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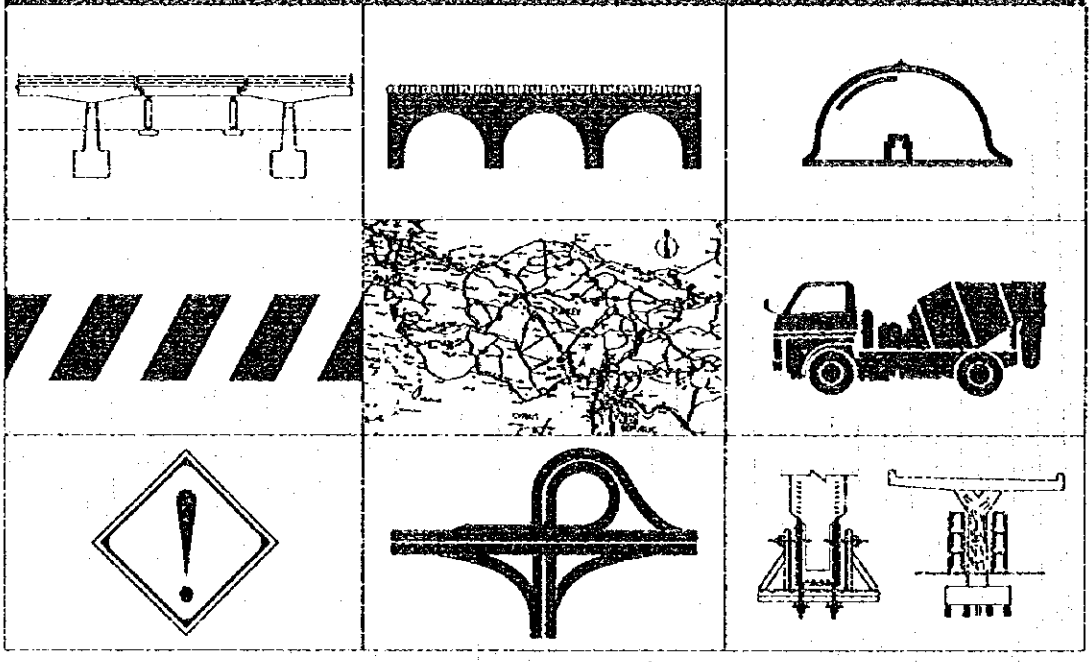
Japan International Cooperation Agency(JICA)

The Republic of Turkey
Ministry of Public Works and Settlement
General Directorate of Highways(KGM)

The Study on The Maintenance and Rehabilitation of Highway Bridges in The Republic of Turkey

FINAL REPORT
MAIN TEXT
VOLUME 2



AUGUST 1996

ORIENTAL CONSULTANTS CO.,LTD.
in association with
JAPAN OVERSEAS CONSULTANTS CO.,LTD.

Japan International
Cooperation Agency(JICA)

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and Settlement
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PREFACE

In response to a request from the Government of the Republic of Turkey, the Government of Japan decided to conduct "The Study on The Maintenance and Rehabilitation of Highway Bridges in The Republic of Turkey", and entrusted the Study to the Japan International Cooperation Agency (JICA).

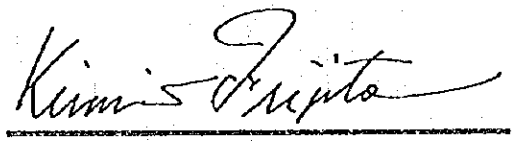
JICA then sent to Turkey a study team headed by Mr. Akihiko Hirotani, and composed of members of Oriental Consultants Co.,Ltd. and Japan Overseas Consultants Co.,Ltd., from March 1995 to May 1996.

The Team held discussions with the officials concerned of the Government of Turkey, and conducted field surveys at the Study Area. After the Team returned to Japan, further studies were made and the present report was prepared.

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

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Turkey for their close cooperation extended to the Team.

August, 1996



Kimio Fujita
President
Japan International Cooperation Agency

THE STUDY ON
THE MAINTENANCE AND REHABILITATION of
HIGHWAY BRIDGES in THE REPUBLIC of TURKEY
AUGUST, 1996
ORIENTAL CONSULTANTS COMPANY LIMITED
in association with
JAPAN OVERSEAS CONSULTANTS COMPANY LIMITED

Project Location

RESUME SUMMARY

I. OUTLINE OF SUMMARY

1. COUNTRY	The Republic of Turkey
2. NAME OF STUDY	The Study on the Maintenance and Rehabilitation of Highway Bridges
3. COUNTERPART AGENCY	Ministry of Public Works and Settlement General Directorate of Highways (KGM)
4. OBJECTIVE OF STUDY	To carry out the feasibility study on the maintenance and rehabilitation of highway bridges

II. SUMMARY OF STUDY RESULT

1. STUDY ROAD	Arterial State Highway (Ankara to Izmir, Rize, Bursa and Antalya)
2. PROJECT COST	

Unit US$

Bridge Name	The Solution	The Disruption to Road User	Economic Comment	Project Cost
1. Buca UG	Repair	Close slip road, divert over-traffic	Full capacity is nearly reached	9,000
2. Hilal-II	Repair	Two lanes into one	Full capacity is nearly reached	350,000
3. Babadat	Build new bridge	New bridge will be diversion	Require service level D and by 2001 at E	125,000
4. Selyeri	Repair	Two lanes into one	3 lanes downhill required by 2004	47,000
5. Akcay	Build new bridge	New bridge will be diversion	Require service level D and by 2001 at E	151,000
6. Koparan-II	Repair	Temporary culvert bridge	Dualing required in 2008 at D service level.	105,000
7. Asagi Cakalli	Repair	Two lanes into one	After 1999, traffic is too high to use parallel bridge	163,000
8. Gelincik	Repair	Traffic lights for one lane-one way	Dualling required in 2003 at D service level	59,000
9. Sardere	Repair	Temporary culvert bridge	Dualling required in 2004 at D service level	124,000
10. Candir Hasanpasa	Repair	Temporary culvert bridge	Require by 2003 at service level D and 2009 at E	190,000

3. ENVIRONMENTAL IMPACT ASSESSMENT

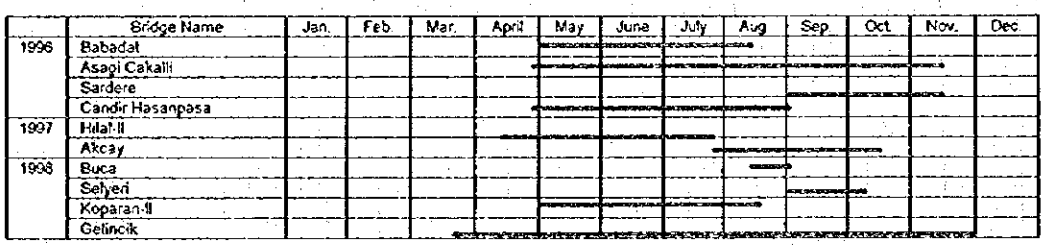
Control Item	Bridge No.										Remarks
	1	2	3	4	5	6	7	8	9	10	
A. New Construction	×	×	×	×	×	×	×	×	×	×	Repair and Rehabilitation
B. Earth Work	×	×	Δ	×	◎	Δ	×	×	Δ	○	For temporary access embankment
C. Effect of Flooding	×	×	×	×	×	×	×	×	×	×	
D. Construction Dust	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	By concrete scraping
E. River Works	×	×	Δ	×	×	×	×	×	×	Δ	Rather to improved
F. Usage of Water	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	In working hours for dust control mainly
G. Solid Waste	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Scraped concrete and some soil
H. Construction Noise	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	By concrete breaker in scraping
I. Cutting Tree	×	×	Δ	×	○	Δ	×	×	×	Δ	KGM Lands except No 5
J. Effect to Farmland	×	×	×	×	○	×	×	×	×	×	KGM Lands except No 5
K. Danger in Construction	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Ordinaly work
L. Effect to Flora/Fauna	×	×	×	×	×	×	×	×	×	×	
M. Others											

◎ : Considerable ○ : Some Δ : Minimal × : Nil

4. ECONOMIC ANALYSIS

Bridge Name	EIRR with next best alternative	EIRR with detour alternative	Repair or Replace
1. Buca UG	43.1 %	53.8 %	Repair by 2004
2. Hilal-II	24.5 %	37.9 %	Rehabilitation in 1990s
3. Babadat	30.6 %	166.7 %	Replace in 1998. Better is to build dual bridge in 1997.
4. Selyeri	26.3 %	55.4 %	Repair 2004
5. Akcay	30.8 %	92.1 %	Put in dual bridge by 1999 and repair in 2000
6. Koparan-II	16.9 %	79.8 %	Repair in 2004
7. Asagi Cakalli	106.9 %	284.2 %	Repair in 1998
8. Gelincik	15.0 %	45.4 %	Repair in 2000
9. Sardere	40.8 %	632.0 %	Repair in 1996
10. Candir Hasanpasa	32.7 %	617.2 %	Repair in 1996

5. IMPLEMENTATION PLAN



6. RECOMMENDATION

1. Bridge maintenance is an indispensable part of the economic development of Turkey. Hence the operation should be expand to cover the whole nation.
2. Sensible budget allocation to enable this operation is urgently needed.
3. Several of the bridges which were inspected this time, were found to be in a very dangerous state and require immediate repair.
4. There is a possibility that similar dangerous bridges may exist on the other routes and urgent inspection work is strongly recommended.
5. Improvement in construction workmanship and supervision are needed.
6. Some measures to secure head room and to regulate over-height vehicles are needed.
7. Strict measures are needed to regulate excessive excavation of aggregate from river beds.
8. There are some areas which require special attention on aggregates selection and salt problems.

The Study on The Maintenance And Rehabilitation of Highway Bridges (MARHB) in The Republic of Turkey

EXECUTIVE SUMMARY

JICA MARHB Study commenced in March, 1995, and continued until the submission of the Final Report in August, 1996, which is a total of 18 months. During the Study, all the bridges on state and principal highways were briefly analysed and those routes and bridges which represent typical types, materials, traffic situations, environs, etc.; were selected as Study areas and bridges. A case study was carried out on those for the bridge inspection, evaluation, maintenance and rehabilitation; and a main report, an inspection data-base system utilising computer, and a manual for bridge maintenance were produced. Technology transfer was a key issue. Economic viability analysis and evaluation confirmed that bridge maintenance contributes greatly to the healthy development of a national economy. It is hoped that the government of Turkey will be sufficiently convinced of this important message, and allocate whatever budget she can manage to this field.

1. Introduction

1.1 Background

The General Directorate of Highways within the Ministry of Public Works and Settlement of the Republic of Turkey (hereinafter referred to as "KGM") is responsible for the maintenance and operation of the national highway network and bridges. The main problems relating to these highway bridges are as follows:

Due to the occurrence of severe cracks, joint and bearing deformation, concrete deterioration, and being subjected to higher axle loading than was envisaged (for the freight routes), it will be necessary for a programme of detailed investigation and remedial measures to be implemented for the safety of these bridges. As Turkey is in an active seismic zone, it is also vital to ensure that these bridges have sufficient capacity against earthquakes. In view of the increasing number of bridges that have "come of age", it is anticipated that systematic inspection, maintenance and rehabilitation will be required.

1.2 Objectives of the Study

The objectives of the study are as follows:

- to provide an overall information on all of the highway bridges by means of visual inspection and survey of object bridges located on arterial study roads
- to formulate rehabilitation plans for typical damaged highway bridges, and
- to prepare manuals for bridge inspection and evaluation.

1.3 Study Roads and Bridges

The Study covered bridges on arterial state highways (excluding motorways) which connect Ankara to Izmir, Rize, Bursa, and Antalya. The objective bridge types beam bridges or slab bridges of concrete construction.

1.4 Study Progress

JICA MARHB Study commenced on 22 March, 1995, and worked twice in Turkey and twice in Japan. A further visit to Turkey for the submission of the Draft Final Report (D/F Mission) and for holding seminars were undertaken to complete the Study.

During the Study in Turkey, their designated counterparts from KGM were combined with the JICA Team in order to conduct the Study together in such activities as, among others, data collection, arrangement of interviews, site reconnaissance, bridges inspection, etc..

During the progress of the Study, many meetings were held with the KGM staff, based on the materials prepared by the JICA Team. The purposes of the meeting were to transfer technology; to report and understand the progress and contents of the Study; and to get to know each other better. Many occasions were planned and bi-weekly (sometimes weekly) meetings were organised except during the periods of bridges inspection.

2. Major Achievements of The Study

Major and large scale economic developments in Turkey were witnessed only after the last war. The trend is still continuing and the emphasis would appear to be on the development of social infrastructure. As most of the social infrastructure is still young, maintenance has not attracted those responsible for strategy planning in the public sector administration.

JICA MARHB Study was planned and targeted, from the beginning, towards preparing enough material for determining how to allocate budget and bridge maintenance manual for implementing the works of maintenance, by conducting a case study covering the whole process.

As the Study progressed, the JICA Team realised the fact that the budget allocated to bridge maintenance is definitely too little to even realise what would be recommended by the Study, leading to the possibility that the product of this Study may not be utilised. While carrying out the complete items of work in the scope, the Team had decided to shift the emphasis of the Study to produce plenty of evidence to prove that bridge maintenance contributes greatly to national economic development.

KGM had learned enough from the Study and had started their own activities to allocate additional budget for the bridge maintenance works, even though the national economy in Turkey is going through a difficult time. However, there seemed to be a lot of constraints that had yet to be overcome.

3. Major Products and Contents

Major products of the Study are presented below together with their contents.

3.1 Main Report

The Main report describes all the findings of the study while presenting all the works as they progressed. It starts off from general guidance of the Study and goes on to describe the works.

There are 13 chapters, which are:

Chapter 1. Introduction
Chapter 2. Socio-Economic Situation of Turkey
Chapter 3. Present Situation of Highway Bridges

Chapter 4. Inspection and Maintenance Concept
Chapter 5. Visual Inspection of Highway Bridges
Chapter 6. Detailed Inspection of Highway Bridges
Chapter 7. Maintenance Design Study
Chapter 8. Economic Analysis
Chapter 9. Environmental Study
Chapter 10. Operation Planning
Chapter 11. Financing for Road Maintenance
Chapter 12. Alkali Aggregate Reaction Study
Chapter 13. Conclusions and Recommendations

Chapter 8 Economic Analysis was intended at the beginning of the Study, to be a section of Chapter 7. However, the JICA Team has decided to make it a chapter of its own in order to emphasise the economic part of this Study such that the viability of bridge maintenance is proved and the lack of budget for bridge maintenance can be stressed. It is hoped that the responsible people in the administration can allocate enough resources for this very important aspect of work, which is maintenance.

3.2 Bridge Inspection Data Base System

The data base system, composed of input section, alteration section and output section, is installed in the computer system which is donated to KGM. The system was developed, with guidance from the JICA Team, by a local system engineering firm (Promin) which was employed by the JICA Team. The source program is the MICROSOFT ACCESS (data base program) on WINDOWS, and uses the Basic language of the program. All of these are part of the donation to KGM. The maintenance of the system, if needed in future, is not dependent on the JICA Team but can be sublet by KGM to Promin.

There is already data for approximately 200 bridges in the data base system. This work was carried out in conjunction with KGM personnel such that the handling of the system had been proven and the technical transfer had also been completed.

3.3 Bridge Management Manual

The bridge management manual is composed of volumes of inspection, evaluation, maintenance and repair/rehabilitation. The manual is prepared by fully utilising the consultants expertise, general knowledge and experiences on bridge maintenance; special knowledge and experience of JICA Team members in Turkey from similar projects; and the findings from this Study.

Safety during the inspection works was also given special attention. The JICA Team requested full cooperation from KGM in this regard and all the Team members were reminded of the importance of safety. Traffic controllers and regulators were posted during the inspection works and traffic safety during transfer was also taken care of. The Manual also describes those in a special section.

4. Evaluation of Projects

As a case study, ten bridges which were selected through visual inspection of more than 200 bridges and detailed inspection of twenty bridges, were put to feasibility study of repair/maintenance.

The bridges were preliminary designed to assess viability in technical terms, utilizing local practice and material as much as possible.

Economic evaluation was one of the most important item to prove. Methodology, values to use and other parameters were set after repeated discussions with planning people of KGM. The results as shown below had been explained to the Turkish side and accepted.

Other items of evaluation included environmental assessment which proved minimal effect by the bridge maintenance works. However, it should be noted that environmental parameters marked with small effect may threaten project sustainability if adequate countermeasures are not taken. Therefore, continuous and appropriate monitoring will be required.

The Results of the Economic Analysis (FIGURES APPLY TO REHABILITATION IN 1996)

Bridge Name	EIRR with 'next best alternative'	EIRR with detour alternative	Repair or Replace	Comment
Buca UG(Izmir) (slip road westbound only)	43.1%	53.8%	Repair by 2004.	
Hilal-II (Izmir) Dual Carriageway (westbound only)	24.5%	39.7%	Rehabilitate in 1990s	
Babadat (Ankara) (Two lane)	30.6%	166.7%	Replace in 1998. But better is to build dual bridge in 1997 and Repair in 1998	Dualling is a key factor
Selyeri (Samsun) (West bound carriageway)	26.3%	55.4%	Repair 2004	
Akcay (Samsun) (2 lane Gerber Bridge)	30.8%	92.1%	Put in dual bridge by 1999 and repair in 2000	Dualling is a key factor
Koparan II (Samsun) (2 Lane)	16.9%	79.8%	Repair in 2004	
Asagi Cakalli (Samsun) (Northbound carriageway)	106.9%	284.2%	Repair in 1998	After 1999 traffic will enforce costly diversions
Gelincik (Trabzon) (2 lane)	15.0%	45.4%	Repair in 2000	If delay to 2001 then better to replace
Sardere (Antalya) (Two Lane)	40.8%	632.0%	Repair in 1996	Closure will enforce repair
Candir Hasanpasa (Bursa) (Two Lane)	32.7%	617.2%	Repair in 1996	Without repair collapse will force replacement
Average Median	30.7%	86.6%		

5. Conclusions and Recommendations by MARHB Study

Conclusions from the MARHB Study are as follows:

Findings	Contents
a. Damages, wear and tear	A quarter of inspected bridges. Some of them in dangerous state.
b. Poor workmanship	Cause of most of damages. Change in attitude needed.
c. Traffic accident	Girder damages by tall vehicle hitting.
d. Excessive excavation of aggregate from river	Cause of damages to foundations and piles
e. Salt damages	Spalling of concrete and corrosion of steel
f. Alkali Aggregate Reaction	Problems found at limited areas
g. Replacement	Most of damages are manageable except a few cases.
h. Economic Evaluation	Bridge management contributes greatly to national economy
i. Environmental Evaluation	Each case shall be investigated however the effect being minimal.
j. Very dangerous damages	Immediate action is needed.

The following recommendations can be derived from the conclusions;

Recommendation	Contents
1. Expand BMS to whole nation	BMS is indispensable part of economic development of Turkey.
2. Budget allocation	Sensible budget allocation for BMA is needed.
3. Immediate action to dangerous ones	Several dangerous ones need immediate action.
4. Urgent BMS	Other dangerous bridges may exist on other routes.
5. Improvement in workmanship	Workmanship in construction and supervision needed.
6. Head room clearance	Some measures needed for clearance and regulation to tall vehicle.
7. Excavation of aggregate	Excess excavation from river to be regulated.
8. Aggregate selection and salt	Some areas needing special attention on aggregate and salt problems.

6. Concluding Remarks

The JICA Study Team would like to convey their sincere appreciation to all KGM counterparts for their generous hospitality and cooperation during their stay in Turkey, without which this Study would not have been as successful.

On the Japanese side, invaluable support and encouragement from the Japanese Embassy, JICA Turkish Office and JICA Experts (seconded to KGM) has provided great assistance in the timely progress of the Study.

The JICA Study Team sincerely hope that the results of the Study will be utilised for further operation of bridge maintenance and that the responsible organisation will be able to receive enough budget and staff to meet this end.

THE STUDY ON THE MAINTENANCE AND REHABILITATION OF HIGHWAY BRIDGES IN THE REPUBLIC OF TURKEY

DRAFT FINAL REPORT

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Project Location
Executive Summary
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Chapter 1

Introduction

Chapter 1 Introduction

1.1 The Study

1.1.1 Background

The government of Japan, in compliance with a request from the government of Turkey, agreed to conduct The Study on The Maintenance and Rehabilitation of Highway Bridges in the Republic of Turkey, in accordance with the laws and regulations of Japan. Based on this decision, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), an official body responsible for the execution of technical assistance programmes for the government of Japan, was assigned to carry out the study in close cooperation with the responsible Turkish authority.

The General Directorate of Highways within the Ministry of Public Works and Settlement of the Republic of Turkey (hereinafter referred to as "KGM") is responsible for the maintenance and operation of around 60,000 km of national highway network, which includes more than 3,000 bridges. More than ninety percent (90 %) of the highway bridges are concrete bridges which were designed and constructed more twenty-five years ago with low axle load capacity. The main problems relating to these highway bridges are as follows:

- Cracked and damaged sub-structures and superstructures
- Damaged expansion joints and bearings
- Scaling and spalling of concrete, and
- Inadequate load carrying capacity.

Though the construction of motorways is now going on at a good pace, the public still depend on the national highways for most of the passenger and freight transport and are expected to keep doing so in the future. The importance of national highways to nationwide and regional centres for transportation will remain for a long while.

Due to the occurrence of severe cracks, joint and bearing deformation concrete deterioration, and being subjected to higher axle load than envisaged (for the freight routes), it will be necessary for a programme of detailed investigation and remedial measures to be implemented for the safety of these bridges. As Turkey is in an active seismic zone, actually sustained severe damages by the latest earthquake which hit Erzincan city, it is also vital to ensure that these bridges have sufficient capacity against earthquakes. In view of the increasing number of bridges being "come of age", it is anticipated that systematic inspection, maintenance and rehabilitation shall be required.

These improvement activities are required to be carried out promptly as well as appropriately and efficiently under limited funds and staff.

1.1.2 Objectives of the Study

The objectives of the study are as follows:

- to provide an overall information of highway bridges by means of visual inspection survey of object bridges located on arterial study roads
- to formulate rehabilitation plans for typical damaged highway bridges, and
- to prepare manuals of bridge inspection and evaluation.

1.1.3 Study Roads and Bridges

The present highway network, which totaled approximately 60,000 km, is shown in Figure - 1.1.1. The Study covered bridges on arterial state highways (excluding moterways) which connect Ankara to Izmir, Rize, Bursa, and Antalya, The objective bridge types are the beam bridges or slab bridges of concrete construction. The maximum number of visual inspection bridges to be studied was 207 bridges.

1.1.4 Study Flow

The Study was conducted during study period which consists of several phases of works in Japan and in Turkey. The Study flow is shown in Figure - 1.1.2.

1.1.5 Study Organization and Participants

The Study was conducted jointly between KGM and the JICA Study Team (hereinafter referred to as "the Team") with guidance by the JICA Advisory Committee. The relations of these institutions are shown in Figure - 1.1.3.

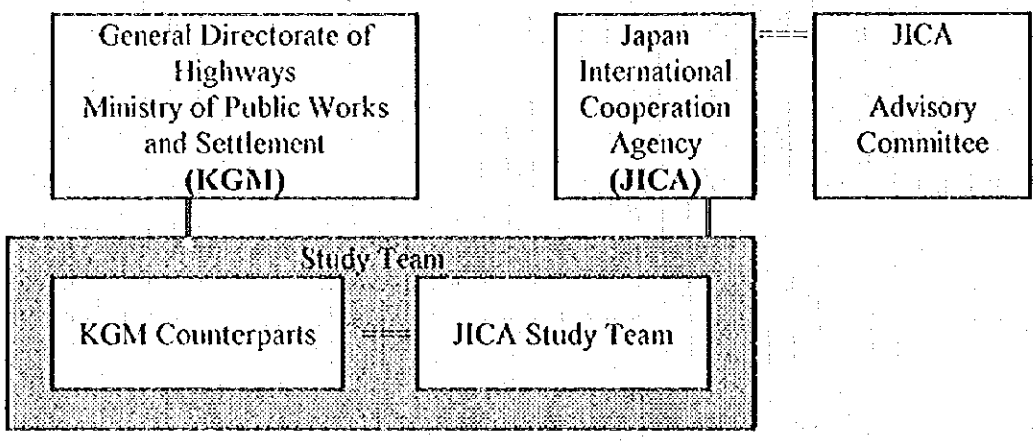
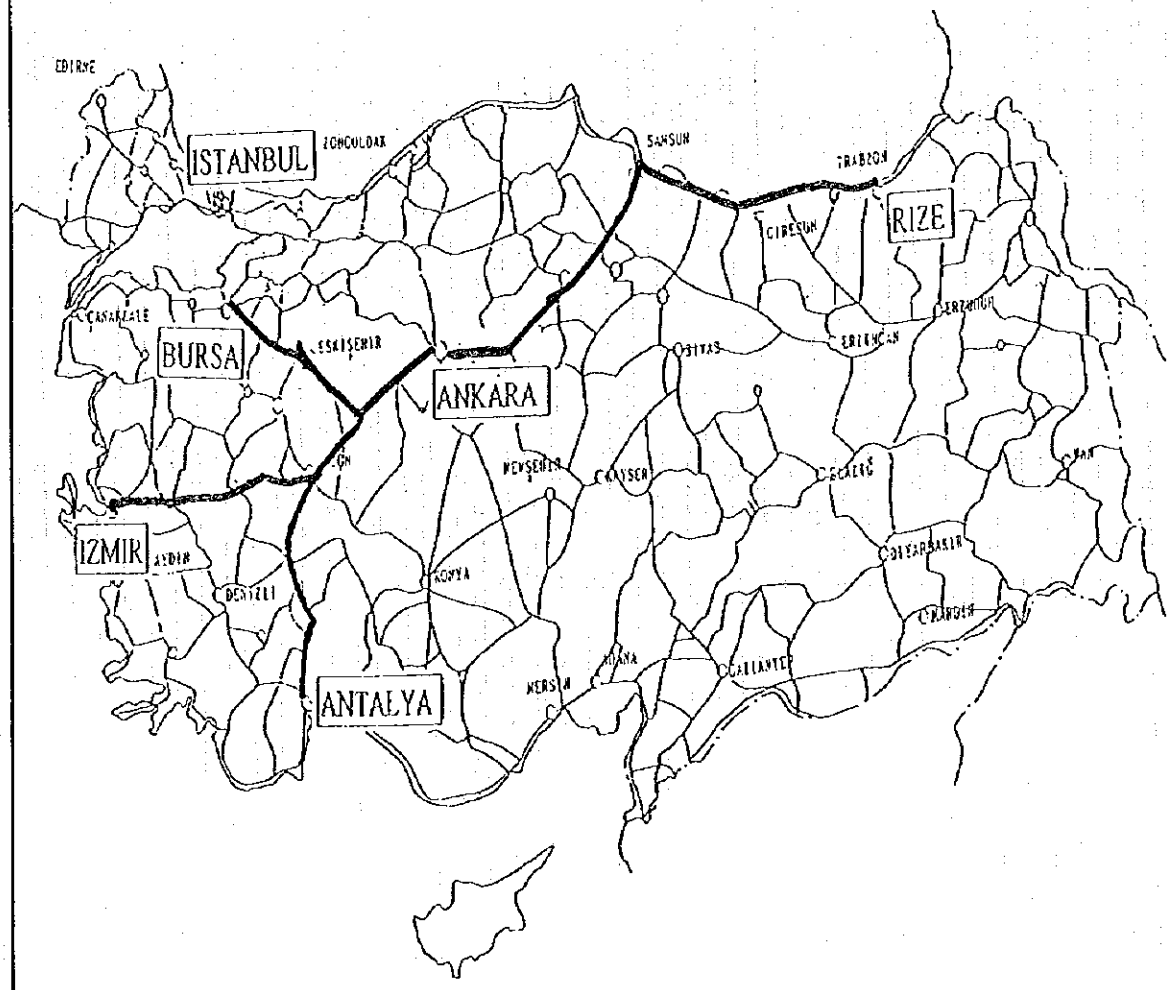


Figure - 1.1.3 Study Organization

Participants of the Study are; (1) JICA Advisory Committee, (2) JICA Study Team and (3) Turkish Counterparts to the JICA Study Team (KGM).

(1) JICA Advisory Committee Members

Mr.Hideya TANAKA	Leader of Committee	(Mar. 95～Aug. 95)
Mr.Akira MORI	ditto	(Sep. 95～Apr. 96)
Mr.Kazutomo ABE	ditto	(May 96～)



Remarks

- ○ Major Cities
- ——— Major Highways
- - - - - - National Border
- ═══ Study Roads

Note: Scale is distorted

THE STUDY ON THE MAINTENANCE AND REHABILITATION of HIGHWAY BRIDGES in THE REPUBLIC of TURKEY AUGUST, 1996 ORIENTAL CONSULTANTS COMPANY LIMITED in association with JAPAN OVERSEAS CONSULTANTS COMPANY LIMITED	Figure - 1.1.1 Study Roads

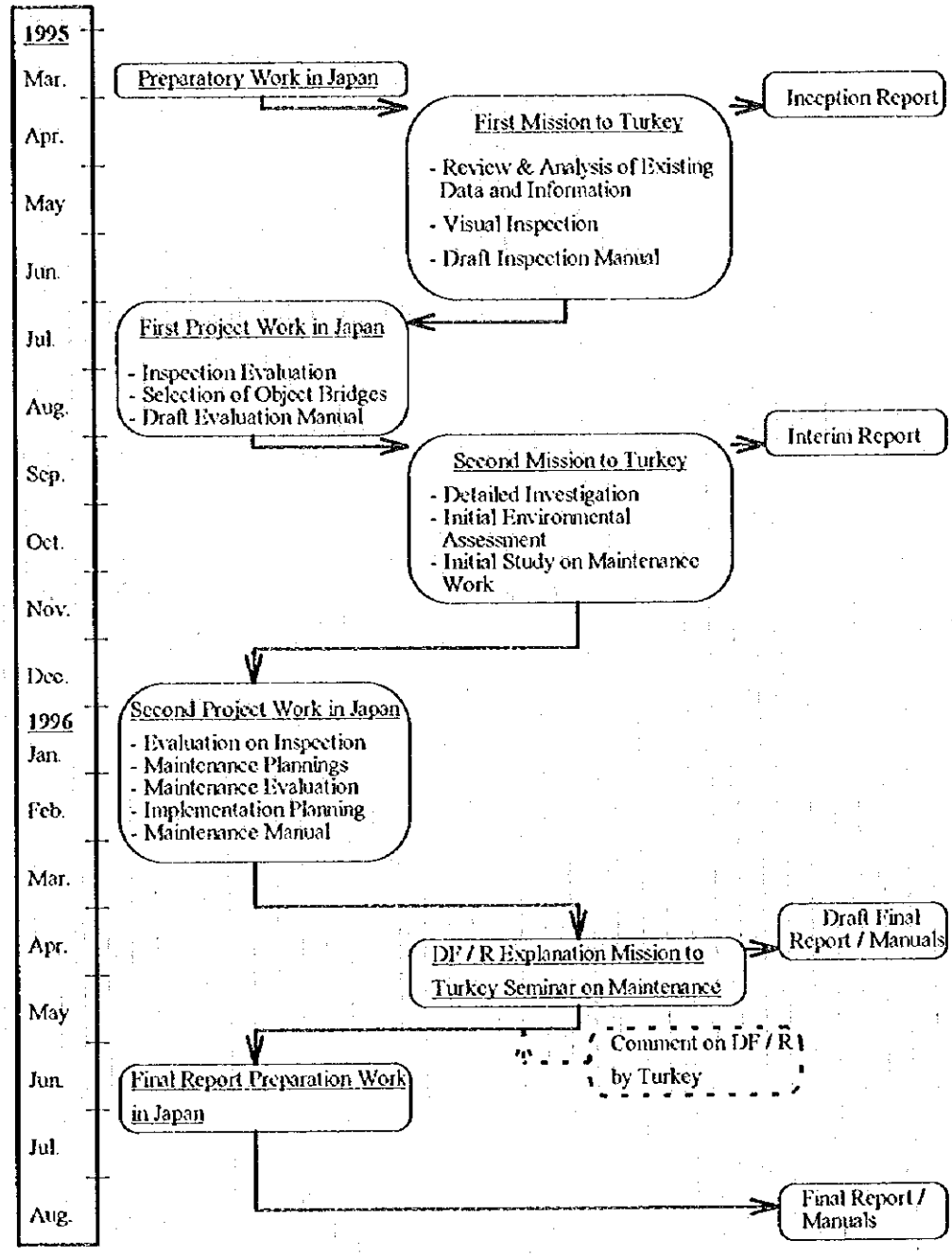
Mr.Tadashi OKUTANI	Member of Committee (Mar. 95～April 96)
Mr.Takaharu KIRIYAMA	ditto (May 96～)

(2) JICA Study Team Members

Mr.Akihiko HIROTANI	Team Leader / Bridge Planner
Mr.Keigo KONNO	Team Sub-Leader / Bridge Designer
Mr.Koji WADA	Team Member / Bridge Maintenance, Repair Planner
Mr.Arun Hans SAHNI	Team Member / Bridge Maintenance, Repair Planner
Mr.Yoshitoshi KOBAYASHI	Team Member / Natural Condition, Environment Specialist
Mr.Fumiyoshi KUBOTA	Team Member / Natural Condition, Environment Specialist
Mr.Chai Seng CHIEW	Team Member / Construction Planner, Cost Estimator
Mr.David McEWEN	Team Member / Economic Evaluation Specialist
Mr.Atsushi MATSUBARA	Team Member / Project Coordinator

(3) Turkish Counterparts to the JICA Study Team

Mr.Mehmet BALTACI	Head,Bridge Department
Mr.Ertan SAYIT	Director, Bridge Maintenance Section, Bridge Department
Mr.Adnan GURKAN	Engineer, Bridge Maintenance Section
Mr.Kuzey YILMAZ	Engineer, Bridge Maintenance Section



THE STUDY ON
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AUGUST, 1996
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Figure - 1.1.2

Study Flow

1.2 Objectives and Goal of Maintenance Operation

1.2.1 General

It is a common understanding that a structure will eventually wear down while in use. It may also suffer from various kinds of accidents, both natural as well as man-made.

In the case of highway structures and bridges, the causes of wear and tear can be due to natural occurrences such as flooding, land slide, scour in river bed and oceanic action. Poor workmanship during construction, traffic accidents, lack of maintenance and sabotage, on the other hand are human related. Whatever the causes of the wear and tear, the inspection and proper maintenance where and when necessary is the responsibility of the designated organization. Adequate and timely maintenance work will prolong the life of the structure and reduces the total whole life cost. Lack of maintenance on the other hand, can reduce the life of the structure considerably and may sometimes become a public hazard where there is a danger of it collapsing or any parts of it falling.

This study recognizes the importance of proper and timely maintenance works for highway bridges. The whole process of maintenance is discoursed with considerations given to the worthiness of such works from technical and economics view point.

1.2.2 Objective of Bridge Maintenance

Objective of the bridge maintenance is simply to prolong the life of bridge and to reduce operational cost.

1.2.3 Goal and Achievement of Operation

Successful achievement in this objective will benefit the public and will increase the welfare of people by increasing the effective use of financial and material resources and reducing the public hazards.

Final goal of the maintenance operation after successful achievement will be;

- to maintain function and serviceability of the bridge
- to provide better and safer services to users
- to protect third parties from an expected accident, and
- to provide better environmental condition.

1.3 Report Structure

1.3.1 Main Report

The Main report describes all the findings of the study while presenting all the works as they progressed. It starts off from general guidance of the Study and goes on to describe the works.

There are 13 chapters, which are:

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Chapter 6.	Detailed Inspection of Highway Bridges
Chapter 7.	Maintenance Design Study
Chapter 8.	Economic Analysis
Chapter 9.	Environmental Study
Chapter 10.	Operation Planning
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Chapter 12.	Alkali Aggregate Reaction Study
Chapter 13.	Conclusions and Recommendations

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1.3.2 Bridge Inspection Database System

The data base system, composed of input section, alteration section and output section, is installed in the computer system which is donated to KGM. The system was developed, with guidance from the JICA Team, by a local system engineering firm (Promin) which was employed by the JICA Team. The source program is the MICROSOFT ACCESS (data base program) on WINDOWS, and uses the Basic language of the program. All of these are part of the donation to KGM. The maintenance of the system, if needed in future, is not dependent on the JICA Team but can be sublet by KGM to Promin.

There is already data for approximately 200 bridges in the data base system. This work was carried out in conjunction with KGM personnel such that the handling of the system had been proven and the technical transfer had also been completed.

1.3.3 Bridge Management Manual

The bridge maintenance manual is composed of volumes of inspection, evaluation, maintenance and repair/rehabilitation. The manual is prepared by fully utilising the consultants expertise, general knowledge and experiences on bridge maintenance; special knowledge and experience of JICA Team members in Turkey from similar projects; and the findings from this Study.

Safety during the inspection works was also given special attention. The JICA Team requested full cooperation from KGM in this regard and all the Team members were reminded of the importance of safety. Traffic controllers and regulators were posted during the inspection works and traffic safety during transfer was also taken care of. The Manual also describes those in a special section.

Chapter 2

Socio-Economic Situation of Turkey

Chapter 2 Socio-Economic Situation of Turkey

2.1 General Situation

2.1.1 Natural Conditions

1) Geography and Topography

Turkey is located between 35° and 42° north latitude, and 26° and 45° east longitude. It has borders with Armenia, Bulgaria, Georgia, Greece, Iran, Iraq and Syria. It is about 1,600km long from east to west and about 650km wide from the Black Sea in the north to the Mediterranean Sea in the south. The country is surrounded by seas (the Mediterranean, the Black Sea, the Aegean, and the Marmara Sea) with 8,333km of coastline. The longest river in Turkey is the Kizilirmak which is 1,355km long and it originates from the Central Anatolia region and flows into the Black Sea near Samsun. It covers an area of 779,452km^2 and the average elevation of the land is approximately 1,100m. The land with elevations of between 500 m - 1,500m covers 55% of the country (mainly in central regions). Whereas plains with elevations lower than 250m is less than 10% of the country (mainly along sea coasts). The rest are mountainous, especially in the eastern region. The major mountain ranges are Koroglu Mountains in the west, Dogu karadeniz Mountain along the Black Sea, the Toros Mountains along the Mediterranean Sea and the Guneydogu Toroslar Mountains in the east. The highest mountain in Turkey is Agri Dagi (Mt. Ararat) at 5,165 meters above the sea level, near the borders to Iran and Almenia. Figure - 2.1.1 shows river systems and mountain ranges in Turkey.

2) Climate

Turkey is topographically diverse with high mountains in the eastern part, rolling steppeland in the central part, long stretched coastlines, and vast river plains and valleys, which cause varying climatic conditions throughout the country.

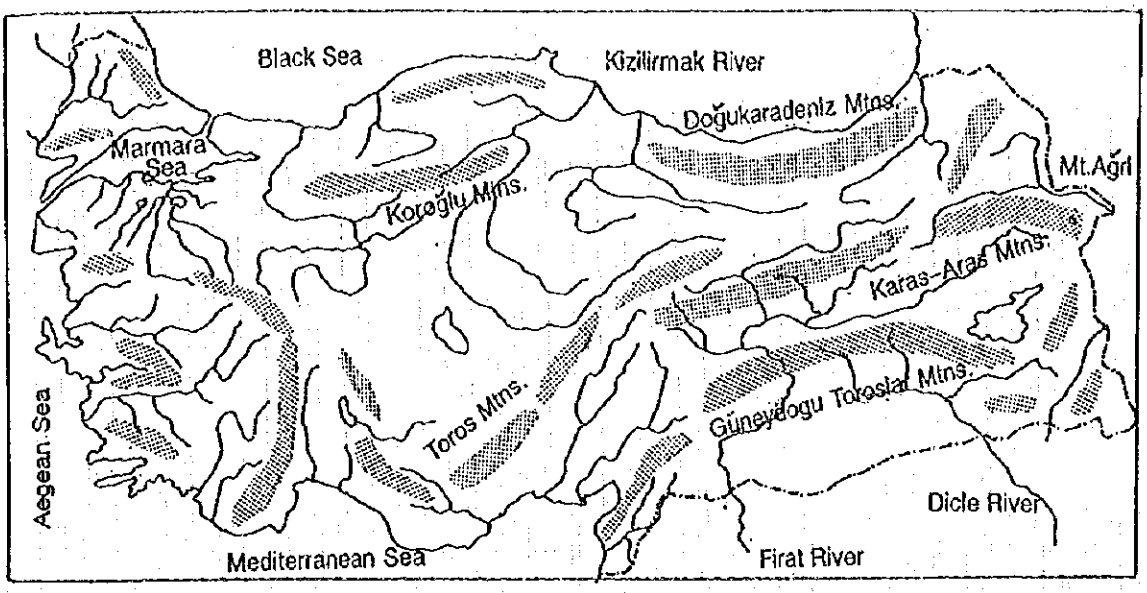
Turkey is divided into the seven (7) principal regions geographically as shown in Figure - 2.1.2; ① Black Sea, ② Marmara, ③ Aegean, ④ Meditterania, ⑤ Central Anatolia, ⑥ East Anatolia and ⑦ Southeastern Anatolia Regions;

① Black Sea Region

The Black Sea coastline is about 1,700km long. It receives rain throughout the year along the coast and in the mountainous hinterland areas. Annual rainfall in the Trabzon area is extremely high and reaches 2,000mm, which is two to three times the national average. The temperatures are moderate; the average temperature is between 22 - 24°C in the Summer and between 5 - 7°C in the winter.

② Marmara Region

The region includes rolling steppeland and low hills around Marmara Sea. Average



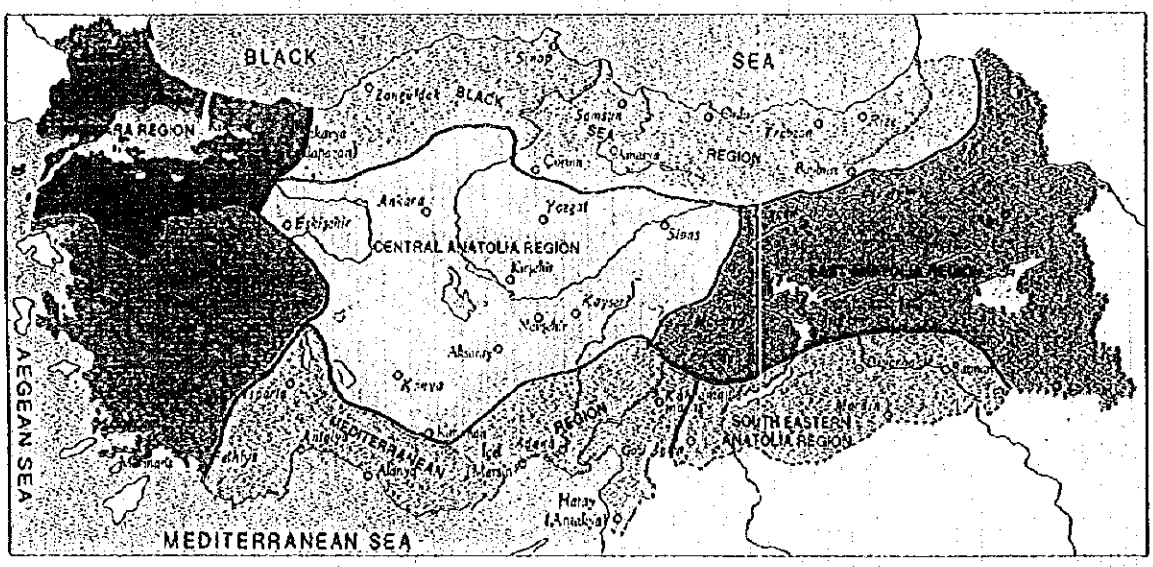


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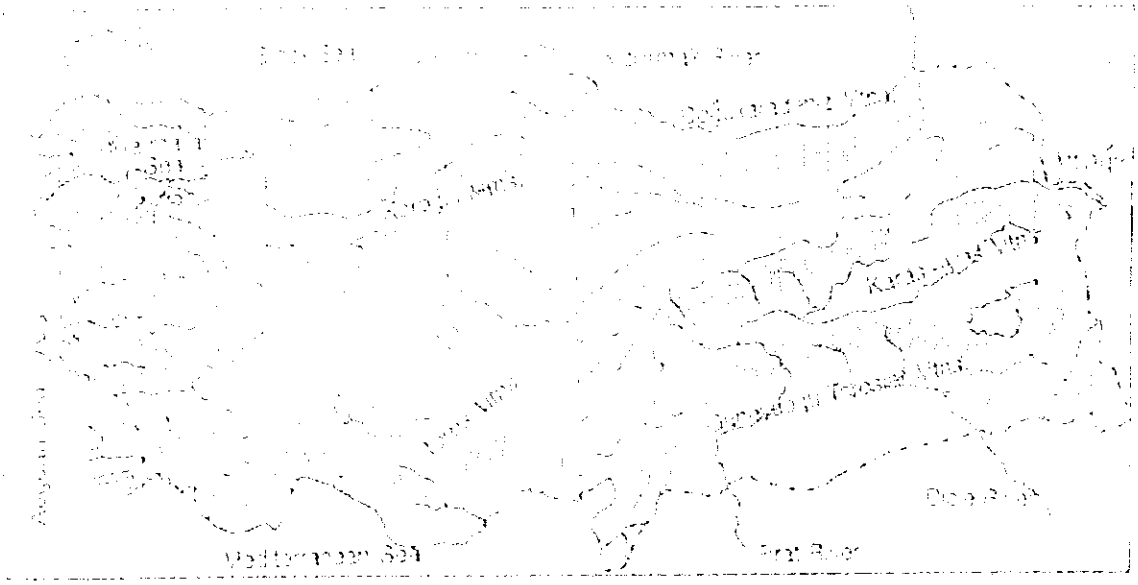
Figure - 2.1.1 River System and Mountains Range in Turkey

Figure - 2.1.2 Geographical District of Turkey



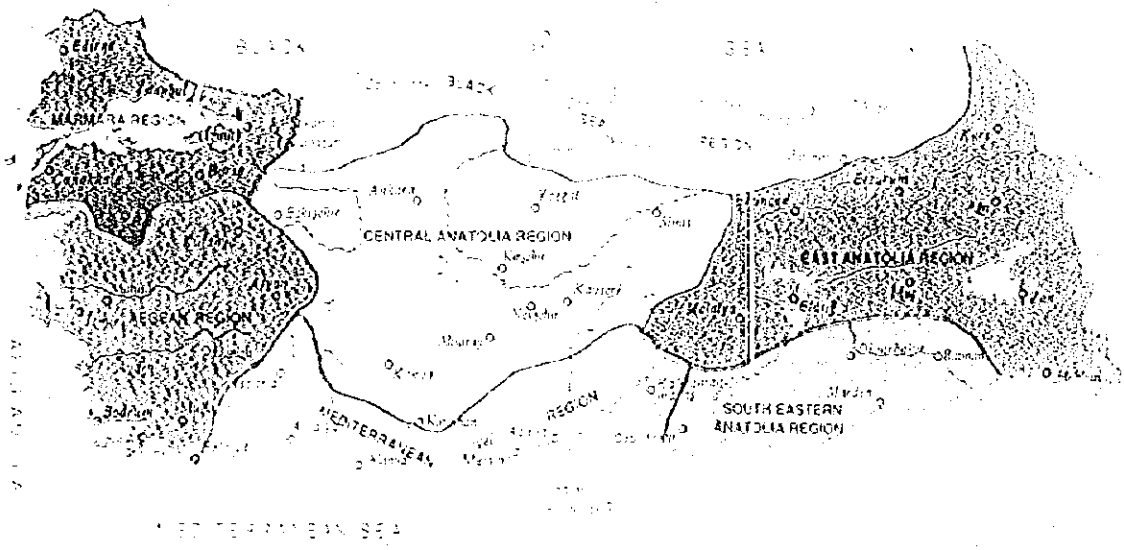


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Figure - 2.1.1 River System and Mountains Range in Turkey

Figure - 2.1.2 Geographical District of Turkey

annual rainfall is 688mm. The average temperature during the hottest months of summer July and August) is about 24°C and it varies from 5°C - 7°C in January. This is the second most humid region in Turkey with an annual average of 73% humidity.

③ Aegean Region

Fertile plains, river valleys, low hills and mountains make up the region. The climate is relatively mild and average annual rainfall is 647mm. The average temperature during the summer is 27°C or more and around 10°C during the winter (in January).

④ Mediterranean Region

All along the Mediterranean coasts, mountain ranges develop with narrow beaches or wide river plains. The climate is a mild Mediterranean climate with an average annual rainfall of 777mm. The average temperature during summer is 27°C or more and between 8 - 12°C in the winter.

⑤ Central Anatolia Region

There develops a vast high plateau broken by mountain ranges including some volcanos with snow-capped peaks. Annual rainfall is a low 382mm and dry. It is hot in the summer and the temperature is about 23°C but it is cold in the winter with average temperature of around 0°C.

⑥ Easter Anatolia Region

A mountainous with plateau and plains between mountain ranges. The average rainfall is 560mm per year. The average temperature is 9.5°C and it is cold except from June to September.

⑦ South-East Anatolia Region

The land is rolling steppe and the major rivers are the Tigris (Dicle) and the Euphrates (Firat) which flows through Iran and Syria. The region is fairly dry with 576mm average annual rainfall. It is very hot in the summer where the average temperature is 30°C and relatively warm, between 2 and 4°C in the winter.

Table - 2.1.1 shows the meteorological data recorded at the weather stations in each region. Figure - 2.1.3 shows the annual average precipitation and Figure - 2.1.4 shows the average temperatures in January and July.

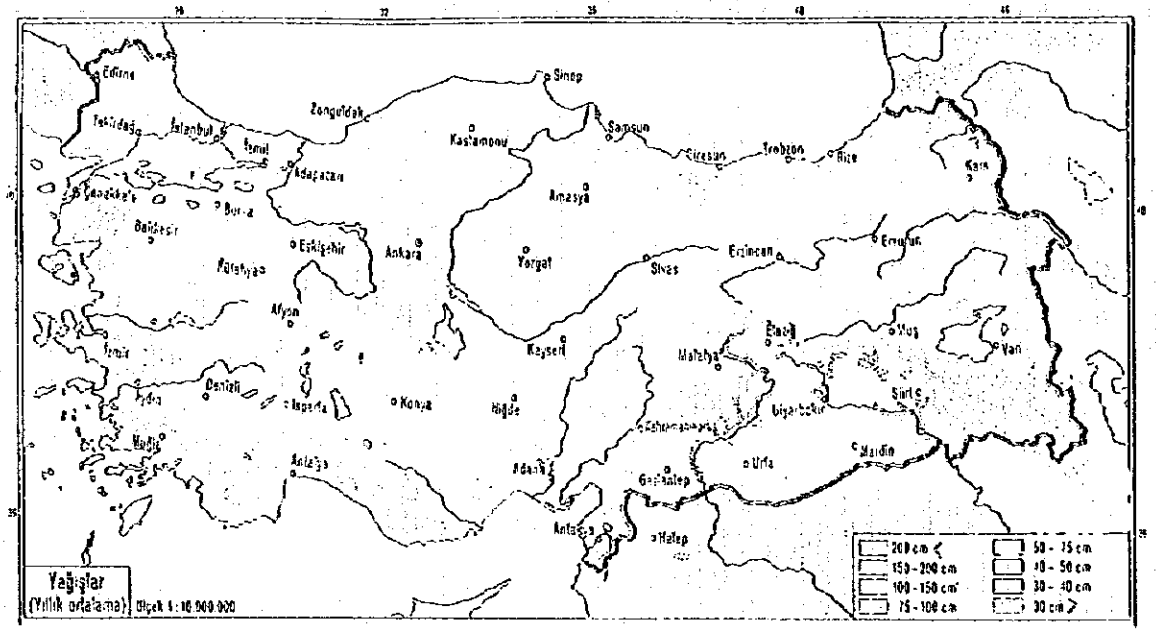
3) Geology

Geology of Turkey is a complex mosaic comprising of various rock association from the oldest Precambrian rocks to the Tertiary formation (refer to Figure - 2.1.5), as Turkey is located in the Alpine-Himalayan belt and has experienced a very complex tectonic evolution,

Table - 2.1.1 Meteological Data in Turkey

Region	Weather Station	Average Temperature (℃)	Average Precipitation (mm)	Days with Snow	Days with Frost
Black Sea	Rize	14.1	2,300.4	12.7	10.1
	Samsun	14.0	650.3	4.5	7.8
	Trabzon	14.5	833.8	6.8	7.6
	Zonguldak	13.5	1,220.2	12.0	15.7
Marmara	Istanbur	14.0	677.2	8.3	20.5
	Edirne	13.4	585.9	15.0	56.6
	Canakkale	14.8	615.4	5.0	24.5
	Bursa	14.6	696.5	9.4	34.8
Aegean	Izmir	17.6	691.1	0.3	6.1
	Mugla	14.9	1,196.3	1.6	34.1
Miditerranian	Antalya	18.5	1,052.3	0.0	1.8
	Anamur	19.2	993.5	0.1	0.3
	Adana	18.8	647.1	0.0	6.1
Central Anatolia	Ankara	11.7	377.7	21.6	84.8
	Kirsehir	11.3	378.1	25.2	96.8
	Konya	11.5	325.9	21.9	99.5
	Kayseri	10.4	375.0	40.6	127.9
East Anatolia	Erzincan	10.6	366.8	42.9	110.1
	Erzurum	5.9	447.2	112.2	155.7
	Kars	4.2	501.2	106.5	179.1
	Van	8.7	380.6	80.0	131.2
South Eastern Anatolia	Diyarbakir	15.8	491.5	12.4	62.7
	Gaziantep	14.5	502.4	11.9	55.8
	Urfa	18.1	463.1	2.8	22.5

Since: Turkey in Statistics 1994



Note: Scale is distorted

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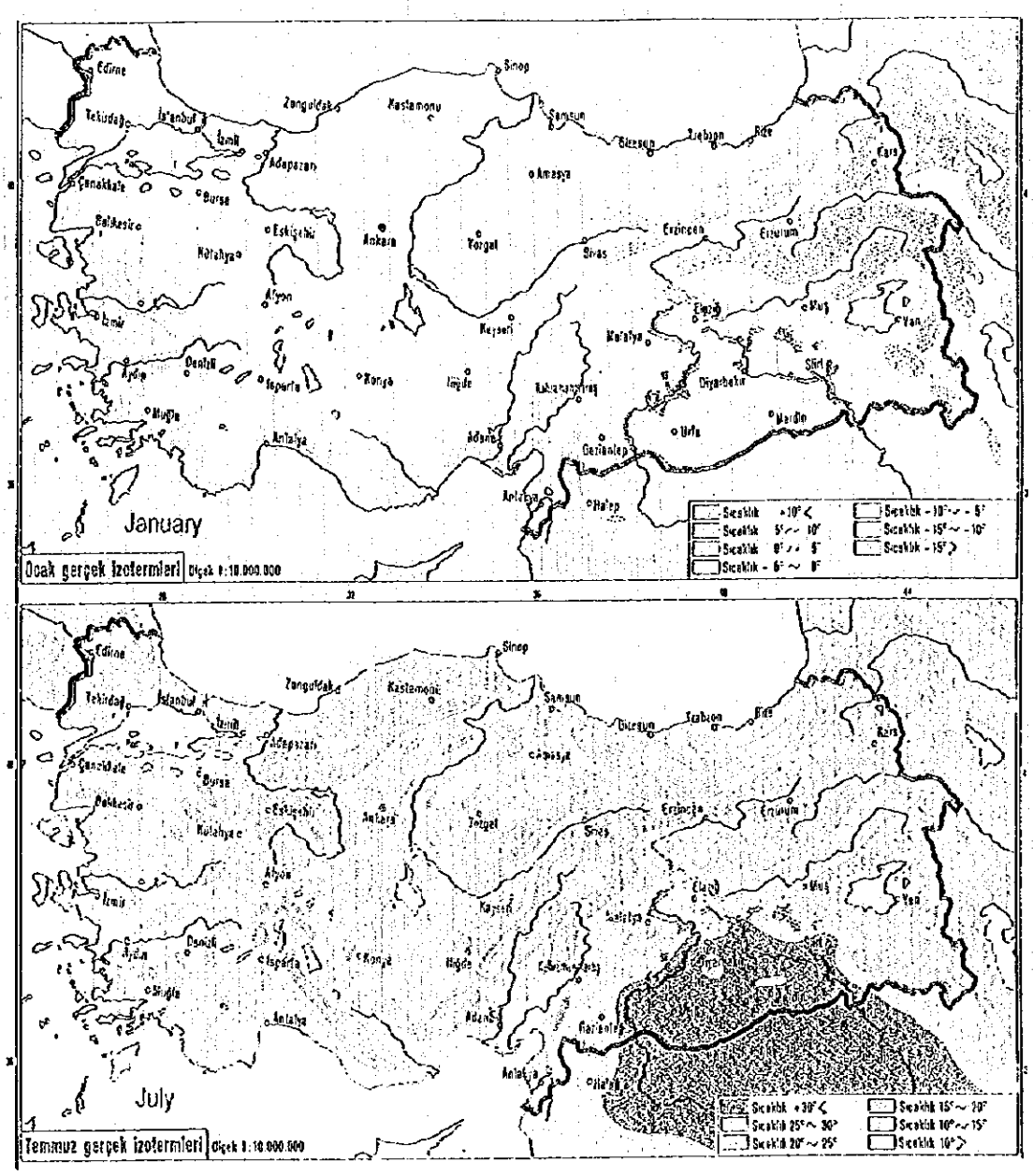

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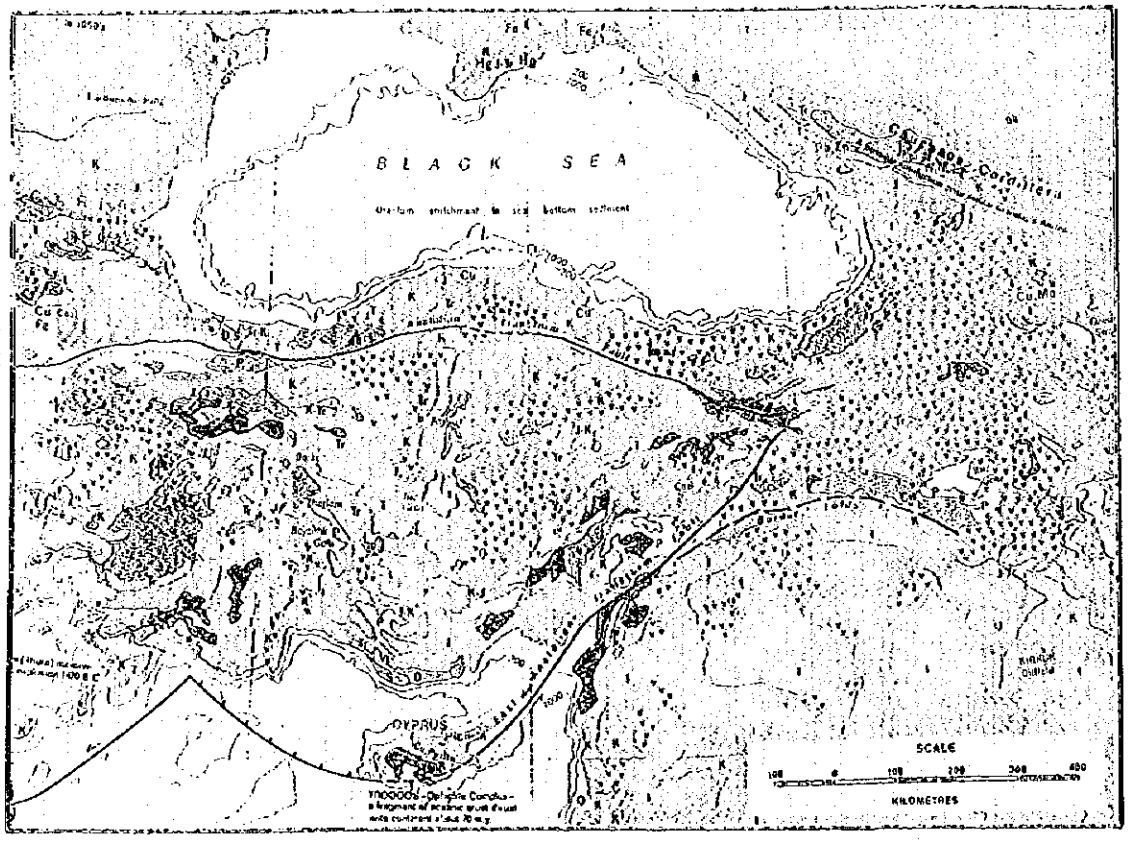

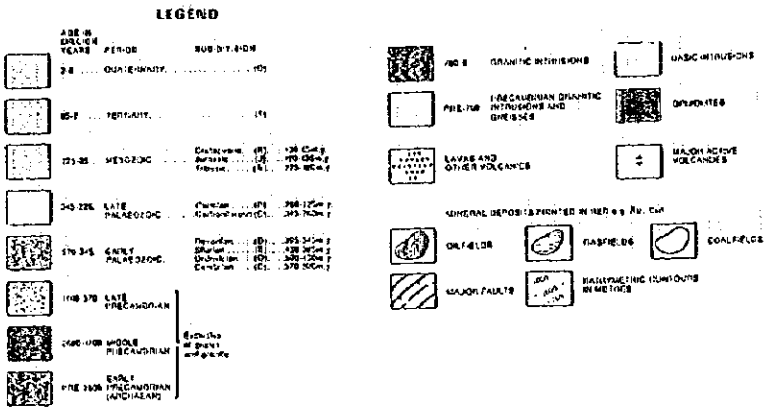

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involving multiple N-S convergence during the Mesozoic and the Tertiary ages. Ketin (1966) grouped these association into four major belts, the Pontides, the Anatolides, the Taurides and the Border folds as shown in Figure - 2.1.6. These belts extending in an east-west direction are characterized by the distinct stratigraphic sequences, indicating different geologic settings. During the Upper Miocene of the Tertiary Period, the collision of the Arabian plate with the Eurasian plate led to the lateral tectonic extrusion of the Anatolian block and formation of large strike-ship faults such as the North Anatolia Fault and the East Anatolia Fault.

Volcanic activities occurred in the Tertiary-Quaternary Periods formed four major distinct volcanic provinces; Eastern Anatolia, Central Anatolia, Western Anatolia, and Galetia Provinces, with numerous smaller volcanic centers scattered throughout Anatolia. The Central Province includes most widely known "Cappadocia region".

4) Earthquake

Turkey is one of the most frequent earthquake centers of the world. Figure - 2.1.7 shows earthquake records between 1901-1955 and 1968-1983 respectively. The seismic coefficients shown in Figure - 2.1.8 are used by KGM to design bridges and highways. Among the several earthquake zones, the followings are most particular in activities.

① The North Anatolia Earthquake Zone

It is the most intensive earthquake zone along the North Anatolia Fault which is a right-lateral strike-slip active fault. It runs about parallel to the Black Sea coast from the east through the Marmara Sea to the Aegean Sea in the west. Along this zone big earthquakes occur in interval of tens of years. The earthquakes which hit the Erzincan Town in eastern Turkey in 1939 and 1992 took 30,000 lives and 677 lives respectively and caused severe damages to buildings.

② The East Anatoria Earthquake Zone

It also runs along the East Anatolia Fault which is an active left lateral strike-slip fault extending all the way from Antakaya to Karhova where it meets the North Anatolia Fault.

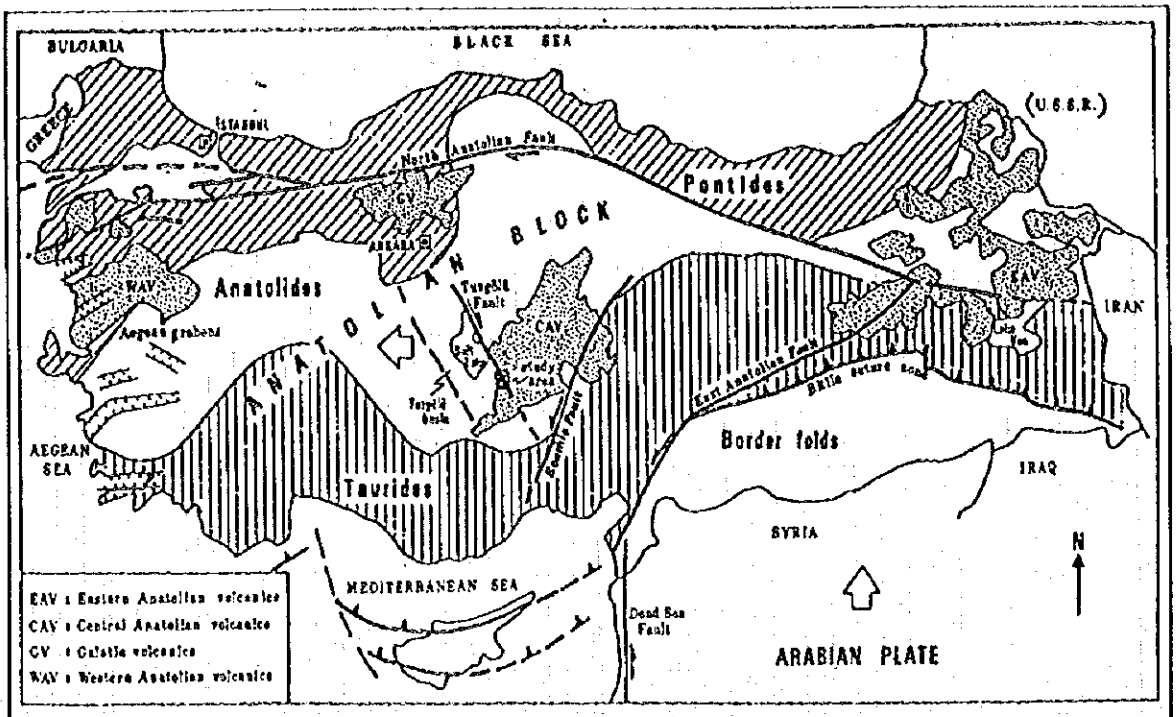
③ The West Anatolia Earthquake Zone

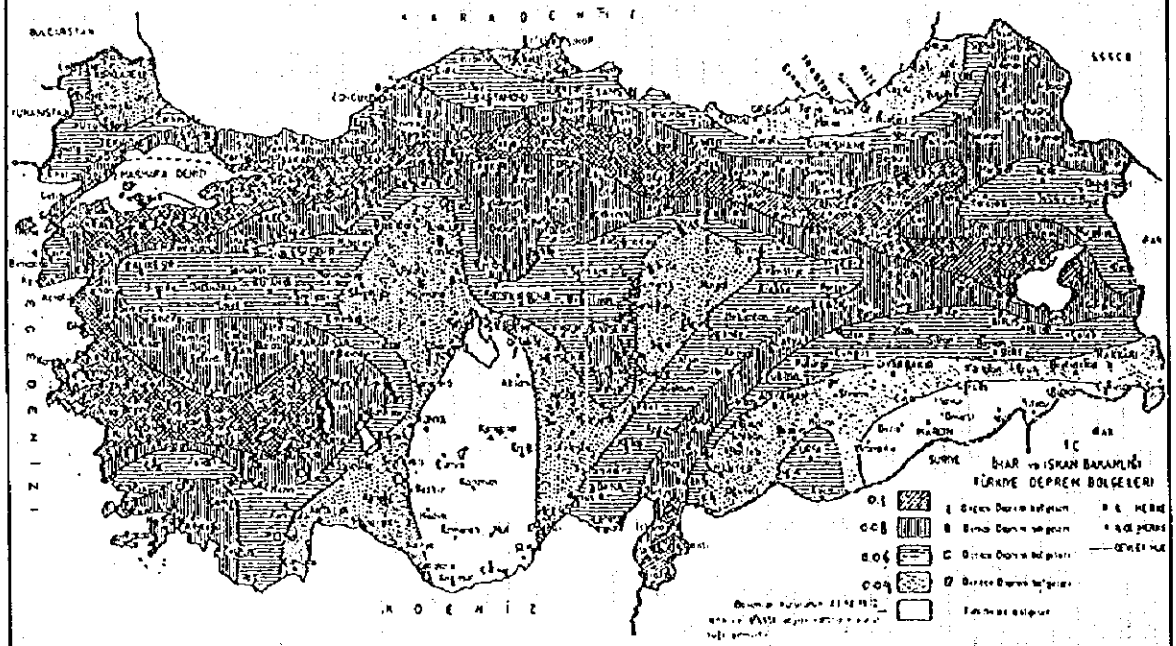
Western Anatolia is an area of intense seismic activity. This activity is closely related to the east-west trending graben complex, all of which are bounded by high angle normal faults.

2.1.2 Socio-Economic Conditions

1) Population

Turkey's population was 13,648,270 in 1927. By the 1990 census, it had reached 56,473,035. During the 63 years between 1927 and 1990, the rate of population increase was steady except for the period between 1940 to 1945, and actual population increased continuously as shown in Table - 2.1.2.





Note: Scale is distorted

THE STUDY ON THE MAINTENANCE AND REHABILITATION of HIGHWAY BRIDGES in THE REPUBLIC of TURKEY AUGUST, 1996 ORIENTAL CONSULTANTS COMPANY LIMITED in association with JAPAN OVERSEAS CONSULTANTS COMPANY LIMITED	Figure - 2.1.6 Simplified Geological Map Showing Major Tectonic Units and the Volcanic Provinces of Neogene-Quaternary Age Figure - 2.1.8 Seismic Map

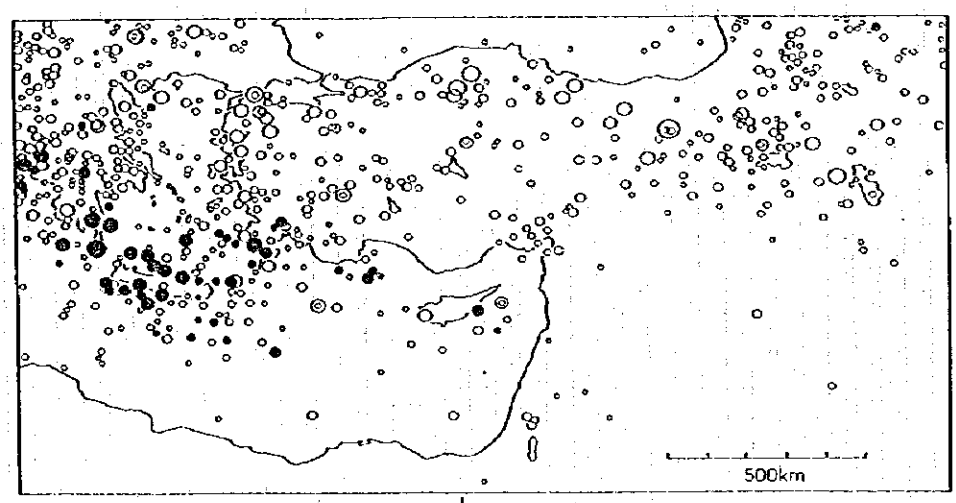
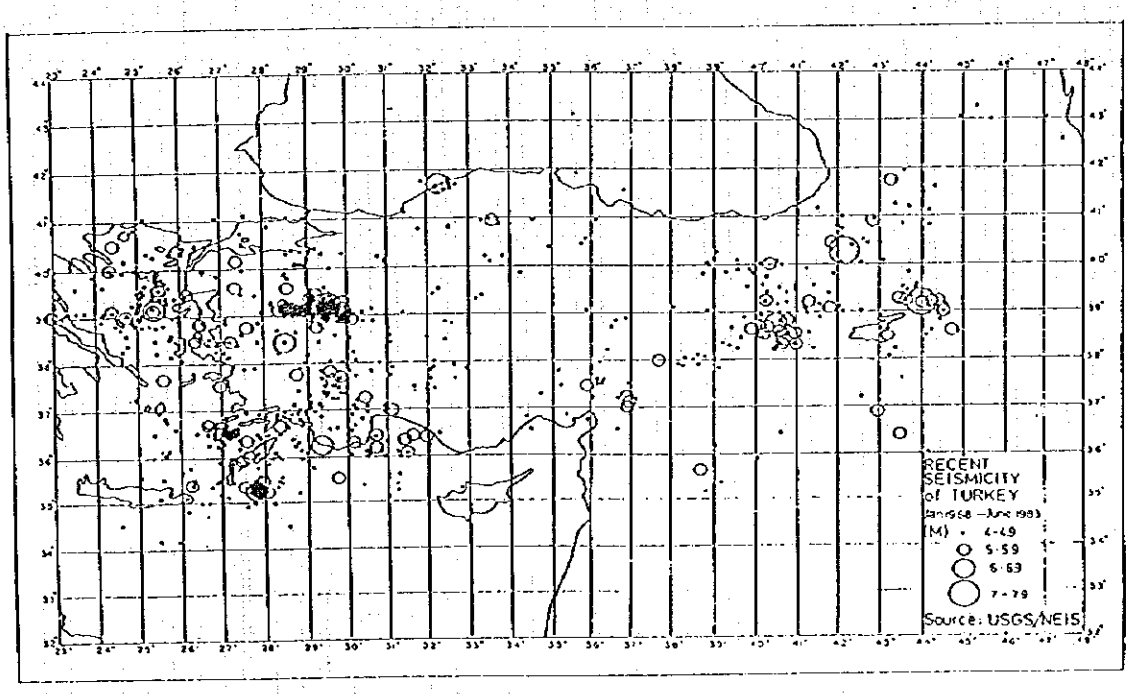


Figure - 2.1.7a Epicenters of Earthquakes in Turkey Registered in the Years 1901 - 1955

(after Karnic 1971)



THE STUDY ON THE MAINTENANCE AND REHABILITATION of HIGHWAY BRIDGES in THE REPUBLIC of TURKEY AUGUST, 1996 ORIENTAL CONSULTANTS COMPANY LIMITED in association with JAPAN OVERSEAS CONSULTANTS COMPANY LIMTED	Figure - 2.1.7 Epicenters of Earthquakes in Turkey Registered in the Years 1901-1955

Table - 2.1.2 Population by Census Year, Annual Intercensal Rate of Increase

	Population in Census Years '000	Annual Rate of Increase 0/00
1927	13,648	--
1935	16,158	21.10
1940	17,821	19.59
1945	18,790	10.59
1950	20,947	21.73
1955	24,065	27.75
1960	27,755	28.53
1965	31,391	24.62
1970	35,605	25.19
1975	40,348	25.00
1980	44,737	20.65
1985	50,664	24.88
1990	56,473	21.71

The State Institute of Statistics at Prime Ministry of the Republic of Turkey, foresees an annual rate of population increase of 2.2% and estimated the population of Turkey to be 70.1 million by the year 2,000 and 87.2 million by 2010. Table - 2.1.3 shows the population and the rates of increase in the major cities. Figure - 2.1.9 shows the population density of Turkey.

Figure - 2.1.10 shows the population distribution of major cities as of 1990. Each of the cities of Istanbul, Ankara, and Izmir have populations of more than one million, and 39 cities including Adana have a population of more than 100 thousand. The percentage of population living in urban areas reached 59% in 1990. Figure - 2.1.11 shows the ratio of city and village populations by which it can be seen that more and more people are migrating into urban areas from isolated rural areas.

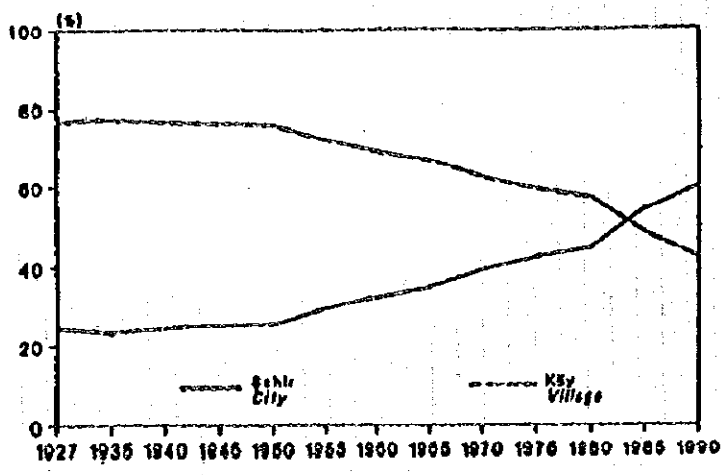
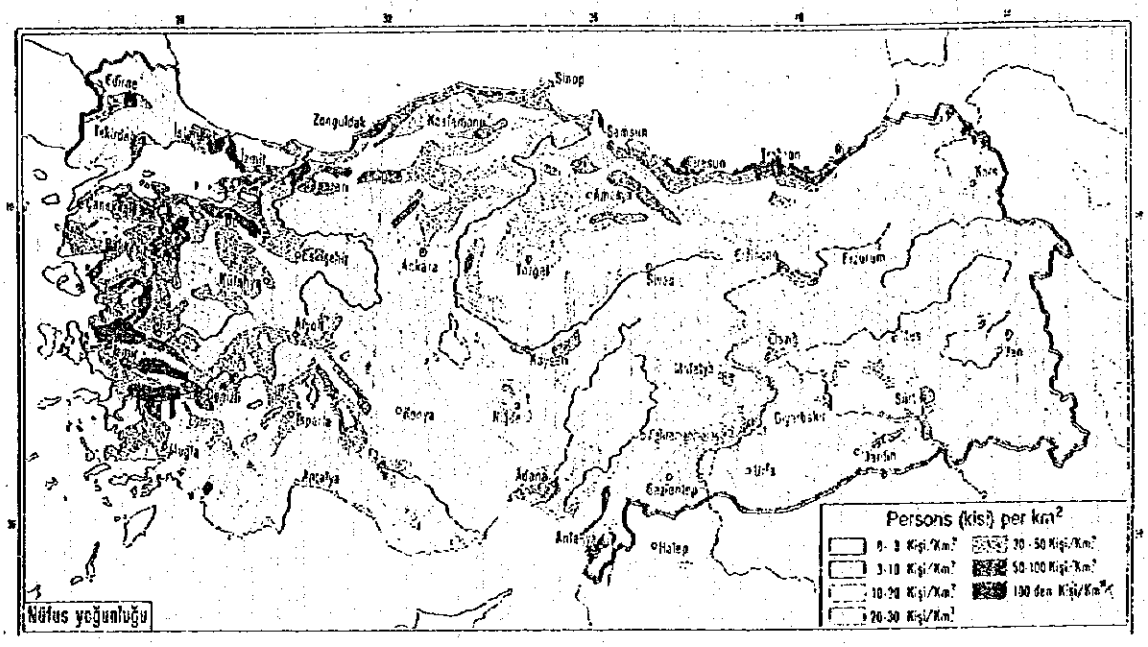


Figure - 2.1.11 Ratio of City and Village Populations by Census Year



Note: Scale is distorted

Source: State Institute of Statistics Prime Ministry
Statistical Yearbook of Turkey 1990 and 1987

THE STUDY ON THE MAINTENANCE AND REHABILITATION of HIGHWAY BRIDGES in THE REPUBLIC of TURKEY AUGUST, 1996 ORIENTAL CONSULTANTS COMPANY LIMITED in association with JAPAN OVERSEAS CONSULTANTS COMPANY LIMTED	Figure - 2.1.9 Population Density in Turkey Figure - 2.1.10 Population Centers

Table - 2.1.3 Population and Annual Rate of Population Increase of the Major Cities

	1985	1990	Annual Rate of Increase 1985-900/00
Istanbul	5,842,985	7,309,190	44.78
Ankara	2,909,946	3,236,626	21.28
Izmir	2,317,829	2,694,770	30.14
Adana	1,725,940	1,934,907	22.86
Konya	1,560,375	1,750,303	22.97
Bursa	1,324,015	1,603,137	38.26
Icel	1,034,085	1,266,995	40.63
Samsun	1,106,219	1,158,400	9.22
Manisa	1,048,297	1,154,418	19.29
Gaziantep	966,918	1,140,594	33.04
Antalya	891,149	1,132,211	47.88
Hatay	1,002,252	1,109,754	20.38
Diyarbakir	934,505	1,094,996	31.70
Zonguldak	1,044,945	1,073,560	5.40
S.Urfa	795,034	1,001,455	46.16
Balikesir	910,282	973,314	13,39
Kayseri	864,060	943,484	17.59
Kocaeli	742,245	936,163	46.42
K.Maras	840,044	892,952	12.22
Erzurum	856,175	848,201	-1.87

Note : 1985 and 1990 General Population Censuses.

Table - 2.1.4 shows the population of Turkey by region.

Persns (Thouands) Table - 2.1.4 Population by Region

Year / Region	1970	1975	1980	1985	1990	2000	2010
Thrace & Marrmara	6,698	7,927	9,288	10,936	13,120	18,746	26,490
Black Sea	4,538	4,859	5,204	5,536	5,607	5,681	5,661
Agean	3,167	3,557	4,009	4,597	5,237	6,679	8,328
Mediterranean	2,795	3,368	3,934	4,653	5,444	7,377	9,874
W. Anatolia	2,809	3,017	3,221	3,538	3,865	4,529	5,192
C. Anatolia	9,345	10,598	11,439	12,697	13,633	15,508	17,347
SE. Anatolia	1,597	1,832	1,976	2,413	2,962	4,203	5,848
E. Anatolia	4,656	5,185	5,662	6,290	6,605	7,441	8,435
Total	35,605	40,343	44,733	50,660	56,473	70,164	87,175

Source : State Institute of Statistics Prime Ministry

2) Political Structure

The Republic of Turkey is a parliamentary democracy. National legislature is unicameral Meclis of 450 members directly elected for a five-year term. Only parties gaining more than 10% of the national vote are eligible for seats in the Turkish Grand National

Assembly (TGNA). Last election was in October, 1991 and next election is due in October 1996. The head of the state is the President, elected by the absolute majority of the Meclis for a seven-year term. He or she is supposed to be above politics and symbolizes the nation. Prime Minister appointed by the president to form a government decides its policies and directions. In April 1993, Mr. Suleyman Demirel was elected to be the 9th president of the Turkish Republic. In June 1993, President Demirel asked Ms. Tansu Ciller to form a government, thereby making her Turkey's first female prime minister. The present government is a coalition of the True Path Party (DYP) and the Social Democrat Populist Party (SHP).

3) Economy

Turkey had traditionally a strong agricultural base to its economy, being among the handful of countries which are net exporters of food. After 1980, Turkey undertook a number of market reform measures. These reforms precipitated a great deal of structural change in the Turkish economy. Since then, some positive improvements have been observed in the manufacturing and financial sectors, and high growth rates have continued until recently, except in 1991 which is 0.4%. Presently, manufactured goods dominate exports and much of the economy. Table - 2.1.5 shows the changes of Gross National Product (GNP) since 1968, and Table - 2.1.6 illustrate various recent economic data.

Table - 2.1.5 Gross National Product (GNP) (At 1987 prices)

Year	Value at Constant Producers Prices Billion TL	Growth Rate %	Per Capita at Current Producers Prices ($)
1968	31,635.2	--	537
1969	33,002.6	4.3	586
1970	34,468.6	4.4	539
1971	36,897.4	7.0	476
1972	40,279.2	9.2	592
1973	42,255.0	4.9	734
1974	43,633.2	3.3	980
1975	46,275.4	6.1	1,184
1976	50,438.0	9.0	1,312
1977	51,944.3	3.0	1,467
1978	52,582.2	1.2	1,567
1979	52,324.2	-0.5	1,877
1980	50,869.9	-2.8	1,539
1981	53,316.8	4.8	1,570
1982	54,963.2	3.1	1,375
1983	57,279.0	4.2	1,264
1984	61,349.8	7.1	1,204
1985	63,989.1	4.3	1,330
1986	68,314.9	6.8	1,462
1987	75,019.4	9.8	1,636
1988	76,108.1	1.5	1,684
1989	77,347.3	1.6	1,959
1990	84,591.7	9.4	2,687
1991	84,892.5	0.4	2,620
1992	90,344.4	6.4	2,700
1993	97,216.4	7.6	2,883

Source : Turkey in Statistics 1994

Table - 2.1.6 Recent Economic Data

Economic structure

Latest available figures

Economic Indicators	1989	1990	1991	1992	1993
GNP at market prices TL trn	233.1	395.3	622.6	1,072.1	1,928
Real GNP growth %	2.3	9.2	0.5	5.9	7.6
Consumer price inflation %	63.3	60.3	66.0	70.1	66.1
Population m (mid-year)	54.9	56.1	57.3	58.6	59.8
Exports fob $ bn	11.78	13.03	13.67	14.89	15.61
Imports cif $ bn	16.00	22.58	21.00	23.08	29.78
Current account $ bn	0.97	-2.61	0.27	-0.94	-6.4
Reserves excl gold $ m (Dec)	4,780	6,050	5,144	6,159	6,277
Total external debt $ bn (Dec)	41.4	49.2	50.3	54.9	65.8
PSBR as % of GNP	n/a	n/a	14.1	12.6	16.3
Exchange rate (av) TL:$	2,122	2,609	4,172	6,872	10,985

October 15, 1994 TL35,000:$1; TL23,025:DM1

Origins of gross domestic product 1993	% of total	Components of gross domestic product 1992	% of total
Agriculture, forestry & fishing	15.1	Private consumption	65.8
Industry	26.6	Government consumption	13.7
Construction	7.4	*Gross fixed investment*	23.5
Services	49.9	Stockbuilding	-0.7
GDP at factor cost	100.0	Exports of goods & services	16.1
		Imports of goods & services	-18.4
		GDP at market prices	100.0

Principal exports 1993	$ m	Principal imports 1993	$ m
Clothing	3,841	Non-electrical machinery	5,261
Iron & steel	1,991	Iron & steel	3,057
Other textiles & carpets	915	Crude oil	2,550
Synthetic fibres	514	Electrical machinery	2,096
Leather	441	Organic chemicals	1,038
Canned food	384	Plastics	830

Main destinations of exports 1993	% of total	Main origins of imports 1993	% of total
Germany	23.8	Germany	15.4
USA	6.4	USA	11.4
UK	5.4	Italy	8.7
France	5.0	France	6.6
Italy	4.9	Japan	5.5
Russia	3.4	Russia	5.2
EU	47.5	Saudi Arabia	5.1
		EU	44.0

Source : EIU Country Report - 4th Quarter 1994

The independence of the Central Asian Turkish speaking countries nearby is giving an important boost to the Turkish economy. These developing countries need modern goods and services of all types and Turkey stands ready and able to provide them. However, at the same time the economic reform has affected the economy causing consumer price inflation to as cakte and a deficit in the natural account. Table - 2.1.7 shows the exchange rate from 1989 to December 1993, the value of one US dollar in Turkish money markets increased from 2,316 to 14,487 TL. By June 1995, this forex policy had gone disastrously wrong. The value of US$1 had gone up to 40,000TL.

Table - 2.1.7 Exchange Rates - US Dollars

	Buying	Selling
1975	15.00	15.30
1976	16.50	16.83
1977	19.25	19.64
1978	25.00	25.50
1979	35.00	35.70
1970	89.25	91.04
1981	132.30	134.95
1982	184.90	188.60
1983	280.00	285.60
1984	442.50	446.97
1985	574.00	579.71
1986	755.90	759.68
1987	1,018.35	1,023.44
1988	1,813.02	1,816.65
1989	2,311.37	2,316.00
1990	2,927.13	2,933.00
1991	5,074.83	5,085.00
1992	8,555.85	8,573.00
1993	14,458.03	14,476.00

Source : Central Bank of Turkey

2.1.3 National Development Plans

The Five-Year Economic Development Plans have been prepared since 1963 after the National Planning Agency was founded in 1960. They have been approved by the Parliament and implemented upto the 6th Five-Year Plan. However the Plan was "vacant" in 1978, due to the political confusion, and again in 1984 because the nation was transferred to the civil administration after the cout d'etat in that year. Plans so far implemented and actual growth rates are as shown below:

	Year	Planned Growth Rate	Results
1st Five-Year Plan	1963-67	7.0%	6.6%
2nd Five-Year Plan	1968-72	7.0%	7.1%
3rd Five-Year Plan	1973-77	7.9%	6.5%
4th Five-Year Plan	1979-83	8.0%	2.1%
5th Five-Year Plan	1985-89	6.3%	5.2%
6th Five-Year Plan	1990-94	7.0%	N.A.

The 6th Five-Year Development Plan for the period 1990 to 1994, approved in the parliament, had following strategy;

a. Rapid development with the growth rate of 5.5% in 1990 to 8.3% in 1994.
b. More private sector investment
c. Increasing social welfare stimulating private consumption
d. A gradual decrease in the rate of inflation to 10% by 1994
e. Foreign exchange balance to be improved

The results of the 6th Plan has not been available. Due to the economic instability of Turkey, the 7th five-year development plan was not approved officially and it is being run under 1995 Transitional Program. The content of the program is summarized as follows;

1995 TRANSITION PROGRAM
PART 1
I. General Economic Conditions and the Basic Aims and Macro-economic Targets of the 1995 transition Program
II. Developments in the World Economy
III. 6th Five Year Development Plan Implementation
IV. Growth and Structure of Production
V. Use and Direction of Resources
VI. Foreign Economic Relations
VII. Balance of Public Finances
VIII. Money-Credit, Banks, Capital Market and Insurance
IX. Prices
X. Agricultural Products Incentive Price and Purchases

PART 2
I. Developments Regarding Economic Sectors
II. Agriculture
III. Mining
IV. Manufacture Industry
V. Energy
VI. Transportation
VII. Communication
VIII. Tourism
IX. Construction, Engineering, Consultancy and Architectural Services

PART 3 Developments Regarding Social Sectors
I. General Conditions
II. Demographic Structure
III. Health
IV. Education and Culture
V. Human force and Employment
VI. Distribution of Income and Wealth
VII. Working Life
VIII. Social Security, Social Services and Aid

IX. Tradesmen, Artisans and Small Industry
X. Science, Research-Development and Technology
XI. Environment
XII. Settlement and Urbanisation
XIII. Development Priority Regions and Regional Development

PART 4 Developments in the Public Services

PART 5 Policies and Measures
I. Macroeconomic Policies and Measures
II. Measures Related to Economic Sectors
III. Measures Related to Social Sectors

The details of the above are not available.

2.2 Transportation

2.2.1 General

The country's transport is multiple-model, consisting of road, water shipping, air and rail.

In passenger tranportation, the road transportation has a dominant share of Transportation, 94.2%, follwed by rail transportion,4.6%. As regards the freight transportation, the road transportation has a dominant share of transportation, 91.1%, fallowed by rail transporation, 7.9%.

Table - 2.2.1 Modal Spilit of passenger/Feight Transportation

Transportation Models	Freight Transportation		Passenger Transportation	
	Ton•km	%	Person•km	%
Road	97,843	91.1	146,029	94.2
Rail	8,511	7.9	7,147	4.6
Water Shipping	901	0.8	53	0.1
Air	152	0.2	1,721	1.1
Total	107,407	100.0	154,950	100.0

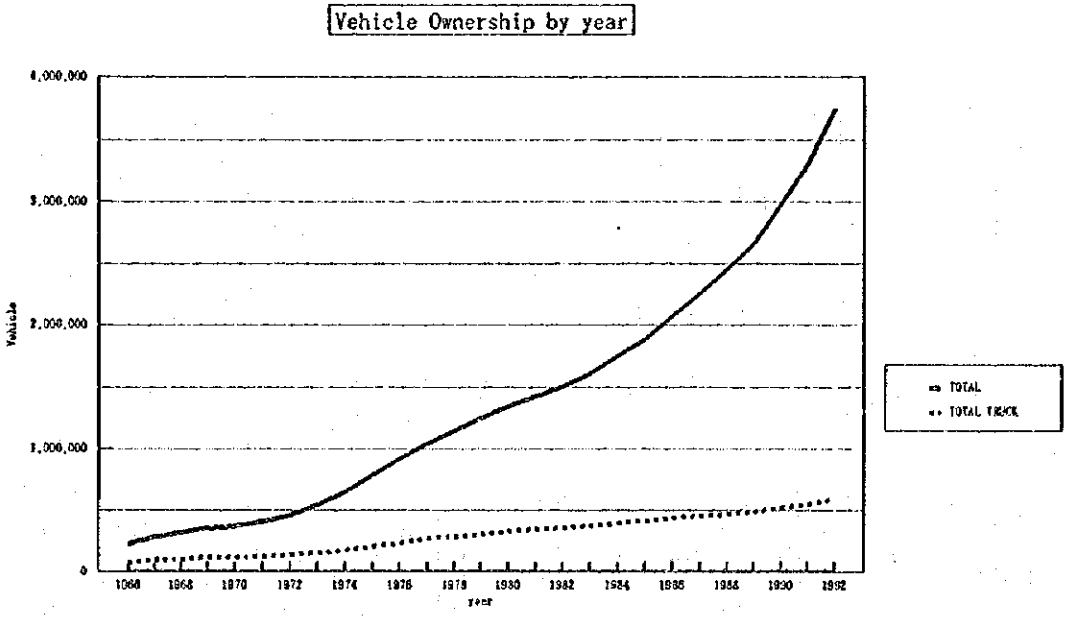
2.2.2 Land Transportation

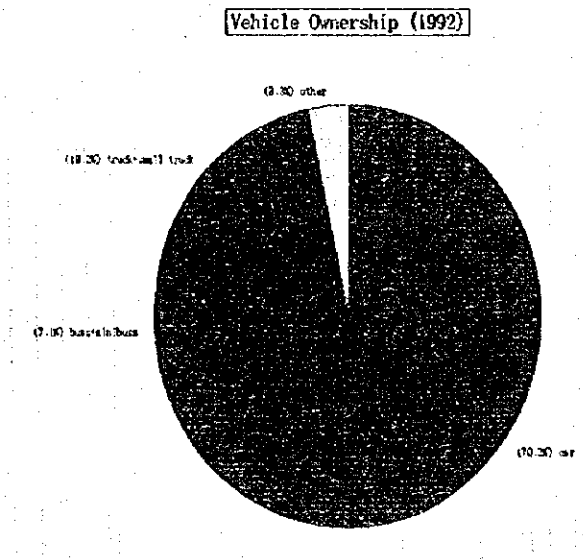
1) Road

a) Vehicle Registration

The total number of registered Vehicles in 1992 accounts for nearly 3.8 million vehicles (include Motorcycle), about 10.2 times in 1970 (Table - 2.2.2, Figure - 2.2.1). Of these, passenger cars have a proportion of 70.3%(2.2million cars), followed by trucks 19.2%(0.6million cars). Number of Vehiles per population in 1,000 person is 53.75.(Table - 2.2.3, Figure - 2.2.2)

As regards the total number of new registered Vehicles in 1993 accounts 0.74 million vehicles. And number of producted vehicles in 1993 accounts 0.45 million vehicles (Table - 2.2.3).





THE STUDY ON THE MAINTENANCE AND REHABILITATION of HIGHWAY BRIDGES in THE REPUBLIC of TURKEY AUGUST, 1996 ORIENTAL CONSULTANTS COMPANY LIMITED in association with JAPAN OVERSEAS CONSULTANTS COMPANY LIMTED	Figure - 2.2.1 Vehicle ownership by year Figure - 2.2.2 Vehicle ownership by car type (1992)

Table - 2.2.2 Motorlu kara tasitlari, 1966-1992-Road motor vehicles, 1966-1992

Year	Total	Car	Minibus	Bus	Small Truck	Truck	Motorcycle	Special purpose vehides	Road constructio n and work machinery
1966	231,977	91,469	10,913	12,041	31,462	47,931	32,099	3,610	2,452
1967	284,194	112,367	16,008	13,332	39,927	56,889	39,647	3,641	2,383
1968	318,768	125,375	18,967	13,948	43,441	62,616	47,062	4,033	3,326
1969	354,398	137,345	20,540	15,529	48,655	69,478	52,959	4,568	5,324
1970	369,808	137,771	20,916	15,980	52,152	70,730	60,994	5,070	6,195
1971	403,880	153,676	22,380	17,140	57,011	73,433	68,417	5,349	6,474
1972	460,087	187,272	25,559	18,504	62,796	78,920	74,402	5,747	6,887
1973	543,318	240,360	30,055	20,011	71,043	86,780	80,860	6,420	7,789
1974	647,947	313,160	34,122	21,404	81,025	95,309	86,028	7,338	9,561
1975	785,920	403,546	40,623	23,763	98,579	108,381	91,421	8,450	11,157
1976	920,141	488,894	46,066	25,388	116,861	122,176	96,984	9,224	14,548
1977	1,042,239	560,424	51,999	27,096	134,213	138,093	102,127	10,137	18,150
1978	1,142,561	624,438	56,836	28,559	144,695	146,551	109,890	10,698	20,894
1979	1,247,834	688,687	61,596	30,634	155,278	157,095	120,378	11,291	22,875
1980	1,344,254	742,252	64,707	32,783	165,821	164,893	137,931	11,777	24,090
1981	1,420,688	776,432	66,514	33,839	172,269	172,372	160,557	12,459	26,246
1982	1,502,370	811,465	69,598	35,432	178,762	180,772	182,795	13,386	30,160
1983	1,610,681	856,350	73,585	38,478	186,427	190,277	217,327	14,705	33,532
1984	1,751,834	919,577	80,697	43,638	198,106	197,721	256,338	16,312	39,445
1985	1,888,767	983,444	87,951	47,119	212,505	205,496	289,052	17,639	45,561
1986	2,075,408	1,087,234	97,917	50,798	224,755	217,111	327,326	19,448	50,819
1987	2,258,500	1,193,021	106,314	53,554	233,480	225,872	369,894	21,236	55,129
1988	2,456,688	1,310,257	112,885	56,172	240,718	234,166	420,889	23,301	58,300
1989	2,659,778	1,434,830	118,026	58,859	248,567	241,392	472,853	25,060	60,191
1990	2,981,222	1,649,879	125,399	63,700	263,407	257,353	531,941	26,519	63,024
1991	3,307,324	1,864,344	133,632	68,973	280,891	273,409	590,488	28,606	66,981
1992	3,756,137	2,181,388	145,312	75,592	308,180	287,160	655,347	31,158	72,000

Source: State Institute of Statistics, Prime Ministry,
Republic of Turkey Motor Vehide Statistics 1992

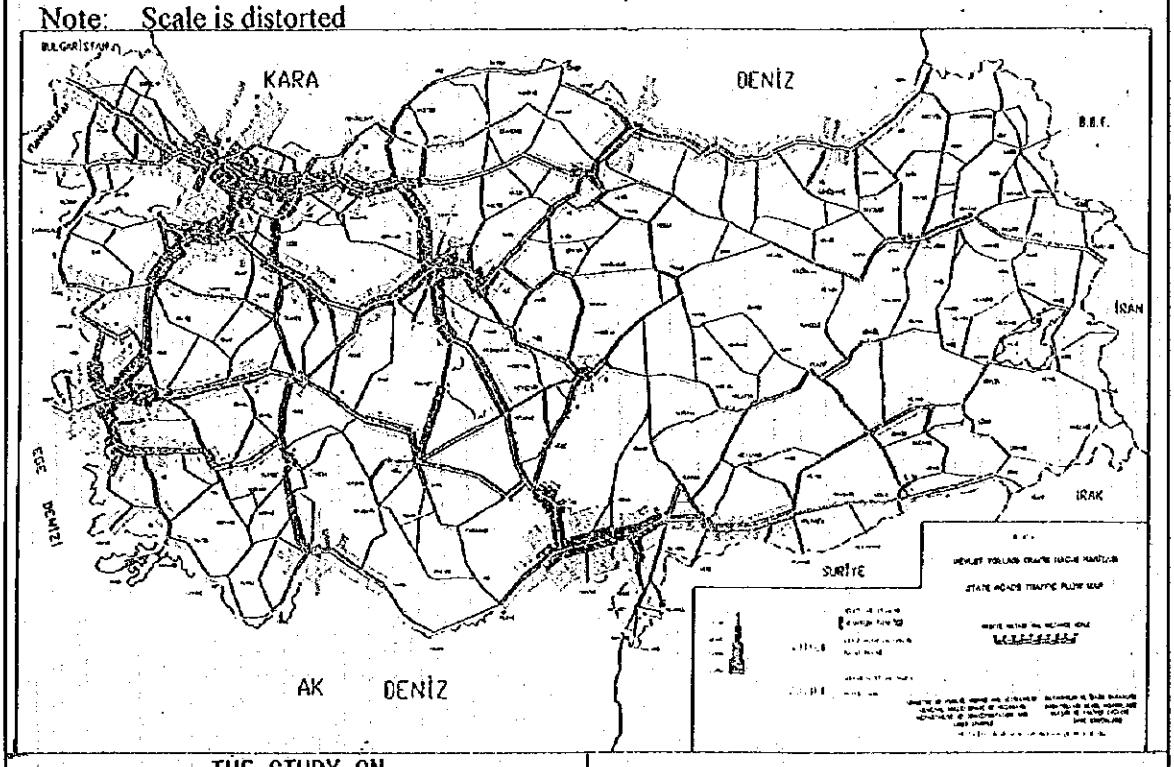
Table - 2.2.3 Vehicle Registration (1993)

	new Registration	product
Passenger car	515,521	360,197
Busses	12,994	9,368
Trucks	89,281	50,563
Others	125,954	33,356
Total	743,750	453,484

b) Road Network

The total length of road in the Turkey is about 390,000km as 1994. Roads in Turkey can be classifified as motorways, state roads, and provincial roads controlled by KGM(61,000km). Village roads are countrolled by the Ministry of Cultivation and Village Affairs, and city streets are controlled by each municipality.
Table - 2.2.4 indicates the length of Highway Network by system and years. The total length of State roads is about 31,000Km, which is 8.1% of the total. Figure - 2.2.3 shows the network of state roads. State roads are facilities which connect major cities in TRurkey. Provincial roads connect local cities whith state highways, and the total length is about 28,000Km.

Note: Scale is distorted



THE STUDY ON THE MAINTENANCE AND REHABILITATION of HIGHWAY BRIDGES in THE REPUBLIC of TURKEY AUGUST, 1996 ORIENTAL CONSULTANTS COMPANY LIMITED in association with JAPAN OVERSEAS CONSULTANTS COMPANY LIMTED	Figure - 2.2.3 State Road Network Figure - 2.2.4 State Road Traffic Flow map (1993)

Table - 2.2.4 Length of Highway Networks(Km) by Systems and Years

Years	Motorways	State Roads	Provincial Roads	Village Roads	TOTAL
1950	-	24306	22774	-	47080
1960	-	26711	34831	-	61542
1970	-	35016	24437	76957	136410
1980	27	31976	28785	172103	232891
1981	27	31888	28824	268817	329556
1982	27	31953	29001	234145	295154
1983	61	31210	28087	243350	302708
1984	81	30982	28130	251209	310402
1985	81	30997	28305	257508	316891
1986	95	30986	28153	261558	320792
1987	115	31062	27853	269154	328184
1988	138	30999	27852	271511	330500
1989	160	31048	27504	297579	356291
1990	281	31149	27979	308597	368006
1991	387	31261	27960	308602	368210
1992	757	31343	28499	326522	387121
1993	1063	31424	28346	327253	388086

c) Pavement Conditions

Table - 2.2.5 shows the total length of roads controlled by KGM, by surface types as 1994. The percentage of pavement (including Stone Block) is 83.4%. Specially,the percentage of State Roads with asphalt pavement is 94.1%.

Table - 2.2.5 Pavement Road Length by Surface types(1994)

Pavement	Asphalt Concrete	Bitumen Surfacing	Stone Block		Gravel	Earth	TOTAL
Motorway	1,070	0	0	0	0	0	1,070
State road	4,488	25,086	43	1,263	128	416	31,424
Provincial road	117	19,874	85	6,089	1,297	884	28,346
TOTAL	5,675	44,960	128	7,352	1,425	1,300	60,840

(km)

d) Traffic volumes

KGM carry out regularly Traffic volume survey and Axle load survey by every year. KGM has a many Axle load meter. Table - 2.2.6 indicates number of survey points by each division, by year. Survey points are presented in Appendix 1.

Table - 2.2.6 Number of survey points

Survey Type	Year	Division No.																Total
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
24hour Traffic volume	1990	5	5	5	7	7	5	5	4	5	3	1	6	4	5	5	3	75
	1991	12	16	14	16	14	10	13	10	10	8	11	10	14	13	6	11	188
	1992	8	14	12	12	13	9	11	5	7	7	6	9	15	9	5	11	153
	1993	5	15	8	7	161	13	16	4	4	11	5	5	19	12	5	12	157
	1994	6	17	9	17	7	12	17	6	0	10	0	15	17	10	9	9	171
	1995	2	13	6	0	2	3	12	3	0	0	0	5	6	6	2	3	63
8hour Traffic volume	1990	14	17	14	10	14	9	147	7	10	11	9	14	17	25	4	11	200
	1991	9	10	6	5	11	5	13	3	6	8	2	8	9	18	5	4	116
	1992	13	15	9	10	13	11	12	8	10	11	6	12	10	23	9	3	176
	1993	12	17	15	10	18	4	8	9	9	11	5	9	9	20	13	2	175
	1994	9	10	12	3	20	5	10	5	10	11	10	7	11	23	12	6	162
	1995	10	5	10	3	29	11		7	10	20	11	12	19	11	19	6	193
8hour Traffic volume	1990	2	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	45
	1991	3	3	3	3	3	3	3	3	3	2	3	3	3	3	1	3	45
	1992	3	3	3	3	2	3	3	3	2	2	2	3	3	3	1	3	42
	1993	3	3	3	3	2	3	2	3	3	2	2	3	3	3	2	3	43
	1994	3	3	3	3	2	3	3	1	3	2	0	3	3	1	1	3	37
	1995	3	3	3	3	2	3	3	3	4	2	2	2	2	2	1	3	41

Traffic volumes on major state road in 1994 are shown in Figure - 2.2.4 Volumes are higher near urban area such as Istanbul, Ankara, Izmir, Adana, Antalya and Mersin.
The road that Truck volume are higher, are near Istanbul, Ankara, Bursa, Izmir, Adana, Mersin.

2) Railway

The railway is maneged and operated by the national railway enterprises(TCDD). The total length of railway was 8,430Km in 1993. The number of passenger carried 150 million in 1993. There is electriced line near urben area such as Istanbul, Ankara. On the other line, Diesel locomotion and a few Streem locomotion are used.

2.2.3 Sea Transportaition

Turkey is surrounded by the Black Sea, Aegean Sea and the Mediterranean Sea. Turkey has a coastline of 8,000Km. Therefore there are many ports and harbors along the coastline. There are 12 main ports, 30smaller ports and another 35 ports , especially five major ports as Istanbul, Izmir, Mersin, Iskenderun and Trabzon, are industrial and trade centers in Turkey. The Turkish ports handled 52.5million tons from freign trade in 1988.

2.2.4 Air Transportation

There are 19 airports in the Turkey, especially three international airports located at Istanbul, Ankara and Izmir. There were a total number of 36,03 flights, consisting of 12,707 international and 23,366 domestic flights in 1989.

The number of annual passengers is 9.4million in Istanbul, 2.8million in Ankara and 2.5million in Izmir.

Chapter 3

Present Situation of Highway Bridges

Chapter 3 Present Situation of Highway Bridges

3.1 Highway Operation and Management

3.1.1 Administration and Funding

The centre for all Highway administration is in the KGM General Directorate in Ankara. The responsibilities of the various departments are clearly defined and nation-wide activities are co-ordinated from here. These departments are in turn assisted by 18 Regional Divisions around the country, the latest being the 18th Division with its centre at Kars in Eastern Turkey. The map showing the eighteen Divisions is attached as

Figure - 3.1.1 With the exception of the 17th Division, all Divisions are responsible for all categories of roads. The 17th Division, based in Istanbul, is only responsible for the administration of motorways. In all the KGM employs a total of 5615 technical personnel (as at 31.12.1994), of which 1990 are engineers and 369 of these engineers are at the General Directorate in Ankara. An organisation chart of the KGM in Turkey is given in Figure - 3.12.

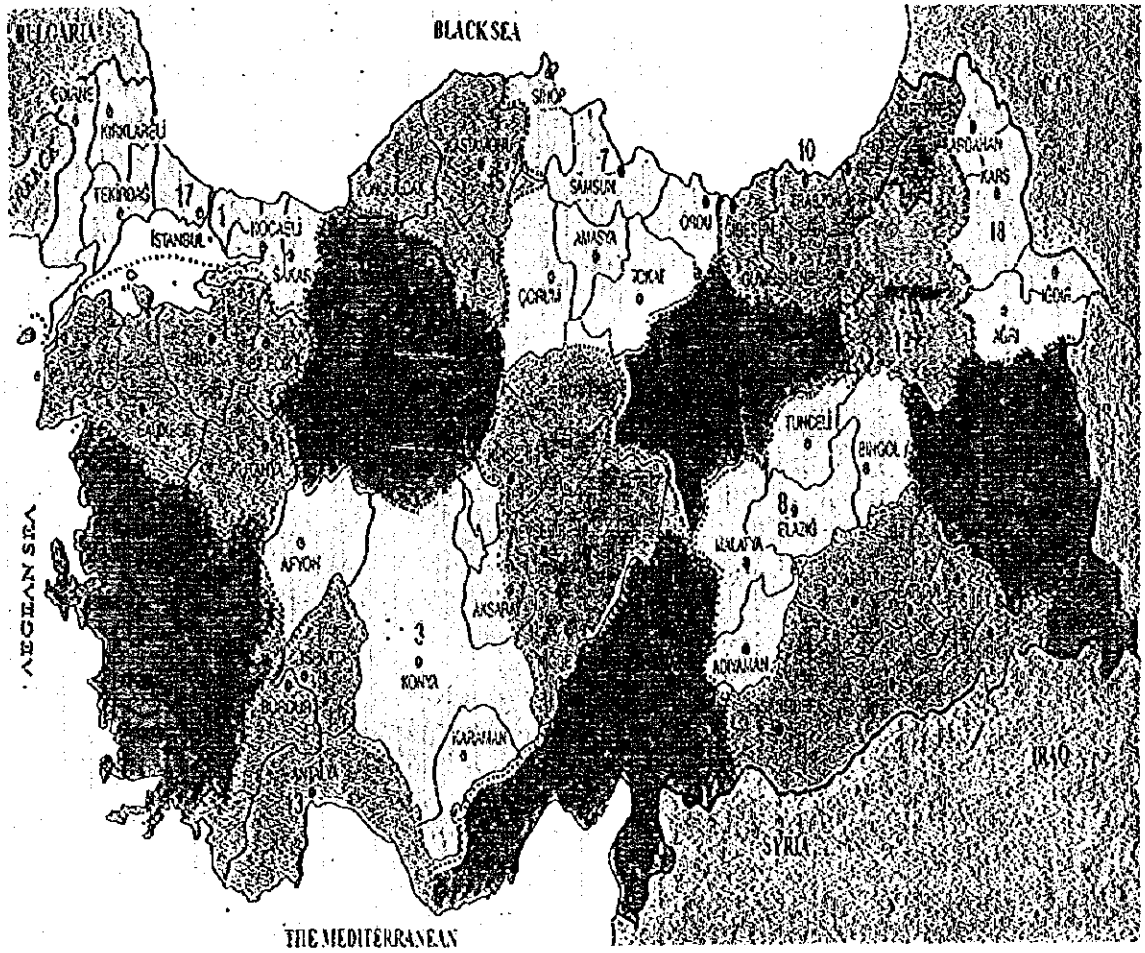
The Highway budget required by the KGM has to be approved by the State Planning Organisation (SPO). Each year the General Directorate will collate all the projected expenditure requirements from all the Regional Divisions for evaluation, both in terms of necessity and urgency. In these days, central government funding is not readily available and only the important and critical expenditures are included in the budget application. KGM is currently facing a budgetary problem and a backlog of work is awaiting funding. There is a worry that the available budget is too thinly spread and ineffective in solving the current dilemmas. Secondary activities such as preventative and necessary maintenance are always on very low priority.

Other sources of funding are from the international funding agencies such as the World bank, OECF, EIB and EBRD. The allocation by these agencies is for specific projects and will always require the approval and guarantee of the Treasury. These projects are usually of essential national importance and have the necessary criteria to satisfy the funding objectives. Also it is imperative for KGM to get the additional finances to be above the allocated annual budget ceiling. Otherwise it will be deducted from the allocated budget, which is of no advantage to KGM.

Currently there is a favoured type of funding that is being actively encouraged by the central government. This is the private financing via the Build, Operate and Transfer (BOT) model. Prospective investors had already been invited to participate on two strategic bridge crossings and concessionaires had been committed for a number of motorway service area projects. The next phase for the invitation of privately financed projects is planned for the motorways itself, in particular the Ankara to Pozanti motorway and the Orhangazi to Izmir motorway. How receptive the investors are for future calls to invest, have yet to be truly demonstrated.

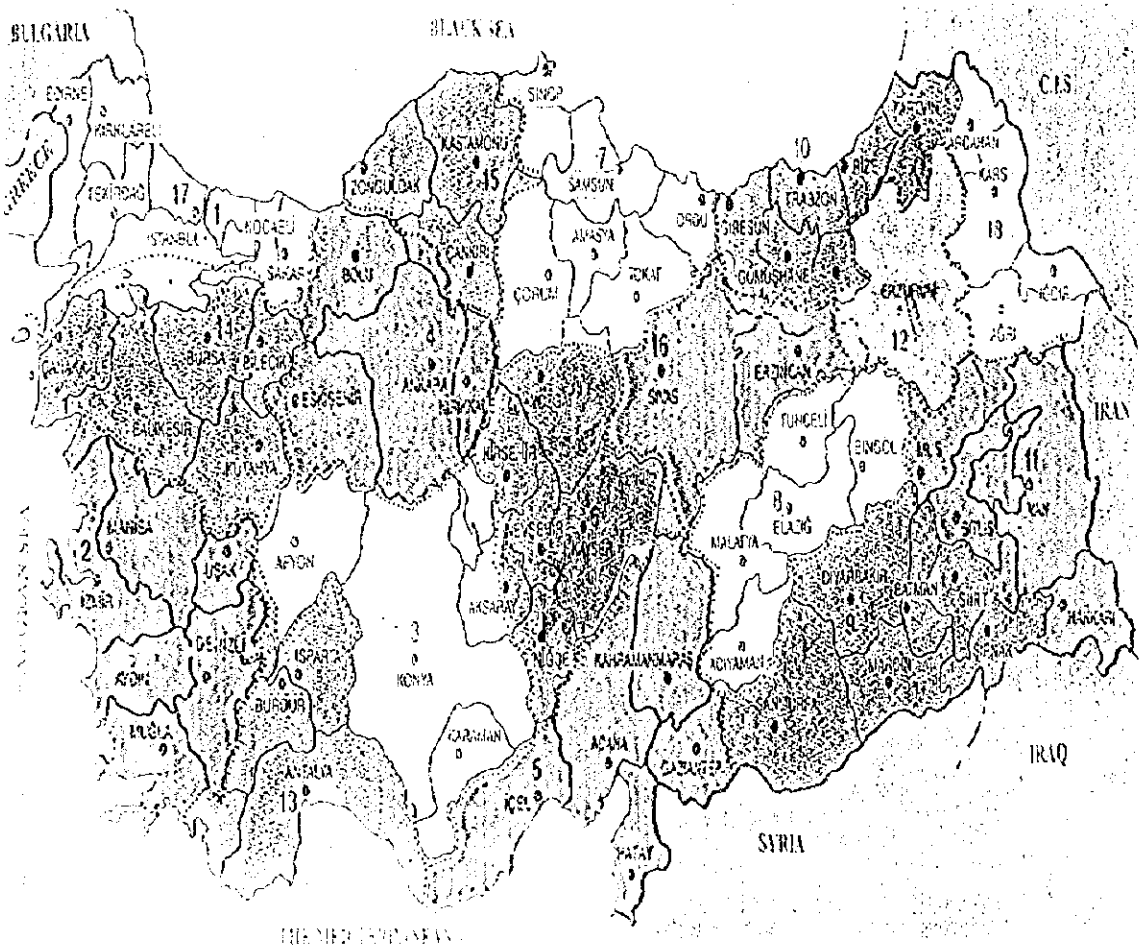
3.1.2 Highway System and Network

As at 01.01.1995, there are 60,999 km of highways in the Republic of Turkey that is under the responsibility of the KGM. The administrative classification of highways are into three categories namely motorways, state roads and provincial roads; all as defined in clause 15 of the Law of the establishment and responsibilities of the KGM (*Karayollary Genel*



Note: Scale is distorted

THE STUDY ON THE MAINTENANCE AND REHABILITATION of HIGHWAY BRIDGES in THE REPUBLIC of TURKEY AUGUST, 1996 ORIENTAL CONSULTANTS COMPANY LIMITED in association with JAPAN OVERSEAS CONSULTANTS COMPANY LIMITED	Figure - 3.1.1 The eighteen Regional Divisions of KGM, Turkey, 1995



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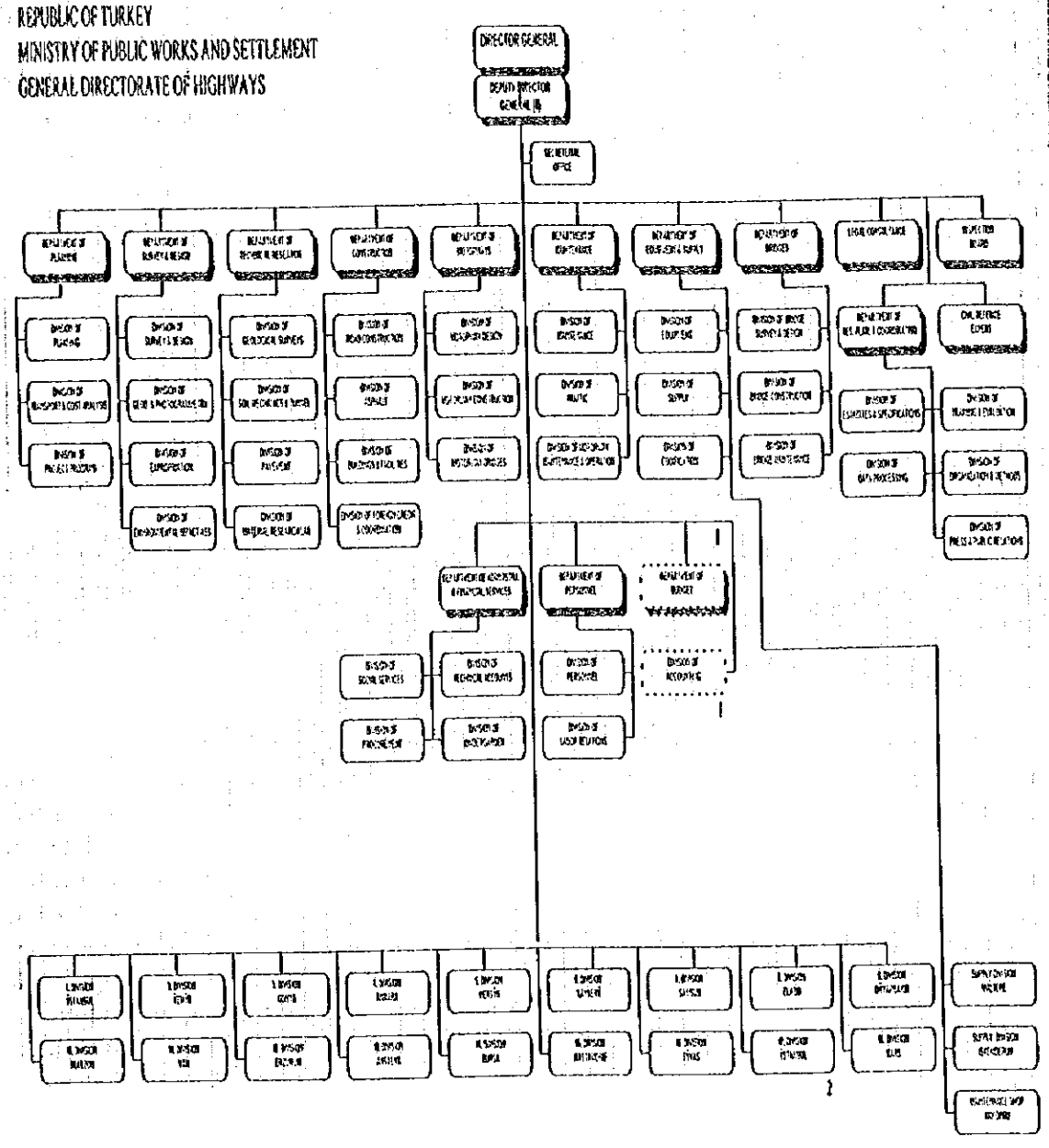
JAPAN OVERSEAS CONSULTANTS COMPANY LIMITED

Figure - 3.1.1

The eighteen Regional Divisions of KGM,
Turkey, 1995

REPUBLIC OF TURKEY
MINISTRY OF PUBLIC WORKS AND SETTLEMENT
GENERAL DIRECTORATE OF HIGHWAYS



Note: 1 - Personnel from Finance Ministry
2 - Responsible for Motorways only

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Figure - 3.1.2

Organization chart of General Directorate of Highways (KGM), Turkey 1995

Müdürlüğü, Kuruluş ve Görevleri Hakkýnda Kanun). These exclude forestry, village roads and municipality roads. The arterial state road network and the provincial road network (including some village roads) are as shown in Figure - 3.1.3 and Figure - 3.1.4 respectively. In general, the state roads are the roads connecting cities and important regional centres whereas the provincial roads are the roads connecting the towns and villages, within or with nearby provinces, to the centres linked by the state roads. The composition of the highways types and the pavement qualities of Turkey's road network are as shown in Table - 3.1.1.

Table - 3.1.1 Composition of Turkish Highways

	Asphaltic concrete	Asphalt Cover	Stone Block	Stabilised	Earth (graded)	Limited access (primitive)	Total in km
Motorway	1167						1167
State rd	4630	25016	40	1311	69	323	31389
Provincial	127	20486	82	5583	1212	953	28443
TOTAL	5924	45502	122	6894	1281	1276	60999

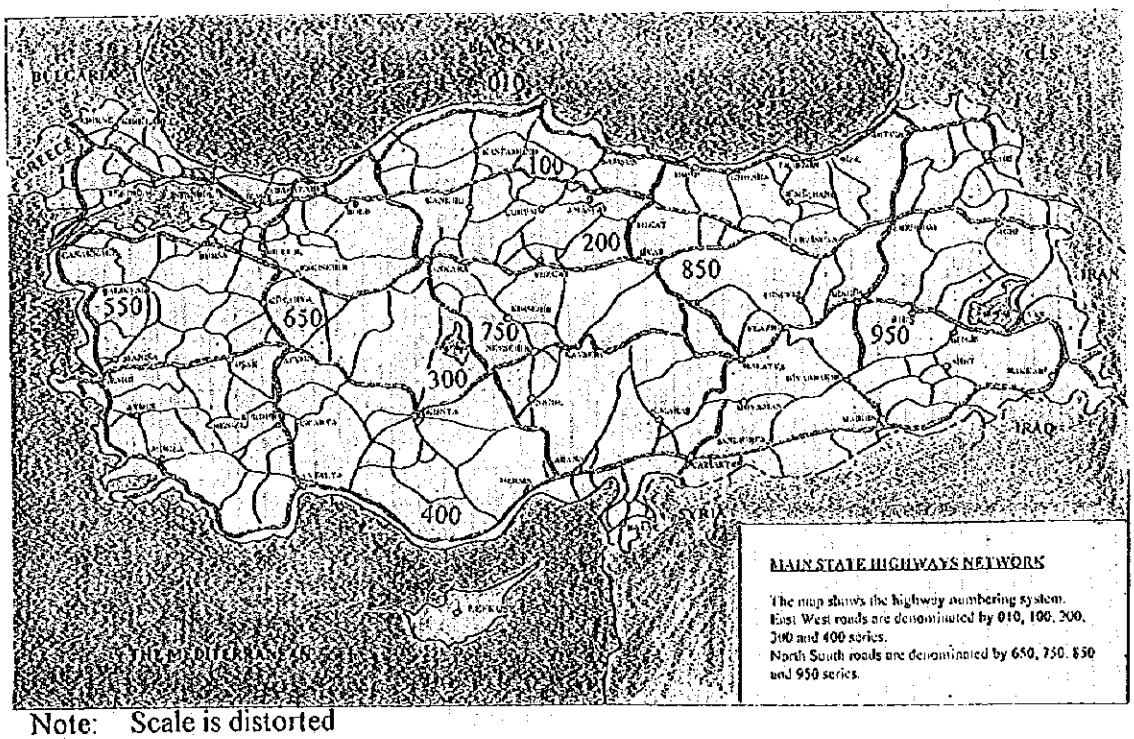
The function, geometric and load carrying criteria for the various categories of roads are different and are dependent on the traffic volume. This relationship for the state and provincial roads are as shown in Figure - 3.1.5.

3.1.3 Highway development plans

Between 1977 and 1980, the Planning Department of the KGM conducted a comprehensive study of the highway and rehabilitation requirements of the National Network in view of developments in Turkey at that time. The aim was also to reduce vehicle operating costs and to connect new settlements. The result indicated a need for the network to be expanded from approximately 60,000 km then, to 100,000 km within five years. A transport master plan was proposed and was accepted by the government of the time. The plan was subsequently shelved by successive governments and it is very unlikely that it will ever be implemented. Since that time, no new state highways have been constructed. Only improvement works for some village roads have been carried out and that would appear to be the way forward for the foreseeable future except perhaps for some much needed by-passes and the motorway construction programmes. The most heavily trafficked sections, from the transport master plan, have been used as the basis for the present motorway network.

The demand for land freight will increase due to increased trade between the developing Eastern neighbouring countries and the developed European Custom Union nations. Coupled with the higher permitted freight vehicle loading (40 t) from European Union, as compared to the bridge design loading of HS20 and HS15 that was used for the vast majority of the State Highway bridges, the highway network will be severely overstressed. The KGM will be under pressure for the existing strategic State Highways to be strengthened, upgraded and certain sections may even have bypasses constructed to protect the investment, otherwise the network could deteriorate rapidly incurring higher reconstruction expenditures in the future.

The Planning Department also carries out sufficiency rating studies as an on going responsibility. This is to evaluate current critical transport requirements for the nation's road network and to identify specific sections for improvement or rehabilitation. Each year as with the



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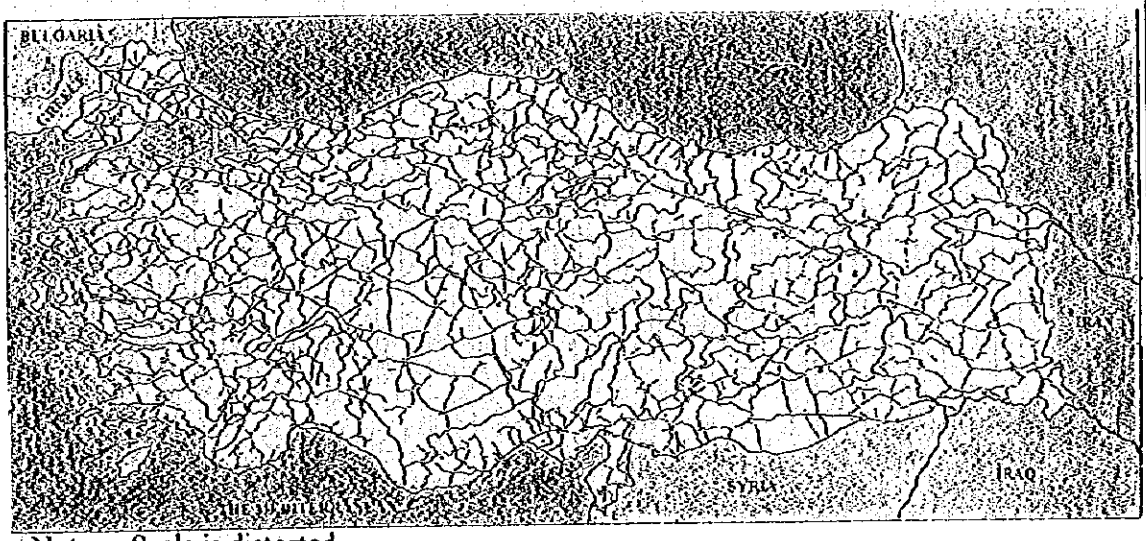

Note: Scale is distorted

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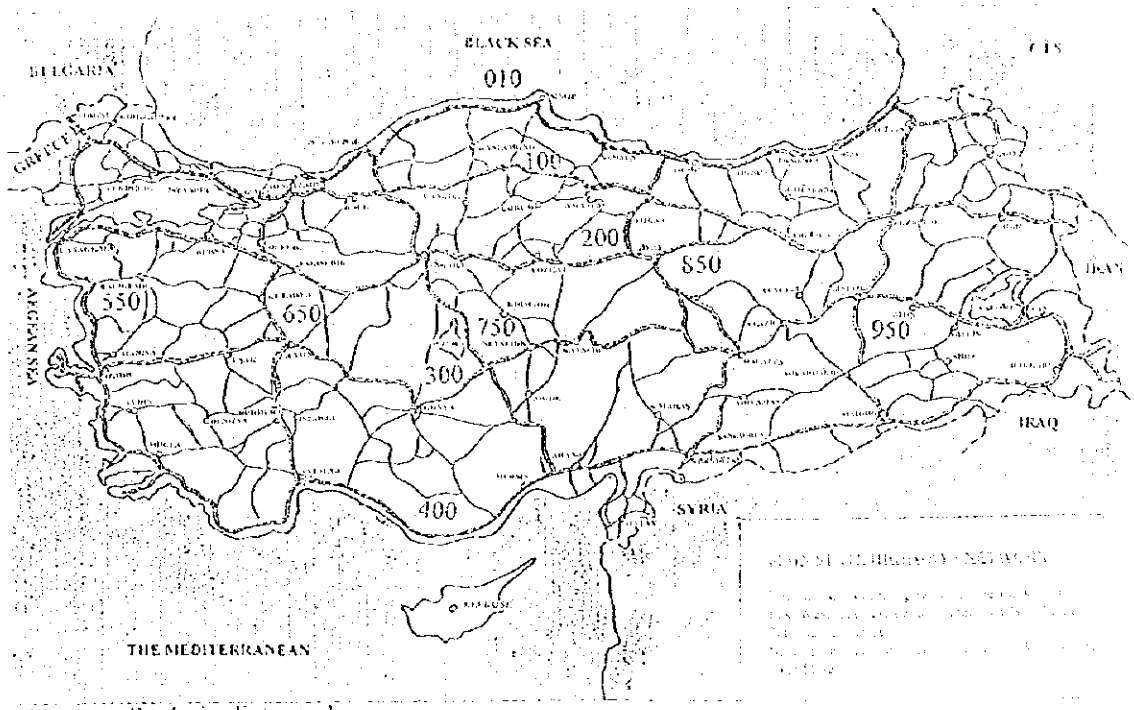

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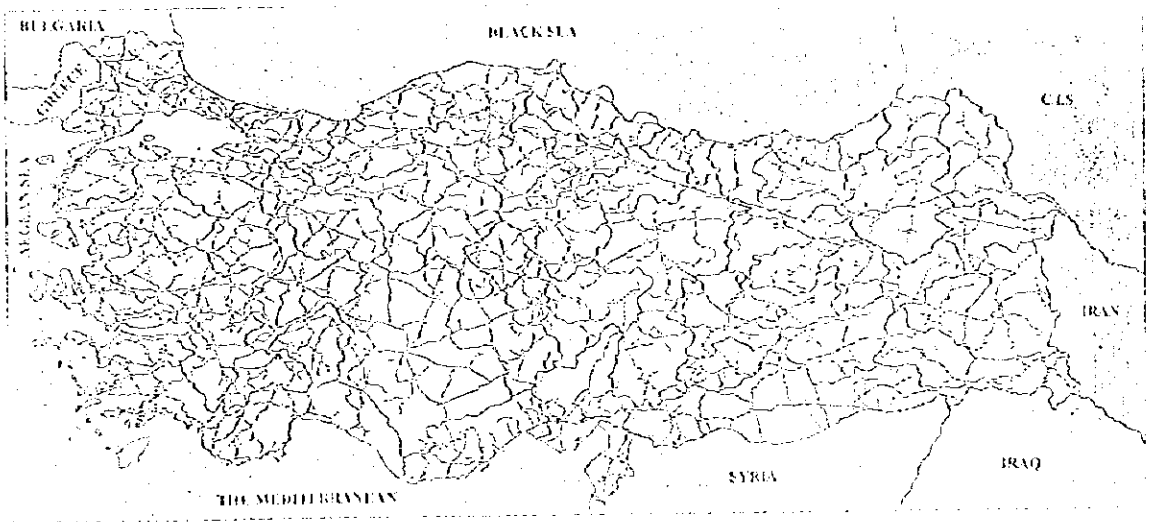

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AUGUST 1996

ORIENTAL CONSULTANTS COMPANY LIMITED
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Figure 3 1 3 Main arterial State Highway Network Turkey 1999

Figure 3 1 4 Provincial Road Network Turkey

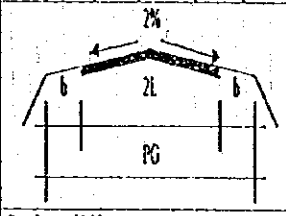
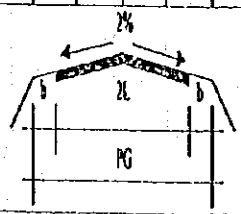
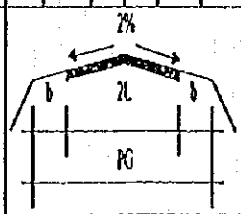
GEOMETRIC STANDARDS OF HIGHWAY			RURAL TWO LANE HIGHWAYS																		S_1
PROJECT FEATURES			FIRST CLASS						SECOND CLASS						THIRD CLASS						
Level Of Service			D		D		D		D		D		D		D		D				
Traffic Volume	Annual Average Daily Traffic A.A.D.T. (Vehicle/Day)		12000		6500		4000		11000		5500		3900		8200		4500		2600		
	Hourly Project Traffic (Vehicle/Hour)		1200		650		400		1100		550		390		820		450		250		
Terrain Type			FLAT		ROLLING		MOUNTAINOUS		FLAT		ROLLING		MOUNTAINOUS		FLAT		ROLLING		MOUNTAINOUS		
Design Speed		(Km/Hr)	100	80	85	70	70	60	80	70	70	60	60	40	70	60	60	50	50	30	
Minimum Radius of Curvature		R (m)	400	250	250	200	200	150	250	200	200	150	150	60	200	150	150	90	90	30	
Minimum Clotoid Parameter		A (-)	160	130	130	120	120	100	130	120	120	100	100	60	120	100	100	70	70	30	
Maximum Gradient		m (%)	4	4	6	6	7	7	5	5	7	7	8	8	6	6	8	8	9	9	
Vertical Curve Coefficient	Crest Curve	Cc (-)	100-50	43-26	43-26	29-20	29-20	13-15	43-26	29-20	29-20	13-15	13-15	6-6	29-20	13-15	13-15	10-9	10-9	5-5	
	Sag Curve	Sc (-)	50-35	30-23	30-23	23-19	23-19	16-15	30-23	23-16	23-16	16-15	16-15	8-8	23-19	16-15	16-15	12-11	12-11	7-7	
Maximum Superelevation		e (%)	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	
Stopping Sight Distance		Ld (m)	155	110	110	90	90	70	110	90	90	70	70	40	90	70	70	55	55	25	
Passing Sight Distance		Lg (m)	670	550	550	480	480	420	550	480	480	420	420	270	480	420	420	340	340	190	
Lane Width		L (m)	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.25	3.25	3.25	3.25	3.00	3.00	3.00	3.00	3.00	3.00	
Width of Shoulder		b (m)	2.50	2.50	2.00	2.00	2.00	2.00	1.50	1.50	1.50	1.50	1.50	1.50	1.00	1.00	1.00	1.00	1.00	1.00	
Width of Pavement		PG (m)	12.00	12.00	11.00	11.00	11.00	11.00	10.00	10.00	9.50	9.50	9.50	9.50	8.00	8.00	8.00	8.00	8.00	8.00	
Width of Bridges	Short Bridges (0-45m)	Wk (m)	9.50						9.50						7.00						
Design Load for Bridges H:20-S:16	Long Bridges (>45m)	Wu (m)	8.50						8.50						7.00						
Vertical Clearance		h (m)	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	
Road Cross Section Type																					
Right of Way Width	Total Width KS	(m)	Regular 60.00m						Regular 40.00m						Regular 15.00m						
	Distance from Center Line		KS 23m 32m KS						KS 20.00m 20.00m KS						KS 7.50m 7.50m KS						

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Figure - 3.1.5

Geometric Standards of Highways, Turkey

18 Regional Divisions, a certain number of critical sections were identified and recommendations were made via the Ministry of Public Works and Settlement to the SPO for the allocation of funding. The success rate is approximately 50%, in monetary terms, for the projects submitted. In terms of schemes, the success rate is much lower. It is then for the KGM to seek alternative sources of funding if the projects are deemed sufficiently important and have the necessary criteria to qualify. Even then, it is not possible to ensure that all the projects will be successful in being funded.

3.1.4 Road Traffic Volumes

According to the traffic figures that was published by the KGM in 1995, there has been a steady increase in the number of vehicles that is on the state roads. The following is a graph indicating the growth in the number of vehicles, excluding special purpose vehicles and construction/work machinery, between 1981 and 1994.

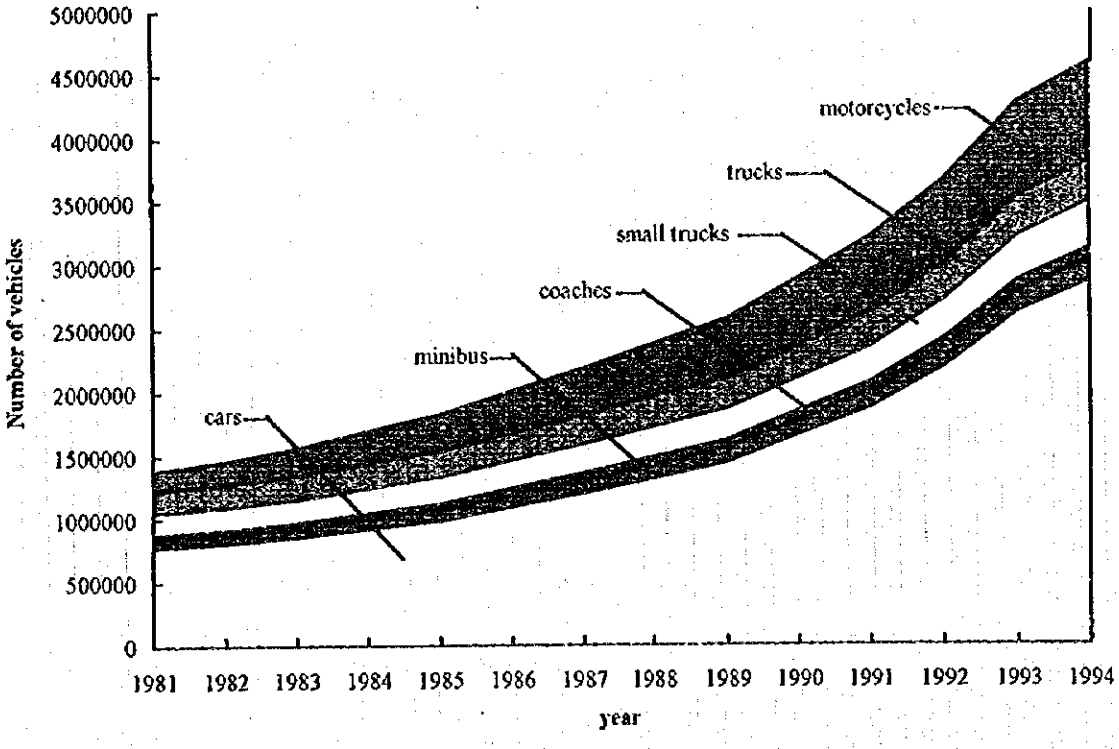

Figure - 3.1.6 Cumulative Traffic Growth

The trend is also similar for the distance covered by vehicles, goods and passengers over the same period. The figures obtained from the KGM shows that in 1994, the state roads still carries 91.0% of all passenger traffic and 91% of all commercial freight traffic. Clearly theimportance of the highways as the infrastructure for development of Turkey, in view of the planned rapid

investment programmes in the Turkic Republics, will add further significance. Graphical illustrations for the above items are shown in Figure - 3.1.6, Figure - 3.1.7 and Figure - 3.1.8.

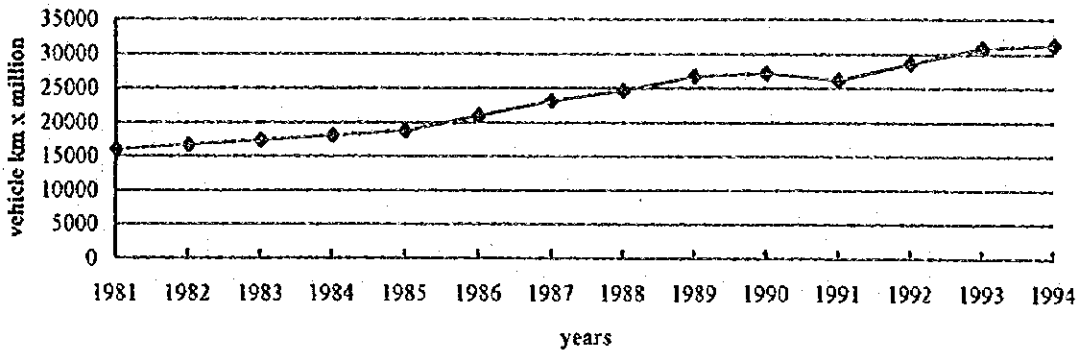

Figure - 3.1.7 Annual Vehicle circulation on State Highways

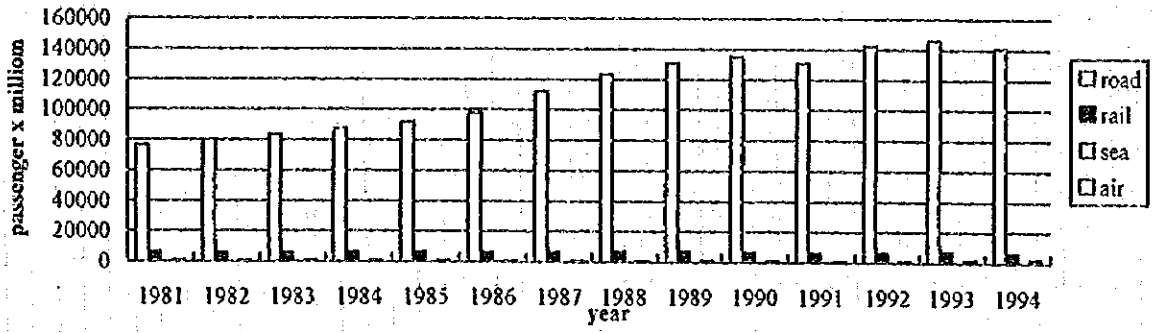

Figure - 3.1.8 Passenger Transport

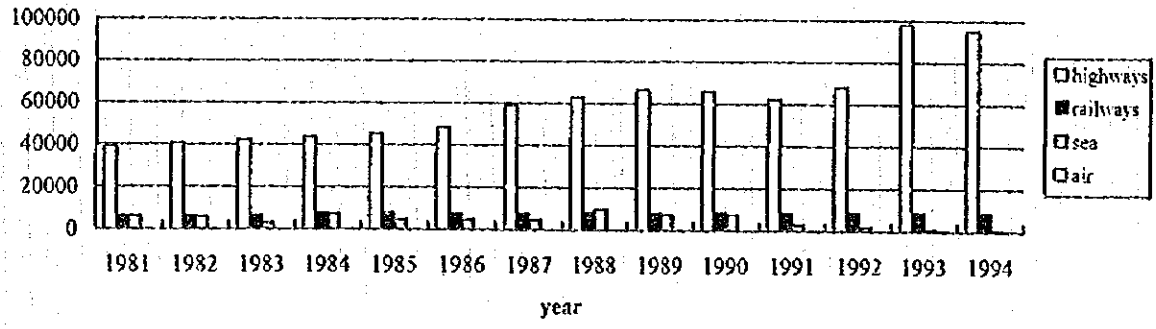

Figure - 3.1.9 Freight Transport

In order to assist the KGM in the data collection of traffic volume, "Marksman" traffic counters made by Golden Rivers of UK were installed throughout the network. The counters can only quantify the traffic in four main classification namely cars, coaches, lorries and trailers. The counters are frequently calibrated and have an accuracy of approximately 90%. Information collected from these counters can be directly accessible at anytime from the KGM general directorate via the computer modem links to the Regional Divisions. The detailed traffic volume information for the entire network are published each year, by the KGM, in a document entitled "National Roads - Traffic and Transportation Survey" *(Devlet Yollarý - Trafik ve Ulaþým Bilgileri)*. The KGM is planning to improve the accuracy of data collection and to implement other system of traffic survey, possibly using the latest electro magnetic system. Currently available international systems are being studied and it is hoped that sufficient funds can be found to purchased them.

3.1.5 Traffic Accidents

One of the most popular subject for the Press is the statistics of highway accidents and deaths during the religious holidays in Turkey. It would seem that the public expects more highway accidents to occur than at other times of the year. Accident statistics tended to confirm this tendency. This may be true as it is the time when the majority of the population in the cities, especially of Istanbul and Ankara, are doing their annual migration to the popular resorts at about the same time and using the same route. Often it is a long tedious journey and highways are having to cope with higher than normal traffic volumes.

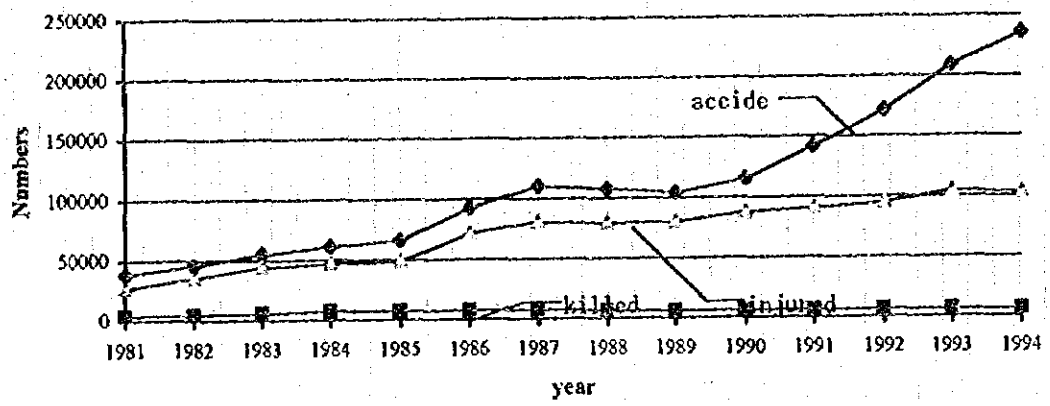

Figure - 3.1.10 Road Accidents

The Police Authority, under the Interior Ministry, is responsible for making the accident reports and evaluations. The statistics are published yearly and are very detailed, including the circumstances of the occurrence, location et cetera. These data are also available to the KGM, who in turn carry out their own analysis. The intention of the KGM is to identify the accident black spots on the network and to provide a solution to overcome the problem. The procedure is as follows:

1. traffic department of the General Directorate (GD) will carry out the initial analysis to identify the accident black spots. This could be a particular spot, 1km section or other appropriate section lengths.

2. once identified, the information will be sent to the responsible Regional Division (RD) for confirmation, remedial proposals and cost estimates of proposals.

3. feedback from the RD is compared to that of the GD and extreme differences discussed and resolved. Site visits from GD are organised as necessary.

4. The GD will re-evaluate all the data and to select critical black spots (subject to the available budget constraints) for remedial work.

The evaluation to implementation process is at least 2 years. From the published traffic statistics of 1993, some 300 black spots were identified. After the evaluation process (including consultations and budget considerations), only 65 to 70 black spots will have the remedial proposals implemented. The rest will be reconsidered the next year. Unfortunately due the lack of available resources, the effectiveness of the remedial work carried out were never monitored.

The GD is aware of the need to educate the public on the awareness of highway safety. In February 1994, the KGM launched a " Traffic Monster " campaign, including a series of television commercials and roadside posters. The television commercials ended in September 1994 due to curtailment by central government on public expenditures. Although generally well received, effectiveness of the campaign was difficult to assess as the government's 5th April 1994 austerity package, huge increases in tax for many essential items, was having an effect in the publics ability to spend. However, the KGM still believes that highway safety is important and negotiations are in progress with the World Bank for a loan to implement highway safety work.

3.2 Maintenance Operation and Systems

3.2.1 Administrative Organisation and System

The management of the maintenance of the State Highways bridges is the responsibility of the Division of Bridge Maintenance (DBM) within the Department of Bridges at the KGM General Directorate. An organisation chart of the DBM is as shown in Figure - 3.2.1. The DBM provides planning, technical and financial support to the seventeen regional divisions (excluding the 17th Division in Istanbul). The maintenance activities of the Regional Divisions are independent of the DBM and are directly under the responsibility of the regional division director. They are allowed to invite tenderers, award and supervise maintenance contracts themselves up to a certain limit which is defined by the Finance Ministry each year and can be reduced by the KGM General Director if he so wishes. For projects awarded by and paid through the DBM, the Regional Divisions are required to provide the suitably experienced personnel for the supervision of the works. In the event that the suitably experienced personnel are unavailable, DBM will provide the personnel from the General Directorate. A typical organisation chart of the Chief Bridge Engineers' department at the Regional Directorate is as shown in Figure - 3.2.2.

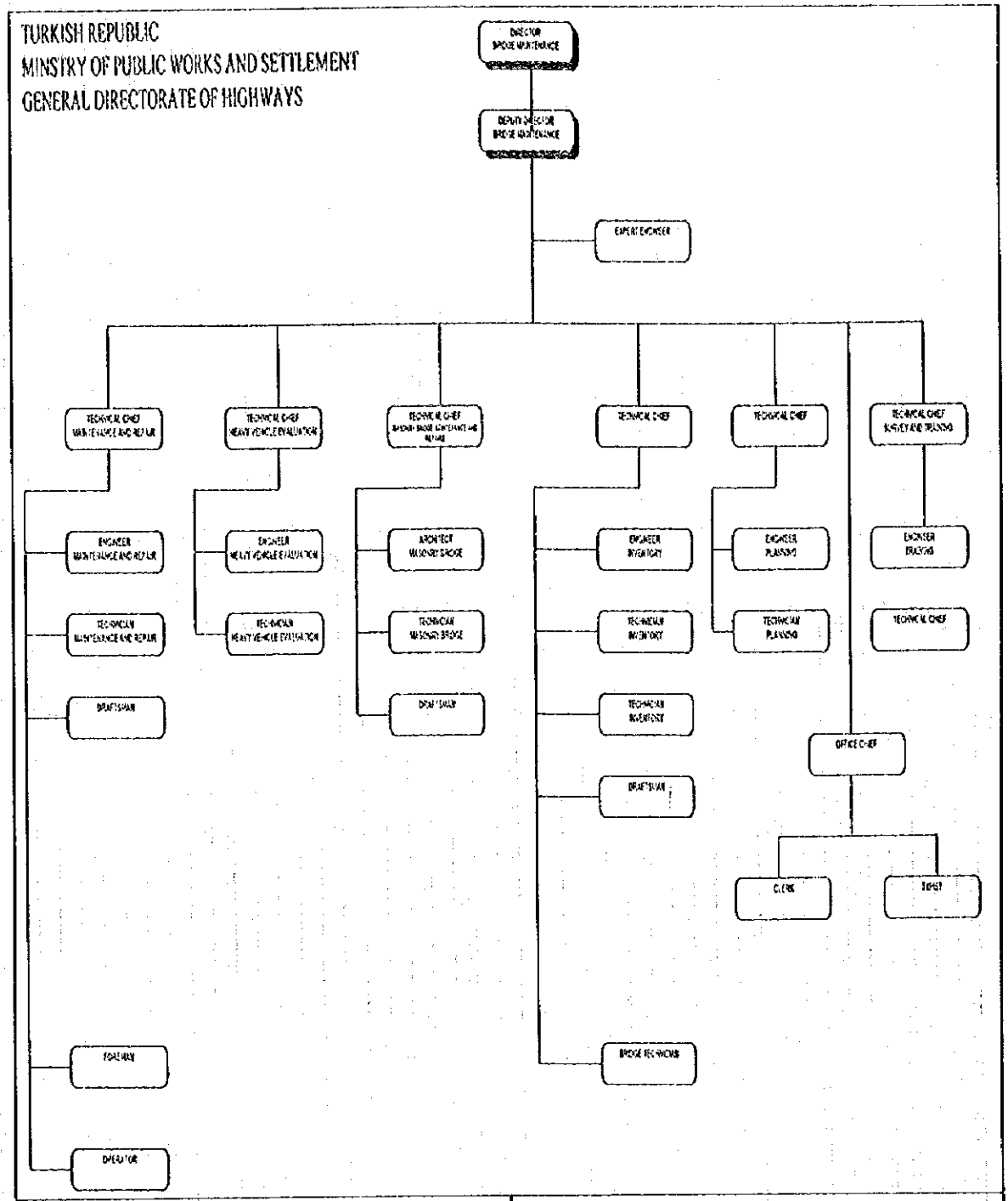

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Figure - 3.2.1

Organization chart of Bridge Maintenance Division, Ankara 1995

TURKISH REPUBLIC
MINISTRY OF PUBLIC WORKS AND SETTLEMENT
GENERAL DIRECTORATE OF HIGHWAYS

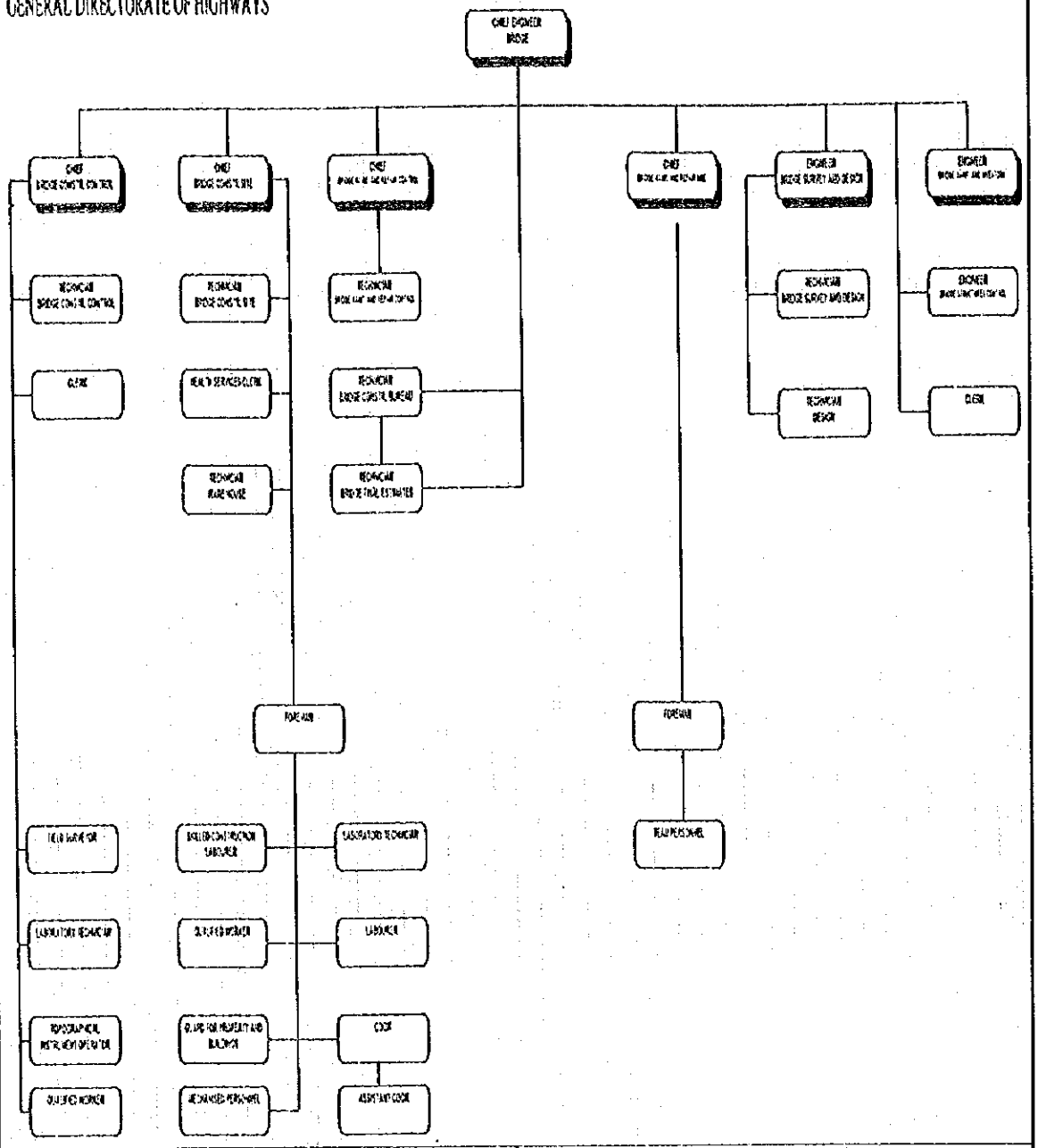

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Figure - 3.2.2

Typical Organization chart of Chief Bridge Engineers Department in the Regional Division1995

As with the policies of the KGM general administration, each year the proposed maintenance activities (including application for money) of all State Highway bridges are co-ordinated by DBM. The information collected are evaluated and the work that is deemed most necessary are forwarded for consideration of budget allocation via the Department of Bridges to the Ministry of Public Works and Settlement who will in turn forward their approval to the SPO. Even then, the amount allocated is often less than required. As a result, project reappraisal becomes a must in order to conform to the budget allocated and resubmitted to the Ministry for approval.

After obtaining the ministerial approval, the regional division director was invited to the KGM General Directorate to discuss their allocation with the General Director, Deputy General director and all the Heads of Departments. In some extenuating circumstances, the plea from the regional director may result in additional allocation of funds. Upon confirmation of allocation, the regional directorate will produce an action plan of how the allocated funds will be utilised. Explanation of the works to be carried out by each Regional Divisions are usually done at the annual meeting of the KGM directorates which is held in Ankara. This is also the forum for informing the mass media, other KGM divisions, others Ministries and the public about the activities of the KGM.

3.2.2 Budget allocation and expenditure

The whole process of project planning to fund allocation can take at least six months. It is no surprise that at the end of the process, some desperately needed work will still not be carried out. Under the present economic circumstances, the Bridge Division is unable to fulfil even the basic necessity of maintenance. Only the most serious and dangerous structures may be allocated some money for maintenance at the expense of other work. Usually it is too late and reconstruction becomes necessary. Such is the case of the Acibadem bridge in Istanbul where the plight of this bridge was brought to the attention of the public by the Media. Only then was it allocated the funds.

To illustrate the difficulties that is being faced by KGM, the 1995 budget allocated for the essential maintenance of bridges amounts to only 114 billion TL when the mininum amount applied for was 350 billion TL. Of the amount allocated, 65 billion was committed to Acibadem and Komurhan bridges which had to be reconstructed and refurbished respectively. The remainder represents a pitiful sum when considering that there are at least 10% of the 4600 State Highway bridges around the country, under the responsibilities of the KGM, which are also in desperate need of some repair work. Maintenance of bridges is of low priority, particularly when there is no money in the budget. Despite the circumstances, the staff responsible for maintenance are trying to do their best.

3.2.3 Inventory data of highway bridges

The Division of Bridge Maintenance was established in 1964. The bridge inventory system started had only been revised once and this was in the 1970's. The system is working and all the known bridge that is under the responsibility of KGM are documented. The information can be easily found in the Division of Bridge Maintenance in Ankara. It is intended that the inventory system be revised. At the instigation of the Director of Division of Bridge