training

  - Coordination with research organizations in Pakistan and overseas; disseminate information
  - Development of new standards
  - On call to assist in problem areas
  - Laboratory, including research of:

    Materials for road construction
    Pavement design
    Construction methods
    Uses of brick
    Soil stabilization
    Cement and concrete.

3.2.2 Ministry of Planning and Development

The National Transport Research Centre (NTRC) is a part of the Ministry of Planning and Development. It is responsible for conducting research on all types of roads, under different soils and climatic conditions, throughout Pakistan. It is also responsible for developing standards such as for road signs. NTRC cooperates in the development of National Transport Plans.

A National Highway Research Institute was proposed a few years ago with the idea of conducting research on the national highway system. The formation of the Institute has been discontinued.

3.2.3 Ministry of Communications

The agency in this Ministry that is concerned with highways is the National Highways Board (NHB).

The NHB is responsible for the design, construction and maintenance of the National highway system. Currently, this system consists of six numbered routes with a total length of 4,893 km. There are, at present, no plans to increase the size of the system, although any highway connecting two provinces may be considered for inclusion.

NHB has no in-house design capability, but awards the work to consulting engineers.

Contracts for construction work on the national systems may be awarded direct by the NHB or the provinces may be asked to act as the Board's agents.

At present, maintenance on the system is conducted by the provinces. There is no formal program, although a target is to resurface, with bituminous surface coat and chips, about 20% of the system each year. NHB inspectors review the work performed by the provinces, but this inspection has been described as "academic"

In an innovative departure from this procedure of assigning the maintenance responsibilities to the provinces, the NHB, on January 24, 1985, issued tender documents for the maintenance of a portion of Highway N-5 between Lahore and Multan. A month was given for the preparation of tenders. The contract will be for one year initially, but may be extended. The work will be supervised by NHB's own staff, consisting of one engineer and two inspectors.

It was observed that maintenance is one of the worst areas for corruption and that small contractors in particular are susceptible to squeezing. It is hoped that much of this loss can be avoided by awarding large, official maintenance contracts such as the one just discussed.

3.3 PROVINCES

Each province has a governor who represents the President of Pakistan. The governors are appointed by the president. The governor is assisted by a council of ministers who are appointed by him and who are also elected members of the provincial assembly.

The departments within the provinces report to the governors and are a part of the provincial government. For example, the Department of Local Government and Rural Development (in Baluchistan, the Department of Local Government, Rural Development and Agrovilles) is a department of the provincial government and not a unit of the Ministry of LGRD, although the ministry has a liaison officer with the department in each province to monitor the activities of the department concerning the expenditure of projects funded by the federal ministry.

Figure 3.4 shows the organization of NWFP, especially as it pertains to roads. The other provinces have similar structures, with the Department of Planning and Development responsible for coordinating the activities of the provincial government.

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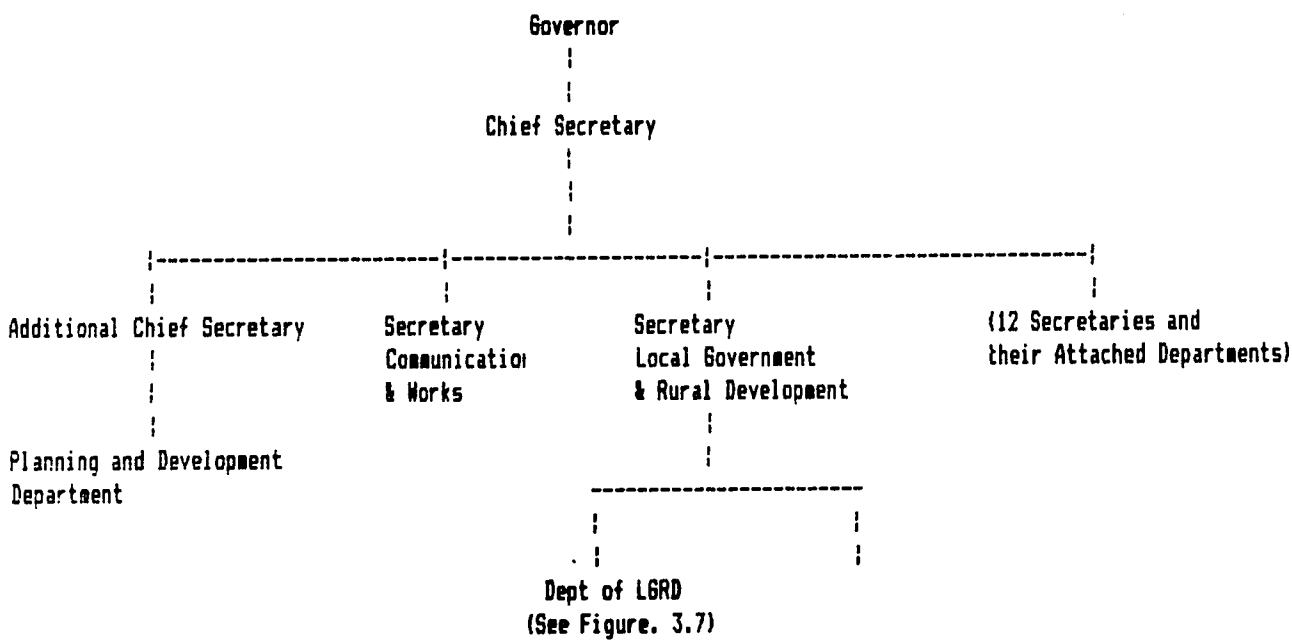
Figure 3.4

NWFP

STRUCTURE OF PROVINCIAL GOVERNMENT



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As the organization of each province is slightly different from the others, the provinces are discussed separately in the following sections. The organization charts presented are for specific provinces etc. but may be considered as more or less typical.

Before discussing the individual provinces and districts, a brief review of the relevant parts of the civil service organization is appropriate.

In the provincial governments, those officials with ranks from Assistant Commissioner up to Chief Secretary are members of the Establishment Division of the federal government. These persons are the elite of the system. Entry is between 21 and 25 years of age with a good second division bachelor's degree (in practice, nearly all those accepted have master's degrees). The candidates then sit the very competitive Central Superior Services (CSS) examination. The total intake is about 150 a year, and these persons go to any one of a number of groups, such as foreign service, police etc. Those in provincial government are in the District Management Group, which admits about 12 new entrants annually. As federal employees, personnel may be moved from province to province.

In a somewhat parallel organization, the senior officials in the districts are provincial employees. The district councils prepare schedules of establishment which are reviewed by the government of the province for position, number, grade and remuneration.

In Sind, for example, the service is known as the Sind Council Unified Grades (SCUG) into which the Sind Local Council Service members have been incorporated. The provincial government may, and does, transfer members of the service from one district to another. The government is responsible for providing a pension fund and a benevolent fund.

The district councils employ personnel in ranks lower than those reserved for the SCUG members.

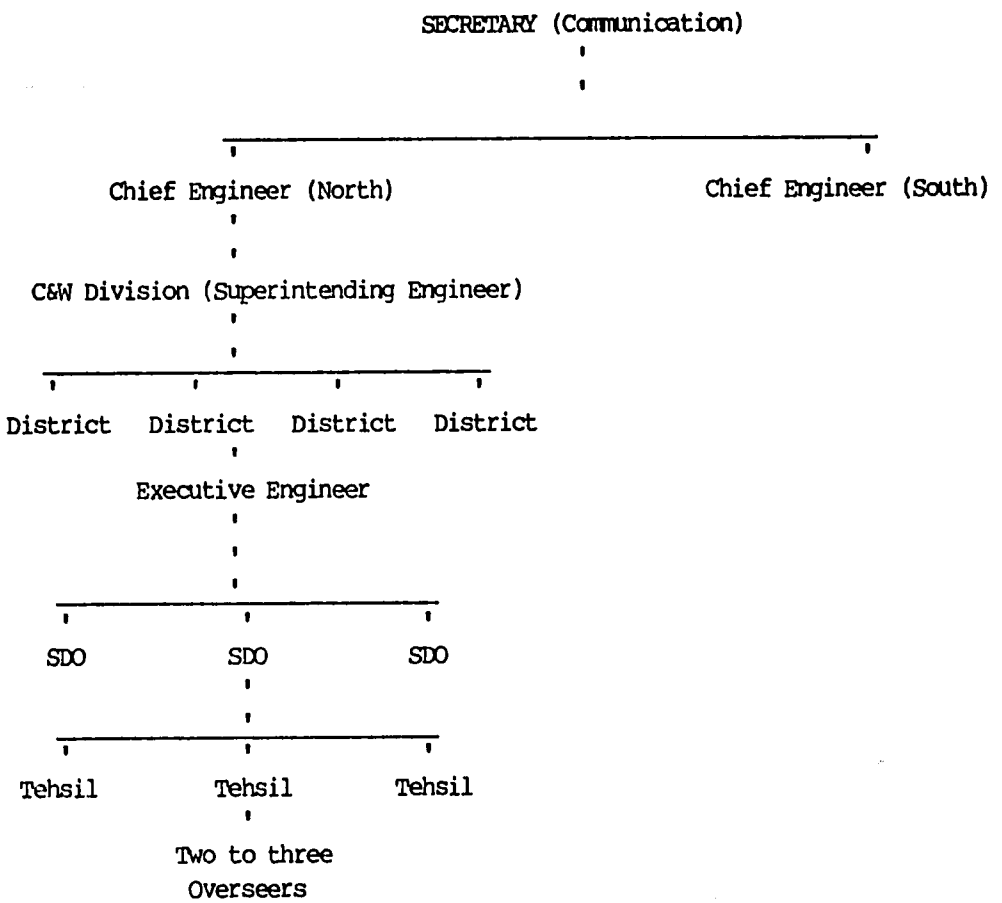
3.3.1 Punjab

3.3.1.1 Department of Communications and Works

Fogure 3.5 shows the organization chart for this department

Figure 3.5

ORGANIZATION OF DEPARTMENT OF COMMUNICATIONS
AND WORKS, PUNJAB



Notes:

1. Punjab, having a big work load, is divided into North & South

2. For some new project an additional division is created for the duration of the project e.g. Ghazighat Division.

3.3.2 Sind

3.3.2.1 Department of Communication and Works

Communications and Works is an administrative department with three attached departments, namely, Highways, Buildings and Design.

As of June, 1984, this province had about 7,500 km of metalled and 70 km of shingle roads. Each year C&W build 200 to 250 km of new roads and improve some 300 km of existing ones.

Any road connecting two or more taluka (tehsil) is considered provincial. In addition, other local roads have been assigned to the provincial Highway Department. However, it is not the practice to transfer roads from a district or other agency to the province; if this is to be done, the agency must first pay the additional cost to bring the road up to C&W standards. The transfer has to be by order of the Governor.

Last year, six farm to market roads were built by the Highway Department for the district councils to maintain.

C&W are given funds by the National Highway Board to maintain national highways within the province, but all improvements such as dualization, overlaying etc. are directly contracted by NHB.

3.3.2.2 Department of Local Government and Rural Development

In Sind, nearly all the power is given to the local councils. The department has an Assistant Director, Local Government and an Assistant Director, Rural Development (ADRD) in each district. In each taluka, a development engineer reports to ADRD. The department has no funds for development, all the ADP money goes to the districts in the form of grants-in-aid or 50/50 matching grants. Most of this money is used on roads.

3.3.2.3 Observations

In response to questions by the Consultant as to what measures might be employed to improve present procedures, the following observations were made:-

- Funding to the districts is insufficient, and they are unable to raise enough funds themselves to perform a satisfactory task.
- If there were more resources, the first priority would be to extend the metalled road links to within no more than ten kilometres from any population center.
- Present base courses are too weak for current traffic, and should be upgraded.

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3.3.3 North West Frontier Province

In this province, the governor appoints and is assisted by five ministers. The senior civil servant is the Chief Secretary, who reports directly to the governor. Reporting to the chief secretary is an Additional Chief Secretary, who supervises the Planning and Development Department of the province. There are also fifteen secretaries who, in turn, supervise the activities of over fifty departments. Together, the secretaries and their assistant section officers make up the civil secretariat, the chief policy-making body of the NWFP government. This organization, especially as it pertains to roads, is presented in Figure 3.4.

As far as the provincial government is concerned, road construction and maintenance falls into two categories. The provincial government roads, which are the responsibility of the Department of Communications and Works, and those district roads for which LGRD provides funding. As will be seen later, there are still many roads outside this category.

Figure 3.6 shows, for roads of different cost categories, the governmental level at which authorization may be granted.

3.3.3.1 Department of Communications and Works

C&W have the construction and maintenance responsibility for 8,105 km of roads, all of which are either blacktopped or shingle. There are no earth provincial roads.

C&W is organized into circles. A circle is a group of districts, not necessarily coinciding with the civil unit known as a division. The primary disbursing officers in the department are the executive engineers. Even the chief engineer has no authority to write checks.

The standard maintenance crew for a blacktop road consists of a mate and four coolies. Their assignment is ten miles of ten foot wide pavement, or the equivalent area for other pavement widths. Crews on gravel roads do not cover the same area in a given time as those on blacktop roads.

The C&W operations in a district are separate from those of the district.

3.3.3.2 Department of LGRD

The Department of LGRD is headed by a Director-General, who reports to the Secretary, LGRD. Figure 3.7 shows the organization chart for the department.

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Figure 3.6

NWFP

AUTHORITIES FOR DECISIONS ON ROAD WORKS

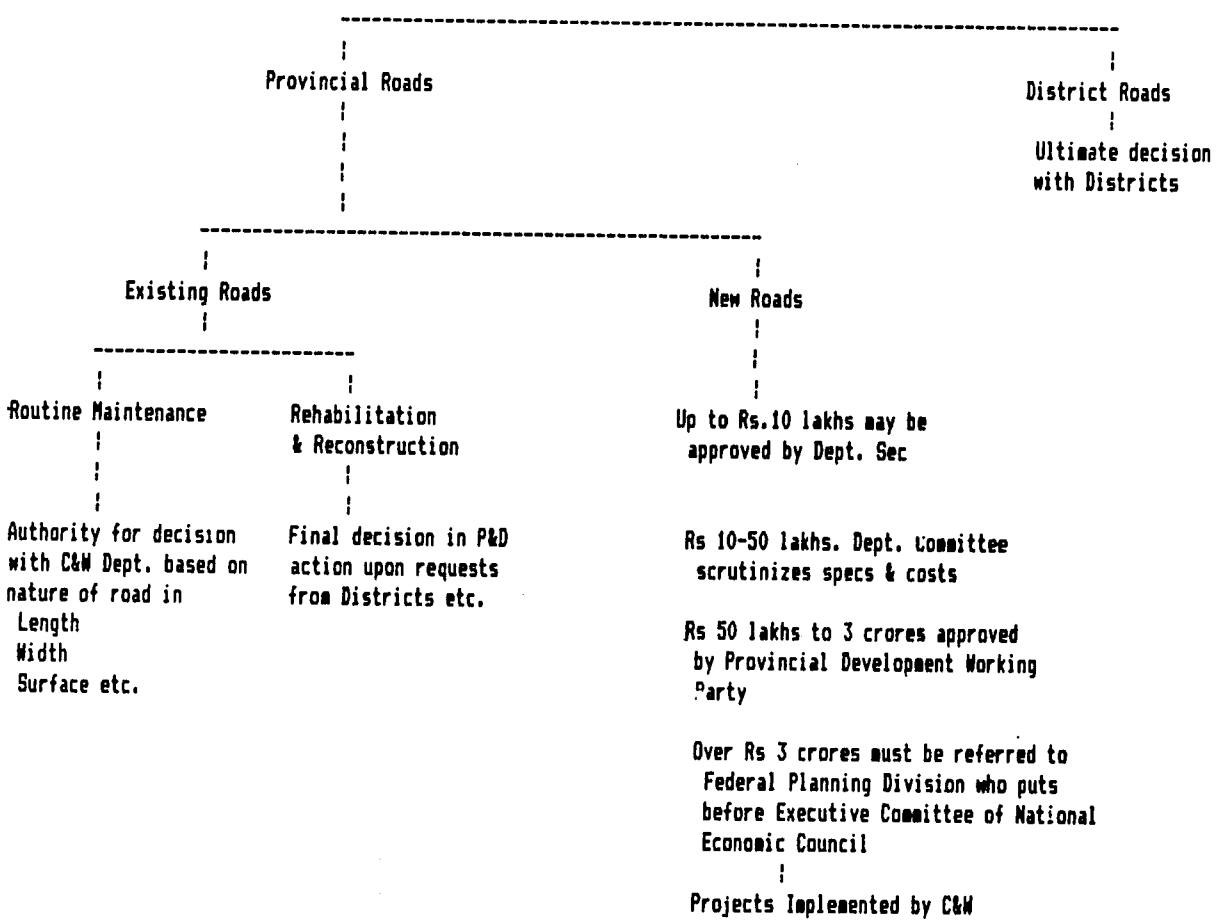

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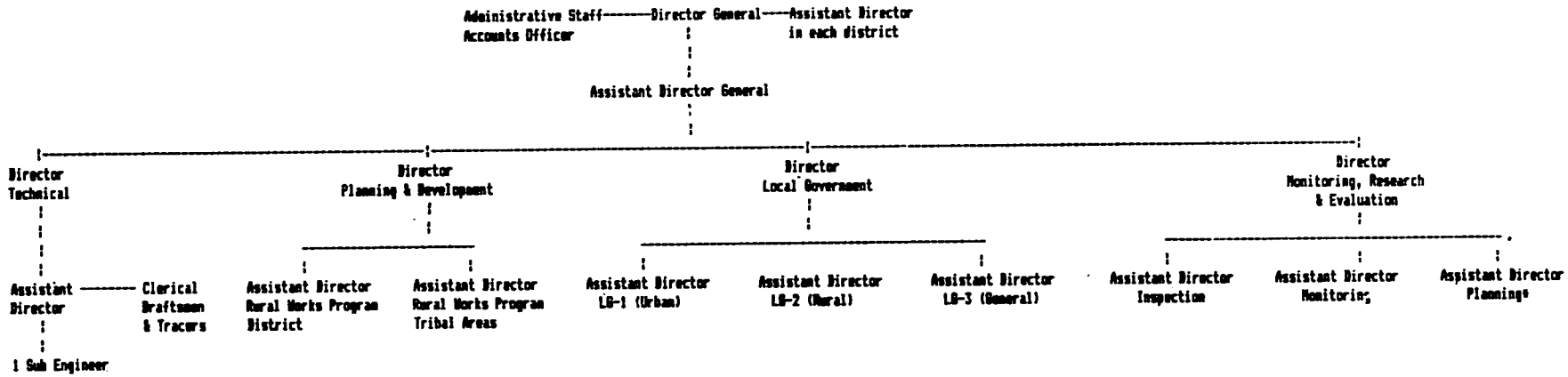
Figure 3.7

NWFP

DEPARTMENT OF LOCAL GOVERNMENT & RURAL DEVELOPMENT



* This unit will be transferred to Director, Planning & Development during 1985

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Chapter 4 describes the financial data in detail. In summary, the funds allocated in the Annual Development Programme for rural development for districts, amounting to Rs 51.5 million for the current fiscal year, are passed on to the LGRD offices in the districts for projects, mostly for roads. Of this allocation, 8% has to be used for maintenance. (This 8% appears to be peculiar to NWFP; other provinces do not mandate a proportion for maintenance)

In addition, LGRD has another block of funding from the ADP for allocation to the union councils. In the current fiscal year, this amounts to Rs 33.6 million. Much of it will be spent on roads, mostly on a grant basis.

3.3.3.3 Observations

In response to questions by the Consultant as to what measures might be employed to improve present procedures, the following observations were made:

- the districts do not know how to plan, they do not develop long-term programs. Their requests for approval of road projects are very much on an ad hoc basis. The procedure for the districts sending up their requests for approval works satisfactorily, but the feeling is that the districts should do a better job of planning

- technical personnel are available in the province, but they are short of equipment

- contractors, especially those working at the district level, are very small concerns and, in many cases, provide only unskilled labor, with the departments or districts having to rent them equipment and provide technical direction. The introduction of larger firms that would have their own equipment and technical personnel would facilitate monitoring of the projects and provide better control against the payment of bribes. Many major bridges and similar works have been conducted by large contractors, and the results have been satisfactory. It is recognized that the evolvement of larger firms is unlikely to occur without giving the industry some assurance that there will be a reasonably constant flow of work opportunities, and that government has a responsibility in this regard.

A further observation made by one of the officials was that the district councils are pressing the Province to take over the existing roads, as the councils are under pressure to build new roads.

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3.3.4 Baluchistan

The transfer of government to the local level has probably been more difficult in this province than in the others because of both the large distances involved and the remaining tribal traditions.

Baluchistan has developed strong guidelines and incentives for minimizing non-development expenditures and maximizing those for development. These include allocating proportions of specified provincial taxes for transfer to the local councils.

The district council is fully authorized to initiate and conduct all coordination within the district, thus eliminating the need for the separate district coordination committees that exist in the other provinces.

In this province, the equivalent LGRD is know as the Department of Local Government, Rural Development and Agrovilles (LGRDA). The Assistant Director in each district is the Secretary of the district council. The departmental organization is shown in Fig. 3.8.

It is to be noted that the district engineer reports to the ADLGRDA, and not to the district council. Also, all ADP funds from the province, at least as far as district roads are concerned, are handled by the assistant director, who is also responsible for disbursing road funds raised by the district's own taxes.

3.4 DIVISIONS

Each province is divided, administratively, into divisions. A division may contain from one to six districts.

Although the divisions do, to some extent, coordinate the road programs among their districts, they do not have any taxing powers, nor are they responsible for allocating ADP or any other funds to the districts.

In fact, in the NWFP, for example, the provincial road system is organized by circles, whose boundaries do not necessarily coincide with those of the divisions.

As the divisions have little influence or effect on the district highway systems, they are not considered further in this report.

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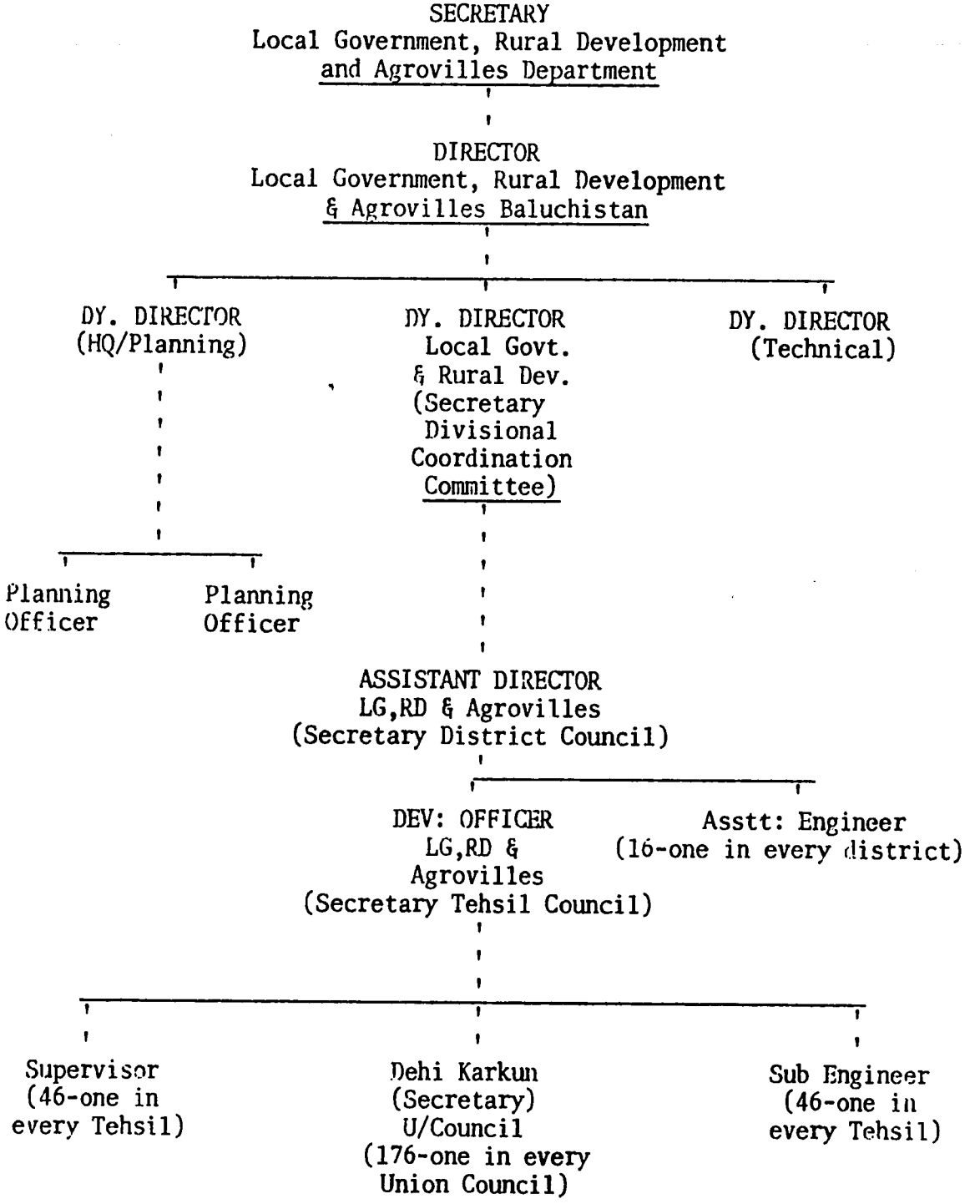
Figure 3.8

ORGANIZATION CHART OF LOCAL GOVERNMENT AND RURAL DEVELOPMENT IN BALUCHISTAN



Source: Ref. 9

3.5 DISTRICTS

District Councils are elected bodies responsible for governing local affairs in rural areas. Actually the lowest level political and administrative unit is a Union Council, representing several districts, but for development purposes the district council is considered the lowest level entity.

According to "Local Government in Pakistan" (Ref. 10), the responsibilities of district councils include:

- construction and maintenance of roads
- management of common places
- lighting
- health
- sanitation
- water supply
- drinking water
- registration of births and deaths
- holding cattle fairs and exhibitions
- agricultural and industrial development
- afforestation
- promotion of sports
- animal husbandry
- first aid
- prevention of diseases
- provision of primary and adult education
  etc etc.

There is another Council, whose members are appointed, known as the Markaz, or Tehsil, Council. It is a subdivision of the district, coordinating a number of union councils. In Sind, it is known as a Taluka Council.

This system of local government was originally instituted in 1959, disbanded in 1971, and revised with changes in 1979. The role of the Deputy Commissioner, who used to be the head of government in a district, is now largely advisory.

Some details extracted from "Local Government System in Sind" (Ref 11) will indicate the type of organization that exists in the provinces:

• Union Councils:	One Union Council for population upto 15,000 in rural areas.
• Taluka Council:	Comprised of all the chairman of the union councils together with the district councillors of the taluka.
• District Council:	One for each district.

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- Divisional and District Coordination Committees have been set up primarily to coordinate activities of all councils and nation building departments. Divisional Committees consist of chairmen of the district councils, representatives from the municipalities, or chairmen of the district coordinating committees. The District Committee consists of eleven members elected from urban and rural areas on a population basis. There are special rules for Karachi. All provincial government functionaries, both at the divisional and district levels, are non-voting official members of the respective coordinating committee.

- The Government of Sind, through conventions, seminars, workshops, training sessions and regular courses, undertakes the training of local councillors in their duties and responsibilities: local government law and rules, fiscal policy and analysis, functioning of government departments and agencies, and inter-council and inter-government collaboration.

The district officers of the provincial Department of Local Government and Rural Development channel development funds from the Federal and Provincial governments to the districts and union councils, and also provide technical and non-technical staff to assist these councils. The size of the LGRD district offices will vary but, in NWFP for example, a typical office will have :

- Assistant Director, Rural Development, Grade 18

- Engineers, Grade 17, two or three

- Sub-engineers, five or six depending upon the number of sub districts.

From the foregoing and the subsequent sections of this chapter it will be apparent that there can be numerous types of roads within the geographical boundaries of a district, with nearly as many agencies responsible for construction and/or maintenance. At this point, a tabulation may be helpful. (Table 3.1)

The sections that follow record some of the information that was gathered in interviews at the districts mentioned. As may be expected, not all districts work in exactly the same way, but the data presented does indicate the typical operations in the districts.

Table 3.1

RESPONSIBILITIES FOR VARIOUS TYPES OF ROADS

Type of Highway or Road		Responsibility			
		Construction		Maintenance	
		Funding	Execution *	Funding	Execution*
National Rural and Urban		ADP (Fed)	NHB	ADP (Fed).	NHB or Prov. C&W as agents
Provincial Rural & Urban		ADP (Prov)	C&W	ADP (Prov)	C&W
District Rural	(1)	ADP (Prov)	LGRD	District (LGRD makes contribution in NWFP)	District (in few cases LGRD)
	(2)	District	District (LGRDA in Baluchistan)	District	District (LGRDA in Baluchistan)
Union		ADP (Prov) (matching funds)	Union	Union	Union
Muncipalities		Mun.	Mun.	Mun.	Mun.
Cantonments		Cantt. Board or MES	Cantt. Board or MES	Cantt. Board or MES	Cantt. Board or MES
Canal Roads		ADP (Prov)	Provincial Irrigation Dept.	ADP (Prov) Irrigation Dept.	Provincial
Forestry Military etc.		(Appropriate agency)		(Appropriate agency)	

* Normally by contract on major projects, by direct labor on others.

3.5.1 Punjab

3.5.1.1 Rawalpindi District

According to the 1981 census, the total population of Rawalpindi district was 2,121,000, of which 1,107,000 were in the rural areas administered by the district council.

The urban areas not included in the district council's jurisdiction are administered by:-

Rawalpindi Muncipal Corporation
Rawalpindi Cantonment
Wah Cantonment
Gujar Khan Muncipal Committee (MC)
Taxila MC
Taxila Cantonment
Murree MC
Murree Cantonment
Kahuta Town Council

The district council consists of 26 elected members representing the following constituencies:

The four tehsils	21	members
Women	2	"
Peasants	1	"
Labor	1	"
Minorities (non Muslims)	1	"
Total	26	

Four of the special interest councillors are elected by the 21 councillors representing the tehsils whereas the minority representative is elected directly by the minority voters. The Chairman is elected by the councillors. He is the only member who receives an honorarium - the others serve without fee, although they are entitled to be reimbursed for expenses.

The district organization consists of two main branches, engineering and administration, which includes the taxation office. The staff of the district are permanent employees of the Punjab government (LGRD jurisdiction) although they are paid by the district. They may be transferred anywhere in the province after a few years service in the district.

The chairman is also the project director of the Rural Development Directorate, which handles LGRD's ADP funds. He is also the chairman of the district coordinating committee.

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The provincial Department of Local Government and Rural Development has an office in each district with an Assistant Director in charge. This officer is also the assistant project director of the rural development directorate.

It will be seen, therefore, that there is close coordination between LGRD and the district government.

The annual program for work on the district roads originates with recommendations from the district councillors. The requests are considered by the council in cooperation with LGRD and a program is developed. (Appendix 3.1 describes this process in detail for NWFP - the procedure is similar in other provinces).

The program indicates those roads that will be constructed by LGRD and then turned over to the district, those that will be constructed by the district and those that will be maintained by the district.

It is to be noted that LGRD is not responsible for maintenance, even on the roads it constructs. The district assigns about 25% of its road budget to maintenance.

The district engineer's main concern is with the paved roads. There are very few shingle roads in the district. For the development of a katcha road, the recommendation is made by the local district councillor and reviewed by the chairman. If approved, the district engineer provides technical assistance while the councillor takes charge of the project. Funding is from LGRD, who normally pay 50% of the cost. The other 50% is self-help provided by the union council, half in cash and half in labor and materials. These katcha roads receive little, if any, maintenance, and then only by the employment of temporary help.

Occasionally, the district's budgets are supplemented by special grants. For example, the Punjab Government has given Rawalpindi Rs 20 million for development in Murree tehsil. This project includes 12 miles of metalled roads. More money will be funded next year.

In response to the Consultant's specific questions, it was observed that the present organization is satisfactory. The problems are the universal ones of not enough money and not enough machinery.

3.5.1.2 Jhelum District

The 1981 census records the total population of Jhelum district as 1,167,000, of which 956,000 are in the rural areas administered by the district council.

Jhelum differs a little from Rawalpindi in that it is at the headwaters of the irrigation canal system.

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The district does not have any shingle roads and has not built any katcha roads recently, but does maintain the existing ones.

The district engineer's technical staff consists of three sub-engineers (civil) and one sub engineer (mechanical), the latter being for water supply projects only.

3.5.2. Sind

3.5.2.1 Jacobabad District

The staff of this district consists of

Chief Officer	1
District Engineer	1
Accountant	1
Engineer	1
SDO	1
Sub Engineers	2
Tracer	1
Head Clerk	1
Clerks	2
Inspectors	5
Tracer	1
Beldars	80

The district does not have any road equipment. All construction and all maintenance on metalled roads is contracted. The contractor usually hires equipment from C&W or some other government agency.

In response to the Consultant's questions as to what improvements would be considered if sufficient funds were available, the district officers said they would metal all roads and would purchase the following equipments:

Bulldozers	1
Graders	2
Rollers	2
Sheeps-foot roller	1

3.5.2.2 Sukkur District

The engineering staff of the district consists of

District Engineer	1
SDO	2
Sub Engineers	6
Road Inspectors	6
Beldars	160

During February, 1985, the District took delivery of its first equipment under a machinery procurement scheme (see Chapter 2 and Ref. 6).

3.5.3 North West Frontier Province

3.5.3.1 Abbottabad District

This district differs from the areas previously discussed in that over half the area is mountainous, with some steep and narrow roads cut into almost sheer cliffs.

The district has 30 councillors. There are 70 union councils, each with from five to eleven members.

LGRD and the district council are concentrating their road building efforts more on opening up areas that have no roads than in improving existing roads. Because of this policy, LGRD is, for the time being, maintaining the roads that it builds instead of turning them over to the district engineer -- a somewhat unusual arrangement.

The ADP funds for the union councils are used for small roads, paths, water supply etc. They are allocated on an equal basis by LGRD to each union council. A formula whereby the more populous districts received a higher proportion of the funds was tried one year but was considered unsatisfactory.

Appendix 3.1 presents the time table of procedures for requesting NWFP ADP funds for the next fiscal year, 1985-86.

3.5.4 Baluchistan

3.5.4.1 Pishin District

As discussed in Section 3.3.4, the district engineer is a part of LGRDA's organization. He is a Grade 16 employee, and is supported by four Grade 11 SDOs. The district council's budget for roads is disbursed by the Assistant Director, LGRDA. One SDO is attached to each tehsil development officer to advise on work.

The union councils build small roads, entirely from ADP funds; they do not use any local tax money for this purpose. No matching grants are involved. The union councils are responsible for maintaining these roads, and may provide self-help during construction.

There are no restrictions on bullock carts using the roads, but as there are only a few of these vehicles in the district they do not present a problem.

Chapter 4

FINANCIAL INVESTIGATION

4.1 INTRODUCTION

This chapter describes the situation regarding road expenditures at Federal, Provincial and District levels, and within the context of overall receipts and expenditures by these authorities. Sources of funds are described, and, where relevant, so are arrangements for transfer of funds from higher to lower levels. Figure 4.1 gives a general description of the sources and flow of funds. This chapter deals with federal and provincial current expenditure budgets, annual development plans (ADPs), and road programs. The provincial ADP's allocations to district road programs are described in as much detail as the available data permits. Detailed descriptions of the budgets for the six districts visited are given. Very little time series data was available so, for the most past, data refer to FY 83/84 or the current year. Finally, a description of road user taxes and revenues is given, including details of the growth of the motor vehicle fleet and fuel consumption.

4.2 FEDERAL RECEIPTS AND EXPENDITURES

To provide the context for road-related expenditures and receipts described later, a brief summary of GOP revenue receipts and current expenditures for the fiscal year July 1, 1983 to June 30 1984 (FY 83/84) is given below in Table 4.1. On the revenue side, it will be noted that almost two-thirds of revenue came from indirect taxation, customs duties alone (import duties) accounting for just over 30 per cent of total revenues. Of expenditure, defence and debit service together comprise a very large proportion, over 70 per cent, of the total. Community, social and economic services together account for about nine per cent of current expenditure.

Under the heading 'Economic Services' - 2023 million rupees, the amount allocated to Transport and Communications for FY 83/84 is 74.2 million rupees (about five million dollars). No detailed breakdown for this amount under current expenditure is available; however, the Transport and Communications heading embraces telephone and postal services, ports and shipping, national roads, railways, civil aviation and airport services so it is apparent that this budget is intended to cover only administrative expenses.

14.5 Rupees = 1 Dollar during 1983-4 period

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Figure 4.1
DIAGRAMMATIC FLOW OF GOVERNMENTAL FUNDS

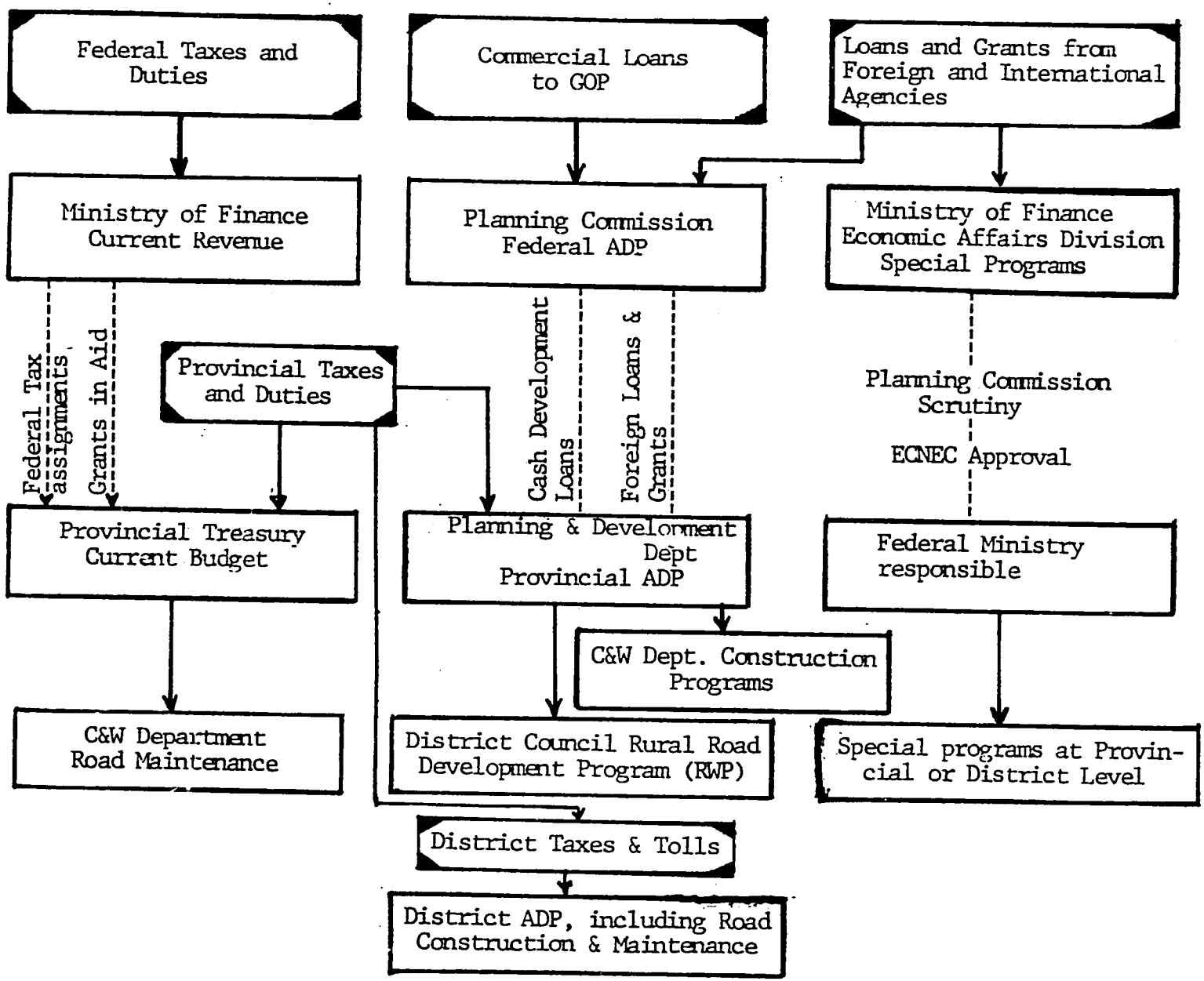

TABLE 4.1

FEDERAL REVENUE AND CURRENT EXPENDITURES 1983/84

Budget Estimates - millions of rupees

Total Revenue	68922	Percent 100	Total Expenditure	63383	Percent 100
Direct Taxes	9999	14.5	General administration	3517	5.5
Income Tax	9800	14.2	Defence	25219	39.8
Others	199	0.3	Law and Order	1397	2.2
			Community services	1254	2.0
Indirect Taxes	44196	64.1	Social Services	2143	3.4
Customs	20821	30.2	Economic Services	2023	3.2
Excise	14905	21.6	Subsidies	1916	3.0
Sales Tax	3747	5.4	Debt Service	19815	31.3
Others	4723	6.9	Other	6099	9.6
Other Revenue	14727	21.4	(Surplus on Revenue	5539)	-
Interest	7650	11.1			
General administration	2120	3.1			
Posts & telephones	1865	2.7			
State Bank	1150	1.7			
Others	1942	2.8			

Source: Pakistan Statistical Yearbook 1984. (Ref. 2) Tables 11.1 and 11.2

4.2.1. Federal Annual Development Program (ADP)

The bulk of expenditure on roads comes from the capital budget, the Annual Development Program (ADP). The Federal ADP overall budget provision for FY 83/84 totalled 24092 million rupees (approximately 1660 million dollars) allocated between major sectors as shown in Table 4.2.

TABLE 4.2

FEDERAL ADP BUDGET FY 1983/84

	Million Rupees	Percent
Agriculture, incl. subsidies	2339	9.7
Industries and Mining	2389	9.9
Water	2910	12.1
Power	6050	25.1
Fuels	2038	8.5
Transport and Communications	4637	19.2
Housing	851	3.5
Other Infrastructure	586	2.4
Education	956	4.0
Health	795	3.3
Other Social Development	541	2.2
Total	24092	100.0

Source: Planning Commission, Federal Government Public Sector Development Programme 83-84 (Ref. 12)

4.2.1.1 Transport and Communications

From the ADP budget of 4637 million rupees (320 million dollars) for Transport and Communications in FY 83/84, a total of 663.7 million rupees (46 million dollars) was allocated to roads, including 24 million rupees for the Frontier Works Organisation (FWO) for road improvement schemes in the Northern Areas. The Transport and Communications ADP is shown below in Table 4.3.

TABLE 4.3

FEDERAL TRANSPORT AND COMMUNICATIONS ADP FY 83/84

	Million Rupees	Percent
Telegraph, Telephone and Posts	1730.6	37.3
Ports and Shipping	181.7	3.9
Roads incl. FWO	663.7	14.3
Railways	1442.2	31.1
Civil Aviation	334.0	7.4
Planning and Research	3.3	-
Azad Kashmir and FATA	271.7	5.9
Total	4637.2	100.0

Source: as Table 4.2

The roads component of the Federal ADP consists primarily of expansion of the capacity of National Highways - widening and improvement of existing roads, including improvements to dual carriageway standard, bypasses and bridges. In addition, funds are allocated to special repairs (43 million for the Karachi - Hyderabad Super Highway) and overlays (8.6 million for N-5 Nowshera - Peshawar), restoration of flood damage (bulk provision of 2.7 million rupees), and items such as traffic signs, feasibility studies and traffic counts (total of 9.7 million. All works are divided into the broad classification of major or minor schemes, minor schemes generally costing less than a total of five million rupees. A detailed summary of the roads ADP is shown below in Table 4.4.

TABLE 4.4

FEDERAL ROADS ADP 1983/84

Major Schemes	Million rupees
IDA 3rd Highway Project	229.0
(Improvement of sections of national highway in four provinces)	
Punjab - 3 schemes	49.0
Sind - 3 schemes (incl. special repairs Karachi-Hyderabad)	49.4
NWFP - 6 schemes	118.8
Baluchistan - 8 schemes	59.7
Other National Highway schemes	72.6
National Logistics Cell Road project	21.5
Total-Major Schemes	600.0
Frontier Works Organisation	
4 Schemes	24.1
Minor Schemes	
Punjab - 8 schemes	11.5
Sind - 13 schemes	17.2
NWFP - 4 schemes	2.5
Baluchistan - 6 schemes	8.4
Total - Minor Schemes	39.6
Grand Total	663.7

Source: as Table 4.2

4.2.2 Federal Road Maintenance Funds

For the Federal road network of some 4900 km, 100 million rupees were allocated for maintenance in FY 84/85. These funds are allocated to the National Highway Board by the Planning Commission, Ministry of Planning and Development, specifically for maintenance. Most of these funds are disbursed, on a quarterly schedule, to the provincial C&W Departments for repair of potholes and periodic resurfacing, which is performed every 5 or 6 years. A recent development is the letting of a contract by NHB directly to a private company for maintenance of the Lahore-Multan road (220 km).

4.3 PROVINCIAL RECEIPTS AND EXPENDITURES

Overall provincial receipts and expenditures for FY 83/84 are summarised below in Tables 4.5 and 4.6, again in order to provide the context for road vehicle taxation and road expenditures.

4.3.1 Provincial Receipts

Provincial tax revenues are derived from two sources, i.e. the provinces's own taxation system, and federal tax assignments, which are of major importance. Under the provisions of a federal government Order of 1975, Provinces are entitled to 80 per cent of the net proceeds of Income Tax, Sales Taxes, and the export duty on cotton. As shown below, a very large proportion of provincial tax revenues, almost three-quarters overall, is derived from federal tax sources.

In addition to shares of federal taxes, all provinces receive substantial grants-in-aid from the GOP in order to balance their current budgets. Table 4.5 shows the position for FY 1982/83.

Provincial tax sources consist of

i) Property and wealth tax
ii) Immovable property tax
iii) Provincial excise duty
iv) Electricity duty
v) Education cess
vi) Hotel tax
vii) Entertainment tax
viii) Motor vehicle tax

(See below, Section 4.6, for details of motor taxation.)

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Table 4.5

TOTAL PROVINCIAL TAX RECEIPTS FY 82/83

Million rupees (per cent)

	Punjab	Sind	NWFP	Baluchistan
Provincial Taxes	1484 (17)	1044 (26)	212 (7)	653* (41)
Federal Taxes	5506 (62)	2056 (51)	1224 (41)	353 (22)
General Revenue	1409 (16)	539 (13)	280 (9)	54 (3)
Federal Grants	408 (5)	384 (10)	1274 (43)	534 (34)
Totals	8807 (100)	4023 (100)	2990 (100)	1594 (100)

* includes 627 million rupees in excise duty and royalties on Sui natural gas; since 1981 these revenues have been paid direct to provincial funds.

Source: Pakistan Economic Survey 1983-4 (Ref. 13); Pakistan Statistical Yearbook, 1984 (Ref. 2)

4.3.2 Provincial Expenditures

Current expenditures by provincial governments are shown below in Table 4.6, under main headings. Under the heading 'Economic Services' expenditures on transport and communications are negligible and for practical purposes can be disregarded. As in the case of the Federal Government, almost all expenditure on communications comes from the development budget, in the form of the annual development programs (ADP's).

Table 4.6

CURRENT EXPENDITURE OF THE PROVINCES FY 82/83
million rupees

	Punjab	Sind	NWFP	Baluchistan
General Administration	859	376	232	167
Law & Order	746	372	252	154
Communities Services	486	253	202	203
Social Services	2870	1219	875	317
Economic Services	1819	646	320	242
Subsidies	248	235	379	179
Debit Service	1760	920	729	332
Other	19	2	1	-
Totals	8807	4023	2990	1594

Note: Current expenditures on transport and communications in FY 82/83 were as follows:-

	million rupees
Punjab	0.1
Sind	2.3
NWFP	0.7
Baluchistan	-
	3.1

Source: Pakistan Economic Survey 1983-84 (Ref. 13)

4.3.3 Provincial Annual Development Programs

A summary of provincial ADP's by sector for financial year 1984-85 is shown in Table 4.7. Funds for the development programs are provided by the GOP in the form of Cash Development Loans, repayable over a period of 25 years, including a grace period of five years during which only interest is payable. Rates of interest appear to be close to commercial rates, for example NWFP and Baluchistan Cash Development Loans since 1980-81 have been approximately 13 per cent per annum (1). Funds are also available to the provinces from Open Market Loans but, at least in the case of NWFP, these loans (normally 10 years) are quite small compared with the GOP loans; NWFP's principal debt in 1984 was 6072 million rupees to the federal government and 436 million to the open market. Examination of data on capital receipts of the provincial governments (2) shows that ADP's for all provinces are covered by federal government loans and that these loans form the bulk of capital receipts for the provinces.

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(1) Government of NWFP - White Paper on the Budget 1984, (Ref. 14)
Government of Baluchistan - White Paper, Budget 1984-85 (Ref. 15)

(2) see Pakistan Statistical Yearbook 1984 Table 11.7 (Ref. 2)

Table 4.7

PROVINCIAL ADPs BY SECTOR FY 84/85

million rupees

	Punjab	Sind	NWFP	Baluchistan
Agriculture & Food	1195.4	175.0	120.9	166.6
Industry & Minerals	50.0	51.1	82.5	24.0
Water and Power	370.0	172.5	154.5	90.2
Housing	986.9	350.9	199.2	77.3
Transport & Communications	272.0	337.9	160.1	100.7
Education & Training	488.9	229.6	264.4	146.8
Health & Social Welfare	566.7	172.5	171.8	54.0
Rural Development	262.6	24.3	87.1	46.2
Other programs	107.5	19.6	4.2	99.2
Total	4300.0	1533.4	1244.7	805.0

Source: Finance Departments of Provincial Governments, Volume V of Annual Development Programs.

Table 4.8

CURRENT PROVINCIAL ROAD PROGRAMS

million rupees

	Estimated Total Cost	Expenditure to June 1984	1984-85 ADP		
			Ongoing	New	Total
Punjab	1156.9	501.5	241.9	30.1	272.0
Sind	1747.1	788.9	194.8	105.2	300.0
NWFP	690.8	106.4	141.1	19.0	160.1
Baluchistan	1200.8	196.4	56.2	44.5	100.7
Total	4795.6	1593.2	634.0	198.8	832.8

Note: road schemes (roads and bridges) in progress FY84/85 are:

	Ongoing	New	Total
Punjab	126	23	149
Sind	71	77	148
NWFP	35	22	57
Baluchistan	17	10	27
Total	249	132	381

Source: Annual Development Program documents, Government of Punjab, Sind, NWFP, and Baluchistan

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4.3.3.1 Provincial Road Programs

Current and estimated total programmed expenditure on road programs in the four provinces is shown in Table 4.8. For FY 84/85 there are a total of 381 schemes in progress at an average estimated cost of 12.6 million rupees each. One-third of the total estimated cost had been spent up to the end of FY 83-84, and a further 17 per cent (832.8 million rupees) planned to be spent in FY 84/85.

Typically schemes consist of construction, or reconstruction and reconditioning, 'black topping', widening and improvement, strengthening and reconstruction of bridges and causeways, and new bridges. In Punjab, a total estimated 15 million rupees is allocated for restoration of flood damages, (of which so far 4.5 million has been spent) and 19 million for research and development and establishment of laboratories. In Sind, funds are programmed for traffic surveys and a road inventory (total of 3.4 million, and 1.0 million rupees to be spent in FY84/85), and construction of low cost experimental roads (5 million rupees total with 1 million to be spent in FY84/85).

Overall, an average of 2.5 million rupees will be spent on the 249 ongoing schemes in FY84/85, and an average 1.5 million rupees for the 132 new schemes started.

4.3.3.2 Provincial Road Maintenance Expenditures

Interviews were held with Construction and Works (C&W) officials in NWFP and Sind. No documentary evidence, e.g. budgets showing details of spending on manpower, materials and equipment, expenditure by location etc. was available. Most work apparently consists of resurfacing and is done by contractors, although for general maintenance work there are permanent gangs of semi-skilled workers employed by the C&W Department.

In Sind province, the FY84/85 maintenance budget was stated to be 90 million rupees, up from a total of 71 million rupees in FY 83/84. These funds are apparently allocated from the province's current expenditure budget although (see above paragraph 4.3.2) it is not known under which heading. Funds are allocated according to a "yardstick" of Rs 10,000/- per 10ft-mile, but C&W officials believe that the yardstick is inadequate because of price increases (e.g. for bitumen) and should be increased to about Rs 15,000/- per 10ft-mile.

In NWFP the total maintenance budget was 61 million rupees for FY84/85, most of which is allocated to resurfacing of 410 km of roads, or 583 "10ft equivalent-km". The "yardstick" budget allocation was given as Rs 12,000 per 10ft-km equivalent, nearly twice the figure for Sind.

4.3.4. Provincial ADP Funds for District Roads

Under the budget head "Rural Development" funds are allocated each year from the provincial ADP destined for district councils. In NWFP, Punjab and Baluchistan these funds are managed by the Local Government and Rural Development departments and accountable through the Assistant Directors Rural Development in each district, to the Directors-General, Local Government and Rural Development. The programs are known as Rural Development Programs (RDPs), or Rural Works Program (RWP) in the case of NWFP. In Sind, funds are managed directly by the district councils. In all cases, however, the actual programs are decided in voting sessions at the full district council. There are no restrictions on these ADP funds as to their use for construction or maintenance.

4.3.4.1 Punjab

In Punjab for FY 84/85 a total of two million rupees is allocated directly for district roads from the total RDP of 26.3 million. Under the RDP, however, there is a further allocation of 16.8 million rupees for "matching grants", (provided funds from the District itself are available), of which varying proportions (often quite large) may be used for district roads.

4.3.4.2 Sind

Sind Province ADP for FY 84/85 has no specific allocation for district roads. Under the heading "Aid to Local Bodies", there is a block amount of 30 million rupees for grant-in-aid to urban and rural councils, and a further 17.5 million rupees for matching grants to rural councils. As in Punjab, varying proportions of these funds may be used for district roads.

Additionally Sind has a "farm to market" road program, managed jointly by the C&W Department and Local Government Department, with an allocation of 24.3 million rupees in FY 84/85. The program provides for completion or near completion of five roads at a total cost of 16.3 million rupees, preparation of a master plan for farm to market roads (cost one million rupees) and allocation of 14,3 million rupees for new schemes.

4.3.4.3 NWFP

NWFP's Annual Development Program allocates a total of 87.1 million rupees to rural development of which 51.5 million is for district roads. A similar amount, 51.7 million, was allocated for FY 83/84. Rural works program (RWP) funds are shared among the 13 districts by dividing 60 per cent equally and allocating the remainder proportionate to total population of each district. According to a provicial government institution, eight per cent of funds for district roads should be set aside for maintenance, although the Consultant could no evidence of this in the allocations (no other province reported a specific "set aside" for maintenance). Details of the district roads program for NWFP, which involves construction of nearly 800 km of metalled, shingle and katcha roads, are given in Appendix 4.5.

4.3.4.4 Baluchistan

The rural development program of Baluchistan's ADP total 26 million rupees for development grants to district councils, with no specifc allocation for district roads. For Kohlu Agency, there is special provision of 5.28 million rupees for seven ongoing and four new road projects (part of Valley Development Project).

4.4 DISTRICT RECEIPTS AND EXPENDITURES

Taxation by district councils is regulated in law by the Provincial Governments' Local Government Ordinances and Laws of 1979 (when district councils came into being) and as subsequently amended. Although, between provinces, taxes which may be levied by district councils differ to some extent, an important provision of the Sind Local Government Ordinance 1979 (Ref. 11), and similar in other provinces, is the following -

i) all taxes, rates, tolls and fees must be sanctioned by the provincial government

ii) the provincial government may frame model tax schedules, and a council shall be guided by them in levying a tax, rate, toll or fee

iii) the provincial government may direct any council -

- to levy any tax, toll etc. under the ordinance
- to increase or reduce any tax, toll etc. to such extent as may be specified
- to suspend or abolish the levy of any tax or toll etc.

(Chapter IX, Paragraphs 60-62, Sind Ordinance)

List of all taxes, tolls and fees permitted for District Councils in Sind and NWFP are given in Appendix 4.6; however, by no means all are used. The main revenue sources are listed below, in (an approximate) order of importance. However, as will be seen, individual districts vary considerably in their revenue generating capacities and the importance of a given source may also vary between districts.

MAIN REVENUE SOURCES OF DISTRICT COUNCILS

- Export Tax
- Tax on transfer of immovable property
- Cattle Market Fees or Taxes
- Royalties on land, gravel and stone or other minerals
- Rents from Council Properties
- Road Tolls
- Local Cess (land tax)
- Bus stand fees

Based on the data for the six districts visited, it is apparent that the councils' capacity to raise revenue varies greatly. Table 4.9 shows the taxes collected in each district under these main headings, and Table 4.10 shows the position for these districts, using tax income (i.e. excluding fees for services etc) per capita of rural population as the measure. Urban population within a district is excluded because urban areas are outside the jurisdiction of the district council; however, the fact that a district like Rawalpindi has a very large urban population within its borders clearly influences its capacity to generate revenues.

Table 4.9

MAIN TAX REVENUES BY DISTRICT

000's rupees/rupees per capita of rural population

	Abbottabad	Rawalpiondi	Jhelum	Pishin	Jacobabad	Sukkur
Export Tax	8850/8.7	4000/3.6	2640/2.8	-	2462/2.9	6350/8.2
Immovable Property	2600/2.6	5000/4.6	520/0.5	190/06	-	600/0.8
Cattle Markets	2570/2.5	4000/3.6	431/0.5	-	44/—	-
Minerals Royalties	-	1800/1.6	-	25/0.1	-	900/1.2
Road Tolls	-	250/0.2	1650/1.7	-	-	185/0.2
Local Cess	-	1200/1.1	450/0.5	16/—	15/—	1000/1.3
Bus Stand Fees	60/—	800/0.7	40/—	-	-	-
Other Taxes	-	650/0.6	20/—	3/-	-	-
Total	14080/13.8	17700/16.1	5751/6.1	234/0.7	2521/3.0	9035/11.6

Note: FY 84/85 proposed budgets for Abbottabad, Rawalpindi and Jhelum.
FY 83/84 actual budgets for Pishin, Jacobabad and Sukkur.

Source: Data supplied by Districts to Consultant

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Table 4.10
DISTRICT COUNCIL INCOMES AND POPULATION

	Council	Tax Income (000s' Rupees)	Total Population (000's)	Rural Population (000's)	Tax Income per capita (Rupees)
1.	Abbottabad	14080	1169	1017	13.84
2.	Rawalpindi	17700	2123	1097	16.13
3.	Jhelum	5751	1162	950	6.05
4.	Pishin	234	379	334	0.75
5.	Jacobabad	2521	1012	854	3.00
6.	Sukkur	9035	1098	779	11.60

Note: Incomes for 1, 2 and 3 from FY 84/85 Budgets, for 4, 5 and 6 from FY 83/84 data.
Population according to 1981 Census

Broadly, revenue generated by a district should be related to its population and total income. However, a given district may or may not exploit its tax sources to advantage. For example, Jhelum has very large salt mines and also some coal mines and gypsum deposits but the District Council imposes no royalties or other charges, such as are levied elsewhere on minerals, e.g. sand and river gravel in Rawalpindi.

4.4.1 Abbottabad

The total revenue budget for FY 84/85 amounted to nearly 14.5 million rupees, of which 10 million was allocated to development - the district Councils' own ADP. Of this, 4.5 million rupees is earmarked for rural roads. In addition, the Rural Works Program of the Provincial ADP is providing 4.524 million rupees for rural roads, so for the district in FY 84/85 a total of 9.024 million rupees is available for roads.

For road maintenance, 500,000 rupees (11 per cent of the budget) was allocated from the district's own funds, and a further 350,000 rupees from the Rural Works Program (Provincial ADP), according to the standing instruction from the NWFP government. In addition, ten per cent of the council's budget, or 1.4 million rupees this year, is held in reserve for emergency works, which may include, for example, removing landslides from roads.

The provincial C&W department's FY 84/85 budget for this district totals Rs 11.7 million, consisting of 11.5 million for 20 km of mostly ongoing projects and 0.2 million for a feasibility study of a bypass for Abbottabad.

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4.4.2 Rawalpindi

In the FY 84/85 development expenditure budget a total of 2.0 million rupees is allocated to repair works, of which council officials estimate 80 per cent is spent on road repairs, mainly by seasonal gangs repairing katcha roads and performing non-mechanised work on paved roads. Also, an estimated 1.5 million rupees from the "ongoing projects" budget (6.9 million rupees) is spent on road repairs. Thus, in FY 84/85, a total of 3.1 million rupees is available for road maintenance. The exact figure for all road works is not known, because the budgets for ongoing and new projects (total 11.3 million) include all council building projects.

From the Provincial ADP, the rural development program, a total of 0.72 million rupees is allocated for roads in FY 84/85; the allocation for FY 83/84 was 1.45 million rupees. According to council officials there is no fixed percentage from the provincial RDP allocated to maintenance. Roads constructed by the rural development department are handed over to the district council for maintenance.

4.4.3. Jhelum

Jhelum district councils' development budget alone exceeds its revenue income by more than 4 million rupees, and it appears likely that this budget will be cut substantially in the outturn, and that a grant-in-aid from the provincial government will be provided. The total budgeted for construction and reconstruction of paved roads in FY 84/85 is 9.15 million rupees, while the allocation for road maintenance gangs (staff wages) is 75,000 rupees. From the provincial rural development program (roads) a total of 3.35 million rupees is available for FY 84/85, consisting of 1.75 million for ongoing projects and a further 1.6 million for new roads. As in Rawalpindi, roads built from RDP funds then become the district's responsibility for maintenance.

4.4.4. Pishin

The only funds available for roads in FY 83/84 (and the situation is the same in 84/85) come in the form of a grant for stage payments on a road grader, and a grant for fuel and maintenance of the grader and driver's salary. This totals 213 thousand rupees in FY 84/85. In Pishin district the 31 union councils are also share some responsibility for road maintenance; however, only four union councils are presently performing maintenance, using tractor-graders. The union councils, except for these four, have no revenue of their own, and received 30,000 rupees each from provincial ADP funds.

4.4.5 Jacobabad

For FY 84/85 the Sind Rural Development Program allocated Rs 400,000 for repairs to 15.8 km of katcha roads in Jacobabad. In addition 2.52 million rupees was allocated in matching grant for completion of 32.7 km of 10 Ft wide black topping. The total cost is estimated at 5.04 million rupees, District Council supplying balance of 2.52 million. However, the accounts officer stated that it was unlikely the council could find the money this year. The proposed FY 84/85 Budget has a total of 2.46 million rupees for capital development, but this includes other calls, e.g. schools, while capital grants, 3.35 million in FY 83/84, have been severely reduced to 0.2 million in 84/85. (see Appendix 4.3)

4.4.6 Sukkur

The Rural Development Program in FY 84/85 allocated Rs 300,000 for completion of 1.6 km of metalled road, plus Rs 177,000 for building of more than 20 brick soled road sections at Union Council villages. Under the matching grant program a total of 2.94 million rupees is budgeted, 1.15 million from the province and 1.79 million from the District, for black topping a total of 20.1 km of 12 ft roads. It appears likely that this program will in fact be completed. Budgeted income for FY 84/85 is 13.3 million rupees, and of Development Expenditure, it is estimated by officials that 90 per cent will be spent on roads.

4.5 DISTRICT FINANCES

It has been noted above that, of total expenditure by provincial governments, an estimated 70-75 per cent is derived from federal taxes, grants or loans (see Tables 4.5 - 4.7).

In the sample of districts examined (see Appendix 4.3) the - admittedly incomplete - data suggest that about 25 per cent of total funds available is provided by provincial governments. A recent publication (Ref. 10) supports this estimate. The table below shows district and union councils' total income and sources for the years 78/79 to 82/83. It will be recalled that the existing local government system started in 1979, so the figures for 78/79 are effectively a part-year or are carried over from the previous system.

The data available show that in FY 82/83 63 per cent of local rural councils income was derived from taxes, 17 per cent from services and 20 per cent from provincial grants. The trends in terms of percentage increases/ decreases on the previous year will be noted. The councils' tax income rose rapidly in the first two years as the administrative systems for collection were brought into full operation, and then much more slowly in the period 1981-1983. Services income appears erratic, possibly due to different definitions being used from year to year, but overall it has an upward trend, rather lower than that of tax income. Grant income evidently follows no consistent trend. In FY 80/81 it represented 22 per cent of total income, in 81/82 16.5 per cent, and in 82/83 20.2 per cent.

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Table 4.11

DISTRICT AND UNION COUNCILS INCOME 1978-1982
million rupees

	78/79	79/80	79/80	81/82	82/83
Taxes, tolls, fees, rates	155.8	271.3	433.3	522.7	607.0
(increase on previous year %)	-	(+74)	(+60)	(+21)	(+16)
Services Income	56.8	9.8	52.1	82.7	167.5
	-	(-83)	(+432)	(+59)	(+103)
Grants	10.8	70.7	136.7	119.6	195.8
	-	(+555)	(+93)	(-13)	(+64)
Total	223.4	351.8	622.1	725.0	970.3
	-	(+58)	(+77)	(+17)	(+34)

Source: Local Government in Pakistan; M. Afzal MLGRD (Feb. 1985) (Ref. 10)

It is worth noting that total rural local council income (4100 Union Councils and 84 District/agency Councils) of 970 million rupees in FY 82/83 compares unfavourably with that of the 450 urban councils, 3209 million, of which 86 per cent was derived from taxes. M. Afzal (Ref. 10) comments that the level of grants to local councils is 'very low indeed' and that the percentages of grants to local income, for instance in the USA and France, are 43 and 44 per cent respectively. This reference also notes that "for an examination of the financial conditions and performance of local councils, the availability of statistics on the finances ... is a pre-requisite. However, not much attention has been given by the provinces toward data collection and analysis."

4.5.1 Management of funds

4.5.1.1 Provincial Funds

Rural development (RDP) or rural works program (RWP) funds are transferred twice a year (in June and January) to the Directors-General of LGRD, by warrants from the provincial finance department. The DGs are then responsible for payments, using checks drawn on the provincial treasury. In the districts, the Assistant Engineers LGRD pass

contractors' bills for payment and send them via the Assistant Director to the DG. Assistant Directors send progress reports, consisting of all accounting documents, to the DG every quarter. In the case of NWFP annual audits are carried out of RWP accounts in each district by an LGRD official. In Sind, RDP annual audits are handled by the Provincial Accountant General's office; the DG-LGRD still has responsibility, however, to watch for irregularities.

4.5.1.2 District Council Funds

The bulk of district councils revenues, e.g. from Export Taxes, are collected by contractors. In certain cases the contractor, to whom the tax has been auctioned on a yearly basis, is required to pay 50 per cent of the auction price in advance, but in most cases the requirement is for monthly payments in advance. Sometimes contractors fail to make payments on time, but these instances are rare and do not appear to cause undue concern to officials. These and other district council revenues are paid to the district's account at the provincial treasury. District council Chairmen or Chief Officers may then draw upon these accounts using checks, provided payments are within the limits of the various headings of the District budget.

4.5.1.3 Timeliness of Funds

The procedures for handling both RDP and district council funds, as described above, are satisfactory. Further, from discussions with the officials met in the various districts, it was evident that there were no delays to planned works as a result of cash flow difficulties. In fact, where required, contractors are given advance payments, or allowed credit for hire of machinery, in order to proceed with the work.

4.6 ROAD USER REVENUES

4.6.1 Motor Vehicle Fleet

Data on vehicle fleet growth 1973-1982, by vehicle type, are shown in Table 4.12. Overall, the fleet grew from about 450 thousand vehicles in 1973 to almost 1.4 million vehicles in 1982, an average annual growth rate of 12.7 per cent. This rapid growth is accounted for by two factors - a high (16.3 per cent) growth rate for motorcycles, which in 1982 represented 51 per cent of the total vehicle population, and a very fast increase for 'other vehicles', which are mainly farm tractors. Rates of growth in this vehicle class are in fact similar in all four provinces, indicating not only increased investment in the agricultural sector throughout Pakistan but a large increase of motorised traffic in rural areas, since farm tractors (pulling trollies) are often the main mode of transport, for goods and passengers, in rural areas.

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The truck fleet appears to have increased rather slowly, except in NWFP and Baluchistan where growth rates, from small bases, are about ten per cent annually. There are two explanations - firstly National Logistics Cell (NLC) trucks are not included in the totals, although this would make only a marginal difference; secondly and more important, it is believed that a large number of truck owners evade annual registration fees and thus are not included in the statistical records. National Transport Research Centre (NTRC) officials accept this as a realistic explanation but there is no reliable estimate of the number of trucks involved. If a growth rate of six per cent was assumed since 1973, (i.e. similar to that for buses) it would mean a total of about 10,000 trucks unregistered in 1982.

Table 4.12
MOTOR VEHICLE FLEET 1973 - 1982
000's

	Motor Cars	Buses	Trucks	S/Total	M/Cycles*	Other	Total
1973	177.3	29.7	49.3	256.3	175.1	26.4	457.8
1974	189.1	33.5	53.5	276.1	199.7	33.1	508.9
1975	203.7	36.4	58.2	298.3	234.0	43.3	575.6
1976	221.6	39.0	61.9	322.5	276.4	57.4	656.4
1977	227.2	41.7	56.9	325.8	314.3	76.0	716.0
1978	262.9	43.4	59.8	366.1	375.3	95.3	836.7
1979	303.3	47.5	65.3	416.1	469.0	129.3	1014.3
1980	283.0	49.9	58.0	390.9	553.9	165.1	1109.9
1981	302.1	51.2	59.6	412.9	594.4	183.8	1191.1
1982	325.1	51.7	72.0	448.8	680.7	208.4	1338.0
Average annual growth (%)	7.0	6.4	4.3	6.4	16.3	25.6	12.7
Per cent of total	24.3	3.9	5.4	33.5	50.9	15.6	100

* includes three wheelers

Source: Pakistan Statistical Yearbook 1984; (P. 177) (Ref. 2).

There are, in any case, some inconsistencies in the available data, possibly due to simple reporting errors.

The 1982 data give an overall vehicle ownership rate for Pakistan of nearly 15 vehicles per 1000 population. Although more than double the figure for neighbouring India, vehicle ownership is still very low by world standards, and it seems likely that growth rates will continue at similar fairly high levels for some years to come.

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4.6.2 Petroleum Consumption

Consumption of gasoline and diesel fuel (HSD) used in road transport is shown below for the period 76/77 to 82/83 in Table 4.9. It is estimated that 85 per cent of diesel fuel use is for road vehicles. The road transport sector is by far the largest user of petroleum fuels, accounting for about 50 per cent of a total consumption of 5,572 million tonnes in FY 82/83.

Table 4.13

CONSUMPTION OF ROAD FUEL 1977 - 1983

000's tonnes

FY	Gasoline	Diesel (HSD)
1976-77	382.9	1053.2
1977-78	445.0	1146.8
1978-79	505.5	1342.2
1979-80	542.3	1509.0
1980-81	589.0	1662.4
1981-82	644.9	1943.8
1982-83	701.7	2123.6

Source: Environment Statistics of Pakistan 1984; p.121 (Ref. 16)

The average annual growth rates of fuel consumption in the period 1977 to 1983 were 10.6 per cent and 12.4% for gasoline and diesel respectively, which appear reasonably consistent with the vehicle fleet data.

Total consumption of fuels in 1983-84 rose by an estimated 6.6 per cent from the previous year (Ref. 13) so using this estimate and assuming a specific gravity of 0.8, consumption of gasoline and diesel for road vehicles in FY 83/84 is estimated as follows:-

Gasoline	935.0	million	litres
Diesel	2829.6	"	"
Total	3764.6	"	"

The trend of growth of motor vehicles indicates that fuel consumption may be currently increasing at about 9.5 per cent per year, based on growth rates shown in Table 4.8 and estimated proportions of fuel consumed by each vehicle class.

4.6.3 Federal Road User Taxes

A detailed list of federal taxes on fuel, oil, tires vehicles and replacement parts is shown in Appendix 4.1. Taxes consist of Central Excise Duty (CED), Sales Tax and the Petroleum Development Surcharge on gasoline and diesel fuel, which is a levy specifically assigned to support the costs of oil exploration by Pakistan Oilfields Limited. In this context it should be noted that all production and distribution of gasoline and diesel fuels is controlled by a federal government company, Pakistan State Oils (PSO). Pump prices are fixed by the government, and although in late 1984 the Petroleum Development Surcharge was reduced, on gasoline from 55 paisas/lt to 5 paisas/lt and on diesel from 68 to 43 paisas/lt, pump prices remained the same. The windfall profit to PSO can be considered as taxation revenue.

However, consideration of economic prices for fuel and current pump prices makes it clear that the GOP is effectively subsidising road diesel fuel. Information obtained from PSO gives an ex-refinery price for HSD as Rs 2.98 per litre, clearly below the economic cost, estimated by the consultant at Rs.4.30 or 28 US cents per litre. Details of prices etc obtained from PSO are shown in Appendix 4.4. Shown below are the economic cost estimates, pump prices, and effective rates of tax for the most common grade of gasoline (super 90) and diesel fuel (HSD).

Table 4.14

EFFECTIVE TAXES/SUBSIDIES ON ROAD FUEL FY 83/84

rupees/litre

	Gasoline	Diesel
Ex-refinery cost	4.94	4.30
Freight margin	0.29	0.27
Dealers commission	0.14	0.07
Total economic cost	5.37	4.64
Sales Price	7.02	4.25
Effective tax (subsidy)	1.65	(0.39)

Source: See Appendix 4.4

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Data on total revenues (gross revenues) obtained from CED, sales taxes and CED surcharge for vehicles, spare parts, tires and batteries etc. were obtained from the Central Board of Revenue. A summary of federal revenues from road user taxation, including the Consultant's estimates of fuel taxes and subsidies, is given in Table 4.15.

Table 4.15

FEDERAL ROAD USER TAXES/SUBSIDIES FY 83/84

	Million rupees
Gasoline	1543
Diesel (HSD) subsidy	(1104)
Engine oils etc.	50
Tires	310
Replacement parts	315
Vehicles	2225
Total	3339

Source: Central Board of Revenue, and Consultants estimates for fuel.

4.6.4. Provincial Road User Taxation

Road user taxation in the provinces consists of registration fees, paid to register new vehicles and on change of ownership, and an annual tax or licence fee which may be paid quarterly or annually. Details of taxation rates for Punjab are given in Appendix 4.2. In addition, provinces collect fees for issuing drivers' licenses and tolls on bridges. Revenues from motor registration and annual license fees are shown in Table 4.16

Table 4.16

PROVINCIAL MOTOR VEHICLE REVENUES 1980-1983
(million rupees)

FY -	80/81	81/82	82/83	83/84
Punjab	179.3	229.1	261.3	282.6
Sind	127.9	148.2	200.0	217.5
NWFP	57.9	58.5	77.3	102.4
Baluchistan	8.1	11.3	9.1	8.5
Total	372.6	447.2	547.7	611.0

Source: Pakistan Economic Survey 83/84 (Ref. 13) and National Highway Board.

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During the four year period, annual revenue increased by 64 per cent, while the vehicle fleet increased by about 32 per cent, indicating either increases in rates or more efficient collection methods, or both. Baluchistan is an exception, in that it appears that revenues have not even managed to keep pace with vehicle fleet growth. The reasons for this decline in per vehicle revenue are not known.

For fiscal year 1983-84 a total of 611 million rupees was collected, or an average of about Rs 450 per vehicle. Details of rates for provinces other than Punjab were not obtained, but it is apparent that rates in NWFP and Baluchistan vary significantly from the other provinces. Dividing revenue for 82/83 by numbers of vehicles registered in each province in 1982 gives the following -

FY 82/83

	Revenue per vehicle (rupees)
Punjab	387
Sind	406
NWFP	654
Baluchistan	174
Average	409

Revenues from drivers' license fees and bridge tolls are shown below.

Table 4.17

PROVINCIAL DRIVERS' FEES AND BRIDGE TOLLS FY 83/84

Million rupees

	Drivers Fees	Bridge Tolls	Total
Punjab	27.2	30.0	57.2
Sind	26.0	28.7	54.7
NWFP	6.2	12.3	18.5
Baluchistan	0.2	1.6	1.8
Total	59.6	72.6	132.2

Source: National Highway Board

Thus total provincial road user revenues in FY 83/84 amounted to 743.2 million rupees, of which 82 per cent derived from registration fees and annual taxation, and the remainder from bridge tolls (10 per cent) and drivers' license fees.

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Although quite small compared with Federal motor tax revenues, provincial road user revenues are nonetheless very significant in terms of total provincial receipts from taxation (i.e. excluding federal tax assignments). Data on bridge tolls and drivers' licenses are not available for 82/83, but assuming them to have been 10 per cent less than 83/84, road user revenues for the provinces in FY 82/83 are compared with total taxation receipts below:

Table 4.18

TOTAL PROVINCIAL ROAD USER REVENUES FY 82/83

million rupees

	Total Provincial Tax Revenue	Road user Revenue	
			Per cent of total
Punjab	1484	313	21
Sind	1044	249	24
NWFP	212	94	44
Baluchistan	26*	11	42
Total	2766	667	24

* excludes Sui gas revenues

Source: Tables 4.5, 4.16 and 4.17 (less 10%)

4.7 TOTAL ROAD EXPENDITURES

A summary of total road expenditures in FY 84/85 is given below in Table 4.19. Data on maintenance expenditures (budgets) for Punjab and Baluchistan were not available, so estimates are made at 120 million and 20 million rupees respectively, based on the Sind and NWFP data.

For district roads, estimates for monies from the provincial ADP's and Baluchistan are made assuming that about half these funds are used for roads. This may be rather a conservative estimate. The estimate (100 million rupees) of district councils own funds for roads is based simply on an average two million rupees per district for Punjab and Sind and one million per district in NWFP and Baluchistan. This may be a high estimate.

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Table 4.19

SUMMARY OF ROAD EXPENDITURES
1984/85

(million rupees)

Federal Highways (approx. 4,900 km)	
- Construction etc.	663.7
- Maintenance	100.0
Total	763.7
Provincial Roads (approx. 39,000 km)	
- Construction etc.	832.8
- Maintenance	290.0 (E)
Total	1122.8
District Roads (approx. 43,000 km)	
From provincial ADPs	120.0 (E)
From district funds	100.0 (E)
Total	220.0

Source: Consultant's estimates

Chapter 5

COSTS FOR ROAD WORKS

Before an analysis of road maintenance and/or rehabilitation costs can be made, both must be clearly defined. In the four provinces and the many districts, there are no clear-cut, consistent definitions. In many areas, as mentioned in section 2.2, above, "rehabilitation," for example, is included as a part of road maintenance. Such terms as "betterments" and "reconstruction" are also used.

5.1 DEFINITIONS

For the purposes of this report, the following definitions will apply:

5.1.1 Road Maintenance

- Routine: those tasks undertaken on a day-to-day basis which can be planned and programmed (i.e., ditch cleaning, pothole patching, the blading of gravel surfaces, etc.)
- Periodic: those tasks which can be planned and programmed, but occur in a frequency of more than one year (i.e., resurfacing, regravelling, etc.)
- Emergency: those tasks which cannot be planned or programmed, but are required in the aftermath of slides, flooding, etc.

5.1.2 Rehabilitation

That work required to bring a road back to its initial design standard from a deteriorated condition brought about by a lack of normal routine and periodic maintenance.

5.1.3 Betterments

Work which improves a road's original design standard (i.e., the lengthening of horizontal curve radii, drainage improvements, pavement and/or formation widening, etc.)

5.1.4 Reconstruction.

A new road, normally constructed within the original right-of-way, and usually to a higher standard than the existing facility, utilizing as much as possible of the established horizontal and vertical alignments.

5.1.5 New Construction

A new road, constructed to whatever appropriate standard, within a new right-of-way.

5.2 AVERAGE CONDITION OF ROADS AND THEIR MAINTAINABILITY

Due to an historical lack of funding, and other resources, almost all district roads are in one state of disrepair or another; all need maintenance attention -- perhaps as much as 50% need rehabilitation and many do not exist as roads as such.

5.2.1 Earth Roads

In the plains areas these roads vary from being mere at-grade tracks, completely un-engineered, to semi-engineered facilities with varying heights of embankment. Most of the former and some of the latter are subjected to flooding during the monsoons of June, July and August, and cannot be used for hours or even days at a time. The tracks cannot be maintained; as "roads," they do not exist. Those on embankment, however, can and should be maintained. Maintainable or not, these roads are very much needed since they remain the only source of surface communication for many thousands of village inhabitants.

As opposed to those in the flat, in the hilly and mountainous areas these earthen roads didn't just "happen"; they have been constructed, but without the benefit of proper design or construction specifications or supervision. They are extremely narrow (10-to-12 feet on the average) with tight horizontal curves and with no apparent restrictions on vertical gradients. They have been given no surfacing. Until these roads are widened and gravelled, they too are unmaintainable, at least by any conventional methods. Potholes can be patched by hand, as can side-borrow be placed over and around rock outcroppings in the subgrade, but this work would have little effect or lasting value. Again, as poor as they are, these roads still provide an essential line of surface communication for the inhabitants of outlying villages to get their produce to market and maintain a connection with social services.

5.2.2 Gravel Roads

Most district roads in this category (termed "shingle" roads) have not been engineered, the embankment has not been machine-compacted, and the surfaces are usually uncrushed, unscreened and uncompacted river gravel, at best. In this state, they cannot be given maintenance attention in a normal manner. However, by scarifying, removing over-sized stones, watering, reshaping and compacting the top layer, it would serve, in most cases, as a sound base. Then adding a layer of crushed and graded aggregate would bring these roads up to a good gravel standard, easily maintainable.

5.2.3 Paved Roads

The average paved district road has a 10-foot-wide surface treatment (usually a triple treatment, using crushed aggregate of 3/4" maximum for the first layer, 1/2" maximum for the sècond and topped with a 1/4" maximum). This treatment is usually placed on compacted base and subbase courses of 4" thickness each. If the California Bearing Ratio (CBR) test values are adequate in the subgrade, this pavement design should stand up under the relatively light traffic flows to which these roads are subjected today. However, because of the narrow width of the pavement, wheel loads will continually be riding over the edge, and if the shoulders are not up to grade, and well compacted, the surface will break up rapidly.

The surface of paved roads is currently receiving little, if any, routine maintenance attention or even inspection. The general philosophy is to do nothing until such time as a complete resurfacing is required. When a pavement is allowed to deteriorate in this manner, user costs become extremely high and the resurfacing costs are made higher because there will also be base and subbase damage to repair when the work is finally undertaken. Unfortunately, the shoulders are not looked after, which hastens the surface failure. However, these roads are definitely maintainable, and could be kept in good serviceable condition with a relatively small investment in minor equipment (and training).

5.3 COST OF RESOURCES

Each Work Activity has been assigned a crew to accomplish that specific task; each crew has its component of equipment, personnel and materials as described in section 5.4 below. To arrive at the daily cost for each crew, the three necessary resources are treated separately.

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5.3.1 Equipment Costs

New equipment prices were supplied by local agents (of foreign and local manufacturers) in Islamabad, Rawalpindi and Karachi. Imported units are quoted as CIF (Karachi) with import duties, taxes, etc. NOT included; other items are quoted at local market value.

The total cost of each purchase must include amortization charges as well. A rate of 12% has been used.

Table 5.1 cites first the purchase price, then the expected life (Y) of the unit, expressed in years. The third column adds the amortization charges to the purchase price; this latter figure is "P" below. Ownership and Operating costs were then calculated, based on the following assumptions:

- Working hours per year = 1500
- Handling charges will be five percent of P
- Equipment maintenance costs will be 50% of P
- Depreciation costs will be 1.05 x P/1500Y
- No salvage value has been included (for some units, 10-15% salvage value could realistically be applied; not so for others. The Consultant has therefore decided to ignore salvage in order to be certain costs are not understated).

Hourly Ownership and Operating costs will then be 1.55P/1500Y (excluding POL costs). POL expenditures contain the following assumptions:

- Diesel price is Rs 4.80/lt; oil and lubricants 50% of this
- Storage and handling will be 15% of total POL costs

The total POL costs are then: 1.15 (4.80 + 2.40) = Rs 8.28/lt of diesel. The table then calculates total hourly costs and finally multiplies these by eight to arrive at daily rates. The latter are on the conservative side in that the actual daily WORKING hours for the equipment will be closer to six than eight; however, if a unit is assigned to a crew for an eight-hour day, at least the ownership costs will continue over the eight hours, regardless of actual hours worked.

No breakdown between foreign and local exchange has been made. All costs are shown in local currency; when it was necessary to convert from US dollars to local rupees, an exchange rate of Rs 16 : $1 was used.

There are no doubt some inaccuracies in the quoted purchase prices due to perhaps insufficient knowledge regarding the need of importing some of the units required; however, any differences should have no significant effect on overall maintenance costs.

Table 5.1
EQUIPMENT COSTS

UNIT	PURCHASE PRICES (RS)	ESTIMATED LIFE (YR)	TOTAL COST INCLUDING AMORTIZATION	HOURLY FUEL CONSUMPTION (lt)	POL COSTS (RS)	OWN & OP COSTS (RS)	HOURLY COSTS (RS)	DAILY COSTS (RS)
2.5-TON PICK-UP TRUCK, DOUBLE CAB	210000	7	322098	3	25	48	72	579
1.5-TON PICK-UP TRUCK, SINGLE CAB	160000	7	1014080	3	25	150	175	1396
MOTOR GRADER, 120-130 HP	1200000	10	2123760	21	174	219	393	3147
PNEUMATIC-TIRED ROLLER, 12-14 TON	800000	12	1549840	17	141	133	274	2194
1-TON VIBRATING ROLLER, HAND OPERATED	100000	10	176980	8	66	18	85	676
BACKHOE/LOADER, 1 CY	1000000	10	1769800	22	182	183	365	2920
FRONT-END WHEELED LOADER, 1.5 CY	1200000	10	2123760	22	182	219	402	3213
LOW-BED TRACTOR-TRAILER, 25 TON	640000	10	1132672	15	124	117	241	1930
8-TON DUMP TRUCK	600000	10	1061880	15	124	110	234	1871
2000-GAL WATER TANKER, TRUCK	350000	12	678055	17	141	58	199	1593
200-GAL WATER TANKER, TRAILER	35000	12	67806	0	0	6	6	47
FARM TRACTOR/TROLLY, 60-80 HP	150000	10	265470	8	66	27	94	749
JACK HAMMER, ENGINE DRIVEN	20000	7	30676	1	8	5	13	102
TAMPER-COMPACTOR, ENGINE DRIVEN	25000	7	38345	1	8	6	14	112
VIBRATING PLATE COMPACTOR	40000	7	61352	1	8	9	17	139
ASPHALT SPRAYER, 50 GAL, HAND OPERATED	70000	7	107366	0	0	16	16	127
1/3-CY CONCRETE MIXER, ENGINE DRIVEN	60000	7	92028	1	8	14	22	175
HAND TOOLS (PER CREW)	10000	2	11834	0	0	6	6	49

NOTE: See text for assumptions and calculating procedures
Amortization at 12%

5.3.2 Labor Costs

Data on daily wages and salaries were taken from discussions with district and provincial officers. Wages for certain categories of personnel differ among the districts; in each case the higher rate has been adopted. Certain allowances are sometimes granted to augment wages (e.g., for food); these have also been included.

Two new categories of personnel have been added to the normal staff: "Foreman" and "Crew Leader." Anticipated wages for these positions have been estimated as follows: A foreman will have complete charge of, and have the responsibility for, one or more crews on any given day. He will also have the responsibility for equipment worth millions of rupees. His basic wage has been "set" at Rs 100/day. With some of the more labor-intensive activities, the work force will be left alone after the foreman has taken them to the site and outlined the work he wants done. In these cases, a crew leader will take the responsibility for the crew and its accomplishment. Much the same thing is currently being done in the districts, but instead of a crew leader, higher paid than the laborers on his crew and with specific responsibilities, there is a "mate," on equal pay status with his crew members with little or no responsibility. The only advantage in being a "mate" is that one is not required to work. In the Consultant's opinion, this creates inefficiency and low production rates; hence the creation of the crew leader position. His wages have been assumed to be 50% higher than an unskilled laborer. Table 5.2 lists all positions, their base wages and any benefits which can be quantified. It is these totals which are used to determine personnel crew-day costs.

The wages quoted are very low and this was expressed as a real concern by all district engineers interviewed. They just could not interest or maintain a qualified staff with the salaries they had to offer. Low salaries breed laziness, inefficiency and low production rates, and the fact that they are also "fixed" eliminates enthusiasm and any conscientious effort to learn and improve one's station. All of the wages above those of the unskilled laborer are in no way commensurate with responsibility -- a motor grader operator, for example, being paid less than Rs 100/day while operating a piece of equipment worth Rs 1.2 million. The low-salary problem is certainly not unique to Pakistan, but just as certainly it is an enigma which affects the quality and quantity of work and reduces the overall capability of a maintenance department.

Table 5.2
PERSONNEL COSTS
(Rs/Day)

	BASIC WAGES	SIDE BENEFITS	DAILY RATES
District Engineer	110	17	127
Sub-Engineer	70	11	81
Foreman (1)	100	15	115
Crew Leader (1)	45	7	52
Driver	40	6	46
Operator	80	12	92
Operator Assistant	60	9	69
Skilled Laborer	65	10	75
Unskilled Laborer	30	5	35

(1) New positions

SOURCE: Averages from district information

5.3.3 Materials Costs

All materials required for road maintenance are listed in Table 5.3 below. The costs per applicable unit are also listed. The amounts have been derived through discussions with district engineers, the data presented in the recently-completed Asian Development Bank study on rural roads, and from the investigative work regarding reasonable unit costs for various materials which is currently being done by the USAID Mission, Pakistan. The most difficult costs to quantify are those for base and subbase materials. Figures can be taken from given projects with confidence; however, to apply those same unit figures in another location would probably yield unsatisfactory results due to the varying haul distances involved. For this report, average, per-cubic-yard costs (including loading and unloading) are recorded as a purchase price; haul distances are then given on a per-cubic-yard-kilometre basis. For the day-to-day routine maintenance tasks, an average haul distance of ten kilometres has been assumed. On a percentage basis, any reasonable increase in this distance will not increase the overall cost appreciably. For periodic tasks, and work associated with rehabilitation, betterment, reconstruction or new construction, however, haul distances will play a much more important role, and should be checked closely.

Table 5.3
MATERIALS COSTS
(Rs)

ITEM	UNIT	COSTS
Bituminous Pre-Mix	CY	230
Liquid Asphalt	Gal	20
Sand	CY	40
Crushed Aggregate	CY	70
Sealing Aggregate	CY	100
Select Aggregate Material	CY	60
Select Side-Borrow	CY	40
Stone	Ton	60
Cement	Sack	70
Paint	Gal	150
Paint Thinner	Gal	140
Form Lumber	CF	110
Grass Seed	lb	150
Mulch	CY	100
Sprigs	100 Lots	20

Hauling Costs: 8-ton Truck, 5 CY, Dist. 10 km, Truck Cost = Rs 1871/day, Six RTs/day (30 CY).
Haul Cost = 1871/30/10 = Rs 6/CY-km.

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5.4 ROAD MAINTENANCE COSTS

The costing of road maintenance activities herein assumes a road to be in a condition to receive normal routine and periodic maintenance. With the situation which exists today, this assumption reflects a great deal of prior rehabilitation, betterment, reconstruction and even new construction effort.

Before the amount of maintenance (and therefore costs) can be quantified, a "level of service" (i.e., what degree of riding comfort and safety will be afforded the user, and at what level will his operating costs be held.) must be established. The optimum situation would be to keep TOTAL costs at a minimum; that is, the costs for the maintenance itself, plus the costs incurred by the users. Clearly, as maintenance attention (and costs) decrease, user costs will increase, and vice versa. However, minimum total costs do NOT occur with maximum maintenance expenditure even though user costs will be minimized. Figure 5.1 attempts to clarify this phenomenon with a non-dimensional graph. Optimum maintenance attention, as shown on the graph, will be the general objective of this study; however, in some instances something less than optimum attention will be assumed. These instances are discussed below in section 5.4.3.

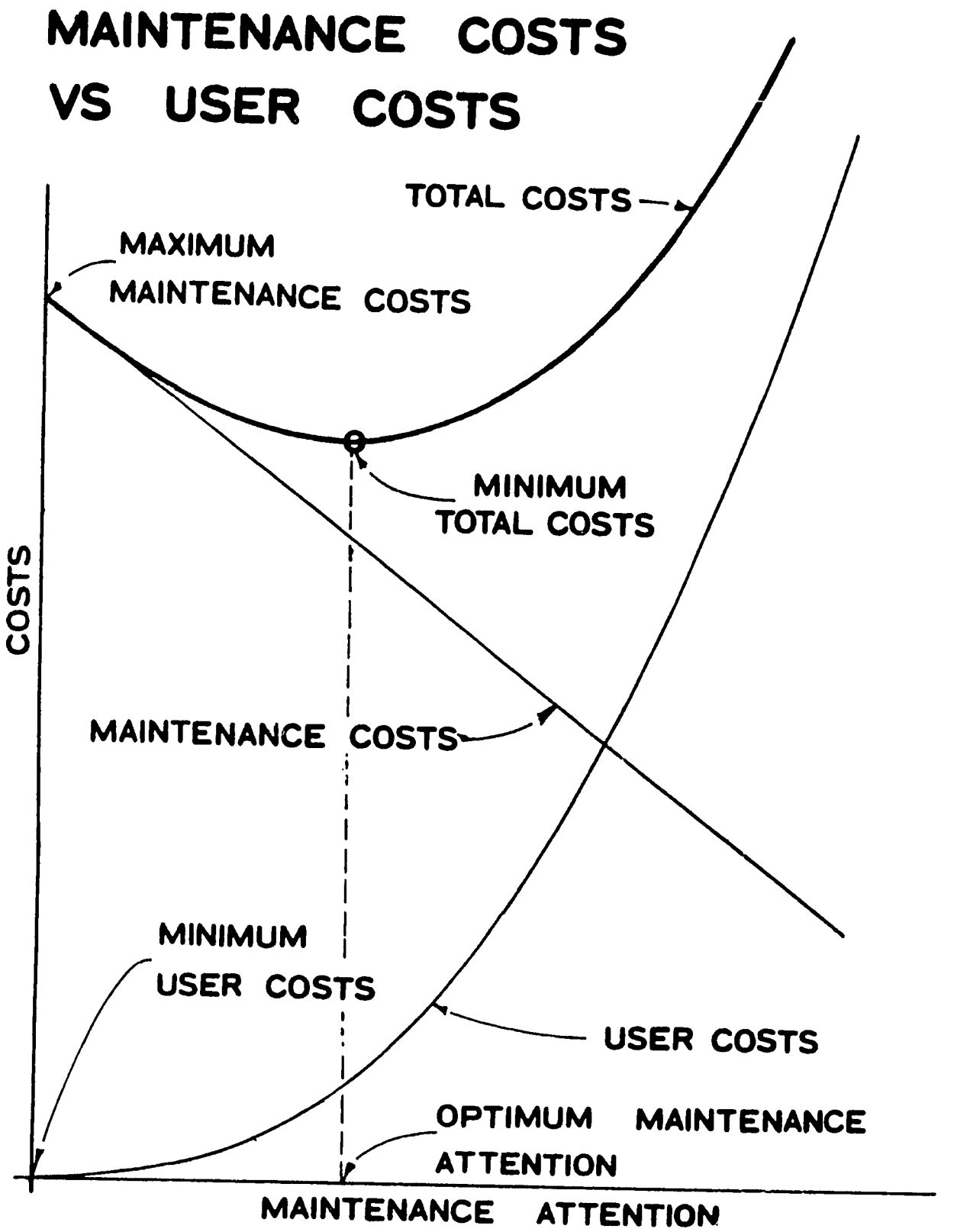
5.4.1 Work Activities for Road Maintenance

A total of 21 Work Activities have been selected, which will generally cover all routine, periodic and emergency needs. These are listed, by category as follows:

5.4.1.1 Routine:

(1) Pothole Patching, Paved Surfaces
(2) Spot Sealing, Paved Surfaces
(3) Pothole Patching, Unpaved Surfaces
(4) Light Grading, Unpaved Surfaces
(5) Shoulder Maintenance
(6) Bridge Repair, Minor
(7) Culvert Repair
(8) Ditch and Culvert Cleaning
(9) Repair of Guardrail, Guard Posts
(10) Sign Repair/Replacement
(11) Vegetation Control
(12) Slope Maintenance
(13) Field Supervision
(14) Field Inspection
(15) Equipment Transportation

Figure 5.1


MAINTENANCE COSTS
VS USER COSTS
TOTAL COSTS
MAXIMUM
MAINTENANCE COSTS
MINIMUM
TOTAL COSTS
COSTS
MAINTENANCE COSTS
MINIMUM
USER COSTS
USER COSTS
OPTIMUM MAINTENANCE
ATTENTION
MAINTENANCE ATTENTION

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5.4.1.2 Periodic:

(16) Resurfacing, Paved Surfaces (DBST)
(17) Heavy Grading, Unpaved Surfaces
(18) Regravelling, Unpaved Surfaces

5.4.1.3 Emergency:

(19) Removal of Slide and Flood Debris
(20) Snow Removal
(21) Bridge Repair, Major

5.4.2 Crew Resources and Production Rates by Work Activity

Each of the above Work Activities will have its own daily complement of equipment, personnel and materials. Each will have a specific work method and, for costing purposes in this instance, an estimated average daily production rate. The latter is based on the balance of equipment and personnel assigned to each task as well as the Consultant's appraisal of equipment operating speeds in the conditions faced in Pakistan.

The equipment selected herein does not necessarily reflect those units best suited for operating in Pakistan. However, the choices made will give a clear indication of total expected costs. An example of possible incorrect selection is the 10-to-14t pneumatic-tired roller for gravel compaction. There is a Pakistani school of thought which prefers a lighter, steel-wheeled vibrating roller for this work because of the difficulty in holding tire pressures during the hot summer months. This could be true and, in the final analysis, the vibrating roller might be the wisest choice. However, the costs are nearly the same and either would suffice for the crew costing required by this study.

In discussions with district engineers, the consensus was that a labor-intensive approach for all tasks was not realistic since wage limitations made it difficult to attract competent workers; that much equipment would be required if their networks were to receive sufficient attention to keep them in a condition commensurate with the established service-level objectives. While the Consultant is in general agreement with this, the equipment envisioned for each activity has been kept to a minimum -- this for several reasons. First, very few, if any, of the districts are presently capable of maintaining equipment; even basic servicing is normally done by workshops in other government or private sectors. Second, there is currently a shortage of qualified operators and there is no indication that this will change in the near future without intensive training programs. Third, a high percentage of the district roads are so narrow (and curvilinear in the hilly and mountainous areas) that they are not conducive to mechanized maintenance.

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Some of the activities which have been at least partially mechanized could be done by entirely labor-oriented procedures. An example is in the slope maintenance activity -- the backhoe/loader has been priced at Rs 2,920/day, which cost can be translated into some 80 unskilled laborers, much more than enough to replace the daily accomplishment expected of the machine for this activity. However, on steep slopes it would be very difficult for labor to work and the handling of a large, unwieldy crew would also be difficult. And, of course, the backhoe/loader is a highly versatile piece of equipment which can be used for many other things. The Consultant is confident that the equipment-labor ratio for each Work Activity, as developed below, is reasonable for Pakistan and reflects the current thinking and desires of the districts.

The resource requirements and production rates below are based on the Consultant's best estimates, after discussions with many provincial and district engineers, coupled with past experience in similar countries and situations of climate, materials, etc. Although not stated, the work methods described all include the placement and removal of appropriate safety devices and signs, and the cleaning of the work area after completion of the task.

5.4.2.1 Pothole Patching, Paved Surfaces (1)

This activity will be fully mechanized, but with minor equipment. Units: Square Yards Patched. Work Method: With jack hammers, break pavement to form a rectangular hole with vertical sides at least six inches outside the periphery of original hole, with two opposite sides perpendicular to flow of traffic. Compact any loose material in the bottom with tamper-compactor and spray bottom and sides with liquid asphalt. Place bituminous pre-mix in loose layers not exceeding three inches and compact with tamper-compactor. Compact final layer with vibrating plate compactor, going over edges first (with plate half on sound pavement) and working toward the center, so that it is flush with surrounding pavement (check with straight-edge). Use sand to absorb any excess liquid asphalt. Average Daily Production Rate: 25 SY Patched.

- Equipment --
  - 1, 2.5-ton Pick-Up Truck, Double Cab
  - 2, Jack Hammers, Engine Driven
  - 2, Tamper-Compactors, Engine Driven
  - 1, Vibrating Plate Compactor
  - 1, Asphalt Sprayer, 200 lt, Hand Operated
  - 1, Wooden Straight-Edge
  - Hand Tools (Shovels, Rakes, Picks, Brooms)
- Personnel --
  - 1, Foreman
  - 1, Driver
  - 6, Skilled Laborers
  - 4, Unskilled Laborers
- Materials --
  - 4, CY, Bituminous Pre-Mix
  - 1/2, CY, Sand
  - 25, lt, Liquid Asphalt

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5.4.2.2 Spot Sealing, Paved Surfaces (2)

This activity will be fully mechanized, but with minor equipment. Units: Square Yards Sealed. Work Method: Clean cracked area with wire brushes and brooms, taking care to clean cracks thoroughly. Spray liquid asphalt and immediately spread light layer of sealing aggregate. Compact with vibrating plate compactor and absorb any excess liquid asphalt with sand. Average Daily Production Rate: 150 SY Sealed.

- Equipment -- 1, 2.5-ton Pick-Up Truck, Double Cab
  1, Vibrating Plate Compactor
  1, Asphalt Sprayer, 200 lt, Hand Operated
  Hand Tools (Shovels, Rakes, Brooms, Wire Brushes)

- Personnel -- 1, Foreman
  1, Driver
  2, Skilled Laborers
  4, Unskilled Laborers

- Materials -- 1-1/2, CY, Sealing Aggregates
  120, lt, Liquid Asphalt
  1/2, CY, Sand

5.4.2.3 Pothole Patching, Unpaved Surfaces (3)

This activity will be fully mechanized, but with minor equipment. Units: Cubic Yards Placed. Work Method: Square up potholes so that sides are as vertical as possible and lightly water sides and bottom. When water has been absorbed, and using tamper-compactors, compact any loose material on the bottom. Add the pre-moistened aggregate material in loose layers not exceeding six inches and compact with tamper-compactors, leaving final compacted layer flush with surrounding surface. Average Daily Production Rate: 4 CY Placed.

- Equipment -- 1, 2.5-ton Pick-Up Truck, Double Cab
  1, Farm Tractor/Trolly, 60-80 hp
  1, 200-Gallon, Water Tanker (Trailer)
  2, Jack Hammers, Engine Driven
  2, Tamper-Compactors, Engine Driven
  Hand Tools (Shovels, Picks, Rakes,)

- Personnel -- 1, Foreman
  1, Driver
  1, Tractor Operator
  4, Skilled Laborers
  2, Unskilled Laborers

- Materials -- 4, CY, Pre-Moistened Select Aggregate Material

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5.4.2.4 Light Grading, Unpaved Surfaces (4)

This activity will be fully mechanized. Units: Kilometres Graded. Work Method: The grader will make its first pass, one kilometre long, working down one side of the roadway, bringing surface material from the edge toward the center and keeping the blade just low enough to pick up sufficient material to fill in the voids. The second pass will be in the opposite direction to accomplish the same result. The final pass will be in the original direction, smoothing out the furrow made by the initial two passes. Laborers will complete smoothing with hand tools. The next kilometre will then be treated in the same manner, and so on. During the first two passes, the blade will be set to leave a cross-slope of between four and six percent. Average Daily Production Rate: 10 km Graded.

- Equipment -- 1, 2.5-ton Pick-Up Truck, 1/4 time
  1, Motor Grader, 120-130 hp
- Personnel -- 1, Foreman, 1/4-time
  1, Driver, 1/4-time
  1, Crew Leader
  1, Operator
  1, Assistant Operator
  2, Unskilled Laborers
- Materials -- None

5.4.2.5 Shoulder Maintenance (5)

This activity will be semi-mechanized, using hand-operated equipment. Units: Cubic Yards Placed. Work Method: Water area to be treated, loosen depressed shoulder material with picks, add necessary pre-moistened aggregate material, smooth with shovels and rakes, and compact with vibratory roller leaving shoulder properly sloped and flush with pavement. Average Daily Production Rate: 4 CY Placed.

- Equipment -- 1, 2.5-ton Pick-Up Truck, Double Cab, 1/4-time
  1, 1-ton Vibratory Roller, Hand Operated
  1, Farm Tractor/Trolly, 60-80 hp
  1, 200-Gallon, Water Tanker (Trailer)
  Hand Tools (Picks, Shovels, Rakes, Brooms)
- Personnel -- 1, Foreman, 1/4-time
  1, Driver, 1/4-time
  1, Crew Leader
  1, Tractor Operator
  1, Skilled Laborers
  5, Unskilled Laborers
- Materials -- 4, CY, Pre-Moistened, Select Aggregate Material

5.4.2.6 Bridge Repair, Minor (6)

The crew make-up for this activity will vary with the type of repair required. From a costing standpoint, the resources set forth below are considered average and lean toward a labor-intensive composition. Units: Man-Days. Work Method: Accomplish what repairs required, including the repainting of exposed steel surfaces. Average Daily Production Rate: 8 Man-Days.

- Equipment -- 1, 2.5-ton Pick-Up Truck, Double Cab
  1, Jack Hammer, Engine Driven
  1, 1/3-CY Concrete Mixer, Engine Driven
  Hand Tools (Wire Brushes Paint Brushes Brooms, Miscellaneous)

- Personnel -- 1, Foreman
  1, Driver
  3, Skilled Laborers
  3, Unskilled Laborers

- Materials -- Cement
  Sand
  Crushed Aggregate, 3/4" Max.
  Water
  Paint
  Paint Thinner
  Form Lumber

5.4.2.7 Culvert Repair (7)

The crew composition will vary depending on the work required but leans toward being labor-intensive. Units: Man-Days. Work Method: Accomplish necessary repairs. Average Daily Production Rate: 5 Man-Days.

- Equipment -- 1, 2.5-ton Pick-Up Truck, Double Cab, 1/2-time
  1, Jack Hammer, Engine Driven
  1, Wheelbarrow
  Hand Tools (Shovels, trowels, etc)

- Personnel -- 1, Foreman, 1/2-time
  1, Driver, 1/2-time
  1, Crew Leader
  1, Skilled Laborer
  3, Unskilled Laborers

- Materials -- Stone
  Cement
  Sand
  Water

5.4.2.8 Ditch and Culvert Cleaning (8)

This activity will be labor-intensive. Units: Ditch-Kilometres Cleaned. Work Method: Remove excess material from ditch to re-establish line and grade and clean culvert openings as encountered, depositing debris well away from line of flow. Average Daily Production Rate: 5 Ditch-Kilometres Cleaned.

- Equipment -- 1, 2.5-ton Pick-Up Truck, Double Cab, 1/4-time
  Hand Tools (Shovels, Picks, Hoes)

- Personnel -- 1, Foreman, 1/4-time
  1, Driver, 1/4-time
  1, Crew Leader
  4, Unskilled Laborers

- Materials -- None

5.4.2.9 Repair of Guardrail, Guard Posts (9)

This activity will not be costed in this report since so little guardrail and few guard posts currently exist in the district systems; however, it should be retained as an activity for the future.

5.4.2.10 Sign Repair/Replacement (10)

So few signs now exist in district networks, this normal routine activity will not be costed for this report. It will become more significant in the future.

5.4.2.11 Vegatation Control (11)

This activity will be labor-intensive. Units: Shoulder-Kilometres Treated. Work Method: Cut and place in trolly all vegatation which encroaches on roadway, limiting sight distance. Daily Production Rate: 1 Shoulder-Kilometre

- Equipment -- 1, Farm Tractor/Trolly
  Hand Tools (Scythes, Saws, Axes)

- Personnel -- 1, Crew Leader
  1, Tractor Operator
  5, Unskilled Laborers

- Materials -- None

4.2.12 Slope Maintenance (12)

This activity involves the maintenance of major and minor slopes adjacent to the roadway in order to reduce land slides and correct or retard erosion. Units: Man-Days. Work Method: Clean cut-slopes of loose rocks and material; fill in any erosion channels and trim fill slopes, making necessary corrections at the roadside to prevent further erosion (and planting where desirable). Average Daily Production Rate: 8 Man-days.

- Equipment -- 1, 2.5-ton Pick-Up Truck, Double Cab, 1/2-time
  1, Backhoe/Loader (1 CY)
  1 200-Gallon Water Tanker (Trailer)
  1, Wheelbarrow
  Hand Tools (Shovels, Picks, Brooms)

- Personnel -- 1, Foreman, 1/2-time
  1, Driver, 1/2-time
  1, Operator
  1, Operator Assistant
  1, Crew Leader
  4, Unskilled Laborers

- Materials -- Grass Seed
  Mulch
  Sprigs
  Water

5.4.2.13 Field Supervision (13)

This activity comprises the time of the district engineer and/or his immediate subordinates in the supervision of specific maintenance works. Units: Man-Days. Average Daily Production Rate: 2 Man-Days.

- Equipment -- 1, 1.5-ton Pick-Up Truck, Single Cab

- Personnel -- 1, Engineer/Sub-Engineer
  1, Driver

- Materials -- None

5.4.2.14 Field Inspection (14)

This is the all-important routine activity of inspecting the road network to ascertain immediate maintenance needs; it is accomplished either by the district engineer or one of his sub-engineers (the entire network should be inspected at least once every two months). Units: Man-Days. Average Daily Production Rate: 2 Man-Days.

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- Equipment -- 1, 2.5-ton Pick-Up Truck, Single Cab
- Personnel -- 1, Engineer/Sub-Engineer
  1, Driver
- Materials -- None

5.4.2.15 Equipment Transportation (15)

This activity is done as needed, moving dozers, rollers and other heavy equipment to distant work sites. Units: Man-Days. Average Daily Production Rate: 2 Man-Days.

- Equipment -- 1, Low-Bed Tractor-Trailer, 25 ton
- Personnel -- 1, Driver
  1, Unskilled Laborer
- Materials -- None

5.4.2.16 Resurfacing, Paved Surfaces (DBST)(16)

This activity will be done by contract under the supervision of the district engineer or one of his sub-engineers (these supervision costs are covered in activity 13 above). Its costing will be handled separately. Average Daily Production Rate: 20,000 SY.

5.4.2.17 Heavy Grading, Unpaved Surfaces (17)

This activity comprises the periodic scarifying, grading and compacting of unpaved surfaces, which have sufficient, well-graded material to receive such treatment, in order to reshape the surface, restoring the proper cross-slope and driving quality (anticipating that some additional material will be needed). This will be a fully mechanized activity. Units: Kilometres Graded. Work Method: Water one half of roadway, immediately scarifying with motor grader to minimum depth of 2" but deep enough to disturb the bottoms of any potholes or depressions (laborers should remove all oversized -- |2" -- stones). Reshape that half of roadway, adding new material and water as required and compact with a pneumatic-tired roller (six passes should be sufficient). Repeat same procedure for other half of the roadway. Average Daily Production Rate: 4 Kilometers Graded.

- Equipment -- 1, 2.5-ton Pick-Up Truck
  1, Motor Grader, 120-130 hp
  2 Pneumatic-Tired Rollers (10-14t)
  2, Farm Tractor/Trollies
  1, Water Tanker, Truck, 2000 Gallons
  Hand Tools (Shovels, Picks, Rakes)

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- Personnel -- 1, Foreman
  2, Drivers
  3, Operators
  1, Operator Assistant
  2, Tractor Operators
  4, Unskilled Laborers

- Materials -- 5, CY, Select Aggregate Material
  Water

5.4.2.18 Regravelling, Unpaved Surfaces (18)

This major activity will be accomplished by contract under the supervision of the district engineer or one of his sub-engineers. It will be costed separately (the supervision costs are covered in activity 13 above).

5.4.2.19 Removal of Slide and Flood Debris (19)

This emergency activity will be fully mechanized in order to minimize traffic disruption. Crew size will vary with the severity of the problem. For costing purposes, an average-size crew has been estimated. Units: Man-Days. Work Method: Remove and dispose of debris, leaving roadway passable and clean. Average Daily Production Rate: 10 Man-Days.

- Equipment -- 1, 2.5-ton Pick-Up Truck, Double Cab
  1, Front-End Wheeled Loader (1.5 CY)
  2, 8-ton Dump Trucks
  Hand Tools (Shovels, Hoes, Brooms)

- Personnel -- 1, Foreman
  3, Drivers
  1, Operator
  1, Operator Assistant
  4, Unskilled Laborers

- Materials -- None

5.4.2.20 Snow Removal (20)

This activity has not been costed per se; however, total per-kilometre costs for roads in mountainous areas should be increased by a percentage to reflect this additional effort.

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5.4.2.21 Bridge Repair, Major (21)

This emergency activity will be accomplished by contract under the supervision of the district engineer or one of his sub-engineers. Its cost will be treated separately (supervision costs are covered in activity 13 above).

5.4.3 Daily Crew Costs

The daily crew costs presented below are in rupees and are derived from the data in Tables 5.1, 5.2 and 5.3.

5.4.3.1 Pothole Patching, Paved Surfaces (1)

- Equipment:

	Unit	Total
1, 2.5-ton Pick-Up Truck, Double Cab	579	579
2, Jack Hammers, Engine Driven	102	204
2, Tamper-Compactors, Engine Driven	112	224
1, Vibrating Plate Compactor	139	139
1, Asphalt Sprayer, 200 lt, Hand Operated	127	127
Hand Tools	49	49
Sub-Total		1,322

- Personnel:

1, Foreman	115	115
1, Driver	46	46
6, Skilled Laborers	75	450
4, Unskilled Laborers	35	140
Sub-Total		751

- Materials:

4, CY, Bituminous Pre-Mix	230	920
1/2, CY, Sand	40	20
25, lt, Liquid Ashpalt	5	125
Sub-Total		1,065

Total, Work Activity (1) 3,138

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5.4.3.2 Spot Sealing, Paved Surfaces (2)

- Equipment:

1,	2.5-ton Pick-Up Truck, Double Cab	579	579
1,	Vibrating Plate Compactor	139	139
1,	Asphalt Sprayer, 200 lt, Hand Operated	127	127
	Hand Tools	49	49
	Sub-Total		894

- Personnel:

1,	Foreman	115	115
1,	Driver	46	46
2,	Skilled Laborers	75	150
4,	Unskilled Laborers	35	140
	Sub-Total		451

- Materials:

1-1/2, CY, Sealing Aggregates	100	150
120, lt, Liquid Asphalt	5	600
1/2, CY, Sand	40	20
Sub-Total		770

Total, Work Activity (2) 2,115

5.4.3.3 Pothole Patching, Unpaved Surfaces (3)

- Equipment:

1,	2.5-ton Pick-Up Truck, Double Cab	579	579
1,	Farm Tractor/Trolly, 60-80 hp	749	749
1,	200-Gallon, Water Tanker (Trailer)	47	47
2,	Jack Hammers, Engine Driven	102	204
2,	Tamper-Compactors, Engine Driven	112	224
	Hand Tools	49	49
	Sub-Total		1,852

- Personnel:

1,	Foreman	115	115
1,	Driver	46	46
1,	Tractor Operator	46	46
4,	Skilled Laborers	75	300
2,	Unskilled Laborers	35	70
	Sub-Total		577

- 100

- Materials:

4, CY, Pre-Moistened, Select Aggregate Material	60	240
Sub-Total		240

Total, Work Activity (3) 2,669

5.4.3.4 Light Grading, Unpaved Surfaces (4)

- Equipment:

1, 2.5-ton Pick-Up Truck, Double Cab, 1/4-time	579	145
1, Motor Grader, 120-130 hp	3,147	3,147
Hand Tools	49	49
Sub-Total		3,341

- Personnel:

1, Foreman, 1/4-time	115	29
1, Driver, 1/4-time	46	12
1, Crew Leader	52	52
1, Operator	92	92
1, Operator Assistant	69	69
2, Unskilled Laborers	35	70
Sub-Total		324

- Materials:

None

Sub-Total 0

Total, Work Activity (4) 3,665

5.4.3.5 Shoulder Maintenance (5)

- Equipment:

1, 2.5-ton Pick-Up Truck, Double Cab, 1/4-time	579	145
1, 1-ton Vibratory Roller, Hand Operated	676	676
1, Farm Tractor/Trolly, 60-80 hp	749	749
1, 200-Gallon, Water Tanker (Trailer)	47	47
Hand Tools	49	49
Sub-Total		1,666

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- Personnel:

1, Foreman, 1/4-time	115	29
1, Driver, 1/4-time	46	12
1, Crew Leader	52	52
1, Tractor Operator	46	46
1, Skilled Laborer	75	75
5, Unskilled Laborers	35	175
Sub-Total		389

- Materials:

4, CY, Pre-Moistened, Select Aggregate Material	60	240
Sub-Total		240

Total, Work Activity (5) 2,295

5.4.3.6 Bridge Repair, Minor (6)

- Equipment:

1, 2.5-ton Pick-Up Truck, Double Cab	579	579
1, Jack Hammer, Engine Driven	102	102
1, 1/3-CY Concrete Mixer, Engine Driven	175	175
Hand Tools	49	49
Sub-Total		905

- Personnel:

1, Foreman	115	115
1, Driver	46	46
3, Skilled Laborers	75	225
3, Unskilled Laborers	35	105
Sub-Total		491

- Materials

Cement, 2 Sacks	70	140
Sand, 1/2 CY	40	20
Crushed Aggregate, 3/4" Max., 1 CY	70	70
Water		
Paint, 1/2 Gal	150	75
Paint Thinner, 1/4 Gal	140	35

Form Lumber, 1 CF	110	110
Sub-Total		450
Total, Work Activity (6)		1,846

5.4.3.7 Culvert Repair (7)

- Equipment:

1, 2.5-ton Pick-Up Truck, Double Cab, 1/2-time	579	290
1, Jack Hammer, Engine Driven	102	102
Hand Tools	49	49
Sub-Total		441

- Personnel:

1, Foreman, 1/2-time	115	58
1, Driver, 1/2-time	46	23
1, Crew Leader	52	52
1, Skilled Laborer	75	75
3, Unskilled Laborers	35	105
Sub-Total		313

- Materials:

Stone, 1 Ton	60	60
Cement, 1 Sack	70	70
Sand, 1/2 CY	40	20
Water		
Sub-Total		150
Total, Work Activity (7)		904

5.4.3.8 Ditch and Culvert Cleaning (8)

- Equipment:

1, 2.5-ton Pick-Up Truck, Double Cab, 1/4-time	579	145
Hand Tools	49	49
Sub-Total		194

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- Personnel:

1, Foreman, 1/4-time	115	29
1, Driver, 1/4-time	46	12
1, Crew Leader	52	52
4, Unskilled Laborers	35	140
Sub-Total		233

- Materials:

None

Sub-Total 0

Total, Work Activity (8) 427

5.4.3.9 Repair of Guardrail, Guard Posts (9)

This activity has not been costed.

5.4.3.10 Sign Repair/Replacement (10)

This activity has not been costed.

5.4.3.11 Vegetation Control (11)

- Equipment:

1, Farm Tractor/Trolly	749	749
Hand Tools	49	49
Sub-Total		798

- Personnel:

1, Crew Leader	52	52
1, Tractor Operator	46	46
5, Unskilled Laborers	35	170
Sub-Total		268

- Materials:

None

Sub-Total 0

Total, Work Activity (11) 1066

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5.4.3.12 Slope Maintenance (12)

- Equipment:

1, 2.5-ton Pick-Up Truck, Double Cab, 1/2-time	579	290
1, Backhoe/Loader (1 CY)	2,920	2,920
1, 200-Gallon Water Tanker (Trailer)	47	47
Hand Tools	49	49
Sub-Total		3,306

- Personnel:

1, Foreman, 1/2-time	115	58
1, Driver, 1/2-time	46	23
1, Operator	92	92
1, Operator Assistant	69	69
1, Crew Leader	52	52
4, Unskilled Laborers	35	140
Sub-Total		434

- Materials:

Grass Seed, 5 lb	150	750
Mulch, 1/2 CY	100	50
Sprigs, 10 Lots	20	200
Water		
Sub-Total		1,000

Total, Work Activity (12) 4,740

5.4.3.13 Field Supervision (13)

- Equipment:

1, 1.5-ton Pick-Up Truck, Single Cab	489	489
Sub-Total		489

- Personnel:

1, Engineer/Sub-Engineer	127	127
1, Driver	46	46
Sub-Total		173

-105'

- Materials:

  None

  Sub-Total 0

Total, Work Activity (13) 662

5.4.3.14 Field Inspection (14)

- Equipment:

1, 1.5-ton Pick-Up Truck, Single Cab	489	489
Sub-Total		489

- Personnel:

1, Engineer/Sub-Engineer	127	127
1, Driver	46	46
Sub-Total		173

- Materials:

  None

  Sub-Total 0

Total, Work Activity (14) 662

5.4.3.15 Equipment Transportation (15)

- Equipment:

1, Low-Bed Tractor-Trailer, 25 ton	1,930	1,930
Sub-Total		1,930

- Personnel:

1, Driver	46	46
1, Unskilled Laborer	35	35
Sub-Total		81

- Materials:

  None

  Sub-Total 0

Total, Work Activity (15) 2,011

5.4.3.16 Resurfacing, Paved Surfaces (DBST)

This activity is recommended to be accomplished by contract; expected contract price is estimated at Rs 14.4 per Square Yard.

5.4.3.17 Heavy Grading, Unpaved Surfaces (17)

- Equipment:

1, 2.5-ton Pick-Up Truck, Double Cab	589	589
1, Motor Grader, 120-130 hp	3,147	3,147
2, Pneumatic-Tired Rollers, 10-14 ton	2,194	4,388
2, Farm Tractor/Trollies, 60-80 hp	749	1,498
1, Water Tanker,Truck, 2000 Gallons	1,593	1,593
Sub-Total		11,215

- Personnel:

1, Foreman	113	113
2, Drivers	46	92
3, Operators	92	276
1, Operator Assistant	69	69
2, Tractor Operators	46	92
4, Unskilled Laborers	35	140
Sub-Total		782

- Materials:

Classifications (D) & (E):		
5, CY, Select Gravel Material	60	300
Classifications (F) & (G):		
5, CY, Select Side-Borrow	40	200
Sub-Total (D) & (E)		300
Sub-Total (F) & (G)		200
Total, Work Activity (17) -- (D) & (E)		12,397
Total, Work Activity (17) -- (F) & (G)		12,297

5.4.3.18 Regravelling, Unpaved Surfaces (18)

This activity is recommended to be accomplished by contract; expected contract price is estimated to be Rs 88 per Cubic Yard for Classifications (D) & (E) and Rs 50 per Cubic Yard for Classifications (F) & (G).

5.4.3.19 Removal of Slide and Flood Debris (19)

- Equipment:

1,	2.5-ton Pick-Up Truck, Double Cab	589	589
1,	Front-End Wheeled Loader, 1.5 CY	3,213	3,213
2,	8-ton Dump Trucks	1,871	3,742
	Hand Tools	49	49
	Sub-Total		7,593

- Personnel:

1,	Foreman	113	113
3,	Drivers	46	139
1,	Operator	92	92
1,	Operator Assistant	69	69
4,	Unskilled Laborers	35	140
	Sub-Total		553

- Materials:

None

Sub-Total 0

Total, Work Activity (19) 8,146

5.4.3.20 Snow Removal (20)

This activity has not been costed.

5.4.3.21 Bridge Repair, Major (21)

This activity has not been costed.

5.4.4 Effort Levels by Road Classification

Given the Work Activities and their individual production rates above, still lacking is the annual effort level, or frequency of attention, for each, if costs are to be estimated.

In developing these costs, the basic assumption is made that all roads are not only fully maintainable, but are in good condition. Treated separately are the rehabilitation costs to achieve this condition.

There are many variables which will have an effect on effort levels; the most important are the type and width of surface and the Average Annual Daily Traffic (AADT) using the facility. Other variables, such as traffic composition (percentage of heavy loads) and climatic conditions, have not been included. To include them here, on an individual basis, would increase the number of unit costs to the point that an attempt to select the correct one would become confusing on one hand, and would lend inappropriate credence to the group as a whole on the other.

5.4.4.1 Road Classification Selection

For the purposes of this report, the following classifications for district roads have been selected:

(A) Paved Surface, 22-foot width, 3-foot shoulders, AADT>800

(B) Paved Surface, 22-foot width, 3-foot shoulders, AADT 200 to 800

(C) Paved Surface, 10-to-12-foot width, 5-foot shoulders, AADT<200

(D) Gravel Surface, 32-foot subgrade (a) formation, AADT>200

(E) Gravel Surface, 32-foot subgrade (a) formation, AADT 50 to 200

(F) Earth Surface, 20-foot formation, AADT 25 to 100

(G) Earth Surface, 14-to-16-foot formation, AADT 25

(a) Surface width = 30 feet

5.4.4.2 Effort Level Calculations and/or Assumptions

- Pothole Patching, Paved Surfaces (1)

In making assumptions regarding this activity, two points should be kept in mind. First, the higher the traffic volume the more surface wear and, hence, a higher frequency of potholes and edge ravelling. Parallel to this, due to the high traffic flow, less surface deficiencies can be tolerated (i.e., user costs will be high). Second, with lower traffic, less deterioration will occur and, at the same time, from the user-cost standpoint, deficiencies are less important. Pavement width also plays an important role.

Amount of attention required annually:

Classification (A): 0.50% of total paved area
Classification (B): 0.33% of total paved area (less traffic)
Classification (C): 0.30% of total paved area (less traffic, but much narrower)

Effort Levels (in SY/km/YR):

Classification (A): (1000 x 3.28 x 22 x 0.0050) / 9 = 40 SY
Classification (B): (1000 x 3.28 x 22 x 0.0033) / 9 = 26 SY
Classification (C): (1000 x 3.28 x 11 x 0.0030) / 9 = 12 SY

- Spot Sealing, Paved Surfaces (2)

The attention paid to this activity of sealing cracks before they become potholes follows the same reasoning as above, and is usually given as a percentage of the full-seal requirements.

Full-seal requirements:

Classification (A): Full seal every 3 years
Classification (B): Full seal every 4 years
Classification (C): Full seal every 4 years

Amount of attention required annually: 5% of full-seal needs

Effort Levels (in SY/km/YR):

Classification (A): (1000 x 3.28 x 22 / 3 / 9) x 0.05 = 134 SY
Classification (B): (1000 x 3.28 x 22 / 4 / 9) x 0.05 = 100 SY
Classification (C): (1000 x 3.28 x 11 / 4 / 9) x 0.05 = 50 SY

- Pothole Patching, Unpaved Surfaces (3)

The attention given to the patching of potholes on gravel and earthen surfaces will vary by traffic, surface type, and the elements. With a lesser original investment in gravel- and earth-surfaced roadways, their surfaces are often not maintained to "optimum" in order to save on maintenance expenditure, knowing that the reduction from "optimum" will not seriously affect user costs in lesser traffic volumes. In this case, it was assumed that 80% of optimum would be reasonable for Classifications (D), (E), and (F), with 60% applicable to (G).

Effort Levels (in CY/km/YR):

Classification (D): 4 CY x 0.8 = 3.2 CY
Classification (E): 3 CY x 0.8 = 2.4 CY
Classification (F): 2 CY x 0.8 = 1.6 CY
Classification (G): 2 CY x 0.6 = 1.2 CY

- Light Grading, Unpaved Surfaces (4)

The amount of light grading required will depend on the amount of traffic, type of surface and the action of the elements; the same assumptions have been applied as those above, for pothole patching.

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Effort Levels (in Number of Gradings/km/YR):

Classification (D): 15 Gradings x 0.8 = 12 Gradings
Classification (E): 8 Gradings x 0.8 = 6 Gradings
Classification (F): 5 Gradings x 0.8 = 4 Gradings
Classification (G): 3 Gradings x 0.6 = 2 Gradings

- Shoulder Maintenance (5)

The attention required of this activity is predominately dependent on width of surface, but closely followed by traffic volume and the severity of the elements. No reduction from optimum is recommended.

Effort Levels (in CY/km):

Classification (A): 1.5 CY/sh-km x 2 = 3 CY
Classification (B): 1.0 CY/sh-km x 2 = 2 CY
Classification (C): 1.5 CY/sh-km x 2 = 3 CY

"sh-km" = Shoulder-Kilometre

- Bridge Repair, Minor (6)

This activity includes low-water crossings and it will be assumed for the purposes of this report that there are one of these structures, or a bridge, every ten kilometres [one every 20 kilometres for Classifications (F) and (G)], that 5% of the structures will require repair each year, and that, on average, it will take the eight-man crew two days to make the necessary repairs on each.

Effort Levels (in Man-Days/km/YR):

Classification, (A) - (E): (1/10) x 0.05 x 2 x 8 = 0.08 Man-Days
Classification, (F) & (G): (1/20) x 0.05 x 2 x 8 = 0.04 Man-Days

- Culvert Repair (7)

Assumptions: Two culverts per kilometre, five percent will require repair each year and it will take the 8-man crew one day to repair each.

Effort Levels (in Man-Days/km/YR):

All Classifications: 2 x 0.05 x 1 x 8 = 0.80 Man-Days

- Ditch and Culvert Cleaning (8)

Assumptions: Longitudinal ditches along 20% of shoulder-kilometres of paved roads, 15% for unpaved roads; all ditches will require cleaning at least once each year and 50% of ditches along paved roads will require a second cleaning each year

Effort Levels (in Ditch-Kilometres Cleaned/km/YR):

Classification, (A) - (C): 2 x 0.20 x 1.50 = 0.60 dit-km Cleaned
Classification, (D) - (G): 2 x 0.15 x 1.00 = 0.30 dit-km Cleaned

- Repair of Guardrail, Guard Posts (9)

Effort Levels: Not Applicable

- Sign Repair/Replacement (10)

Effort Levels: Not Applicable

- Vegetation Control (11)

Assumptions: Five percent of shoulder-kilometres will require attention once each year on paved network, two percent on unpaved.

Effort Levels (in sh-km/km/YR):

Classifications (A) - (C): 2 x 0.05 = 0.10 sh-km
Classifications (D) - (G): 2 x 0.02 = 0.04 sh-km

- Slope Maintenance (12)

Assumptions: 10% of shoulder-kilometres in paved and gravel systems will have slopes requiring attention each year; 5% for earthen roads. One 8-man crew can attend to 0.50 shoulder-kilometres/day.

Effort Levels (in Man-Days/km/YR):

Classifications (A) - (E): (2 x 0.10 / 0.50) x 8 = 3.2 Man-Days
Classifications (F) & (G): (2 x 0.05 / 0.50) x 8 = 1.6 Man-Days

- Field Supervision (13)

Assumptions: Ten percent of each kilometre of the paved network will be undergoing major works requiring part-time senior supervision for six months out of each year. Five percent of the gravel and earth roads will require similar attention. A senior engineer will be in attendance, 25% of the time at such works each year. One crew-day = two man-days.

Effort Levels (in Man-Days/km/YR):

Classifications (A) - (C): 0.10 x 0.50 x 0.25 x 2 = 0.025 Man-Days
Classifications (D) - (G): 0.05 x 0.50 x 0.25 x 2 = 0.013 Man-Days

- Field Inspection (14)

Assumptions: One crew-day = two man-days; crew can inspect at the rate of 20 kilometres per day on the paved roads, 50 kilometres per day on gravel and earth roads. Attention requirements (in times per year) by Classifications (A) through (G), respectively: 12, 6, 6, 4, 3, 2, 1.

Effort Levels (in Man-Days/km/YR):

Classification (A): (1 / 20) x 12 x 2 = 1.20 Man-Days
Classification (B): (1 / 20) x 6 x 2 = 0.60 Man-Days
Classification (C): (1 / 20) x 6 x 2 = 0.60 Man-Days
Classification (D): (1 / 50) x 4 x 2 = 0.16 Man-Days
Classification (E): (1 / 50) x 3 x 2 = 0.12 Man-Days
Classification (F): (1 / 50) x 2 x 2 = 0.08 Man-Days
Classification (G): (1 / 50) x 1 x 2 = 0.04 Man-Days

- Equipment Transport (15)

Assumptions: Crew will be used 150 days per year; network contains 1000 kilometres. One crew = two Man-Days.

Effort Levels (in Man-Days/km/YR):

All Classifications: (150 / 1000) x 2 = 0.30 Man-Days

- Resurfacing Paved Surfaces (DBST) (16)

This activity is recommended to be done by contract.

Attention required (for 20 years):

Classification (A): Years 5, 9, 12, 15 and 18
Classification (B): Years 7, 13 and 18
Classification (C): Years 5, 9, 12, 15 and 18

Weighted Attention (in Kilometres/km/YR):

Classification (A): 1 / [(1x5+1x4+4x3)/6] = 0.20 km
Classification (B): 1 / [(1x7+1x6+1x5)/3] = 0.17 km
Classification (C): 1 / [(1x5+1x4+4x3)/6] = 0.20 km

Effort Levels (in SY/km/YR):

Classification (A): (1000 x 3.28 x 0.20 x 22)/9 = 1600 SY
Classification (B): (1000 x 3.28 x 0.17 x 22)/9 = 1360 SY
Classification (C): (1000 x 3.28 x 0.20 x 11)/9 = 800 SY

- Heavy Grading, Unpaved Surfaces (17)

This major activity will be accomplished on road classifications (E) through (G) only [it will not be required on Classification (D) roads since these will be regravelled every two years and light grading will be sufficient in the interim]. Attention will vary by classification and will not be done in the years when regravelling will be required.

Attention required (for 20 years):

Classification (E): Years 2, 6, 10, 14 and 18
Classification (F): Years 2, 6, 10, 14 and 18
Classification (G): Years 3, 6, 12, and 15

Effort Levels (in Kilometres Graded/km/YR):

Classification (E): 1 / 4 = 0.25 km
Classification (F): 1 / 4 = 0.25 km
Classification (G): 1 / [(3x3 + 2x6)/5] = 0.28 km

- Regravelling, Unpaved Surfaces (18)

This activity is recommended to be done by contract (because of the heavy plant requirements). It amounts to the placing of a 4" compacted layer (5" loose) of crushed and graded gravel for Classifications (D) and (E), or a 4" compacted layer (6" loose) of select side-borrow for Classifications (F) and (G). Gravel (or earth) loss was assumed to be 1" per 100 AADT per year.

Attention required (for 20 years):

Classification (D): Years 2, 4, 6, 8, 10, 12, 14, 16, 18 and 20
Classification (E): Years 4, 8, 12, 16, and 20
Classification (F): Years 4, 8, 12, 16, and 20
Classification (G): Years 9 and 18

Weighted Attention (in Kilometres/km/YR):

Classification (D): 1 / 2 = 0.50 km
Classification (E): 1 / 4 = 0.25 km
Classification (F): 1 / 4 = 0.25 km
Classification (G): 1 / 9 = 0.11 km

Effort Levels (in CY/km/YR):

Classification (D): [1000 x 3.28 x 0.50 x 30 x (5/12)]/ 27 = 760 CY
Classification (E): [1000 x 3.28 x 0.25 x 30 x (5/12)]/ 27 = 380 CY
Classification (F): [1000 x 3.28 x 0.25 x 20 x (6/12)]/ 27 = 300 CY
Classification (G): [1000 x 3.28 x 0.11 x 15 x (6/12)]/ 27 = 100 CY

- Removal of Slide and Flood Debris (19)

Slides will be applicable only to mountainous roads and floods to those roads in flat areas; washouts can occur in either terrain. For costing purposes, the following assumptions have been made:

One crew-day = 10 man-days; crew will be active 20 days per year; network contains 1000 kilometres.

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Effort Levels (in Man-Days/km/YR):

All Classifications: (1 / 1000) x 20 x 10 = 0.03 Man-Days)

- Snow Removal (20)

This activity is applicable only to roads in mountainous areas and has not been costed. To complete maintenance estimates in these specific areas, it is suggested that a lump sum be added to the detailed estimate.

- Bridge Repair, Major (21)

This activity is recommended to be accomplished by contract. Since it is not possible to predict any reasonable frequency of need, it is suggested that a lump sum be added to the detailed estimate in those specific areas where bridge structures are known to be experiencing high water, scouring, etc.

5.4.5 Annual Per-Kilometre Unit Costs, Maintenance

Table 5.4, A through G, indicate the daily resource cost of each Work Activity and then totals them to arrive at an average annual cost per kilometre -- this for each of seven road classifications.

5.4.6 Discounted Unit Costs per Kilometre for Maintenance

Table 5.5, A through G, discounts the costs of Table 5.4 over a 20-year period for the seven road classifications considered. The discount rate was chosen as 12%.

Table 5.4 (A)
ANNUAL PER-KILOMETRE UNIT COSTS
MAINTENANCE

CLASSIFICATION A
22-Foot Pavement, 3-Foot Shoulders, AADT >800

CATEGORY	ACTIVITY	DESCRIPTION	DAILY COST (Rs) EQUIPMENT	PERSONNEL	MATERIALS	TOTAL	UNIT	AVERAGE DAILY PRODUCTION RATES	ANNUAL EFFORT LEVELS PER KM	ANNUAL CREW DAYS REQUIRED	ANNUAL COST PER KM (Rs)
Routine	1	Pothole Patching, Paved Surfaces	1322.00	751.00	1065.00	3138.00	SY	25.00	40.00	1.60	5020.80
	2	Spot Sealing, Paved Surfaces	894.00	451.00	770.00	2115.00	SY	150.00	134.00	0.89	1889.40
	3	Pothole Patching, Unpaved Surfaces	0.00	0.00	0.00	0.00	CY	4.00	0.00	0.00	0.00
	4	Light Grading, Unpaved Surfaces	0.00	0.00	0.00	0.00	Km	10.00	0.00	0.00	0.00
	5	Shoulder Maintenance	1666.00	389.00	240.00	2295.00	CY	4.00	3.00	0.75	1721.25
	6	Bridge Repair, Minor	905.00	491.00	450.00	1846.00	Man-Days	8.00	0.08	0.01	18.46
	7	Culvert Repair	441.00	313.00	150.00	904.00	Man-Days	5.00	0.80	0.16	144.64
	8	Ditch and Culvert Cleaning	194.00	233.00	0.00	427.00	Ditch-Km	5.00	0.60	0.12	51.24
	9	Repair of Guardrail, Guard Posts	Not Costed				LY				
	10	Sign Repair/Replacement	Not Costed				No. Signs				
	11	Vegetation Control	798.00	268.00	0.00	1066.00	Sh-Km	1.00	0.10	0.10	106.60
	12	Slope Maintenance	3306.00	434.00	1000.00	4740.00	Man-Days	8.00	3.20	0.40	1896.00
	13	Field Supervision	489.00	173.00	0.00	662.00	Man-Days	2.00	0.03	0.01	8.28
	14	Field Inspection	489.00	173.00	0.00	662.00	Man-Days	2.00	1.20	0.60	397.20
	15	Equipment Transportation	1930.00	81.00	0.00	2011.00	Man-Days	2.00	0.30	0.15	301.65
Periodic	16	Resurfacing, Paved Surfaces - DBST	By Contract @ Rs 14.4/SY				SY	20000.00	1600.00	0.08	22928.00
	17	Heavy Grading, Unpaved Surfaces	0.00	0.00	0.00	0.00	Km	4.00	0.00	0.00	0.00
	18	Regravelling, Unpaved Surfaces	0.00	0.00	0.00	0.00	CY	400.00	0.00	0.00	0.00
Emergency	19	Removal of Slide and Flood Debris	7593.00	553.00	0.00	8146.00	Man-Days	10.00	0.03	0.00	24.44
	20	Snow Removal	Not Costed				Km				
	21	Bridge Repair, Major	Not Costed				Man-Days				

ANNUAL PER-KILOMETRE COSTS:

ROUTINE PLUS EMERGENCY..... 11579.95
PERIODIC..(In years 5, 9, 12, 15, 18)..... 22928.00

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Table 5.4 (B)
ANNUAL PER-KILOMETRE UNIT COSTS
MAINTENANCE

CLASSIFICATION B
22-Foot Pavement, 3-Foot Shoulders, AADT 200-800

CATEGORY	ACTIVITY	DESCRIPTION	DAILY COST (Rs) EQUIPMENT	PERSONNEL	MATERIALS	TOTAL	UNIT	AVERAGE DAILY PRODUCTION RATES	ANNUAL EFFORT LEVELS PER KM	ANNUAL CREW DAYS REQUIRED	ANNUAL COST PER KM (Rs)
Routine	1	Pothole Patching, Paved Surfaces	1322.00	751.00	1065.00	3138.00	SY	25.00	26.00	1.04	3263.52
	2	Spot Sealing, Paved Surfaces	894.00	451.00	770.00	2115.00	SY	150.00	100.00	0.67	1410.00
	3	Pothole Patching, Unpaved Surfaces	0.00	0.00	0.00	0.00	CY	4.00	0.00	0.00	0.00
	4	Light Grading, Unpaved Surfaces	0.00	0.00	0.00	0.00	Km	10.00	0.00	0.00	0.00
	5	Shoulder Maintenance	1666.00	389.00	240.00	2295.00	CY	4.00	2.00	0.50	1147.50
	6	Bridge Repair, Minor	905.00	491.00	450.00	1846.00	Man-Days	8.00	0.08	0.01	18.46
	7	Culvert Repair	441.00	313.00	150.00	904.00	Man-Days	5.00	0.80	0.16	144.64
	8	Ditch and Culvert Cleaning	194.00	233.00	0.00	427.00	Ditch-Km	5.00	0.60	0.12	51.24
	9	Repair of Guardrail, Guard Posts	Not Costed				LY				
	10	Sign Repair/Replacement	Not Costed				No. Signs				
	11	Vegetation Control	798.00	268.00	0.00	1066.00	Sh-Km	1.00	0.10	0.10	106.60
	12	Slope Maintenance	3306.00	434.00	1000.00	4740.00	Man-Days	8.00	3.20	0.40	1896.00
	13	Field Supervision	489.00	173.00	0.00	662.00	Man-Days	2.00	0.03	0.01	8.28
	14	Field Inspection	489.00	173.00	0.00	662.00	Man-Days	2.00	0.60	0.30	198.60
	15	Equipment Transportation	1930.00	81.00	0.00	2011.00	Man-Days	2.00	0.30	0.15	301.65
Periodic	16	Resurfacing, Paved Surfaces - BBST	By Contract @ Rs 14.4/SY				SY	20000.00	1360.00	0.07	19488.80
	17	Heavy Grading, Unpaved Surfaces	0.00	0.00	0.00	0.00	Km	4.00	0.00	0.00	0.00
	18	Regravelling, Unpaved Surfaces	0.00	0.00	0.00	0.00	CY	400.00	0.00	0.00	0.00
Emergency	19	Removal of Slide and Flood Debris	7593.00	553.00	0.00	8146.00	Man-Days	10.00	0.03	0.00	24.44
	20	Snow Removal	Not Costed				Km				
	21	Bridge Repair, Major	Not Costed				Man-Days				

ANNUAL PER-KILOMETRE COSTS:

ROUTINE PLUS EMERGENCY..... 8570.92
PERIODIC.. (In years 7, 13 & 18)..... 19488.80

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Table 5.4 (C)

ANNUAL PER-KILOMETRE UNIT COSTS

MAINTENANCE

CLASSIFICATION C

10-to-12 Foot Pavement, 5-Foot Shoulders, Assume AADT <200

CATEGORY	ACTIVITY	DESCRIPTION	DAILY COST (Rs) EQUIPMENT	PERSONNEL	MATERIALS	TOTAL	UNIT	AVERAGE DAILY PRODUCTION RATES	ANNUAL EFFORT LEVELS PER KM	ANNUAL CREW DAYS REQUIRED	ANNUAL COST PER KM (Rs)
Routine	1	Pothole Patching, Paved Surfaces	1322.00	751.00	1065.00	3138.00	SY	25.00	12.00	0.48	1506.24
	2	Spot Sealing, Paved Surfaces	894.00	451.00	770.00	2115.00	SY	150.00	60.00	0.40	846.00
	3	Pothole Patching, Unpaved Surfaces	0.00	0.00	0.00	0.00	CY	4.00	0.00	0.00	0.00
	4	Light Grading, Unpaved Surfaces	0.00	0.00	0.00	0.00	Km	10.00	0.00	0.00	0.00
	5	Shoulder Maintenance	1666.00	389.00	240.00	2295.00	CY	4.00	3.00	0.75	1721.25
	6	Bridge Repair, Minor	905.00	491.00	450.00	1846.00	Man-Days	8.00	0.08	0.01	18.46
	7	Culvert Repair	441.00	313.00	150.00	904.00	Man-Days	5.00	0.80	0.16	144.64
	8	Ditch and Culvert Cleaning	194.00	233.00	0.00	427.00	Ditch-Km	5.00	0.60	0.12	51.24
	9	Repair of Guardrail, Guard Posts	Not Costed				LY				
	10	Sign Repair/Replacement	Not Costed				No. Signs				
	11	Vegetation Control	798.00	268.00	0.00	1066.00	Sh-Km	1.00	0.10	0.10	106.60
	12	Slope Maintenance	3306.00	434.00	1000.00	4740.00	Man-Days	8.00	3.20	0.40	1896.00
	13	Field Supervision	489.00	173.00	0.00	662.00	Man-Days	2.00	0.03	0.01	8.28
	14	Field Inspection	489.00	173.00	0.00	662.00	Man-Days	2.00	0.60	0.30	198.60
	15	Equipment Transportation	1930.00	81.00	0.00	2011.00	Man-Days	2.00	0.30	0.15	301.65
Periodic	16	Resurfacing, Paved Surfaces - DBST	By Contract @ Rs 14.4/SY				SY	20000.00	800.00	0.04	11464.00
	17	Heavy Grading, Unpaved Surfaces	0.00	0.00	0.00	0.00	Km	4.00	0.00	0.00	0.00
	18	Regravelling, Unpaved Surfaces	0.00	0.00	0.00	0.00	CY	400.00	0.00	0.00	0.00
Emergency	19	Removal of Slide and Flood Debris	7593.00	553.00	0.00	8146.00	Man-Days	10.00	0.03	0.00	24.44
	20	Snow Removal	Not Costed				Km				
	21	Bridge Repair, Major	Not Costed				Man-Days				

ANNUAL PER-KILOMETRE COSTS:

ROUTINE PLUS EMERGENCY..... 6823.39

PERIODIC..(In years 5, 9, 12, 15, 18)..... 11464.00

118.

Table 5.4 (D)
ANNUAL PER-KILOMETRE UNIT COSTS
MAINTENANCE

CLASSIFICATION D
Gravel Surface, 32-Foot Subgrade, AADT > 200

CATEGORY	ACTIVITY	DESCRIPTION	DAILY COST (Rs) EQUIPMENT	PERSONNEL	MATERIALS	TOTAL	UNIT	AVERAGE DAILY PRODUCTION RATES	ANNUAL EFFORT LEVELS PER KM	ANNUAL CREW DAYS REQUIRED	ANNUAL COST PER KM (Rs)
Routine	1	Pothole Patching, Paved Surfaces	0.00	0.00	0.00	0.00	SY	25.00	0.00	0.00	0.00
	2	Spot Sealing, Paved Surfaces	0.00	0.00	0.00	0.00	SY	150.00	0.00	0.00	0.00
	3	Pothole Patching, Unpaved Surfaces	1852.00	577.00	240.00	2669.00	CY	4.00	3.20	0.80	2135.20
	4	Light Grading, Unpaved Surfaces	3341.00	324.00	0.00	3665.00	Km	10.00	12.00	1.20	4398.00
	5	Shoulder Maintenance	0.00	0.00	0.00	0.00	CY	4.00	0.00	0.00	0.00
	6	Bridge Repair, Minor	905.00	491.00	450.00	1846.00	Man-Days	8.00	0.08	0.01	18.46
	7	Culvert Repair	441.00	313.00	150.00	904.00	Man-Days	5.00	0.80	0.16	144.64
	8	Ditch and Culvert Cleaning	194.00	233.00	0.00	427.00	Ditch-Km	5.00	0.30	0.06	25.62
	9	Repair of Guardrail, Guard Posts	Not Costed				LY				
	10	Sign Repair/Replacement	Not Costed				No. Signs				
	11	Vegetation Control	798.00	268.00	0.00	1066.00	Sh-Km	1.00	0.04	0.04	42.64
	12	Slope Maintenance	3306.00	434.00	1000.00	4740.00	Man-Days	8.00	3.20	0.40	1896.00
	13	Field Supervision	489.00	173.00	0.00	662.00	Man-Days	2.00	0.01	0.01	4.30
	14	Field Inspection	489.00	173.00	0.00	662.00	Man-Days	2.00	0.16	0.08	52.96
	15	Equipment Transportation	1930.00	81.00	0.00	2011.00	Man-Days	2.00	0.30	0.15	301.65
Periodic	16	Resurfacing, Paved Surfaces - BBST	0.00	0.00	0.00	0.00	SY	20000.00	0.00	0.00	0.00
	17	Heavy Grading, Unpaved Surfaces	0.00	0.00	0.00	0.00	Km	4.00	0.00	0.00	0.00
	18	Regravelling, Unpaved Surfaces	By Contract @ Rs 88/CY				CY	400.00	760.00	1.90	66880.00
Emergency	19	Removal of Slide and Flood Debris	7593.00	553.00	0.00	8146.00	Man-Days	10.00	0.03	0.00	24.44
	20	Snow Removal	Not Costed				Km				
	21	Bridge Repair, Major	Not Costed				Man-Days				

ANNUAL PER-KILOMETRE COSTS:

ROUTINE PLUS EMERGENCY..... 9043.91
PERIODIC..(Act. 18 only, once every two years)..... 66880.00

Table 5.4 (E)
ANNUAL PER-KILOMETRE UNIT COSTS
MAINTENANCE

CLASSIFICATION E
Gravel Surface, 32-Foot Subgrade, AADT 50-200

CATEGORY	ACTIVITY	DESCRIPTION	DAILY COST (Rs) EQUIPMENT	PERSONNEL	MATERIALS	TOTAL	UNIT	AVERAGE DAILY PRODUCTION RATES	ANNUAL EFFORT LEVELS PER KM	ANNUAL CREW DAYS REQUIRED	ANNUAL COST PER KM (Rs)
Routine	1	Pothole Patching, Paved Surfaces	0.00	0.00	0.00	0.00	SY	25.00	0.00	0.00	0.00
	2	Spot Sealing, Paved Surfaces	0.00	0.00	0.00	0.00	SY	150.00	0.00	0.00	0.00
	3	Pothole Patching, Unpaved Surfaces	1852.00	577.00	240.00	2669.00	CY	4.00	2.40	0.60	1601.40
	4	Light Grading, Unpaved Surfaces	3341.00	324.00	0.00	3665.00	Km	10.00	6.00	0.60	2199.00
	5	Shoulder Maintenance	0.00	0.00	0.00	0.00	CY	4.00	0.00	0.00	0.00
	6	Bridge Repair, Minor	905.00	491.00	450.00	1846.00	Man-Days	8.00	0.08	0.01	18.46
	7	Culvert Repair	441.00	313.00	150.00	904.00	Man-Days	5.00	0.80	0.16	144.64
	8	Ditch and Culvert Cleaning	194.00	233.00	0.00	427.00	Ditch-Km	5.00	0.30	0.06	25.62
	9	Repair of Guardrail, Guard Posts	Not Costed				LY				
	10	Sign Repair/Replacement	Not Costed				No. Signs				
	11	Vegetation Control	798.00	268.00	0.00	1066.00	Sh-Km	1.00	0.04	0.04	42.64
	12	Slope Maintenance	3306.00	434.00	1000.00	4740.00	Man-Days	8.00	3.20	0.40	1896.00
	13	Field Supervision	489.00	173.00	0.00	662.00	Man-Days	2.00	0.01	0.01	4.30
	14	Field Inspection	489.00	173.00	0.00	662.00	Man-Days	2.00	0.12	0.06	39.72
	15	Equipment Transportation	1930.00	81.00	0.00	2011.00	Man-Days	2.00	0.30	0.15	301.65
Periodic	16	Resurfacing, Paved Surfaces - DBST	0.00	0.00	0.00	0.00	SY	20000.00	0.00	0.00	0.00
	17	Heavy Grading, Unpaved Surfaces	11215.00	782.00	300.00	12297.00	Km	4.00	0.25	0.06	768.56
	18	Regravelling, Unpaved Surfaces	By Contract @ Rs 88/CY				CY	400.00	380.00	0.95	33440.00
Emergency	19	Removal of Slide and Flood Debris	7593.00	553.00	0.00	8146.00	Man-Days	10.00	0.03	0.00	24.44
	20	Snow Removal	Not Costed				Km				
	21	Bridge Repair, Major	Not Costed				Man-Days				

ANNUAL PER-KILOMETRE COSTS:

ROUTINE PLUS EMERGENCY..... 6297.87
PERIODIC..(Activity 17 -- In years 2, 6, 10, 14, 18)..... 768.56
(Activity 18 -- In years 4, 8, 12, 16, 20)..... 33440.00

120

Table 5.4 (F)
ANNUAL PER-KILOMETRE UNIT COSTS
MAINTENANCE

CLASSIFICATION F
Earth Surface, >20-Foot Formation, Assume AADT 50-100

CATEGORY	ACTIVITY	DESCRIPTION	DAILY COST (Rs) EQUIPMENT	PERSONNEL	MATERIALS	TOTAL	UNIT	AVERAGE DAILY PRODUCTION RATES	ANNUAL EFFORT LEVELS PER KM	ANNUAL CREW DAYS REQUIRED	ANNUAL COST PER KM (Rs)
Routine	1	Pothole Patching, Paved Surfaces	0.00	0.00	0.00	0.00	SY	25.00	0.00	0.00	0.00
	2	Spot Sealing, Paved Surfaces	0.00	0.00	0.00	0.00	SY	150.00	0.00	0.00	0.00
	3	Pothole Patching, Unpaved Surfaces	1852.00	577.00	240.00	2669.00	CY	4.00	1.60	0.40	1067.60
	4	Light Grading, Unpaved Surfaces	3341.00	324.00	0.00	3665.00	Km	10.00	4.00	0.40	1466.00
	5	Shoulder Maintenance	0.00	0.00	0.00	0.00	CY	4.00	0.00	0.00	0.00
	6	Bridge Repair, Minor	905.00	491.00	450.00	1846.00	Man-Days	8.00	0.04	0.01	9.23
	7	Culvert Repair	441.00	313.00	150.00	904.00	Man-Days	5.00	0.80	0.16	144.64
	8	Ditch and Culvert Cleaning	194.00	233.00	0.00	427.00	Ditch-Km	5.00	0.30	0.06	25.62
	9	Repair of Guardrail, Guard Posts	Not Costed				LY				
	10	Sign Repair/Replacement	Not Costed				No. Signs				
	11	Vegetation Control	798.00	268.00	0.00	1066.00	Sh-Km	1.00	0.04	0.04	42.64
	12	Slope Maintenance	3306.00	434.00	1000.00	4740.00	Man-Days	8.00	1.60	0.20	948.00
	13	Field Supervision	489.00	173.00	0.00	662.00	Man-Days	2.00	0.01	0.01	4.30
	14	Field Inspection	489.00	173.00	0.00	662.00	Man-Days	2.00	0.08	0.04	26.48
	15	Equipment Transportation	1930.00	81.00	0.00	2011.00	Man-Days	2.00	0.30	0.15	301.65
Periodic	16	Resurfacing, Paved Surfaces - DBST	0.00	0.00	0.00	0.00	SY	20000.00	0.00	0.00	0.00
	17	Heavy Grading, Unpaved Surfaces (1)	11215.00	782.00	200.00	12197.00	Km	4.00	0.25	0.06	762.31
	18	Regravelling, Unpaved Surfaces (1)	By Contract @ Rs 50/CY				CY	400.00	300.00	0.75	15000.00
Emergency	19	Removal of Slide and Flood Debris	7593.00	553.00	0.00	8146.00	Man-Days	10.00	0.03	0.00	24.44
	20	Snow Removal	Not Costed				Km				
	21	Bridge Repair, Major	Not Costed				Man-Days				

(1) Material added is side-borrow supplied on "self-help" basis

ANNUAL PER-KILOMETRE COSTS:

ROUTINE PLUS EMERGENCY..... 4060.60
PERIODIC..(Activity 17 -- In years 2, 6, 10, 14, 18)..... 762.31
(Activity 18 -- In years 4, 8, 12, 16, 20)..... 15000.00

121

Table 5.4 (G)
ANNUAL PER-KILOMETRE UNIT COSTS
MAINTENANCE

CLASSIFICATION G
Earth Surface, <20-Foot Formation, Assume AADT <50

CATEGORY	ACTIVITY	DESCRIPTION	DAILY COST (Rs) EQUIPMENT	PERSONNEL	MATERIALS	TOTAL	UNIT	AVERAGE DAILY PRODUCTION RATES	ANNUAL EFFORT LEVELS PER KM	ANNUAL CREW DAYS REQUIRED	ANNUAL COST PER KM (Rs)
Routine	1	Pothole Patching, Paved Surfaces	0.00	0.00	0.00	0.00	SY	25.00	0.00	0.00	0.00
	2	Spot Sealing, Paved Surfaces	0.00	0.00	0.00	0.00	SY	150.00	0.00	0.00	0.00
	3	Pothole Patching, Unpaved Surfaces	1852.00	577.00	240.00	2669.00	CY	4.00	1.20	0.30	800.70
	4	Light Grading, Unpaved Surfaces	3341.00	324.00	0.00	3665.00	Km	10.00	2.00	0.20	733.00
	5	Shoulder Maintenance	0.00	0.00	0.00	0.00	CY	4.00	0.00	0.00	0.00
	6	Bridge Repair, Minor	905.00	491.00	450.00	1846.00	Man-Days	8.00	0.04	0.01	9.23
	7	Culvert Repair	441.00	313.00	150.00	904.00	Man-Days	5.00	0.80	0.16	144.64
	8	Ditch and Culvert Cleaning	194.00	233.00	0.00	427.00	Ditch-Km	5.00	0.30	0.06	25.62
	9	Repair of Guardrail, Guard Posts	Not Costed				LY				
	10	Sign Repair/Replacement	Not Costed				No. Signs				
	11	Vegetation Control	798.00	268.00	0.00	1066.00	Sh-Km	1.00	0.04	0.04	42.64
	12	Slope Maintenance	3306.00	434.00	1000.00	4740.00	Man-Days	8.00	1.60	0.20	948.00
	13	Field Supervision	489.00	173.00	0.00	662.00	Man-Days	2.00	0.01	0.01	4.30
	14	Field Inspection	489.00	173.00	0.00	662.00	Man-Days	2.00	0.04	0.02	13.24
	15	Equipment Transportation	1930.00	81.00	0.00	2011.00	Man-Days	2.00	0.30	0.15	301.65
Periodic	16	Resurfacing, Paved Surfaces - DBST	0.00	0.00	0.00	0.00	SY	20000.00	0.00	0.00	0.00
	17	Heavy Grading, Unpaved Surfaces (1)	11215.00	782.00	200.00	12197.00	Km	4.00	0.24	0.06	731.82
	18	Regravelling, Unpaved Surfaces (1)	By Contract @ Rs 50/CY				CY	400.00	100.00	0.25	5000.00
Emergency	19	Removal of Slide and Flood Debris	7593.00	553.00	0.00	8146.00	Man-Days	10.00	0.03	0.00	24.44
	20	Snow Removal	Not Costed				Km				
	21	Bridge Repair, Major	Not Costed				Man-Days				

(1) Material added is side-borrow supplied on 'self-help' basis

ANNUAL PER-KILOMETRE COSTS:

ROUTINE PLUS EMERGENCY..... 3047.46
PERIODIC..(Activity 17 -- In years 3, 6, 12, 15)..... 731.82
(Activity 18 -- In years 9 & 18)..... 5000.00

122.

Table 5.5 (A)
DISCOUNTED UNIT COSTS PER KILOMETRE FOR MAINTENANCE
CLASSIFICATION A
(Rs)

22-Foot Pavement, 3-Foot Shoulders, AADT >800 Discount Rate = 12%

YEAR	PRESENT WORTH FACTORS	ROUTINE AND EMERGENCY	PERIODIC	TOTALS
0			115500.00 (1)	
1	1.00	11579.95		11579.95
2	0.89	10339.24		10339.24
3	0.80	9231.47		9231.47
4	0.71	8242.38		8242.38
5	0.64	7359.27	73402.34	80761.61
6	0.57	6570.77		6570.77
7	0.51	5866.76		5866.76
8	0.45	5238.18		5238.18
9	0.40	4676.95	46648.51	51325.46
10	0.36	4175.85		4175.85
11	0.32	3728.43		3728.43
12	0.29	3328.96	33203.49	36532.45
13	0.26	2972.28		2972.28
14	0.23	2653.83		2653.83
15	0.20	2369.49	23633.59	26003.08
16	0.18	2115.61		2115.61
17	0.16	1888.94		1888.94
18	0.15	1686.55	16821.92	18508.48
19	0.13	1505.85		1505.85
20	0.12	1344.51		1344.51
	TOTALS....	96875.28	193709.85	290585.13

(1) RESURFACING COST PER KILOMETRE (DBST)

123

Table 5.5 (B)
DISCOUNTED UNIT COSTS PER KILOMETRE FOR MAINTENANCE
CLASSIFICATION B
(Rs)

22-Foot Pavement, 3-Foot Shoulders, AADT 200-800 Discount Rate = 12%

YEAR	PRESENT WORTH FACTORS	ROUTINE AND EMERGENCY	PERIODIC	TOTALS
0			115500.00 (1)	
1	1.00	8570.92		8570.92
2	0.89	7652.61		7652.61
3	0.80	6832.68		6832.68
4	0.71	6100.61		6100.61
5	0.64	5446.97		5446.97
6	0.57	4863.37		4863.37
7	0.51	4342.29	58515.89	62858.19
8	0.45	3877.05		3877.05
9	0.40	3461.65		3461.65
10	0.36	3090.76		3090.76
11	0.32	2759.61		2759.61
12	0.29	2463.93		2463.93
13	0.26	2199.94	29645.97	31845.91
14	0.23	1964.23		1964.23
15	0.20	1753.78		1753.78
16	0.18	1565.88		1565.88
17	0.16	1398.10		1398.10
18	0.15	1249.31	16821.92	18070.23
19	0.13	1114.56		1114.56
20	0.12	995.14		995.14
TOTALS....		71702.40	104983.79	176686.19

(1) RESURFACING COST PER KILOMETRE (DBST)

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Table 5.5 (C)
DISCOUNTED UNIT COSTS PER KILOMETRE FOR MAINTENANCE
CLASSIFICATION C
(Rs)

10-to-12-Foot Pavement, 5-Foot Shoulders, Assume AADT <200 Discount Rate = 12%

YEAR	PRESENT WORTH FACTORS	ROUTINE AND EMERGENCY	PERIODIC	TOTALS
0			57750.00 (1)	
1	1.00	6823.39		6823.39
2	0.89	6092.31		6092.31
3	0.80	5439.56		5439.56
4	0.71	4856.75		4856.75
5	0.64	4336.39	36701.17	41037.56
6	0.57	3871.77		3871.77
7	0.51	3456.94		3456.94
8	0.45	3086.56		3086.56
9	0.40	2755.85	23324.26	26080.11
10	0.36	2460.58		2460.58
11	0.32	2196.95		2196.95
12	0.29	1961.56	16601.75	18563.31
13	0.26	1751.39		1751.39
14	0.23	1563.74		1563.74
15	0.20	1396.20	11816.79	13212.99
16	0.18	1246.61		1246.61
17	0.16	1113.04		1113.04
18	0.15	993.79	8410.96	9404.75
19	0.13	887.31		887.31
20	0.12	792.24		792.24
TOTALS....		57082.96	96854.93	153937.88

(1) RESURFACING COST PER KILOMETRE (DBST) 11 FEET WIDE

125

Table 5.5 (B)
DISCOUNTED UNIT COSTS PER KILOMETRE FOR MAINTENANCE
CLASSIFICATION B
(Rs)

Gravel Surface, 32-Foot Subgrade, AADT >200 Discount Rate = 12%

YEAR	PRESENT WORTH FACTORS	ROUTINE AND EMERGENCY	PERIODIC	TOTALS
0			133760.00 (1)	
1	1.00	9043.91		9043.91
2	0.89	8074.92		8074.92
3	0.80	7209.75	106632.65	113842.40
4	0.71	6437.28		6437.28
5	0.64	5747.57	85006.90	90754.47
6	0.57	5131.76		5131.76
7	0.51	4581.93	67766.98	72348.91
8	0.45	4091.01		4091.01
9	0.40	3652.68	54023.42	57676.10
10	0.36	3261.32		3261.32
11	0.32	2911.90	43067.14	45979.04
12	0.29	2599.91		2599.91
13	0.26	2321.35	34332.86	36654.21
14	0.23	2072.63		2072.63
15	0.20	1850.56	27369.95	29220.51
16	0.18	1652.29		1652.29
17	0.16	1475.26	21819.15	23294.41
18	0.15	1317.19		1317.19
19	0.13	1176.07	17394.10	18570.16
20	0.12	1050.06		1050.06
	TOTALS....	75659.33	457413.15	533072.48

(1) RESURFACING COST PER KILOMETRE. 4" COMPACTED THICKNESS, CRUSHED ROCK, 30 FEET WIDE

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Table 5.5 (E)
DISCOUNTED COSTS PER KILOMETRE FOR MAINTENANCE
CLASSIFICATION E
(Rs)

Gravel Surface, 32-Foot Subgrade, AADT 50-200 — Discount Rate = 12%

YEAR	PRESENT WORTH FACTORS	ROUTINE AND EMERGENCY	PERIODIC ACT 17 (1)	PERIODIC ACT 18 (2)	TOTALS
0			3074.24(3)	133760.00(4)	
1	1.00	6297.87			6297.87
2	0.89	5623.10	2744.86		8367.96
3	0.80	5020.62			5020.62
4	0.71	4482.70		95207.73	99690.43
5	0.64	4002.41			4002.41
6	0.57	3573.58	1744.41		5317.99
7	0.51	3190.70			3190.70
8	0.45	2848.84		60506.23	63355.07
9	0.40	2543.60			2543.60
10	0.36	2271.08	1108.60		3379.68
11	0.32	2027.75			2027.75
12	0.29	1810.49		38452.80	40263.29
13	0.26	1616.51			1616.51
14	0.23	1443.31	704.54		2147.85
15	0.20	1288.67			1288.67
16	0.18	1150.60		24437.45	25588.05
17	0.16	1027.32			1027.32
18	0.15	917.25	447.75		1364.99
19	0.13	818.97			818.97
20	0.12	731.23		15530.44	16261.67
TOTALS....		52686.58	6750.15	234134.66	293571.38

(1) HEAVY GRADING (2) REGRAVELLING WITH 4" COMPACTED THICKNESS, 30 FEET WIDE, CRUSHED ROCK
(3) HEAVY GRADING COST PER KILOMETRE (4) REGRAVELLING COST PER KILOMETRE

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Table 5.5 (F)
DISCOUNTED COSTS PER KILOMETRE FOR MAINTENANCE
CLASSIFICATION F
(Rs)

Earth Surface, >20-Foot Formation, Assume AADT 50-200 Discount Rate = 12%

YEAR	PRESENT WORTH FACTORS	ROUTINE AND EMERGENCY	PERIODIC ACT 17 (1)	PERIODIC ACT 18 (2)	TOTALS
0			3049.24(3)	55700.00(4)	
1	1.00	4060.60			4060.60
2	0.89	3625.54	2722.54		6348.07
3	0.80	3237.09			3237.09
4	0.71	2890.25		39646.16	42536.41
5	0.64	2580.58			2580.58
6	0.57	2304.09	1730.22		4034.31
7	0.51	2057.23			2057.23
8	0.45	1836.81		25195.85	27032.66
9	0.40	1640.01			1640.01
10	0.36	1464.29	1099.59		2563.88
11	0.32	1307.40			1307.40
12	0.29	1167.33		16012.42	17179.74
13	0.26	1042.25			1042.25
14	0.23	930.58	698.81		1629.39
15	0.20	830.88			830.88
16	0.19	741.86		10176.18	10918.04
17	0.15	662.37			662.37
18	0.15	591.40	444.10		1035.51
19	0.13	528.04			528.04
20	0.12	471.46		6467.15	6938.61
	TOTALS....	33970.07	6695.25	97497.76	138163.09

(1) HEAVY GRADING (2) RESURFACING WITH 4" COMPACTED (5" LOOSE) THICKNESS, 22' WIDE, SELECT SIDE-BORROW (3) HEAVY GRADING COST PER KILOMETRE (4) RESURFACING COST PER KILOMETRE

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Table 5.5 (8)
DISCOUNTED UNIT COSTS PER KILOMETRE FOR MAINTENANCE
CLASSIFICATION 6
(Rs)

Earth Surface, (20-Foot Formation, Assume AADT (50 — Discount Rate = 12%

YEAR	PRESENT WORTH FACTORS	ROUTINE AND EMERGENCY	PERIODIC ACT 17 (1)	PERIODIC ACT 18 (2)	TOTALS
0			3049.25(3)	35450.00(4)	
1	1.00	3047.46			3047.46
2	0.89	2720.95			2720.95
3	0.80	2429.42	2430.84		4860.26
4	0.71	2169.12			2169.12
5	0.64	1936.72			1936.72
6	0.57	1729.21	1730.23		3459.44
7	0.51	1543.94			1543.94
8	0.45	1378.52			1378.52
9	0.40	1230.82		14317.66	15548.48
10	0.36	1098.94			1098.94
11	0.32	981.20			981.20
12	0.29	876.07	876.59		1752.66
13	0.26	782.21			782.21
14	0.23	698.40			698.40
15	0.20	623.57	623.94		1247.51
16	0.18	556.76			556.76
17	0.16	497.11			497.11
18	0.15	443.85		5163.09	5606.94
19	0.13	396.29			396.29
20	0.12	353.83			353.83
TOTALS....		25494.37	5661.59	19480.75	50636.72

(1) HEAVY GRADING (2) RESURFACING WITH 4" COMPACTED (5" LOOSE) THICKNESS, 14' WIDE, SELECT SIDE-BORROW (3) HEAVY GRADING COST PER KILOMETRE (4) RESURFACING COST PER KILOMETRE

5.5 NEW CONSTRUCTION COSTS

At each of the provincial and district headquarters offices visited, information was gathered on new construction costs. Unfortunately, these data varied so widely, no conclusive figures could be drawn for most road types; however, the figure of Rs 500,000/km for a new paved (TBST) road (12-foot pavement) on a 20-to-24-foot formation was recorded several times. Using this basic figure, the costs for lower types of roads were estimated and checked against the figures in two publications: 1) USAID's Project Paper AID-DLC/P-2233, PAKISTAN - RURAL ROADS, August 1977, (Ref. 17) and 2) the report submitted to USAID/Islamabad by LBII in 1982, FARM-TO-MARKET ROAD PROJECT (391-0480) (Ref. 18). Updating the costs indicated in these publications for a paved road of similar characteristics as those above, assuming 24' formation, 12' x 4" stone, 12' DBST checked very closely (Rs 474,000) with the Rs 500,000 quoted. The Consultant then used the various components of this figure to estimate the per-kilometre costs for roads of lesser standard.

Calculations were, with the exception of bituminous paving, based or prices shown in the 1982 report (Ref. 18). Page and item numbers in Table 5.6 below refer to Annex A of that report.

Prices shown are extracted from the summary on page 28, using the "Total Contract Price" line. The dimensions of each stage of construction have been reconstructed from the quantities shown in the tables on pages 9 to 17.

The Consultant is recommending that new and rehabilitated paving be Double Bituminous Surface Treatment (DBST), as this is considered adequate on a properly graded and compacted subbase and base courses. A 1985 price of Rs 14.4 per square yard is used, the same as in Table 5.4, instead of attempting to modify the TBST figure in the 1982 report. All other 1982 prices are used without escalation, as the labor and materials are all domestic and have not been subjected to the same upward pressure.

Table 5.6

UNIT COSTS - NEW CONSTRUCTION

(Rs 000/km)

Construction item (Ref. 18)	Basic Cost (Ref. 18)	Width of form.	32'	20'	30'	30'	20'	20'	12'	12'	
		Ht. of form.	3'	3'							
		Thick. of layer			6"	4"	6"	4"	6"	4"	
		Width of layer									22'
Katcha road, incl. embankment & culverts (items 1-5) 18' formation, 4' high	360		390	260							
Subbase & shoulders (item 6 & 7) Gravel Layer 27' x 6"	115				128	85	85	57	51	34	
Base course and shoulders (items 7 & 8) crushed stone layer 19' x 4"	103				244	163	163	108	98	65	
Surface course, DBST 12' wide @ Rs 14.4/SY	63										116

Note: Due to side slopes, layers of aggregate are not the full width of the formation. It was not considered justified, within the accuracy of this data, to include this refinement, except in the case of the 32' formation.

Source: Consultant's calculations derived from Ref. 18

By adding the appropriate numbers from Table 5.6, numerous combination of construction costs per kilometre may be developed. For example:

(1)	Katcha road [20' x 3'-high formation]	Rs 260,000
(2)	Gravel road 20' wide [(1) + 6" gravel]	Rs 345,000
(3)	Paved road 20' wide (formation) [(2) + 12' DBST]	Rs 410,000
(4)	Paved road 32' wide (formation) [32' x 3'-high formation, 30' x 6" gravel; 30' x 6" crushed stone; 22' DBST]	Rs 880,000

5.6 REHABILITATION COSTS

The costs to rehabilitate an existing road, that is the costs to bring it back to its original condition, were taken as a percentage of the new construction costs.

A basic figure for the formation of 15% was used, being an estimate of the average cost of roads being rehabilitated after an average of three years from the date of construction or rehabilitation, without any maintenance having been performed.

In the case of gravel and paved roads, it is assumed that the cost of the aggregates and surfacing will be 80% of new construction costs, which is to say that only 20% is salvagable.

Examples of rehabilitation costs are:

(1)	Katcha road [20' x 3' formation] 260,000 x 0.15	39,000
(2)	Gravel road [(1) + 12' x 4" gravel] 39,000 + (0.8 x 34,000)	66,000
(3)	Crushed stone [(2) + 12' x 4" crushed stone] 66,000 + (0.8 x 65,000)	118,000
(4)	Paved road [(3) + 12' DBST] 118,000 + (0.8 x 63,000)	168,000

5.7 BETTERMENTS

Betterment work will consist of widening, lengthening curve radii, improving drainage (more culverts and the construction of low-water crossings), etc. All of these activities are specific, rather than

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general, and while a percentage of reconstruction costs might be given as an "average" per-kilometre cost, it would truly be meaningless -- only when a complete road inventory is in hand can betterment costs be developed with any degree of accuracy. The technical assistance consultant will have to develop these costs on the basis of need in the districts chosen for the project.

5.8 RECONSTRUCTION COSTS

Reconstruction of a road signifies a new road (usually to higher standards), utilizing as much as possible of the existing formation. In developing these costs, it was assumed that 30% of the original formation was all that could be used of the existing road. All other costs would, therefore, be 100% of those shown in Table 5.6.

A few examples of reconstruction costs are:

		Rs 000/km (Rounded)
(1)	Katcha road [20' x 3' formation] 260 x 0.7	180
(2)	Katcha road [32' x 3' formation] 390 - (260 - 180)	310
(3)	Gravel road [(2) + 30' x 6" gravel] 310 + 128	440
(4)	Gravel road [(1) + 20' x 6" gravel] 180 + 85	265
(5)	Paved road [(3) + 30' x 6" stone, 22' DBST] 440 + 244 + 116	800
(6)	Paved road [(3) + 12' DBST] 440 + 63	505
(7)	Paved road [(4) + 12' DBST] 265 + 63	505

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5.9 LIFE-CYCLE COSTING

Life-cycle costing analysis consists of comparing the capital costs plus the discounted operation and maintenance costs of alternatives over an expected life span.

In the case of roads, there are no operating costs as far as the road owner is concerned, only capital and maintenance costs.

In table 5.8, a life of 20 years is assumed and the costing of various alternatives of maintenance, and rehabilitation without maintenance, are compared. Table 5.7 shows the calculations for Discounted Rehabilitation Costs where no maintenance is performed, the Discounted Rehabilitation Costs being the product of the Rehabilitation Cost and the Total Discount Factor.

It is assumed that the value of a katcha road has a straight-line depreciation rate of 5% (of the new construction cost) per year. Rehabilitation at the end of three years means that the work will be done in year 4. The same procedure has been applied to five and eight year cycles. Costs of rehabilitation will then be 15%, 25% and 40% respectively of the new construction cost. In actual fact, the rate of depreciation accelerates if no maintenance is conducted; the straight line method was used to simplify the presentation.

Discount factors are taken from Table 5.5.

As has been assumed in section 5.6, 80% of the pavement of paved roads is lost at the time of rehabilitation. The rehabilitation costs for five and eight years can hardly be increased. In fact, the eight year calculation is probably an exercise in futility, as it is unlikely, under present Pakistani practices, whether such a road would be passable.

Table 5.7

DISCOUNTED REHABILITATION COSTS
(NO MAINTENANCE)

(A) KATCHA ROADS

Assumes New Road - 20' x 3' Formation
(1985 Rupees)

	Discount Factors Rehabilitation Interval		
	3 years	5 years	8 years
Original Cost	260,000	260,000	260,000
Rehabilitation Cost (% of av.cost)	39,000 (15)	65,000 (25)	104,000 (40)
Year			
4	.71		
6		.57	
7	.51		
9			.40
10	.36		
11		.32	
13	.26		
16	.18	.18	
17			.16
19	.13		
20 (pro-rated)	.04	.11	.06
Total Discount Factors, 20 years	2.19	1.18	0.62
Discounted Rehab. Cost	85,000	77,000	64,000

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(B) PAVED ROADS

(20' x 3' Formation, 12' x 4" gravel; 12' x 4" crushed stone; 12' DBST)

(Rupees)

	3 years	5 years	8 years
Rehabilitation cost	168,000	168,000	168,000
Discount factors (from A)	2.19	1.18	0.62
Discounted Rehab. cost	368,000	198,000	104,000

The results of these calculations are shown in table 5.8. It must be emphasized that these are financial costs, and do not take into account the costs to the travelling public of unmaintained roads. An analysis in section 6.5 shows the effect of including vehicle operating costs in the calculations.

Table 5.8
LIFE-CYCLE COSTS
(Rs/Kilometre)

Road Type	Capital Investment (New Construction) Cost	Recurrent Costs: Maintenance Costs: Routine & Emergency	Recurrent Costs: Maintenance Costs: Periodic	Recurrent Costs: Rehabilitation	Life-Cycle Cost
SCHEME 1 -Current Practice, No Maintenance, Rehabilitate every 3 years					
Katcha	260000	0	0	85000	345000
Paved	410000	0	0	368000	778000
SCHEME 2 -Current Practice, No Maintenance, Rehabilitate every 5 years					
Katcha	260000	0	0	77000	337000
Paved	410000	0	0	198000	608000
SCHEME 3 -Current Practice, No Maintenance, Rehabilitate every 8 years					
Katcha	260000	0	0	64000	324000
Paved	410000	0	0	104000	514000
SCHEME 4 -Rehabilitate and apply routine and periodic maintenance					
Katcha	260000	25490	25140	0	310630
Paved	410000	57100	96900	0	564000

NOTES:
Discount Rate = 12%; Period = 20 years

Chapter 6

ANALYSIS

6.1 INSTITUTIONAL AND TECHNICAL

6.1.1 Introduction

As the institutional and technical aspects of district road construction and maintenance are closely related, the joint analysis is being presented under this heading.

In general, the concept of the governmental structure of Pakistan is sound. The "basic democracy" idea allows many desires and decisions to develop at the village level and pass up the chain of command for approvals and funding. Considering that the present system has been functioning for only just over five years, it is working remarkably well.

There are obviously many decisions that cannot, and should not, originate at the village level. For example, the type of locomotives for the railways cannot be selected by universal voting. In a similar manner, the major elements of a national transport system have to be conceived and developed by those with wider horizons than the person dedicated to raising crops in a small village.

For this reason, the national highway system, consisting of six major trunk roads, is under the jurisdiction of the National Highway Board at the federal level, responding to the needs for the backbone of the road system of the nation.

Similarly, the provincial road systems extend the highway network, with the provincial government developing the program for each year.

6.1.2 Responsibilities for District Roads

It is not until the level of the district roads is reached that the basic democracy concept becomes apparent. As has been discussed in Chapter 3, the priority of roads to be worked on is generated by the district councils, taking into account the requests of its individual members, who, in turn, are guided by their constituencies.

This system has one great advantage in that it is responsive to the needs of the people. Even so, one may question whether the priority list is determined by good socio-economic principles, or whether the decisions are largely political. However, even giving the system the benefit of the doubt, there is a real problem in that decisions are made on an ad hoc basis each year, and there is no, or very little, long-term planning.

The second area of concern regarding the district roads in Punjab and NWFP is that there are two agencies involved in their funding and construction, namely the LGRD department and the district council. Apparently, there is no undue difficulty in reaching an agreement upon the division of the annual work program. The question to be asked is whether this system of two agencies performing parallel work is the best form of organization. One lot of funding, of course, is from the provincial ADP to LGRD, and, in many districts, this is the major source of income for road works; without it, there would be little work done at the district level.

On the other hand, there are duplicate organizations of professional and sub professional manpower, as well as equipment. This is not to say that the combined totals are too high -- far from it, even if the organizations were merged, the manpower and equipment would still be much less than that needed to do the job. The point is that a combined operation would permit more flexibility in scheduling men and equipment.

But it must be recognized that both LGRD and the district engineer have responsibilities beyond roads, such as water supply; so a combining of the two organizations would mean either that all activities would be combined or that the non-road activities would have to continue to be handled by the same organizations as at present.

The combining could be accomplished very easily by assigning the ADP funds for each district direct to the district council. This would, of course, reduce LGRD to the role of observer, possibly of monitor, as far as the districts were concerned, but would leave them their responsibilities for the union council funding.

The problem appears to have been solved in Sind and Baluchistan. In Sind, the ADP funding for roads is given to the districts as grant-in-aid or matching grants. The Assistant Director of the LGRD in each district has no control over these funds nor does he have a technical road-building staff. In Baluchistan, the opposite situation prevails. The Assistant Director of the LGRD controls the funding for roads, both from the Provincial ADP and the District, and the District Engineer is a member of his staff.

The fact that these two provinces do combine the ADP and district funds for district roads, apparently without any adverse consequences, reinforces the argument for considering the combination of activities in the other two provinces.

A further concept that could be considered is to remove responsibility for the district roads from the LGRD/district and assign it to the provincial highway department. This would have several apparent advantages:

- the control of resources of equipment and manpower would be centralized and so could be concentrated where the needs were greatest. In this respect, it must be borne in mind that the department already has responsibility for the provincial roads which occur in the great majority of districts.

- the highway department would undoubtedly have transporters for moving equipment, especially tracked equipment and rollers, thus saving a considerable amount of time and wear and tear over the almost universal practice of "walking" this equipment under its own power (in the cases where the district has the equipment!)

- planning of construction and maintenance could be conducted on a more long-term basis instead of being responsive to the needs of each district councillor.

- the provinces have some materials testing laboratories, which, at present, do not seem to be available to the districts. Thus a better quality of work should result.

- the resulting larger pool of equipment would justify the establishment of much better organizations for the maintenance and repair of the equipment than seems possible under the present district managements.

The disadvantages of centralized road operations may not be technical so much as political. The centralized planning concept should result in work being performed where there are the greatest needs in the province. This may well -- and probably would -- result in a distribution of work effort that is not at all proportional to that which the districts now experience, which could be interpreted as a departure from the ideal of basic democracy and the ongoing district council maturing process.

Furthermore, although the centralized system funding would no doubt include the ADP monies that are currently earmarked for district roads, the question arises as to what would happen to the road funds generated by the districts themselves. The districts could hardly be expected to contribute these funds to the provincial "pool".

The argument that there is no "right" or "wrong" way to approach this administrative organization has some parallel in the United States, where the governmental concept of federalism is fairly similar to that of Pakistan. For the sake of this argument, an American state can be equated to a province, a county to a district and a township to a union. The state of Pennsylvania, for example, has a large state network of highways, the counties have practically no roads to administer, and the rural townships own the purely local roads, many of which are of gravel surface. Neighboring New Jersey, about 20% the size of Pennsylvania, has only 4% as large a state highway system, but the counties do have substantial networks. Yet another organization exists in Maryland where,

apart from the state system, the counties are very strong organizations, there are no townships and very few incorporated municipalities, resulting in the county road networks being quite substantial and including many heavily-travelled roads. All of these systems operate satisfactorily, and there is no indication that any state is anxious to change to a "better" system.

6.1.3 Quality of District Roads

Having discussed possible adjustments to the organization, it is now necessary to consider the effectiveness of the system, especially as evidenced by the product, namely, the roads.

It is not too sweeping a statement to say that, by and large, the quality of the entire road system of Pakistan is far from satisfactory.

It can be argued, with much justification, that this state of affairs could be rectified by a sufficient influx of resources, principally money. There is merit in this argument, but the analysis cannot end there.

Stated generally, the problem is that there is strong evidence that available funds have not been, and are not being, used to the best advantage. Setting aside, for the moment, the subject of maintenance, it is obvious that most of the roads have not been constructed properly. It is realized that, in all probability, this is due to a desire to stretch inadequate funds as far as possible, but that does not alter the consequences.

Although there are undoubtedly deficiencies in may of the construction phases, it is the Consultant's opinion that the most serious -- and probably the easiest to correct without extensive expenditure -- is the failure to use selected materials and to compact them properly in the roadway formation.

Because of the low standards of construction, the roads fail much quicker than they should. The situation is exacerbated by inadequate maintenance.* This failure is followed by expensive reconstruction or rehabilitation, resulting, as indicated in the analysis of life cycle costs in Chapter 5, in a total cost higher than if the road had been built properly in the first place.

There is no doubt that, generally, senior technical people in at least the federal and provincial governments know how a highway should be designed and constructed, as well as having the facilities to conduct the work.

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* Although maintenance on katcha roads by laborers appears to be well organized (not necessarily well executed), maintenance on metalled roads seems to be mostly a matter of reconstruction every four-to-five years.

In the districts, however, the situation is different. In the first place, the district engineer has no design staff, and sometimes not even a surveyor. The geometrics are not as important for low-speed roads as for major highways, but some improvement is desirable. The main problem lies in the construction of the roadbed and, where there is one, the pavement. Here again, the district engineer usually has no means of carrying out soil tests before construction in order to determine the procedures that should be adopted in placing the earthwork. During construction, he has no scientific method of controlling the quality of work, of applying the correct amount of moisture and of ensuring that the compaction is adequate. In many cases, he does not even have a roller or other equipment to perform adequate compaction; however well-qualified and well-intentioned a district engineer may be, he just does not have the tools to do the job.

Apart from the lack of equipment, laboratory testing, surveyors and the other aspects that have been discussed, the Consultant is of the opinion that the ability and personality of the district engineer is not always adequate for the task. This job requires a man with a good theoretical and practical knowledge of civil engineering; a man who is resourceful, especially when he is working with so few amenities; a man of good organizing ability, coupled with energy and strong moral fiber. It is by no means an easy job.

6.2 FINANCIAL ANALYSIS

This section presents the concept of the highway system of Pakistan being conducted as a business -- in at least as far as opportunities for revenues are concerned. Section 6.2.1 discusses this concept and summarizes the possibilities, which are then analyzed in more detail in the subsequent sections.

"Road user costs" are the costs incurred by the owner in operating his vehicle; "road user charges" are the charges imposed by governmental agencies for vehicle tax, fuel tax, tolls etc; and "expenditures" are those sums spent by the various levels of government on the construction and maintenance of roads.

6.2.1 Road User Costs and Charges

Considered as a supplier of roads the GOP is in a very strong position. There are no other suppliers and, furthermore, demand for the services is increasing steadily and at a rate which at present exceeds growth in the economy as a whole.

If any supplier, even in a competitive situation, finds that demand is increasing at a rate which exceeds his capacity to maintain the existing services (much less provide for expansion) than he will raise prices to some point of equilibrium where he can maintain his services and stay in business. (He should also, of course, try to increase efficiency and reduce costs). It is essentially this strategy which is recommended if the GOP wishes to "stay in business" with respect to roads.

Table 6.1 shows estimated vehicle population by class, average annual travel and estimated financial cost per kilometre by vehicle type. Vehicle operating costs are derived from the ADB Farm to Market Roads Study (Ref. 19)

Table 6.1

ESTIMATED ROAD USER COSTS 1984-5

Vehicle Class	Vehicles (000's)	Annual Km per vehicle (000's)	Operating cost per Km (Rs.)	Total Veh. km (millions)	Total Costs (Rs millions)
Cars, jeeps etc.	379	8	1.8	3032	5458
Buses	61	50	4.5	3050	13725
Trucks	84	50	4.5	4200	18900
Motor cycles	794	6	0.5	4764	2382
Tractors etc.	243	10	4.5	2430	10935
Totals	1560	-	-	17476	51400

Total road user costs are, therefore, estimated to be about Rs 51,400 million in 1984-85. In practice, they may be higher because costs due to poor quality roads and congestion in towns are not taken fully into account.

A coherent policy on road user charges should consider the network as a whole. Although administrative and practical reasons mean responsibility is divided, in the economic sense and from the point of view of the user, the net work is one.

In Table 6.2 below estimates are made of total travel and user costs on the national, provincial and district networks. Data is taken from the previous table and the assumption is made that 15-20 per cent of vehicle use is in urban areas. Costs are compared with estimated road user changes for FY 84/85 collected by federal, provincial and district authorities, and with road expenditures from Table 4.11.

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The implied AADT estimates are necessarily speculative but serve at this stage to give a rough picture of the system. User charges are derived from the estimates in Tables 4.15 - 4.17 updated to FY 84/85 by adding ten per cent. The estimate of Rs 10 million for District charges (road tolls) is likely to be high. The estimate of Rs 30 million for spending on maintenance (as opposed to construction) is also speculative, but even at national and provincial levels it is difficult to separate construction and maintenance expenditure in a satisfactory way.

Table 6.2

COSTS, CHARGES AND EXPENDITURES, ALL RURAL ROADS FY 84/85
(Millions of rupees)

	Length (km)	Veh-km (millions)	Implied AADT	User Costs	User Charges	Expenditures Const.	Expenditures Maint.	Expenditures Total
Federal	4900	8050	4500	23680	3700	664	100	764
Provincial	39000	4980	350	14650	820	833	290	1123
District	43000	630	40	3520	10	190	30	220
Total	86900	13660	-	41850	4530	1697	410	2107

Of charges attributable to federal authorities, about 43 per cent derive from use of provincial and district roads, as that is the proportion of total user costs incurred on these roads. Of the total current expenditures, an estimated 64 per cent is spent on the provincial and district networks, while only 18 per cent of user charges are collected by the provinces and districts. The main point is that user charges collected by Federal, Provincial and District authorities cannot be related in any way to road spending at these levels; nor is it desirable that they should be related, as this would involve large collection costs and a cumbersome duplication of taxes, which is clearly not the GOP's objective.

The fact that charges exceed total expenditure by a large margin, more than 100 per cent, is not surprising or significant. Governments may raise revenues by any means they choose, and road travel, at least in the comfort of a private car, is often considered a luxury and taxed as such. In many countries the ratio of road use charges to road spending is considerably greater, perhaps 400 per cent in countries with high levels of car ownership.

The main issue is - can the GOP raise additional funds from road users in order to maintain and improve service levels, particularly, in this case, on district roads? Currently user charges amount to approximately nine or ten per cent of total road user costs. It is considered quite feasible to increase charges by about Rs 2,000 million rupees per year (or an average of four paisas per vehicle-km). This would increase total user costs by an estimated three to four per cent, but provide funds for major improvements (and thus cost savings to users) to the network as a whole, as well as to district roads.

This can be done by increasing federal user taxes by Rs 1,500 million, mainly by raising the price of diesel fuel. Any exemptions from central excise duty and development surcharges enjoyed by Government-owned transport fleets should also be cancelled since, although it might be considered as just a 'paper transfer' of money, such exemption encourages waste of resources.

The other main taxes, i.e. import duties on vehicles, spare parts and tyres, require careful study because of technical and commercial considerations and foreign currency demands. They are not obvious candidates for further revenue. Similarly, the gasoline price appears reasonable at its present level and it is doubtful if significant extra revenue could be gained.

An additional 500 million rupees can be derived from provincial motor taxes, by adjusting registration fees and annual license rates. This sum represents no more than simply bringing overall tax revenues back to 1978 levels in real terms. A comprehensive study of charges might recommend, for instance, additional taxes on cars (and again, government vehicles should not be exempt) and trucks. Higher fixed annual fees for trucks would take account of road damage factors, and might also be effective in encouraging efficient vehicle utilisation,

6.2.2 Federal Fuel Tax

Perhaps the clearest signal the GOP could give, when serious attention is devoted to the overall road maintenance problem, would be to eliminate the effective subsidy on diesel fuel. The pump price of diesel (HSD) is currently Rs 4.25/Litre or 26 US cents/litre, well below an acceptable economic value. The Government's own vehicle fleets (NLC for example) pay even less, as they are exempt from excise duty and development surcharge. The Consultant estimates that the total effective subsidy is about 1100 million rupees in FY 84/85.

Cheap fuel means that some fuel is being wasted, and prices should perform the function of rationing a scarce resource. If it is accepted that users should pay for the marginal costs of the road system (the usual economic rule) then the subsidy on diesel should be not only eliminated but replaced by an effective tax, equal to the costs that the next diesel powered vehicle imposes on the road network.

In the context of the national and provincial road networks particularly, higher diesel prices would encourage the use of larger and more fuel-efficient trucks. Larger trucks would normally cause considerably less road damage per unit of payload than the typical two-axle truck so popular at present. In the following example the common Bedford or Isuzu two axle truck is compared with a three-axle truck and a four axle 'semi'. Equivalent Standard Axles (ESA) is calculated by (axle load/8160 kg) to power of 4.5; fuel consumption, payloads and weight distribution over each axle from the Consultant's estimates.

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Table 6.3

FUEL EFFICIENCY AND DAMAGE FACTORS FOR TRUCKS

	2 axle	3 axle	4 axle
Fuel consumption (Lt/1000 km)	300	350	450
Payload (tonnes)	9.5	14.0	22.0
Fuel, per 1000 t-km	31.6	25.0	20.5
Equivalent standard Axles, ESA	2.57	2.08	4.76
Damage Factor (ESA per 100 t payload)	27.1	14.9	21.6

Source: Consultant's calculations, based on published data

As can be seen from the damage factors, the more fuel efficient trucks are also likely to cause less damage to roads. This reinforces the case for higher diesel fuel prices, but also indicates that the road user taxes question might be usefully examined from the view point of economic efficiency. Chapter 7 contains a recommendation for a detailed and comprehensive study of road user charges.

For the moment, subsidies on diesel fuel, whether to road users in general or government owned fleets, should be removed. This measure would have to be effected gradually, but it is worth noting that for FY 84/85, a ten paisas per litre increase in the pump price would yield an estimated 300 million rupees in additional revenue.

However, looking beyond the removal of the subsidies, it must be observed that an estimated 2,800 million litres of road diesel fuel was consumed in FY 83/84 (see page 4-21) and it is likely that current growth rates of consumption will be maintained for the next few years. On this assumption, raising the pump price of diesel by 40 paisas, which could be done in two or three stages over the next 18 months or so, would produce some Rs 1,400 million of extra annual revenue by 1987, the year when the proposed project starts. The immediate effect of this increase would be to raise road transport costs (for goods and most passengers) by an estimated three per cent. In the longer term, however, savings should result, particularly in goods transport, from a move to more-efficient vehicles. As noted earlier, a three-axle truck, for example, not only consumes about twenty per cent less fuel per ton of payload but causes much less road damage than the two-axle version.

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6.3.3 Provincial Motor Tax Revenues

For fiscal year 1983-84 a total of 611 million rupees was collected, or an average of about Rs 450/per vehicle. Details of rates for provinces other than Punjab were not obtained, but it is apparent that rates in NWFP and Baluchistan vary significantly from the other provinces. Dividing revenue for 82/83 by numbers of vehicles registered in each province in 1982 gives the following :

FY 82/83

	Revenue per vehicle (rupees)
Punjab	387
Sind	406
NWFP	654
Baluchistan	174
Average	409

The almost 60 per cent above average revenue per vehicle for NWFP is accounted for by the provincial government raising its tax rates in FY 80/81, 82/83, and 83/84. In contrast, Punjab rates in FY 84/85 are the same as those set in June 1978. Since that date, the consumer price index has increased by approximately 80 per cent (see Appendix 6.1).

If motor registration and annual tax rates had been raised in line with the consumer price index, Punjab could have realised an estimated extra 200 to 250 million rupees in motor tax revenue in FY 84/85.

If rates per vehicle, in Punjab, Sind, and Baluchistan were similar to those of NWFP (i.e. average Rs 654 per vehicle in 82/83) then the shortfall, that is, the lost opportunity for the collection of M.V. taxes for FY 1982/3 is calculated as follows -

Table 6.4

PROVINCIAL MOTOR VEHICLE TAXES

FY 1982/83

	1982 Vehicle Fleet (000's)	million rupees		
		MV Tax collected	MV Tax at NWFP rates	Shortfall
Punjab	675.5	261.3	441.8	180.5
Sind	492.1	200.0	321.8	121.8
NWFP	118.2	77.3	77.3	-
Baluchistan	52.2	9.1	34.1	25.0
Total	1338.0	547.7	875.0	327.2

Source: Consultant's estimates

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Assuming vehicle fleet growth of 10 per cent per year since 1982, the shortfall in the provinces of Punjab, Sind, and Baluchistan in FY 84/85 by not "keeping up" with NWFP is of the order of 400 million rupees. (1)

Assuming that the comprehensive study on road user charges, discussed in the previous section, is conducted, the GOP could issue guidelines, on an annual basis, to provinces in respect of motor vehicle registration fees and annual taxes. This annual tax is particularly useful since it bears on the existing population of vehicles and is therefore reasonably predictable in its outturn, whereas registration fees for new vehicles (like import duties) may vary substantially, depending on economic and financial conditions in the short term.

Although it may not be Federal policy to issue specific directives on provincial taxes, nonetheless the GOP would be in a position to ensure that the guidelines are followed, by matching the total revenues from motor vehicle taxation with grants. In effect, if the province fails to follow the guidelines, its grant could be reduced by an amount equal to the shortfall in MV revenue. Such a mechanism could provide a powerful incentive for the provinces to adopt GOP guidelines with respect to road user charges.

6.2.4 District Tax Revenues

From Table 4.10 it will be noted that the variations in overall "tax performance" per capita of rural population are quite marked. The fact that certain taxes vary in these terms may not, of course, be significant, especially for example in the case of mineral royalties, cattle taxes, or export taxes. However, with respect to immovable property taxes or local cess (land tax) it seems reasonable to expect some measure of consistency. In overall terms also "tax performance" ought to be much more consistent if it is accepted that both income distribution and per capita income cannot be so markedly different between districts (ignoring, for the moment, non-cash incomes).

Some specific inconsistencies which should be noted are as follows -

i) Jacobabad collects no Immovable Property Tax, while Sukkur, its neighbor in Sind, does so.

ii) Pishin, in Baluchistan, collects no Export Tax. Export tax could be levied on apples and vegetables for the market in Quetta, but so far the District Council has resisted persuasion by provincial government officials to levy a tax.

iii) Jhelum, which has rich mineral deposits, obtains no income at all from royalties. Abbottabad has large quantities of river gravel (shingle) and also does not collect mineral royalties.

(1) NWFP's expected revenue from M.V. Tax in FY 84/85 is 117.6 million rupees - see 'White Paper' page 28. (Ref. 14)

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More detailed study would certainly reveal other inconsistencies, for example in road tolls, bus stand fees and other taxes. There is enough evidence, however, to conclude that many districts might be able to increase tax revenues considerably. To do this would require detailed studies and surveys, which could be carried out by the Provincial Governments. Subsequently, directives from the provincial Finance Departments, which have the force of law, and technical assistance in implementation would be required.

It is considered that there is very limited scope for measurable increases in other taxes which are not currently levied by the districts (see lists in Appendix 4.6). A tax on wooden wheeled bullock carts might be imposed to encourage use of pnuematic tires for such vehicles. Not much revenue would result, but damage to earth roads would be reduced.

It is difficult to see how 'conservancy rates' (Sind No. 17) "Fees.... for public utilities' etc. (Sind No. 21 and NWFP No. 11) might be levied, other than those, such as road tolls, already being applied.

While clearly difficult to predict the effect of improved tax performance by district councils, some projection might be useful. Estimates are made below of existing per capita tax income by province, and it is assumed that a two rupee per capita improvement is possible in Punjab and Sind, and one rupee per capita in NWFP. In Baluchistan extra tax income, on any projection, would still be insignificant.

Table 6.5

PROJECTED DISTRICT COUNCIL TAX INCOME FY 84/85

	Punjab	Sind	NWFP	Baluchistan	Total
Rural Population (millions)	34	11	9	4	58
Estimated existing per capita tax income (Rs)	12	10	8	-	-
Total estimated tax income (Rs millions)	408	110	72	-	-
Possible Improvement (Rs millions)	68	22	9	-	99

Source: Consultant's projections

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Even quite a significant improvement in tax performance by all districts might yield only an additional 100 million rupees. The full extra yield could not be expected for two or three years after initial action was taken. Furthermore, it must be recognized that there will be many calls besides roads on this additional revenue.

6.2.5 District Road Tolls

Demand for rural road services is rising particularly fast (see 4.6.1) as evidenced by the growth rate of farm tractors. Tractors with trollies are the main users of many district roads. Yet in Punjab such vehicles have been allowed exemption from annual registration fees in a recent directive of the Provincial Government (Nov 30, 1984). Tractor-trollies are not, however, exempt from tolls which District Councils levy on certain metalled roads. These tolls vary significantly from district to district; in Jhelum a toll of 10 rupees is charged for tractor-trollies on 17 roads, while in Rawalpindi the charge is 1.50 rupees on 7 roads.

In Jhelum in FY 84/85 a net average of 97000 rupees will be derived from each of the 17 tollgates, and in Rawalpindi the average from 7 points will be 36000 rupees. Collection costs (i.e. the difference between the net amounts as quoted and total amounts collected) are not known since the posts are auctioned to contractors each year. However, Jhelum Council is sufficiently concerned about possible abuse of the system that it intends to post council-employed taxation staff at the various points to ensure fairness.

It is worth noting that the Jhelum District toll charge for a Suzuki, six rupees, increases the financial cost of operation for this vehicle by about 15 per cent, assuming an average journey of 20 km. In Rawalpindi the Suzuki charge of 1.50 rupees seems quite reasonable, increasing costs by only four per cent; but the much lower annual revenue per tollgate makes it probable that collection costs are a higher proportion of revenue than in Jhelum.

Overall, there is not much to be said in favor of tolls for district roads. They can only be imposed on metalled roads, which comprise about ten per cent of the total district network.

Tolls may in fact be harmful to a rational policy on roads, in so far as District Councils, in order to exploit new revenue sources, may press for ADP funds for blacktopping while failing to consider the other 90 per cent of their networks.

It is estimated that, at the maximum, 10 million rupees per year is currently being collected from district road tolls.

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If 250,000 rupees per year (FY 84/85) i.e. as for Rawalpindi, is considered a reasonable target that each district (in the four provinces) could achieve from this source, then the total of District Council road toll revenues - 17.25 million rupees - could be replaced by an average 11 rupee surcharge per vehicle on provincial annual motor vehicle taxes. Costs of collection would be virtually eliminated and all districts would benefit, including those which for various reasons do not present impose tolls.

A prerequisite for such an arrangement is that a tax sharing plan be implemented between the province and districts. This is discussed in more detail in section 6.2.6.

6.2.6 Transfer of Funds

The question of the means of delivering additional money to the district councils is difficult. In any event, the additional resources required are of such magnitude that the question clearly has legal and institutional implications.

The simplest way would be by direct grants, presumably with the provincial treasuries managing the funds rather as they do now in respect of ADP funds for districts. This might be the safest temporary solution. In the longer term, however, if the idea of district councils' autonomy is to be maintained, their financial position should be strengthened by making federal and provincial tax assignments, in the same way as the present arrangement between GOP and the provinces. One candidate for such treatment is the Provincial Motor Vehicle Tax. Additional revenues from the GOP's diesel fuel tax would need to be assigned to provinces, and then to districts. In this case there are likely to be some legal complexities. However, such funds could be channeled through the provincial ADPs, provided that the provincial governments agreed to allocate them to districts and to specify that use of the money was solely for road maintenance/reconstruction, according to previously agreed plans for each district.

6.3 FINANCIAL REQUIREMENTS FOR DISTRICT ROADS

6.3.1 Introduction

This section presents an indicative analysis of forecasted maintenance and rehabilitation costs for five and for fifteen years. The forecasts are presented for three assumed situations.

- Situation 1, Revenues for district road works remain constant at the present level

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- Situation 2, Revenues are available to bring all district roads up to a maintainable status and then to apply full maintenance procedures

- Situation 3, Revenues for district road works remain constant at the present level, but are supplemented by the AID project.

It must be clearly understood that this analysis is indicative only. The Consultant is using his best estimates of the amount of work that needs to be accomplished to bring the road system up to an acceptable level, but, without any inventory of the present condition of roads, any degree of accuracy is impossible.

6.3.2 Calculations

The approximate lengths of the different types of district roads in the four provinces are:

Earth	34,000 km
Gravel	4,500 "
Metalled	4,300 "
Total	42,800 km

In the following table, the percentages of reconstruction and rehabilitation, of each type of road, needed to bring the district road system up to a maintainable level have been estimated. No allowance has been made for improvements or betterments.

The reconstruction costs shown for earth and gravel roads are essentially for those that are at grade now and, especially in flat country, need to be raised on to an embankment of a 20' formation and three feet height. These roads require frequent grading and so are virtually unmaintainable at grade. On the other hand, a paved road at or near grade is considered maintainable, so reconstruction of this category is not considered necessary.

Unit costs for this table are those developed in sections 5.6 and 5.8.

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Table 6.6

ESTIMATED COSTS OF RECONSTRUCTION AND REHABILITATION

	Earth		Gravel		Metalled	
	Recon.	Rehab.	Recon.	Rehab.	Recon.	Rehab.
Total Length (km)	34,000		4,500		4,300	
% needed	20	30	10	75	-	40
Length of work	6,800	10,200	450	3,375	-	1,720
Unit cost (Rs 000)	180	39	265	66	-	118
Total cost (Rs Mill.)	1,224	398	119	223	-	203
Total per type	1,622		342		203	
Grand Total	Rs 2,167 million for 22,545 km					

Source: Consultant's calculations

This figure of Rs 2,167,000,000 represents the estimated total needed to bring the district roads in the four provinces up to a maintainable standard. This averages Rs 50,600/km or $ 5,100 per mile of the total system or Rs 96,100/km ($9,700/mile) of the roads to be reconstructed or rehabilitated.

A very rough estimate of annual funds presently available for district roads, including construction and maintenance, from ADP and district revenue sources is Rs 220 million. This amount may be assumed to include the cost of the district engineers' headquarters' staff.

Maintenance costs developed in chapter 5 were adjusted to give the following numbers. The figures for earth roads are the averages of classifications F and G. For gravel roads, the averages of classification D and E were used, then adjusted to a 20' width.

Rs/km

	Routine & Emergency	Periodic	Total (Rounded)
Earth 20'	3,600	10,700	14,300
Gravel 20'	4,800	31,600	36,400
Metal 12' + shoulders	6,800	11,500	18,300

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Using these figures, the nationwide annual maintenance requirements are:

Earth	34,000	x	14,300	=	486	million
Gravel	4,500	x	36,400	=	164	"
Metalled	4,300	x	18,300	=	79	"
					729	

This figures means that just to keep the district roads maintained (assuming they were all maintainable) would require well over three times the present funds available for all road works. Situation 1 (section 6.3.1), therefore, would result in continued completely inadequate funding and an accelerating disintegration of the district road networks.

In table 6.6 it was calculated that 22,545 km of road cannot be maintained at present. This is 53% of the system. Table 6.7 below makes the following additional assumptions:-

- road surfaces will be rehabilitated in kind, i.e. to existing material.

- all reconstruction and rehabilitation will be accomplished in eight years. (2,167 million / 8 = 271 m./year.)

- Rs 80 million is to be spent annually on new roads (not improvements). This could represent 80 to 320 km in length, depending upon the type of road. An average of 200 would be less than one half percent of the existing system, so an adjustment of 5% has been made to the maintenance costs after 10 years. This is estimated to be considerably less than the present annual construction program.

- maintenance is possible on only 47% of the system in the first year, so requirement is 729 x 0.47 = 343 million. This percentage increases as the roads are rehabilitated.

- the AID Project, as shown in PID (Ref. 4) tentatively indicates $31,650,000 for maintenance and rehabilitation. This equals to Rs 500,400,000, say Rs 126 million per year for four years.

- the costs for maintenance that have been developed in chapter 5 include the capital cost of equipment and supervisory labor, so that the costs of the expanded district engineers' establishment shown in Figure 7.1 are included in Table 6.7.

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Table 6.7

ESTIMATED DISTRICT ROAD COSTS AND REVENUES OVER 15 YEARS

(Million of Rupees)

Year	New Construction	Recon/ Rehab	Maintenance % of existing	Maintenance Cost	Total (2+3+5)	Funding currently available	Addl Funding required (6-7)	AID Project	Net deficit (8-9)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	80	271	47	343	694	220	474	126	348
2	80	271	53	386	737	220	517	126	391
3	80	271	60	437	788	220	568	126	442
4	80	271	66	481	832	220	612	126	486
5	80	271	73	532	883	220	663	-	663
Sub-total	400	1355	-	2179	3934	1100	2834	504	2330
6	80	271	79	576	927	220	707	-	707
7	80	271	86	627	978	220	758	-	758
8	80	270	93	638	988	220	768	-	768
9	80	-	100	729	809	220	589	-	589
10	80	-	100	729	809	220	589	-	589
11	80	-	105	765	845	220	625	-	625
12	80	-	105	765	845	220	625	-	625
13	80	-	105	765	845	220	625	-	625
14	80	-	105	765	845	220	625	-	625
15	80	-	105	765	845	220	625	-	625
Totals	1200	2167	-	9303	12670	3300	9370	504	8866

Source: Consultant's calculations

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Table 6.8

SUMMARY OF ESTIMATED DISTRICT ROAD
COSTS AND REVENUES OVER 15 YEARS

(Million of Rupees)

Column numbers refer to Table 6.7

Line		First 5 years	All 15 years
1	New construction (col.2)	400	1,200
2	Recon/Rehab (3)	1,355	2,167
3	Maintenance (5)	2,179	9,303
4	Totals (6)	3,934	12,670
5	Currently available (7)	1,100	3,300
6	Additional Funding Required (8)	2,834	9,370
7	AID Project (9)	504	504
8	Net deficit (10)	2,330	8,866

Source: Data extracted from Table 6.7

Column 6 of Table 6.7 shows the annual requirements for accomplishing Situation 2 -- adequate funding necessary for the full program. The totals for 5 and 15 years are contained in line 4 of Table 6.8.

The additional funding, over present revenues, to implement the Situation 2 program is shown in column 8 in Table 6.7 and line 6 in Table 6.8.

Situation 3, which reflects the financial effect of the AID project, is covered in columns 9 and 10 and lines 7 and 8 of the two tables.

6.3.3 Alternative Solutions

Some saving can be effected by paving all the gravel roads with a 12' wide DBST surface. This is not the best engineering solution, but will reduce maintenance costs. This would eliminate that category.

The rehabilitation would still have to be done. There would then be a one-time charge of 63,000/km for paving 12' wide DBST. This should be added to the recon/rehab figure:

9	Total recon/rehab. 15 years (Line 2)	2,167 m.
10	4,500 x 63,000	284
11	Revised total recon/rehab, 15 years	2,451 m.

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The maintenance costs would then be

12	Earth	34,000 x 14,300	=	486 m.
13	Metalled	8,800 x 18,300	=	161
14				647
15	Thus effecting a saving of 729-647		=	82 m/yr

Assuming the paving is done in the first five years; then

		5 years	15 years
16	Saving @ 82m/yr	410	
16a	10 years @ 82		820
17	5 yrs x 82 x 1.05		430
18	Period total	410	1,250
10	Less paving cost	284	284
19	Saving	126	966

Table 6.8 would then be amended as follows:

		5 years	15 years
8		2,330	8,866
19		- 126	966
20	Net deficit	2,204	7,900

As discussed in the opening paragraphs of this section, these estimates are based on very little data. It is possible that the amount of work estimated is overstated by a factor of two. If this is so, then the recon/rehab figure (line 2, 15 years) is reduced to Rs 1,084 million. Table 6.8 would then be further adjusted to.

		5 years	15 years
20		2,204	7,900
21		1,084	1,084
22	Net deficit	1,120	6,816

Yet another approach may be considered. Assume that the amount of work shown in Table 6.6 is correct, and that the gravel roads are paved, then the net deficit totals are as in line 20. The figure of Rs 14,300/km for earth roads was an average of Rs 19,800 for roads over 20' with AADT of 50-200 and of Rs 8,800 for roads under 20' with AADT of less than 50. Now assume that 50% of the earth roads fall into each category, and that the heavier travelled roads are paved.

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Additional cost of upgrading 20-22' earth road to 12' DBST on 20' gravel:

Rehabilitation of katcha road	(included in col.3, table 6.7)	
6" gravel (Table 5.6)	85,000	
DBST	63,000	
	148,000 /km	

	Increase of recon/rehab costs		
23	34,000 x 0.5 x 148,000		2,516 million
	Revised maintenance costs		
24	Earth 17,000 x 8,800		150 million
25	Metalled 25,800 x 18,300		472 "
26	Revised maintenance cost		622
	The accumulative saving over line 15 is		
27	647 - 622	=	25 million/year

		5 years	15 years
28	Savings (27) of 25 m/year	125	
29	10 years @ 25		250
30	5 year @ 1.05 x 25		131
31	Total for period	125	381
23	Less paving cost	2,516	2,516
24	Savings	(2,391)	(2,135)

This analysis shows that it is not financially feasible to pave the katcha roads. A further analysis, introducing the economic savings of reduced vehicle operating costs, is contained in section 6.5.

6.3.2.1 Observations

All the figures presented in these calculations, regardless of the option and even allowing for a considerable variation in the assumptions made, show that funds available for district road development and maintenance are woefully inadequate.

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6.3.3 Effect of AID Project

The additional funds required by GOP for the first four years of the analysis (col. 8 of table 6.7) total Rs 2171 m. If it is assumed that these funds are assigned equally among the districts, then the nine districts in the AID project would need about one eighth of this total, or about Rs 271 million. Therefore, the AID funding will be more than sufficient to conduct the recon/rehab procedure and maintain the district roads properly. In fact, the recon/rehab work could be accelerated in those districts.

One scenario would be to assume that the nine districts require one eighth the totals in table 6.7, that all recon/rehab is done in the four years; then recon/rehab total is 2167/8 = 271 m. and annual maintenance cost is 809/8 = 101 m.

Table 6.9

POSSIBLE EFFECT OF AID PROJECT ON DISTRICT ROAD FINANCES

Year	New Construction	Recon/ Rehab	Maintenance %	Maintenance Cost	Total	Funding Available	Addl Funding Required	AID Project	Net deficit
1	10	68	47	47	125	27	98	126	(28)
2	10	68	60	61	139	28	111	126	(15)
3	10	68	73	74	152	27	125	126	(1)
4	10	67	87	88	165	28	137	126	11
5			(100)	(101)					
Total	40	271		270	581	110	471	504	(33)

Source: Consultant's projections

This shows that, in nine "typical" districts, the AID project would bring all the district roads up to a maintainable standard and would be able to maintain all maintainable roads properly for the four year period.

6.3.4 Districts Studied

In this section, the costs are presented of maintaining the roads in the six districts studied that is to say, those visited by the Consultant. It is assumed that all the roads will have been rehabilitated, so the costs are for routine, emergency and periodic maintenance only, using the unit costs developed on page 6-16. These costs are then compared with the funds currently available for this work.

The lengths of roads in each category have been extracted from Table 2-1, updated by responses from the districts where the Consultant specifically asked for this information.

Table 6.10

ESTIMATED MAINTENANCE COSTS OF DISTRICTS STUDIED
(Millions of rupees)

		Rawalpindi		Jhelum		Jacobabad	
Category	Cost/km	km	Rs	km	Rs	km	Rs
Earth	14,300	722	10.3	1025	14.7	1500*	21.5
Gravel	36,400	11	0.4	0	-	0*	-
Metalled	18,300	95	1.7	383	7.0	23*	0.4
Total			12.4		21.7		21.9
Revenues available, constr. + maintenance			10.0 (Est)		12.6		5.4
Revenues available Maintenance only			3.1		1.8		0.4
Road rev/cost, %			81		58		25
Maint/cost, %			25		8		2

	Sukkur		Abbottabad		Pishin	
Category	km	Rs	km	Rs	km	Rs
Earth	2000*	28.6	979	14.0	165	2.4
Gravel	0*	-	3	0.1	93	3.4
Metalled	102*(1)	1.9	6	0.1	3	0.1
Total		30.5		14.2		5.9
Revenues available, constr. + maintenance		9.6		9.0		0.2
Revenues available Maintenance only		(not ident)		2.3		0.2
Road rev/cost, %		31		63		3
Maint/cost, %		-		16		3

* Data supplied at Consultant's interview

(1) Includes 68 km of brick roads

Source: Consultant's calculations based on data provided by districts

The data for the district revenues have been extracted from section 4.4. Although these data are open to some questions, they are much more reliable than the estimated costs developed in the above table.

Nevertheless, it can be seen, from the examples above, that if all the road funds available to the district were applied to maintenance only (completely excluding new construction, rehabilitation and upgrading), the coverage would run from 81% for Rawalpindi down to 3% for Pishin. If the amount actually identified for maintenance is applied to the estimated costs, the coverage figures descend from a high of 25% to a low of 2%.

Once again, it is readily apparent that there are insufficient funds just to maintain the existing system, even assuming it was fully maintainable (which it is not), let alone any expansion or upgrading.

6.4 LIFE-CYCLE COSTING

Life-cycle costs are the total of first-year costs plus and discounted expenditures over a period (in this case 20 years). For this analysis, a discount rate of 12% was used.

Table 5.8, shows that, even from a financial consideration only, it is less costly to maintain a katcha road than it is to neglect maintenance and to rehabilitate periodically.

The same is generally time of a metalled road, except that the table indicates rehabilitation every eight years cost less than regular maintenance. The fallacy is that a road that had been neglected for eight years could well be impassible.

It is also pointed out that the rehabilitation costs are merely the discounted financial costs over the 20 years; i.e., the physical outlays required which affect revenues and budgets. They do not, in any way, reflect the true and actual total costs, because as the road surface is allowed to deteriorate, user costs go higher and higher. These latter costs have an obvious effect on the national economy, but are not seen or felt by the maintenance organizations. They are discussed more fully in section 6.5.

6.5 ECONOMIC EFFECT OF VEHICLE OPERATING COSTS

The analyses of costs in Chapter 5 and in section 6.3 are financial costs; that is to say that no economic costs and benefits have been included in the calculations.

The life cycle costs presented in Table 5.8 demonstrate that it is cheaper to provide routine and periodic maintenance to a road than to let it deteriorate and then rehabilitate it every few years. The vehicle operating costs (VOC) will obviously be less on a maintained road than on one that is deteriorating, so that an analysis including the VOC would only reinforce the finding that routine maintenance is the better solution.

In Section 6.3, it was shown that, financially, it is less expensive to pave gravel roads than to rehabilitate and maintain them. Again, an analysis involving VOC would merely reinforce this finding.

On the other hand, section 6.3 clearly shows that the cost of paving a katcha road is not financially feasible. Therefore, an economic feasibility study involving VOC is justified, and such an analysis follows.

The vehicle operating cost data are taken from the preliminary ADB report (Ref. 19), prepared by the Consultant in December, 1984. Parenthetical references are to that report.

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Economic VOC's for paved road in good condition

	%	Rs/km (P.A-5)	Weighted
Motor cycle	25	0.433	0.108
Suzuki 600 kg	25	1.432	0.358
Datsun 1000 kg	16	1.692	0.271
Ford Minibus	16	1.808	0.289
Tractor/trolly	10	3.898	0.390
Truck	5	3.912	0.196
Bus	3	3.962	0.119
	Weighted cost per vehicle = Rs		1.731

The following indices show the comparison between VOC on different road surfaces and conditions (Table A-3):

	Paved	Earth
Good	100	125
Fair	108	152
Poor	131	194
Very Poor	176	249

6.5.1 Comparison between Good Paved Road and Good Earth Road

At this report advocates that roads be well maintained, it is reasonable to assume the "good" index for both paved and earth roads. Then costs per vehicle are:

Paved		Rs 1.731/km
Earth	1.731 x 1.25	Rs 2.164/km

Test for four conditions of traffic, multiplying each by the unit costs per vehicle and by 365 to give the annual costs. These annual costs are then multiplied by 8.37 (being the sum of the factors for 12% discounted over 20 years):

	Paved		Earth	
AADT	Yearly	20 yrs	Yearly	20 yrs
40	25,300	211,800	31,600	264,500
80	50,500	422,700	63,200	529,000
120	75,800	634,400	94,800	793,500
160	101,100	846,200	126,400	1,058,000

Further, assume traffic remains constant over the period (if it increases, as it undoubtedly will, the next category of AADT will become relevant).

Table 6.11

ECONOMIC COSTS OF DISTRICT ROADS OVER 20 YEARS
COMPARISON BETWEEN EARTH AND PAVED ROADS

Discounted at 12%
(000 Rupees)

Katcha roads
AADT

	40	80	120	160
Class from Table 5.5	(G)	(F)	(F)	(F)
Maintenance	51	138	138	138
VOC	265	524	794	1,058
Cost of paving (First year)	-	-	-	-
Total economic cost	316	667	932	1,196

Paved Roads
AADT
(Classification C)

	40	80	120	160
Maintenance	154	154	154	154
VOC	212	423	634	846
Cost of paving (First year)	155	155	155	155
Total economic cost	521	732	943	1,155

Source: Consultant's calculations

When the total cost of the paved road becomes less than that of the katcha, it becomes more economical to pave. The above table shows that this occurs at just over 120 AADT.

There are, of course, other benefits of paving that are not necessarily quantifiable, such as the comfort of the riders travellors over a smoother surface and the virtual elimination of the dust problem. The abutment of dust is probable for more beneficial to those who have buildings alongside the road that it is to the actual traveller. Time savings can be quantified, but at the low speeds on district roads, coupled with the low incomes in the rural areas, this is not considered too significant.

There are numerous calculations that can be made, using different combinations of assumptions. Two further examples will be illustrative.

6.5.2 Comparison between Good Earth Road and Poor Earth Road

Assume earth roads with 40 AADT. The good road is regularly maintained, the poor road is not maintained but is rehabilitated every five years. Using indices on p.6-25; VOC's are:

Good	1.731 x 1.25	Rs 2.164/km
Poor	1.731 x 1.94	Rs 3.358/km

Rehabilitation and maintenance costs are from Table 5.8

Table 6.12

ECONOMIC COSTS OF DISTRICT ROADS OVER 20 YEARS
COMPARISON BETWEEN GOOD EARTH AND POOR EARTH ROADS

Discounted at 12%
(Rupees)

Yearly traffic	14,600	14,600
VOC	31,600	49,400
Discounted (x8.37)	264,000	410,000
Maintenance	51,000	
Rehabilitation		77,000
Total VOC and recurrent costs, 20 years	315,000	487,000

This calculation shows that it is about 55% more costly, economically, to rehabilitate every five years than it is to conduct regular maintenance. The financial costs of rehabilitation (Table 5.8) of earth roads are always higher than for regular maintenance, and so adding the VOC's (which are obviously greater for an unmaintained road) merely emphasizes the desirability of regular maintenance.

6.5.3 Comparisons among Paved Road Conditions

Assume road with 100 AADT in four conditions, with VOCs calculated from data on p.6-26 and rehabilitation and maintenance costs from Table 5.8.

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Table 6.13

ECONOMIC COSTS OF DISTRICT ROADS OVER 20 YEARS
COMPARISON AMONG PAVED ROAD CONDITIONS

Discounted at 12%
(Rupees)

Procedure	Maintained Regularly	Rehab. 3 years	Rehab. 5 years	Rehab 8 years
Average Road condition over period considered	Good	Fair	Poor	Very Poor
Index	100	108	131	176
VOC/vehicle	1.731	1.869	2.268	3.047
Yearly traffic (100 AADT)	36,500	36,500	36,500	36,500
Annual VOC	63,200	68,200	82,800	111,200
Discounted (x8.37)	529,000	571,000	693,000	931,000
Maintenance	154,000			
Rehabilitation		368,000	198,000	104,000
Total VOC and Recurrent Costs (20 years)	683,000	939,000	891,000	1,035,000

Once again, based on the assumptions made, it is clear that the regular maintenance of a road is less costly, economically, than the alternative of no maintenance but periodic rehabilitation.

6.5.4 Summary

The results shown in table 5.8 show clearly that the maintenance of katcha roads is the lowest cost financial solution. In the case of the paved roads, the case is not so clear.

By taking vehicle operating costs into account, it is shown that the regular maintenance solution has the least economic cost in all cases.

As mentioned earlier, there are additional benefits to regular maintenance which, if quantified, would reinforce the conclusions reached. One benefit is that of time saved on a good road surface; another is the comfort factor of the vehicle occupants.

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Chapter 7

CONCLUSIONS AND RECOMMENDATIONS

7.1 GENERAL

There is no glamour in maintenance. It does not win votes; it does not add to the road system capacity; it causes inconvenience while it is being performed; it costs money without showing much.

This lack of glamour in maintenance is certainly not confined to Pakistan. Even in the developed countries, everything just said is true, but most administrations recognize that it is essential and so provide maintenance to a more or less adequate degree. In the developing countries and some of the more developed countries maintenance is usually neglected, frequently even more so than in Pakistan.

But good maintenance is economically essential. This applies throughout society -- one's clothes, one's house, one's bicycle or car, the aircraft we fly in, as examples -- and road maintenance is no exception.

7.2 CONCLUSIONS

7.2.1 Institutional and technical

- Roads are poorly constructed and inadequately maintained throughout most of the country. In the districts, this can be attributed principally to the lack of equipment to perform either construction or maintenance, but also to the inadequate strengths of the districts' engineering staffing.

- Many district roads are not maintainable in their present condition -- they will first have to be rehabilitated.

- The organizational "basic democracy" concept of the Pakistani system of government, from the federal government down to the union councils, has much to recommend it.

- The highways and roads sector is nationally organized with the main divisions being national, provincial and district. The flow of development funds, from the federal government through the provinces to the districts, ensures a fair, albeit inadequate, share for all.

- The system of selection of the districts' annual road programs, frequently based upon each councillor getting a share for his constituency, may result in a political compromise rather than a program that best serves the real needs of the districts.

- At the federal level, the FRREC of the Ministry of LGRD is the only agency concerned with rural roads. With the director as the only technical person, the capacity is obviously inadequate to perform the monitoring tasks for which the Cell is responsible. Good work has been achieved in the production of the four manuals mentioned in Chapter 3. The deficiency in personnel, and consequently in function, should be rectified when the FRREC's scheduled July 1, 1985 organization is fully staffed.

- The LGRD departments are the provincial agencies responsible for rural roads. In the provinces where LGRD is responsible for the construction of district roads, the capability and capacity must be considered generally inadequate due to a shortage of qualified staff and of equipment and other facilities.

- The districts, in most cases, do not have the capability or resources to perform their tasks properly. Equipment and qualified manpower are sadly lacking. It is even questionable whether more equipment could be used and maintained efficiently without better training and the recruitment of mechanics.

- In the districts, it appears that most of the construction or maintenance of metalled roads is performed by contractors. In many cases, these contractors are little more than brokers for labor, having little or no equipment themselves. But the country does have large, well-equipped contractors for whom the average district road project is much too small.

- Very little quality control of construction or maintenance is performed, either for contracted work or for that done by force account.

7.2.2 Financial

- Although some considerable scope exists for improvement of district councils' tax incomes, the additional funds raised would still be very small compared to the needs. More revenue could, and indeed should, be collected by using the existing main tax sources in an efficient and consistent manner, as this would decrease the councils' dependence on provincial and federal resources, and demonstrate the desire of inhabitants for better roads.

- There is clear evidence that provincial governments have (perhaps because of their heavy dependence on Federal sources of funds) neglected to make good use of their motor vehicle taxation powers; in the last few years large amounts of revenue have been foregone by not gearing tax rates to inflation.

- Provinces should move to reform their motor vehicle taxes and include legal provisions to make it easier to update tax rates, not only in order to increase revenues, but in the interests of a rational road user charges policy. Such a policy would attempt to recover, from each type of vehicle, the costs of its use of the road network and in generating additional revenues, would ensure social equity and the minimum of economic distortion.

- The Federal Government obtains substantial revenues from road users, particularly from vehicle purchases and gasoline, but subsidises diesel fuel, presumably in an attempt to keep passenger and goods transport costs low. It is believed that this policy is counterproductive in the longer term because it tends to wastage of fuel and unnecessary road damage, as well as foregoing the much needed revenue which could be used to improve the road system and reduce the social costs (mainly vehicle operating costs) of the system.

- Road tolls on district roads appear to obscure district councils' perception of the real needs and correct allocation of funds to roads, because they are imposed only on entry to paved roads.

- No tax sharing mechanism exists at present between provinces and districts, which appears to be absolutely necessary in order to strengthen districts general financial position.

7.3 RECOMMENDATIONS

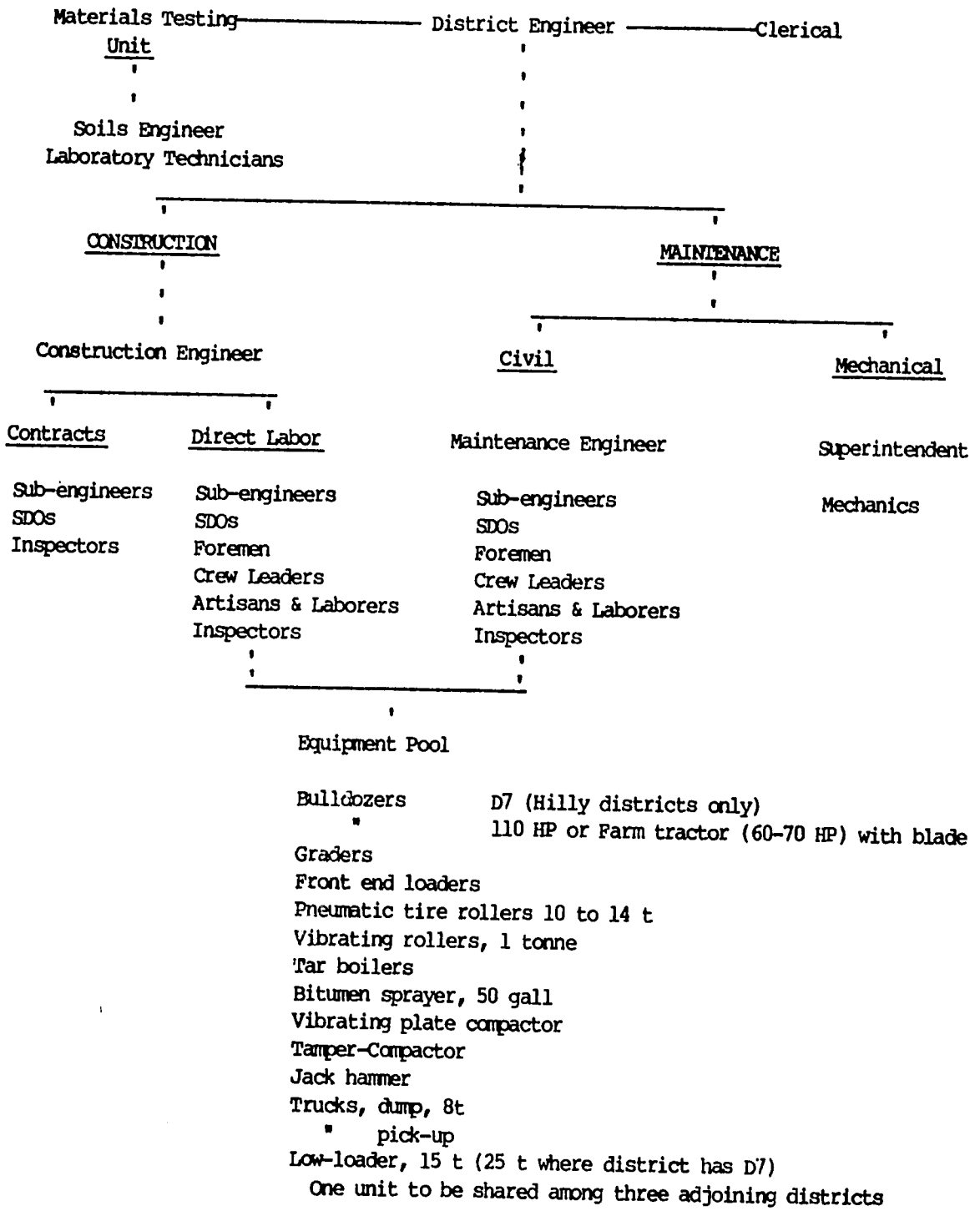
7.3.1 District Engineering Organization

Figure 7.1 illustrates a proposed typical District Engineering Organization. As will be seen, this is a considerably larger establishment than any that presently exist. The main feature is to have two separate branches for construction and maintenance.

The suggested organization is also based on the recommendations that: all routine and some periodic maintenance, including that of metalled roads, be performed by the districts' own staff and equipment (force account, as it is frequently known), whereas the construction of metalled roads should be contracted out if the district forces cannot handle them. Katcha roads should be constructed by force account.

Figure 7.1

PROPOSED TYPICAL DISTRICT
ENGINEERING ORGANIZATION



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Numbers for each category of personnel and equipment have been omitted for two reasons. First, there has to be some flexibility to allow for differences in the sizes -- and funding -- of the districts. Second, the same structure with, of course, more equipment and personnel, can be adopted should a district be one of those chosen for AID funding under the project.

It will be noted that Fig.7.1 indicates that D-7 bulldozers should be assigned to districts in hilly country only. The Consultant believes that, in the districts in the plains, one bulldozer is adequate, as there is little need to cut into existing earth or rock formations. A front-end loader will, because of its versatility, probably prove a much more useful piece of equipment.

It may be argued that the organization shown has too much equipment, and that this will put people out of work, which is especially undesirable in areas of high unemployment. This important social fact is fully recognized, but it must be pointed out that many of the operations advocated for high quality work just cannot be conducted by purely manual labor -- the proper compaction of fills is an example.

Even if it is not feasible to change the present organization, there are improvements that can be initiated with very little expense. As one example, the road maintenance personnel should be equipped with hand rammers as well as picks and shovels. With this tool, the laborers will be able to hand compact the potholes they are filling, even in katcha roads, instead of hoping that the traffic will do an adequate job.

7.3.2 Federal Rural Roads and Engineering Cell

As stated previously, the planning, monitoring and quality control of the district roads are essential to the welfare of the system.

Some time in the future, it may be appropriate for the Government of Pakistan to form a Ministry of Transport that would be responsible for directing and controlling the development and operation of all forms of transport. The Consultant does not perceive the immediate need for such a ministry. In any event, such a development should take several years of study and careful consideration.

The FRREC is the only federal organization that is concerned with district roads. By building up this cell, the GOP would have an organization that could play an important part in improving the district roads system. Specific recommendations for the appropriate GOP agencies are:-

- bring the cell up to the strength proposed in the draft PC-1 soon after July 1, 1985 (see Chapter 3)

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- arrange for FRREC to include in its responsibilities:

  - the review of provincial annual programs for the construction and maintenance of the districts' roads, with the purpose of offering advice and guidance on the scope of the elements of each program, especially in relation to probable funds and resources available.

  - standardize various rural road designs suited to different regions, soil conditions etc.

  - the preparation of manuals and standards (in addition to the four manuals already published) for the design, construction and maintenance and district roads.

  - the preparation and implementation of a system, or procedure, for reviewing the application of these manuals and standards, in particular methods for the enforcement of quality control standards.

  - undertake a few demonstration projects at provincial levels as part of the training component.

  - the arrangements for regular training and refresher courses for the district engineers' staff.

- FRREC may be better located in the Ministry of Planning and Development. This would give the Cell much more stature and would facilitate its relationship with the appropriate provincial departments. It would also simplify coordination with NTRC, which is also in the Ministry of Planning and Development.

- with or without a transfer of ministries, give FRREC authority to fulfill its responsibilities by working with and through the appropriate provincial departments, including Planning and Development, LGRD and C&W.

- consider after, say, three to five years the expansion of FRREC by setting up field offices so as to facilitate coordination with and monitoring of the districts.

7.3.3 Other Institutional and Technical Recommendations

These recommendations could be included in the AID Project. If not, the appropriate Government of Pakistan agency should review.

- do not at present change the method by which the districts develop their annual programs.

- evaluate more thoroughly the parallel LGRD and district road building organizations in Punjab and NWFP, and determine whether or not the approaches used in Sind or Baluchistan are more appropriate.

- if the recommendation for FRREC cannot be implemented, then study the possibility of the provincial departments of C&W playing a larger part in the district road program, especially monitoring and advising the district engineers. The feasibility of C&W taking over all the road building and maintenance functions of the district engineers should also be considered, especially for paved roads. Katcha roads could be left to the districts responsibility both for construction and maintenance.

- encourage the construction industry to form larger firms with their own equipment and technical staff. This will require the provincial and district governments to try to plan a steady flow of contracted work, to increase the size of the lettings by putting several small projects in each contract, and to announce the projects several months in advance. Discouraging C&W and the districts from renting their equipment to contractors would be a first step.

- conduct research into the greater use of lime and cement stabilization for roads.

- conduct research into technical and economic feasibility of a greater use of brick as surfaces and bases, especially in areas remote from aggregate sources.

- conduct research into technical and economic viability of using water bound macadam.

7.3.4 Guidelines for Road Works

As a great deal of the districts' road network is in an unmaintainable state, decisions will have to be made regarding the amount of funds to go into rehabilitation, reconstruction and, in some cases, new construction.

Clearly, in the light of overall economy, the first priority for improvements should be aimed at those roads most heavily trafficked, and the amount of traffic should, in turn, determine which improvement effort is most suitable. At the same time, however, there are other points which must be considered before decisions are made. There are existing tracks, for example, which, given the current state of the road, carry little vehicular traffic even though the population served is in the thousands. In these instances, an improvement will generate substantial traffic by itself and this should be taken into account when setting

investment priorities. Political pressures will also be felt and socio-economic factors will arise; while the latter are clearly important, unfortunately the former will often have more influence in deciding an issue.

A system of traffic counting and forecasting should be installed on a continuing basis and, based on say a five-year forecast, the following recommendations could be used as a guidelines:

- For a projected AADT of 50, construct, reconstruct or rehabilitate to Classification G, and 18-to-20-foot formation with a compacted side-borrow surface

- For a projected AADT of 50-100, construct, reconstruct or rehabilitate to Classification F, a 22-to-24-foot formation with a compacted side-borrow surface

- For a projected AADT of over 100, an economic feasibility study is probably warranted in order to determine if a stage construction approach might be the most beneficial; i.e., going to a Classification E to begin with (32-foot formation with a compacted gravel surface) and then either upgrading to a Classification C (adding a crushed stone base course and a 12-foot DBST surface) at a later date.

- For a projected AADT of over 200, construct, reconstruct or rehabilitate to a Classification C (32-foot formation).

As has been demonstrated financially and economically in chapters 5 and 6, regular maintenance is less costly than rehabilitation and, given those two choices only, the recommendation is to maintain.

The choice between spending funds on maintenance and on construction/reconstruction/betterments cannot be made arbitrarily. The thoughts mentioned in the second paragraph above apply to this decision process.

There are undoubtedly additional considerations such as cases where a road is heavily over-loaded with traffic to the point that maintenance becomes very costly. Reconstruction may well be the most economical solution. Another example would be the possibility of constructing a cut-off road that would considerably reduce travel distance (thus maintenance) on the existing road.

The Consultant's recommendation is that districts give first priority to the maintenance of the existing system, but carefully consider the effect of other options on the total district network.

7.3.5 Financial Recommendations

As an indication of its intention seriously to address the road finance issue, the GOP should raise the price of diesel fuel by 20 paisas per litre immediately, and by a further 20 paisas as soon as possible thereafter; a six to nine month period between increases is considered fair. All subsidies or exemptions of tax for Government transport fleets should be removed as soon as practically possible. This would helps to sweeten the pill' for private transport companies.

In order to achieve maximum benefits from road user taxation, a comprehensive road user charges study should be undertaken by the GOP, with its main objective as the implementation of a rational charges system at federal, provincial and district levels. The benefits of such a system would be felt on the provincial and national networks as well as district roads. It is considered that a full road user charges study could be completed in six person-months using two consultants and additional local resources, for example from NTRC, who have already done some work in this area. The total cost is estimated at about $60,000. It should be carried out as soon as possible in order to draw attention to this important issue. (It is understood that there are several top ministerial officials who advocate more user charges in all sectors in order to avoid a large GOP budgetary deficit).

Having finalised and adopted a new road user charges system, the GOP should encourage provinces to follow the system by using financial incentives. An important result would be an improvement of the financial position of the provinces and liberation of additional funds for the districts.

Provincial authorities should make use of their powers under the Local Government Ordinance of 1979 (and amendments), to ensure that districts maximise their own tax revenues.

Additional revenues from the GOP diesel fuel tax should be devolved to provinces and to districts by tax sharing schemes which have built in provisos or financial incentives to ensure that these funds are spent on roads, and according to new GOP policies on road maintenance and construction.

Provincial motor vehicle taxes should be raised substantially, it is suggested by about 500 million rupees per year at current prices, but subject to results of the road user charges study. All motor vehicle revenues should be shared with the districts on a 'road needs' principle and on this basis road tolls on district roads would be abolished.

7.3.6 The AID Project

The Consultant recommends that the following activities be made an integral part of the AID Project:

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7.3.6.1 Maintenance Management System

The planning and development of a District Maintenance Management system, which should include, in the form of a manual, at least:

- the description of duties for each position
- a detailed description of each element of maintenance
- guidelines on how to plan a maintenance program, including routine and periodic maintenance

- directions for preparing a budget
- instructions on the scheduling of operations on a day-to-day basis, including the optimum use of equipment
- suggestions on how to handle emergency maintenance (as snow removal, washouts, etc.).

- a plan for controlling quality schedules and costs
- a control system for stores and materials
- a system for periodic reporting to the district chairman and to the ADLGRD

- operations and maintenance manuals for the mechanical equipment

7.3.6.2 Training

There is little doubt that, whether or not the district engineers' establishments are increased in size, and whether or not a maintenance management system is implemented, personnel in the districts would benefit by improved training, including refresher courses.

The consultant developing the District Maintenance Management System would be in an ideal position to initiate the training procedure. The objective would be that, in the first instance, all those concerned in the districts selected would receive thorough training in the details of the system. If budgetting permits, this training could be extended to districts other than those selected for the AID project.

The first stage of the training could be repeated in each province, and would consist of, perhaps, a two-week course for the district engineers and their top people, say down to the sub-engineer level. This course would present the management system including all the elements of planning and execution. Practical details of maintenance would not be covered during this course. One or two days could be set aside specially for administrative officials such as the Deputy Commissioners, District Chairmen, Chief District Officers et al.

In the districts themselves -- and here time requirements would probably limit instruction to the selected districts only -- seminars and demonstrations of a more practical nature should be conducted. In the case of the SDOs, foremen and other supervisory personnel, this would include the "paperwork" aspects of the system that they will become involved in. Then physical demonstrations should be given to all engineers, overseers, equipment operators, and even the laborers, on how to use equipment and to conduct the various elements of maintenance.

The technical staff of the district engineers' establishments should also receive both theoretical and practical instruction in road construction. This should include training in selecting the geometrics for a new road or a betterment, in drainage design, and in the design and construction control of embankments and pavements. Quality control during construction and maintenance must be emphasized.

The series of manuals that have been produced by FRREC (see section 3.2.1), as well as some prepared by NTRC, will make a good basis for the training programs, and each sub-engineer, and above, should be issued with a set for his retention.

The next question is how to keep both the management system and the training program operating after the end of the project. The responsibility for ensuring that refresher courses and annual seminars are held should be assigned to FRREC, as discussed in Section 7.3.2.

7.3.6.3 ADB Report

The Pakistan Farm to Market Road Project, sponsored by the Asian Development Bank (Ref. 19), recommends the construction (or upgrading) of the lengths of roads shown in Table 7.1.

The report proposes that all roads in Punjab, Sind and Baluchistan be constructed of one lane (10 foot) DBST. In NWFP, some of the roads will be of gravel, which is plentiful in that province.

Table 7.1

ADB REPORT

RECOMMENDED CONSTRUCTION SCHEDULE

Kilometres

District	Feasible FY 86/87	Probably Feasible FY 87/88	Possibly Feasible FY 88/89
Punjab			
Sheikhupura	59	128	69
Sargodha	88	88	53
Jhang	11	39	75
Faisalabad	97	59	65
Toba Tek Singh	150	72	18
Sind			
Jacobabad	74	59	71
NWFP			
Peshawar	47	24	3
Mardan	15	14	48
Bannu	0	7	12
Baluchistan			
Nasirabad	33	62	53
Total	574	552	467

Source: ADB Report (Ref. 19)

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The Consultant considers that the ADB program will provide considerable assistance to the districts selected. It is, therefore, recommended:

- that AID does not consider the inclusion in the proposed project of the ten districts covered in the ADB report. (It could be argued that these new roads are just the ones that need an improved maintenance system. On the other hand, those districts will not have to construct many roads for several years, so should have funds available for better maintenance).

- that AID shares with ADB the findings of this Rural Roads Project report, and explores ways of strengthening the case for implementation of some or all of the recommendations.

7.3.6.4 NHB Maintenance Contract

In section 3.2.3, it was mentioned that the National Highway Board, on January 25, 1985, issued tender documents for the maintenance of a portion of Highway N-5 between Lahore and Multan. This is a departure from the usual process of passing the maintenance responsibility to the provincial C&W departments.

The Consultant recommends that USAID tracks this contract -- bids received, unit prices bid, actual method of operation, quality control, measurements of quantities, and, of course, the success or otherwise of the contract.

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Appendix 1.1

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Appendix 1.2

Population (1981 Census) by District
(000)

	Urban	Rural	Total
Punjab			
Bahawalnagar	245	1126	1371
Bahawalpur	328	1119	1447
Rahim Yar Khan	299	1535	1834
D.G. Khan	123	738	861
Leiah	63	598	661
Muzaffargarh	155	1335	1490
Rajanpur	62	658	720
Faisalabad	1235	2312	3547
Jhang	442	1520	1962
Toba Tek Singh	185	924	1109
Gujranwala	1056	1603	2659
Gujrat	436	1811	2247
Sialkot	560	2146	2706
Kasur	329	1201	1530
Lahore	2958	554	3512
Okara	273	1221	1494
Sheikhupura	379	1722	2101
Multan	1098	2970	4068
Sahiwal	316	1803	2119
Vehari	180	1140	1320
Attock	151	989	1140
Jhelum	212	950	1162
Rawalpindi	1026	1097	2123
Bhakkar	97	570	667
Khushab	146	505	651
Mianwali	139	570	709
Sargodha	505	1401	1906
Total	12998	34118	47116

Source: Table 220 'Punjab Development Statistics' 1983

(1981 Census)
(000)

	Urban	Rural	Total
Sind			
Karachi East	1,697	188	1,885
Karachi South	1,396	-	1,396
Karachi West	2,114	42	2,156
Khairpur	247	734	981
Larkana	256	882	1138
Nawabshah	266	1381	1647
Dadu	152	925	1077
Sanghar	198	725	923
Tharparkar	257	1245	1502
Badin	82	694	777
Thatta	73	688	761
Shikarpur	115	505	620
Sukkur	319	779	1098
Hyderabad	911	1,143	2,054
Jacobabad	158	854	1012
Total	8,241	10,785	19,027
NWFP			
Peshawar	849	1433	2282
Mardan	224	1282	1506
Mansehra	37	1029	1067
Kohistan	-	465	465
D.I. Khan	116	519	635
Malakand	-	258	258
Swat	88	1145	1233
Bannu	62	649	711
Dir	-	767	767
Chitral	-	209	209
Kohat (incl. Karak)	136	623	759
Abbottabad	152	1017	1169
Total:	1,664	9,396	11,061

Note: Totals may not add due to rounding

(1981 Census)
(000)

	Urban	Rural	Total
Baluchistan			
Sibi (incl. Dera Bugti)	28	103	131
Kalat	27	314	341
Loralai	19	369	388
Kachhi	23	282	305
Khuzdar	31	356	387
Quetta	286	96	382
Pishin	45	334	379
Zhob	32	330	362
Nasirabad	28	367	395
Chagai	11	109	120
Kohlu	-	175	175
Kharan	10	118	128
Lasbela	31	157	188
Panjgur	9	151	161
Turbat	52	327	379
Gawadar	43	69	112
Total	675	3,657	4,332

Source: 1981 Census Report of (individual districts), Statistics Division, Population Census Organization, 1984. (Ref. 20)

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Appendix 3.1

North West Frontier Provinc

TIME SCHEDULE FOR FORMULATION OF A.D.P. 1985-86

Action	Last date
i) Based on the Medium Term Plan allocations and the experience of the preceding years, the Planning & Development Deptt. will intimate to all Secretaries to the Provincial Government and Heads of Attached Departments the likely availability of resources and sectoral break-up.	25 November 1984
ii) The District level Heads of Departments will brief Members of the District Councils in a Session of the Council of the following:- a) the likely availability or resources; b) throw-forward liability of on-going schemes; and c) new schemes proposed for inclusion.	15 December 1984
iii) Having been briefed on the probable size of the next year's programme in each sector and apprised of Departmental thinking on the inclusion of new schemes, each member of the District Council will hold a meeting with the Union Councillors within his constituency and after explaining to them the resources availability and the requirements of the on-going schemes, elicit from them proposals regarding inclusion of new schemes. Based on these discussions initial lists of new schemes will be drawn up;	30 December 1984
iv) The initial lists of the new schemes drawn up in consultation with the Union Councillors will be placed before a Session of the District Councils by the Members and keeping in view the resources, a tentative programme framed which should list new schemes in order of priority after suitably altering, deleting or modifying the proposals in the initial lists.	15 January 1985

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v) The tentative programme will then be placed before the District Co-ordination Committee as required of the Local Govt. Ordinance. After the required deliberations and scrutiny by this committee an agreed programme will emerge from the District; which will be supplied to the concerned Chiefs of Sections in Planning and Dev. Department. — 1 February 1985

vi) The agreed programme of the Districts will then be discussed at the Divisional level in a meeting presided over by the Commissioners and attended by:- — 15 February 1985

a) Chairmen District Councils within the Division;

b) Deputy Commissioners of Districts within the Division;

c) Heads of Attached Departments.

d) Mayor, Municipal Corporation, Peshawar/Chairman, Municipal and Town Committees within the Division; and

e) Representative of the Planning and Development Department

In this meeting the agreed programme after allowing for such modifications as may be introduced to cater to the requirements of the Divisional Administration will be consolidated; and

vii) Finally, the consolidated programme from each Division will be integrated into the tentative Provincial Programme by the P&D Department. Thereafter, the programme would be submitted for consideration of the Cabinet in a meeting presided over by the Governor and attended by Secretaries to the Government. — 15 March 1985

The proposals for the Municipal and Town Committees will be discussed by their Chairmen in the meeting of the District Co-ordination Committee on which they, the Chairmen of the District Councils and District Levels Heads of Departments are represented.

Appendix 4.1

FEDERAL TAXES ON ROAD USERS, 1984/85

Item	Central Excise Duty	Sales Tax	Other Charges (1)
Gasoline	Rs.0.88/Lt	Zero	Petroleum Development Surcharge Rs.0.05/Lt.
High Speed Diesel	Rs.0.25/Lt	Zero	Petroleum Development Surcharge Rs.0.43/Lt.
Engine Lube Oil Upto	10 Lt Drums Rs.0.88/Lt	10%	See below (1)
Over	10 Lt Drums Rs.0.66/Lt	10%	"
Tires, Tubes, Flaps			
Tractors	No C.E.D.	10%	"
Motorcycles	30%	10%	"
Trailers & Trollies	100%	10%	"
Cars, Buses, Trucks	110%	10%	"
Locally made Tires* (see below for sizes)	100%	10%	"
Replacement Parts			
Tractors	70%	Zero	"
Other Vehicles	70%	10%	"
Vehicles			
CKD	30%	Zero	"
CBU**			
1000 cc	70%	30%	"
1000 1300 cc	120%	30%	"
1300 1600 cc	175%	30%	"
1600 cc	350%	30%	"

** only Public Sector, and expatriates under the 'Personal Baggage' scheme, allowed to import CBU vehicles.

(1) General Note — On all items above, a 5 per cent surcharge is currently applicable on Central Excise Duty.

Tyre Sizes not allowed to be imported

5.60 - 13	9.00 - 16
7.50 - 14	7.00 - 20
6.50 - 15	7.50 - 20
6.70 - 15	9.00 - 20
7.00 - 15	10.00 - 20
7.60 - 15	11.00 - 20

Appendix 4.2

VEHICLE TAXATION RATES - PUNJAB PROVINCE

1. Annual License Fees

Vehicle class	Rupees Paid quarterly	Paid annually*
Motorcycle upto 100 cc	13.00	47.00
" more than 100 cc	17.00	62.00
Pickups etc. upto 2020 Kg.	94.00	339.00
Motor Car	96.00	348.00
Goods vehicle 2030 - 4060 Kg	157.00	565.00
" " 4060 - 6090 Kg	238.00	857.00
" " 6090 - 8120 Kg	469.00	1688.00
" " more than 8120 Kg	707.00	2546.00

Buses and other passenger carrying vehicles (i.e. including Suzuki etc) - 42.00 per seat per year
Suzuki 336/year
Datsun 420/year

Note: Weights refer to maximum laden weight.
* 10 per cent rebate for one time annual payment

2. Registration Fees - Paid to register a new vehicle, and on each change of ownership.

Motorcycle	Rs. 100/-
Buses, Trucks	Rs.1000/-
Other vehicles	Rs. 450/-

3. Other Fees

	Rupees
Driving Test	20.00
Learner's Driving License	20.00
Duplicate License	20.00
Driver's License	40.00
License Renewal	20.00
Duplicate certificate of registration	20.00

General Note: All above taxes and fees were fixed in June 1978 - see Punjab Gazette (Extraordinary) dated June 27, 1978, Page 779.

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Appendix 4.3

INCOME AND EXPENDITURE OF DISTRICT COUNCILS STUDIED

ABBOTTABAD DISTRICT COUNCIL
INCOME AND EXPENDITURE FY 84/85 (BUDGET)

000's Rupees

Income		Percent	Expenditure		Percent
Export Tax	8850	61	Development		
Cattle Markets	2570	18	Rural Roads	4500	31
Immovable Property Tax	2600	18	Other development	5500	38
Rents	400	3		---	--
Bus stand fees	60	-	Total-Development	10000	69
---	---	---		---	--
Total	14480	100	Non-development (Current Expenditure)	4480	31
	---	---	---	---	---
			Total	14480	100

RAWALPINDI DISTRICT COUNCIL
INCOME AND EXPENDITURE FY 84/85 (BUDGET)

000's Rupees

Income		Percent	Expenditure		Percent
Cattle Markets	4000	17	Development		
Immovable Property Tax	5000	21	Liabilities	1311	6
Sand and Stone Royalties	1800	7	Ongoing Projects	6915	30
Export Tax	4000	17	New Projects	4400	19
Bus Stand Fees	800	3	Repair Works	2000	9
Sale of Land	2500	10	Emergency Works	600	2
Arrears of tax	1900	8		---	--
Local Cess	1200	5	Total-development	15226	66
Road Toll Tax	250	1			
Ferries	100	-	Non-development (Current Expenditure)	7750	34
Water Rates	500	2	---	---	---
Building Fees	500	2	Total	22976	100
Rents	450	2			
Sale of trees	300	1			
Contractor regn-fees	150	1			
Miscellaneous	654	3			
---	---	---			
Total	24104	100			

JHELUM DISTRICT COUNCIL
INCOME AND EXPENDITURE FY 84/85 (BUDGET)

000's Rupees

Income

		Percent
Export Tax	2640	31
Immovable Property Tax	520	6
Cattle Markets	431	5
Road Toll Tax	1650	20
Arrears of tax	1200	14
Sale of Land	520	6
Local Cess	450	5
Rents	731	9
Ferries	60	1
Bus Stand Fees	40	1
Water Rates	150	2
Contractor regn-fees	20	-
Total	8412	100

Expenditure

		Percent
Development		
Council Buildings	1150	9
Commercial Centres	775	6
Health & Sanitation	915	7
Veterinary Buildings	310	3
Construction and Reconstruction, metalled roads	9152	73
Road maintenance staff	75	-
Repairs to buildings	200	2
Total	12577	100

(Current Expenditure)
Not available

PISHIN DISTRICT COUNCIL
INCOME AND EXPENDITURE FY 83/84 (ACTUAL)

000's Rupees

Income

		Percent
Immovable Property Tax	190	39
Local Cess	16	3
Rents	3	1
Bank Interest	15	3
Royalties on Sand & Stone	25	5
Contractor regn-fees	3	1
Grant to Chairman	18	4
Grant for road grader	213	44
Total	483	100

Expenditure

		Percent
Salaries & Pension	139	33
Stationery, Heating	17	4
Grant for Women	10	2
Sports & celebrations	4	1
Contingencies	9	2
Fuel and oil	20	5
Vehicle repairs	7	2
Road grader payment	213	51
Total	419	100

Note: Income from royalties on sand and stone is projected to double in FY84/85, while other incomes will remain approximately the same.

JACOBABAD DISTRICT COUNCIL
INCOME AND EXPENDITURE FY 83/84 (ACTUAL)

000's Rupees

Income		Percent	Expenditure		Percent
Export Taxes	2462	30	General Administration	831	11
Fisheries & Rents	1032	13	Finance Dept.	16	-
Capital grants	3348	41	Taxation Dept.	349	5
Suspense Account	1200	14	Education & Social	31	-
Local Cess	15	-	Health	766	10
Cattle Pounds	44	0.5	Animal Husbandry	353	5
Health Dept.	32	0.5	Cattle Pounds	90	1
Miscellaneous	31	0.5	Works Dept.	711	10
Bank Interest	50	0.5	Capital Development	2603	35
---	---	---	Suspense Account	1200	16
Total	8214	100	Miscellaneous	50	1
			Contribution to Union Councils	451	6
			---	---	---
			Total	7452	100

INCOME AND EXPENDITURE FY 84/85 (PROPOSED)

000's Rupees

Income		Percent	Expenditure		Percent
Export Taxes	2956	40	General Administration	826	10
Fisheries & Rents	2821	38	Finance Dept.	16	-
Capital grants	200	3	Taxation Dept.	384	5
Suspense Account	550	7	Education & Social	107	1
Local Cess	700	9	Health	1336	16
Cattle Pounds	144	2	Animal Husbandry	302	4
Health Dept.	32	0.5	Cattle Pounds	96	1
Miscellaneous	13	-	Works Dept.	1629	20
Bank Interest	50	0.5	Capital Development	2459	30
---	---	---	Suspense Account	450	5
Total	7466	100	Miscellaneous	20	-
			Union Councils	632	8
			---	---	---
			Total	8257	100

SUKKUR DISTRICT COUNCIL
INCOME AND EXPENDITURE FY 83/84

000's Rupees

Income

		Percent
Export Taxes	6350	53
Fisheries	300	3
Minerals	900	7
Local Cess	1000	8
Immovable property	600	5
Toll Tax	185	2
Rents	150	1
Miscellaneous	372	3
Sub-Total	9857	82
Grant	2196	18
Total	12053	100

Expenditure

		Percent
Salaries	2451	19
Contingencies	1246	9
Maintenance of Buildings	300	2
Contribution to Union Councils	353	5
	2188	16
Sub-Total	6185	7
Katcha roads	900	7
Metalled roads	2130	16
Brick roads	790	6
Pipe Culverts	200	2
Construction/repair of Schools	1510	11
Ongoing schemes	1600	12
Sub-Total Development	7130	54
Total	13315	100

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Appendix 4.4

PSO PRICES OF PETROLEUM PRODUCTS JUNE 1984

Rupees/Litre

	Motor Spirit		100 Octane	HSD	Kerosene
Ex-Refinery	4.64337	5.39595	2.97923	2.44340	
Excise Duty	0.88	0.88	0.25	-	
Distribution Margin	0.07833	0.06575	0.02877	0.04660	
Dealers Commission	0.05830	0.05830	0.03200	-	
Prescribed Price	5.66	6.40	3.29	2.49	
Inland Freight	0.29	0.29	0.28	0.24	
Development Surcharge	0.55	1.11	0.68	0.27	
Fixed sale Price	6.50	7.80	4.25	3.00	

Note: Super (90 Octane) gasoline is a blend of 60 per cent motor spirit and 40 per cent 100 octane.

Source: Internal Document of Pakistan State Oil (PSO) dated 14 June 1984. Notifications of sale prices, freight margins, dealers commissions and development surcharge rates are published in the Gazette of Pakistan Extra-Ordinary.

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Appendix 4.5

NWFP District Council Roads Program FY 84/85

District	Allocation (million rupees)	Construction Program (miles)		
		Metalled	Shingle	Katcha
Peshawar	6.532	4.0	6.5	3.0
Mardan	5.048	20.0	-	26.0
Kohat	3.274	-	17.4	-
Karak	2.771	2.0	13.0	35.5
Abbottabad	4.524	10.0	20.0	29.0
Mansehra	4.564	1.0	11.0	13.0
Kohistan	3.355	-	10.0	30.0
Bannu	3.738	5.75	5.50	1.0
D.I. Khan	3.456	1.0	10.4	24.75
Chitral	2.791	-	2.0	37.0
Dir	4.000	-	8.0	30.0
Swat	4.826	-	10.0	52.0
Malakand	2.650	3.75	1.0	-
Total	51.529	47.5	114.8	291.25 Miles
	(76.4)	(184.7)	(468.7) (Km)	

Source: NWFP, Annual Development Program 1984-5 (Ref. 21)

Appendix 4.6

SIND
DISTRICT COUNCIL TAXES

1. Tax on the annual value of buildings and lands.
2. Tax on lands not subject to local rate.
3. Tax on hearths.
4. Tax on the transfer of immovable property.
5. Tax on the import of goods for consumption, use or sale in the local areas (by union council only).
6. Tax on the export of goods from the local area.
7. Tax on professions trades and callings.
8. Tax on births, marriages and feasts.
9. Tax on advertisements.
10. Tax on cinemas, dramatic and theatrical shows, and other entertainments and amusements.
11. Tax on animals.
12. Tax on vehicles (other than motor vehicles but including carts, bicycles and all kinds of boats).
13. Tolls on roads, bridges and ferries.
14. Lighting rate.
15. Drainage rate.
16. Rate for the execution of any works of public utility.
17. Conservancy rate.
18. Rate for the provision of water works or the supply of water.
19. Fees on application for the erection and re-erection of building.
20. Schools fees in respect of schools established or maintained by the council.
21. Fee for the use of benefits derived from any works of public utility maintained by the council.
22. Fees at fairs, agricultural shows, industrial exhibitions, tournaments and other public gatherings.
23. Fees for markets.
24. Fees for licences, sanctions and permits granted by the council.
25. Fees for specific services rendered by the council.
26. Fees for the slaughtering of animals.
27. Any other tax which is levied by Government.
28. Community tax on the adult males for the construction of any public work of general utility for the inhabitants of the local areas concerned unless the council exempts any person in lieu of doing voluntary labor or having it done on its behalf.

Appendix 4.7

NWFP
DISTRICT COUNCIL TAXES

1. Tax on the transfer of immovable property.
2. Fees for licences, sanctions and permits granted by the District Council.
3. Market fees for the markets maintained by the District council.
4. Rates on the services like water-supply, drainage, lighting, provided by the District Council.
5. Fees at fairs, agricultural shows and industrial exhibitions tournaments and other public gathering.
6. Fees for specific services rendered by a District Council.
7. Fees for the export of goods and animals from the District.
8. Tax on the annual rental value of buildings and land.
9. Toll on roads and bridges and ferries maintained by the District Council.
10. Tax on vehicles other than motor vehicles and including carts, bicycles, and tongas.
11. Tax for the construction or maintenance of a work of public utility;
12. Any other tax which Government is empowered to levy by law.

Appendix 6.1

COMBINED CONSUMER PRICE INDEX (all Income Groups)
(1969-70 = 100)

FY	Index
1973-74	157.8
74-75	200.0
75-76	223.3
76-77	243.9
77-78	260.7
78-79	282.5
79-80	311.8
80-81	335.0
81-82	396.0
82-83	416.5

Source: Pakistan Statistical Yearbook, Table 17.5 (b)