

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
DIRECTORATE GENERAL OF ROADS
MINISTRY OF COMMUNICATIONS
THE SULTANATE OF OMAN

**THE DETAILED DESIGN STUDY
ON
ROAD DEVELOPMENT PROJECT**

**FINAL REPORT
MAIN REPORT**

MARCH 1997

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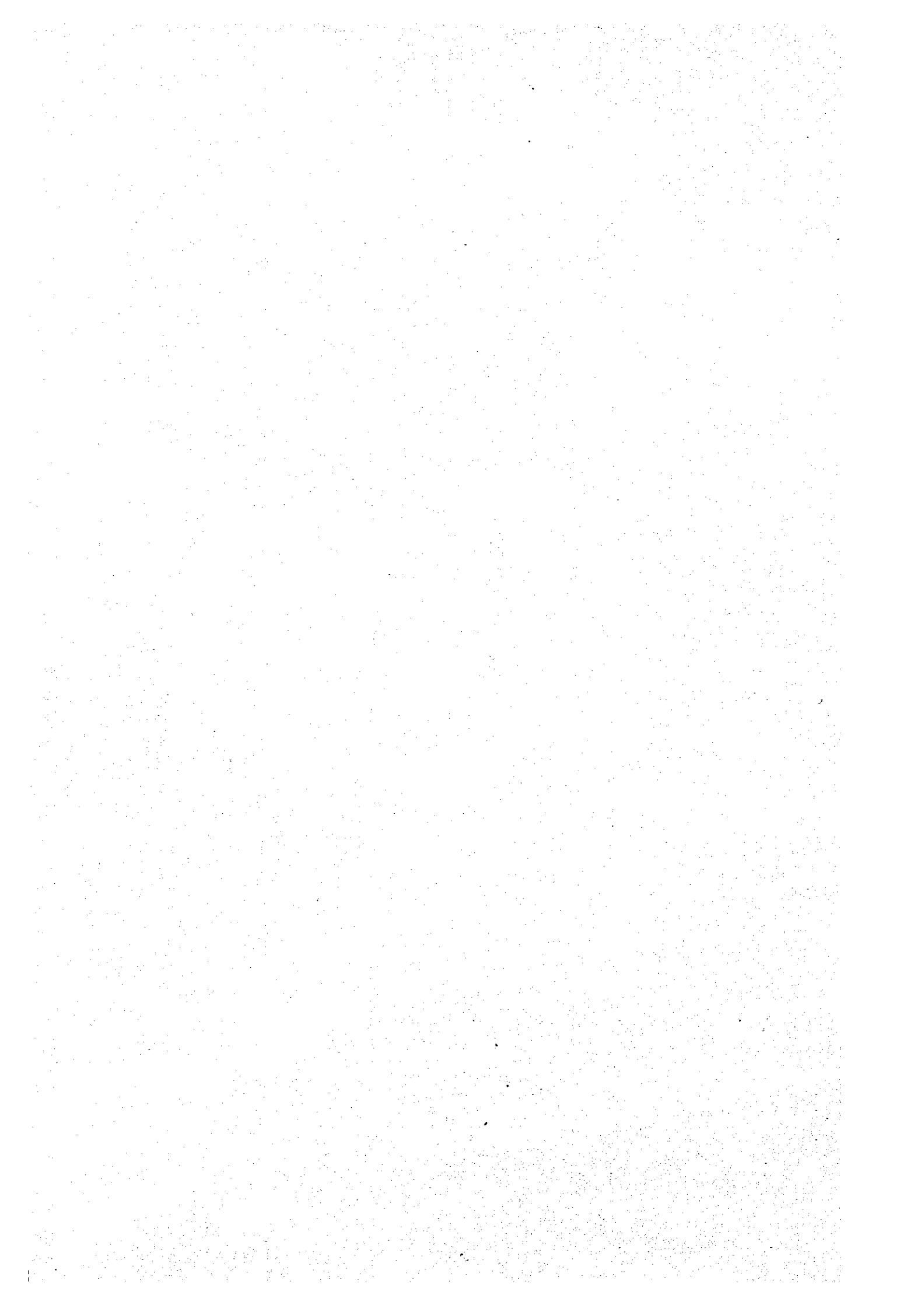
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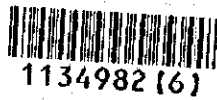
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NOTE

The following exchange rate was adopted through this report:

US\$1.00 = R.O. 0.381 = Yen 108.81 (August 1996)

PREFACE

In response to a request from the Government of the Sultanate of Oman, the Government of Japan decided to conduct the Detailed Design Study on ROAD DEVELOPMENT PROJECT IN THE SULTANATE OF OMAN and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent a study team to the Oman between December 1995 and December 1996. The study team was headed by Mr. Yoshimi TAKAI and composed of members of Pacific Consultants International and Fukuyama Consultants International.

The team held discussions with the officials concerned of the Government of Oman, and conducted the field surveys at the study area. After the team returned to Japan, further studies were made and 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 Sultanate of Oman for their close cooperation extended to the team.

March 1997



Kimio FUJITA
President

Japan International Cooperation Agency

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March 1997

Mr. Kimio FUJITA
President
Japan International Cooperation Agency
Tokyo, Japan

Dear Mr. Fujita

Letter of Transmittal

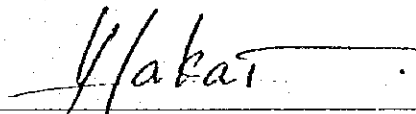
We are pleased to submit you the detailed design report on the Road Development Project in the Sultanate of Oman. The report contains the advice and suggestions of the authorities concerned of the Government of Japan and your Agency as well as the formulation of the above mentioned project. Also included are comments made by the Ministry of Communications, the Sultanate of Oman during technical discussions on the draft final report which were held in Muscat.

This report presents a scheme for construction of flyovers and pedestrian underpasses.

In view of the urgency of the road development plan in the Sultanate of Oman and of need for socio-economic development of Oman as a whole, we recommend that the Sultanate of Oman implement this project as a top priority.

We wish to take this opportunity to express our sincere gratitude to your agency and the Ministry of Foreign Affairs. We also wish to express our deep gratitude to the officials concerned of Ministry of Communications, the Japanese Embassy at Oman for the close cooperation and assistance extended to us during our investigation and study.

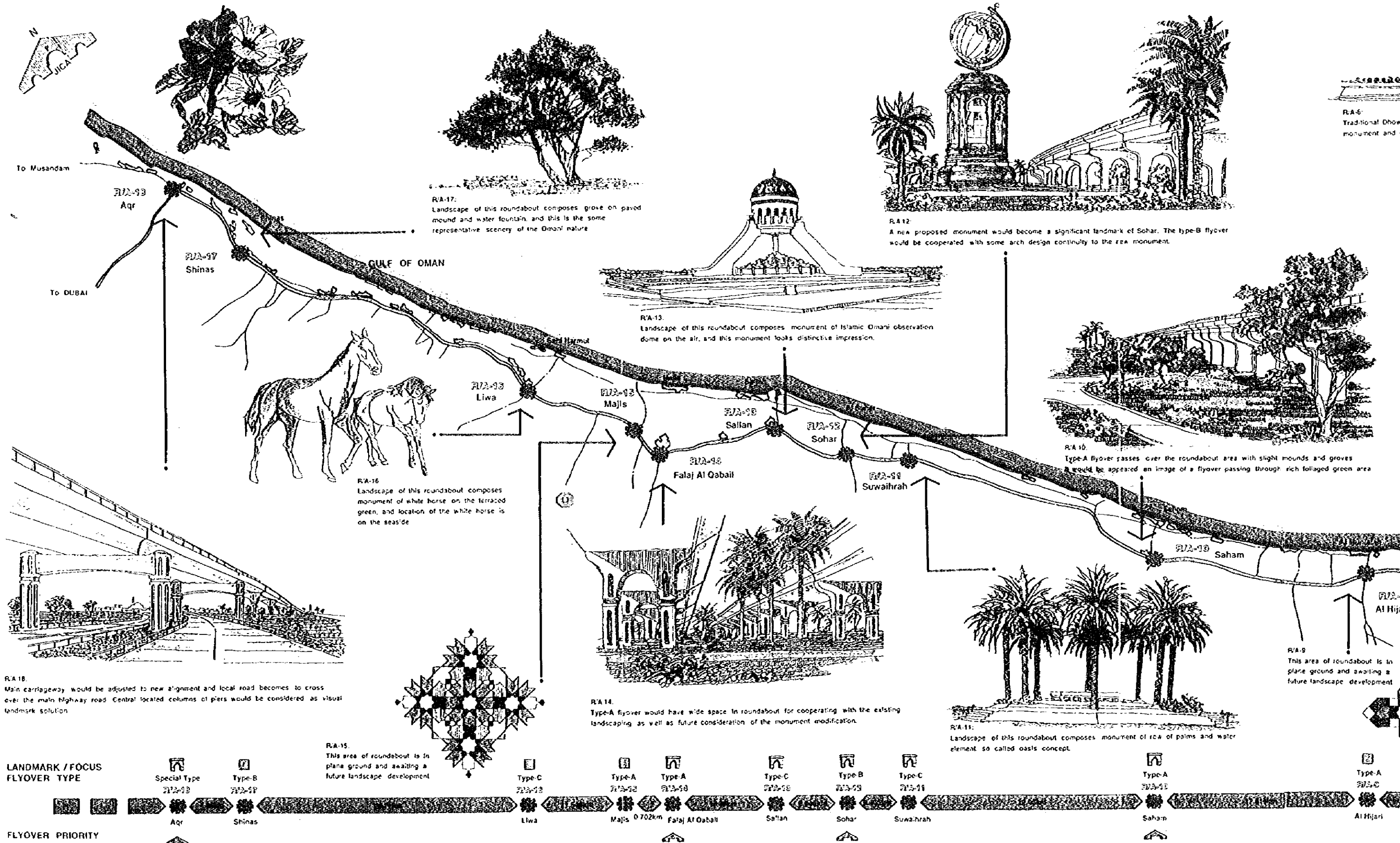
Very truly yours,



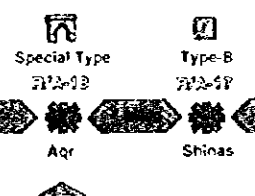
Yoshimi TAKAI
Team Leader
The Study on the Road Development Project
in the Sultanate of Oman

THE STUDY ON ROAD DEVELOPMENT PROJECT

LANDSCAPE PLAN FOR FLYOVERS AND ROUNDABOUTS THROUGH BATINAH HIGHWAY



LANDMARK / FOCUS FLYOVER TYPE

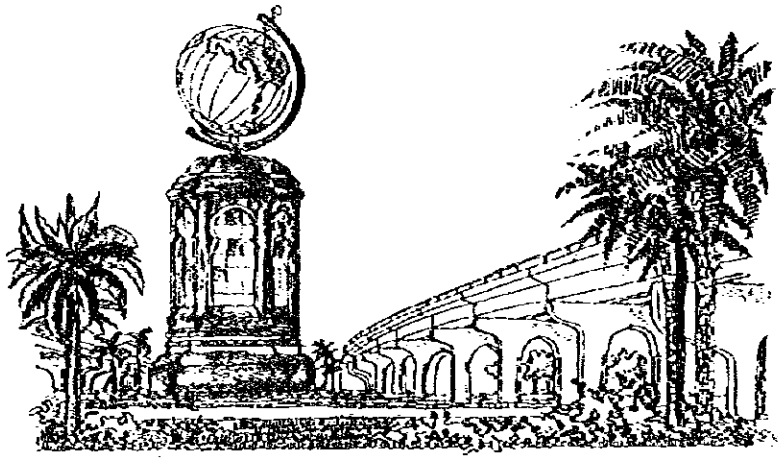


FLYOVER PRIORITY

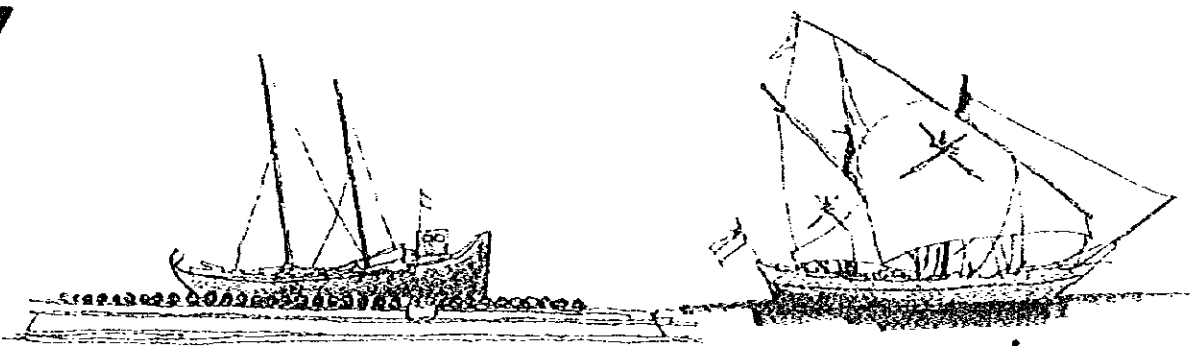


NT PROJECT

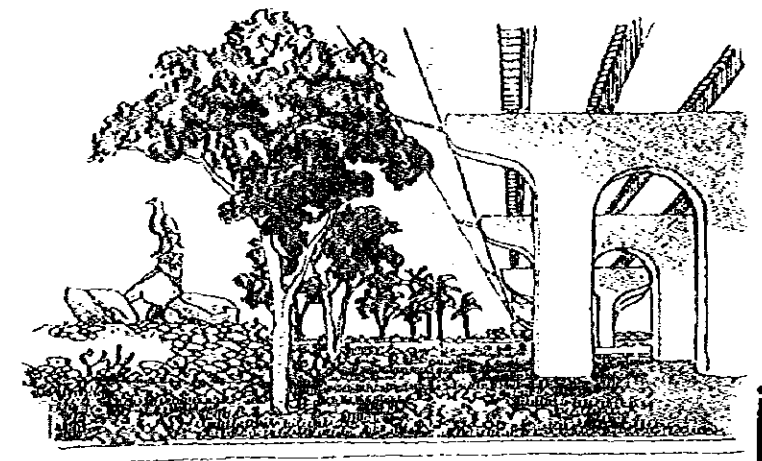
BOUHS THROUGH BATINAH HIGHWAY



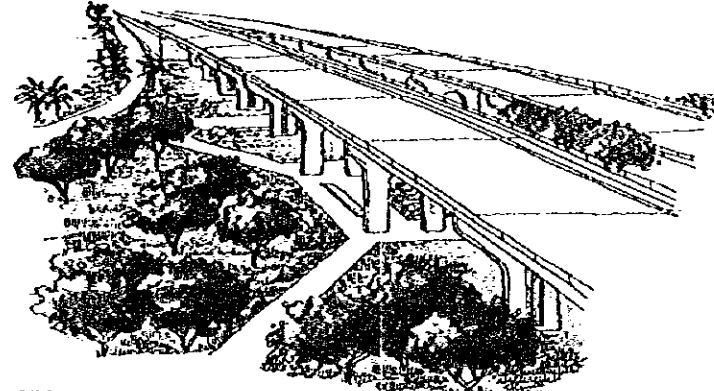
RA-12
A new proposed monument would become a significant landmark of Sohar. The type-B flyover would be cooperated with some arch design continuity to the new monument.



RA-5:
Traditional Dhow ship on the water concept is considered as a significant symbol monument and distinctive silhouette. It should be preserved with high priority.



RA-5:
A new landscape of this area would be organized by reflection of a type-A flyover and relocation of a pair of eagle become a new effective landscape focus.

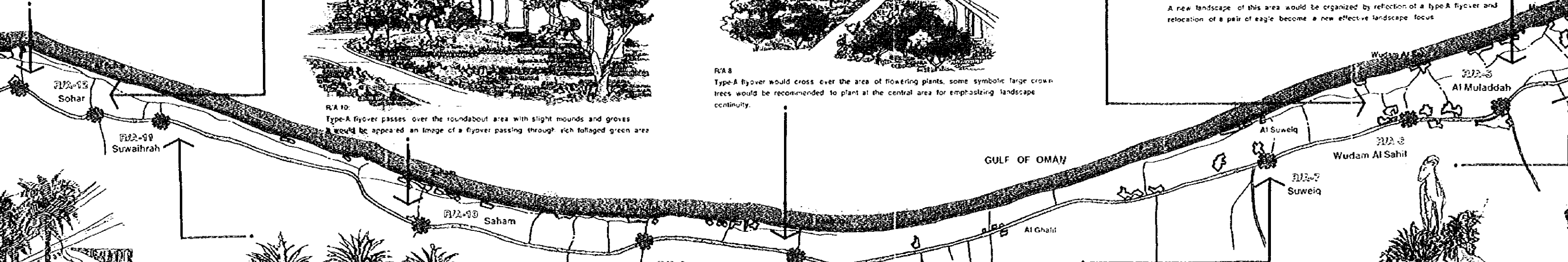


RA-8
Type-A flyover would cross over the area of flowering plants, some symbolic large crown trees would be recommended to plant at the central area for emphasizing landscape continuity.



RA-10:
Type-A flyover passes over the roundabout area with slight mounds and groves. It would be appeared an image of a flyover passing through rich foliage green area.

composes monument of Islamic Omani observation. monument looks distinctive impression.

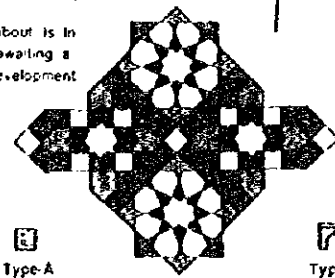


roundabout for cooperating with the existing monument modification.

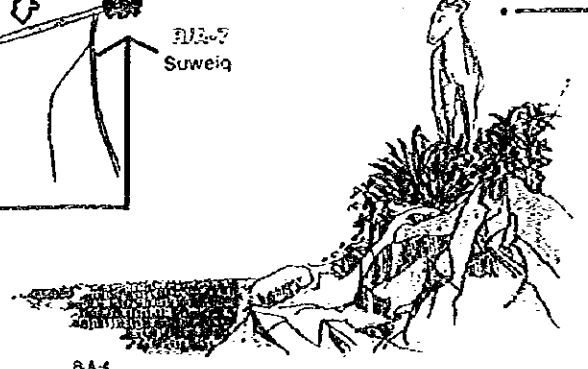


RA-11:
Landscape of this roundabout composes monument of row of palms and water element, so called oasis concept.

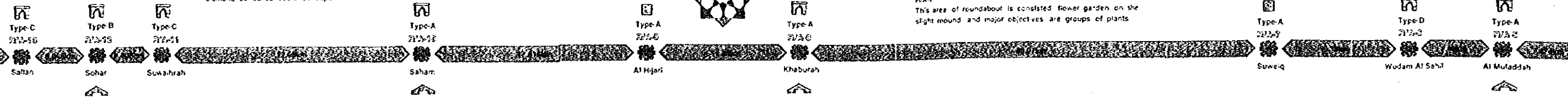
RA-9:
This area of roundabout is in plane ground and awaiting a future landscape development.

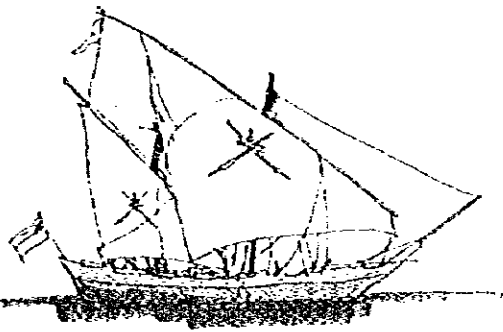


RA-7
This area of roundabout is consisted flower garden on the slight mound and major objectives are groups of plants.

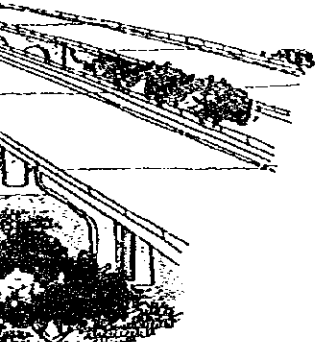


RA-4:
Rock piled mound with animal sculptures on the flat garden is landscape character of the area and this landscape concept shall be express part of representative Omani natural features.

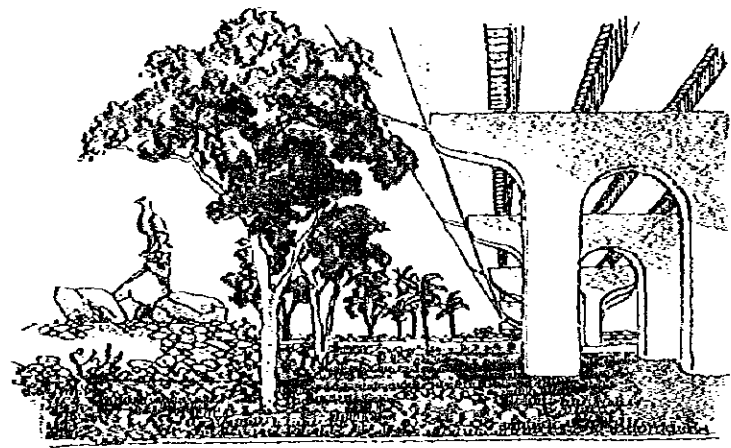




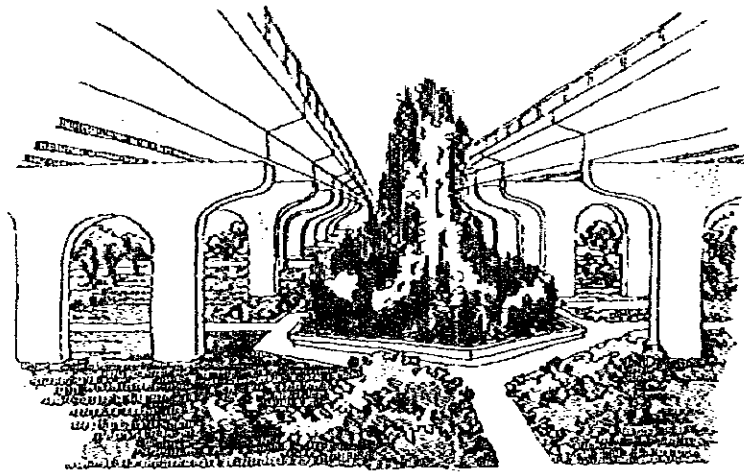
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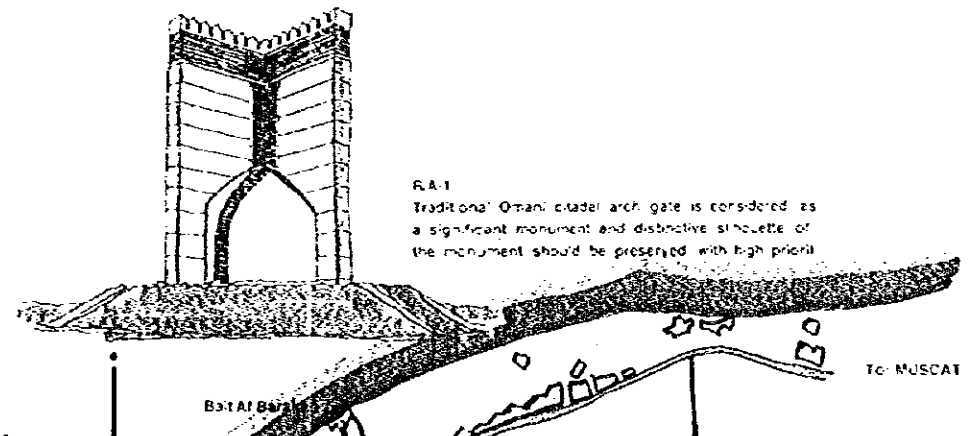
g plants, some symbolic large crown area for emphasizing landscape



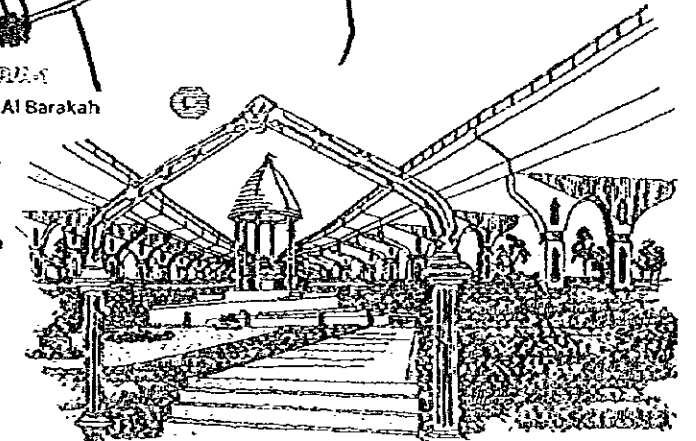
RA.5.
A new landscape of this area would be organized by reflection of a type-A flyover and relocation of a pair of eagle become a new effective landscape focus



RA.3
Existing water fountain would be observed at openings between central piers of the flyover, and the water fountain appears in white and elegant silhouette with arch formed piers



RA.1
Traditional Omani clader arch gate is considered as a significant monument and distinctive silhouette of the monument should be preserved with high priority



RA.2
Type-A flyover would be a new symbol of the roundabout, an image of white flyover and white garden tower with flowering plants would represent Naseem Garden environment



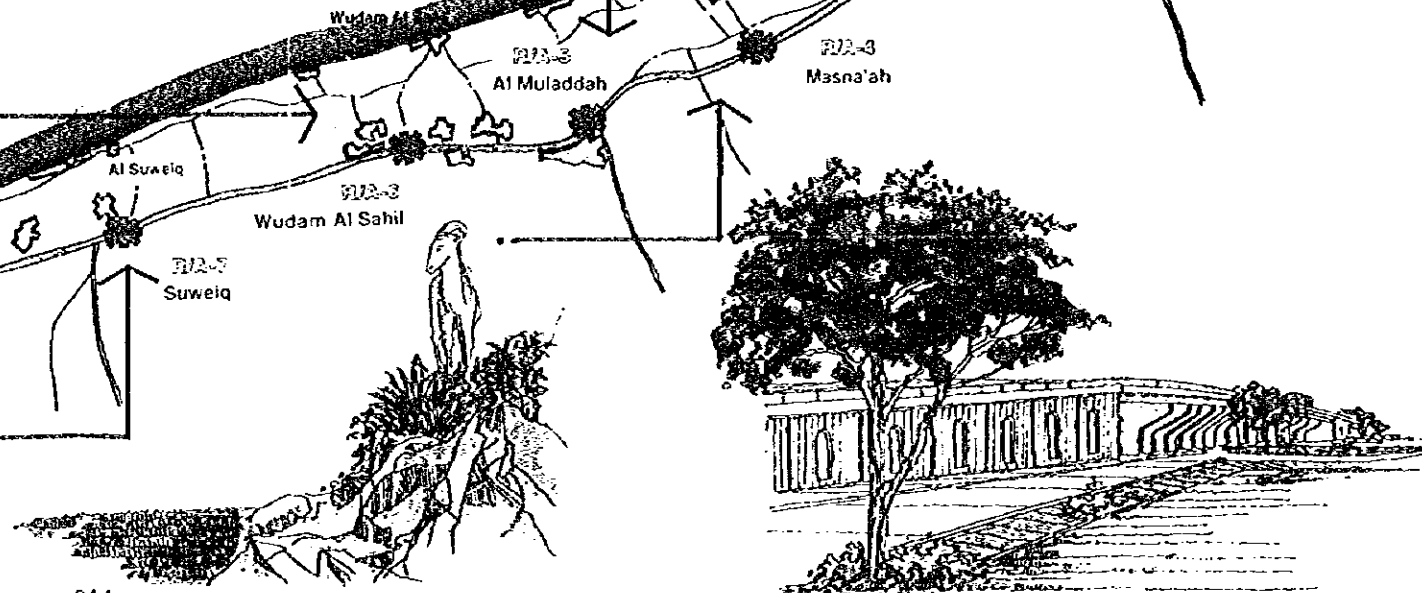
g plants, some symbolic large crown area for emphasizing landscape

GULF OF OMAN

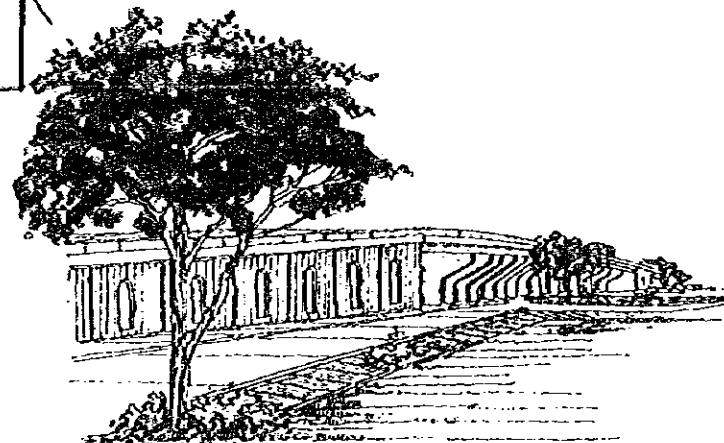
Al Ghail



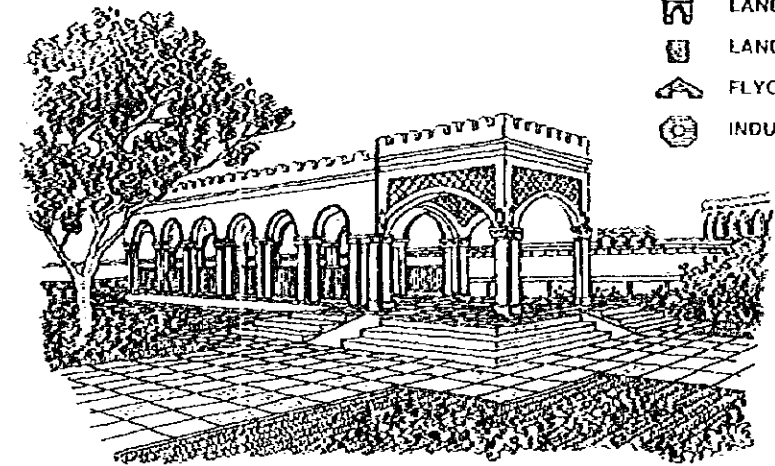
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This area of roundabout is consisted flower garden on the slight mound and major objectives are groups of plants



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Rock piled mound with animal sculptures on the fat garden is landscape character of the area and this landscape concept shall be express part of representative Omani natural features

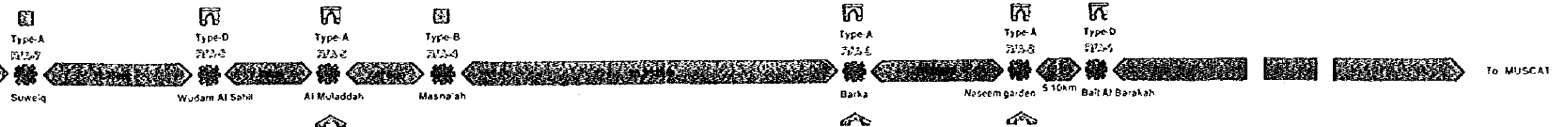


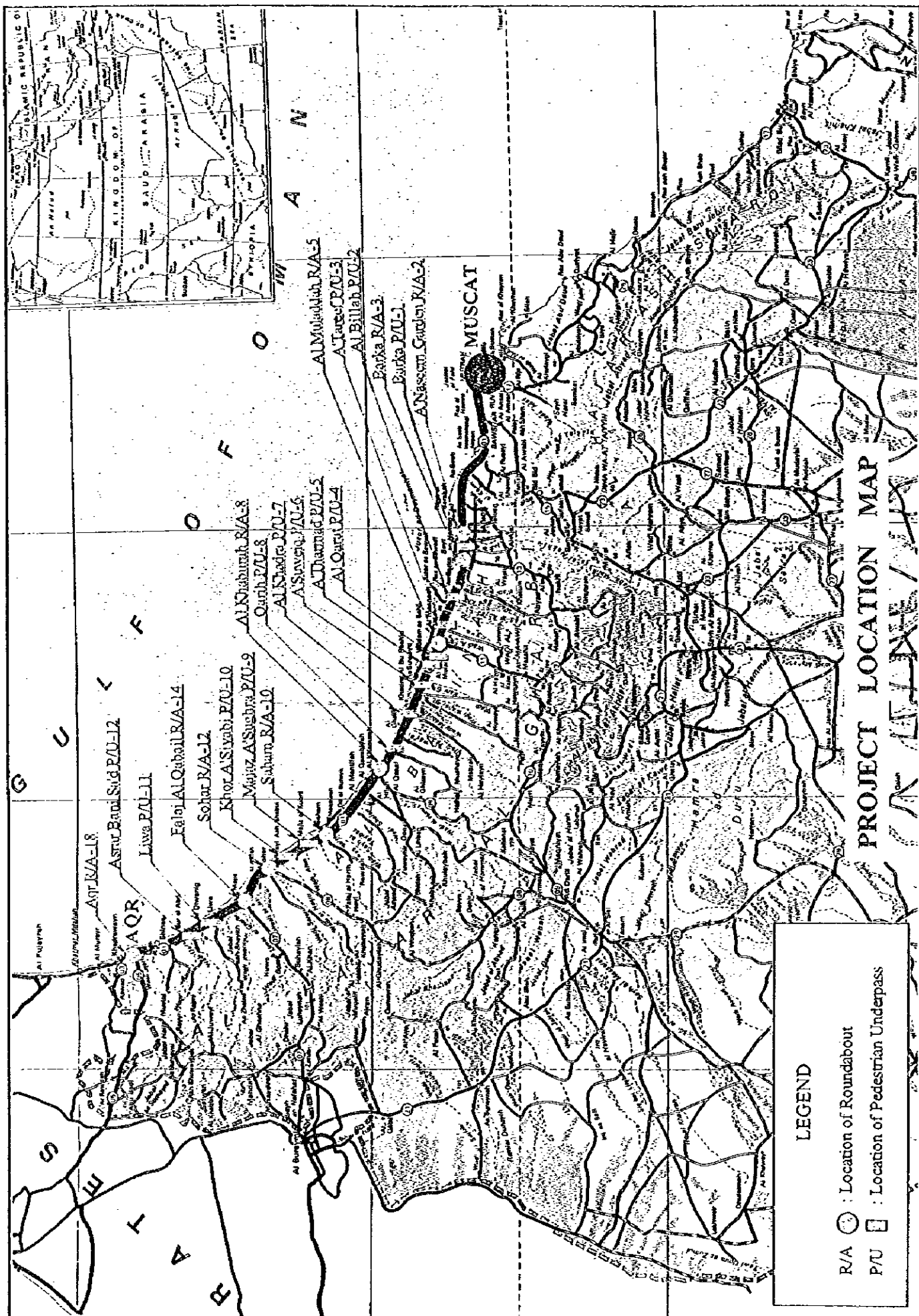
Retaining wall:
Long expanded solid surface of the retaining wall would need familiar features. Introduction of the engrave of traditional patterns to the wall would present more harmony and continuity



Entrance facility of pedestrian underpass
Location identification, community amicable and attractive appearance design feature of the entrance facility would encourage peoples to use the pedestrian underpass

- LEGEND
- ROUNDABOUT / JUNCTION
 - COMMUNITY & TOWNSHIP
 - LANDMARK
 - LANDSCAPE FOCUS
 - FLYOVER PRIORITY
 - INDUSTRIAL ESTATE





PROJECT LOCATION MAP

LEGEND

R/A ○ : Location of Roundabout

PTU □ : Location of Pedestrian Underpass

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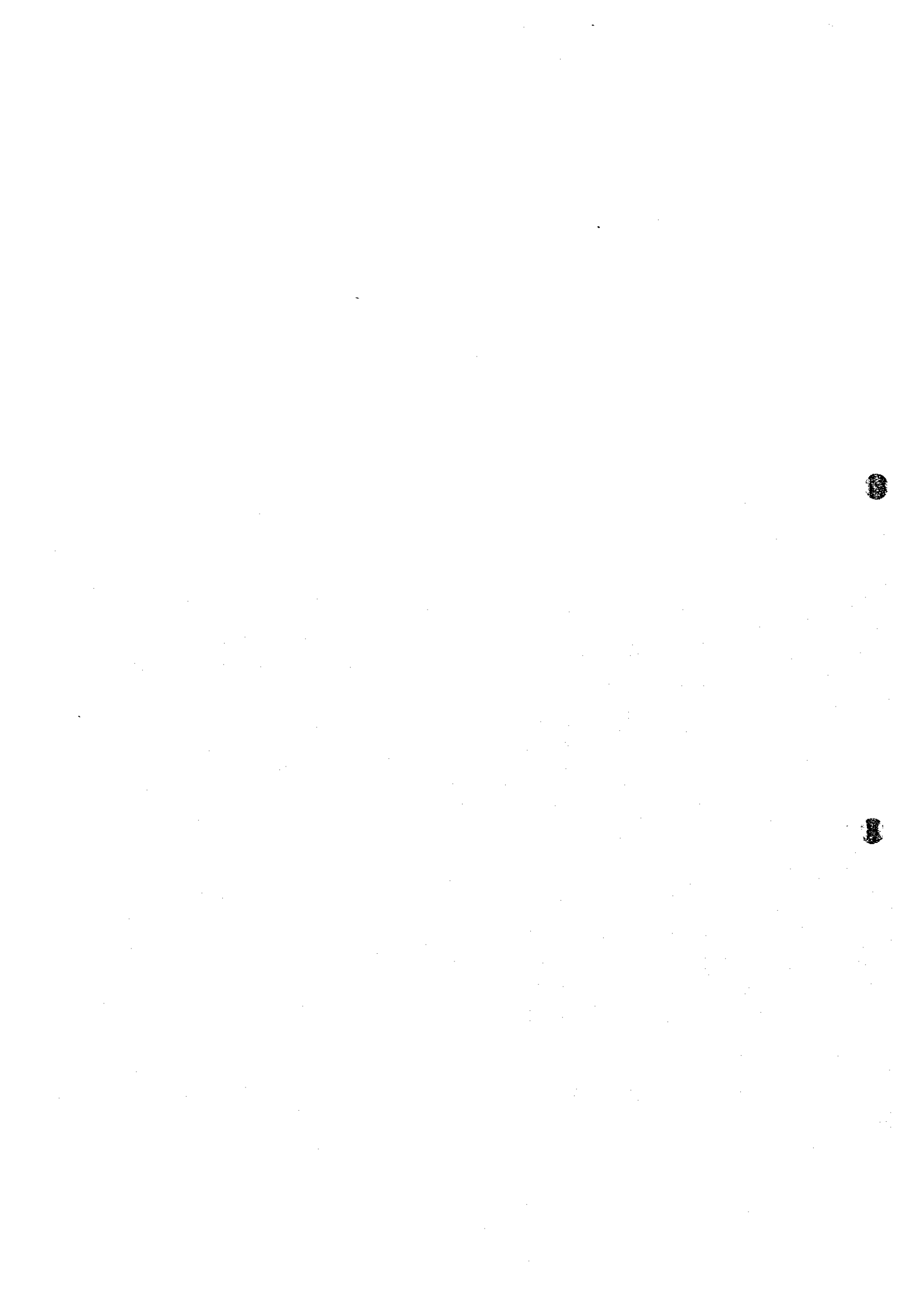
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CHAPTER 1

INTRODUCTION

CHAPTER 1 INTRODUCTION

1.1 Background of the Study

In response to the request of the Government of the Sultanate of Oman, the Government of Japan decided to conduct THE DETAILED DESIGN STUDY ON ROAD DEVELOPMENT PROJECT IN THE SULTANATE OF OMAN (hereinafter referred to as "the study"), in accordance with the relevant laws and regulations in force in Japan.

The Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programmes of the Government of Japan, is to undertake the study in close cooperation with the relevant authorities concerned of the Government of the Sultanate of Oman.

This study officially commenced at the beginning of December 1995 in Japan, as agreed the scope and schedule between Directorate General of Roads (hereinafter referred to as "DGR") and JICA.

The Japanese consultants, Pacific Consultants international and Fukuyama Consultants International witnessed JICA Advisory Committee (herein after referred to as "Study Team") was dispatched to Oman for the first visit on the 19th of December 1995, and conducted the study until December 1996 as shown study flow chart.

The Batinah Highway begins in the capital Muscat and traverses the Gulf of Oman over a stretch of 274 km to the border of the United Arab Emirates at Khatmat Malahah.

Although the Batinah Highway is an expressway, there are practically no grade separations; thus pedestrians are forced to cross on the highway itself where vehicles are traveling often more than 100 kph. Needless to say, there occur a large number of vehicle/pedestrian accidents; and communities which are divided by this expressway daily face risks in crossing. The introduction of grade separations as well as pedestrian underpasses at important locations along the Highway has been of great significance in ensuring smooth vehicle movement as well as in upgrading safety.

As stated above, the two following issues have been important problems along the Batinah and other neighboring highways:

- Dangers and problems occurring from reduction of speed at roundabouts
- Pedestrian crossing

In order to resolve the above problems, the Government of the Sultanate of Oman requested the Government of Japan to conduct a feasibility study, which was carried out between February 1994 and January 1995.

The Sultanate has been actively pursuing domestic economic development since 1970, and has spent a large amount of its oil revenues on infrastructure development. The First Five-year Development Plan was initiated and carried out beginning in 1976. At present, the Fifth Five-year plan is in progress. The details of the First to Fourth Five-year Plans are

shown in Table 1.

Table 1 Five-Year Development Plan

Plan	Period	Outline
First Five-Year Plan	1976 - 1980	-Promotion of agriculture and industries and infrastructure development
Second Five-Year Plan	1981 - 1985	- Development of Muscat area and road development in capital area
Third Five-Year Plan	1986 - 1990	- Promotion of agriculture and industries to avoid over-dependency of oil and development of under-developed areas - Development of water sources and infrastructure as fundamental conditions of national development
Fourth Five-Year Plan	1991 - 1995	- Attainment of actual GNP of 6.3 % per capita - Alleviate over-dependency on oil - Promote free competition by introduction of market economy system and protect private enterprise - Development of basic infrastructure

As in previous five-year plans, further development of the transportation infrastructure continues to be of top priority in the Fifth Five-year Plan. Therefore, the Directorate General of Roads of the Ministry of Communications, having drawn up a long-term plan for the construction of flyovers and pedestrian underpasses along the Batinah Highway to continue throughout the Fifth and Sixth Five-year Plans, requested the Japanese Government to conduct detailed design work. This detailed design work was conducted by the Japanese Government as this project between December 1995 and December 1996.

1.2 Study Objectives

Based on the request of the Omani government as stated above, This study was conducted according to the following objectives.

- To carry out the final design for the construction of eight flyovers and twelve pedestrian underpasses along the Batinah Highway to ensure smoother traffic and improve safety for citizens, based on the results of the previously conducted feasibility study.
- To conduct site surveys, soil and material studies as well as supplementary traffic volume surveys while reviewing the results of the feasibility study.
- To conduct final design for flyovers and pedestrian underpasses and prepare tender and contract documents.
- To conduct an Environmental Impact Assessment
- To conduct transfer of skills to engineer counterparts in the Directorate General of Roads

1.3 Study Area

The study area for the detailed design study on the construction of flyovers and underpasses was the 230km stretch of the Batinah Highway between Bait Al Barakah and Aqr. More specifically, the study was carried out for the construction of flyovers at eight roundabouts/junction and twelve pedestrian underpasses.

The final locations examined through this detailed design study as shown on the flow chart step 2.

The high-priority locations for flyovers and pedestrian underpasses determined are shown in Tables 1.1 and 1.2.

1.4 Scope of the Study

The detailed design study on construction of flyovers at eight (8) roundabouts/junction and pedestrian underpasses at twelve (12) locations was undertaken according to the procedure shown in Figure 1.1.

The detailed design study has been divided into seven different steps according to study activities and work location.

Step 1: Preparatory Work in Japan

This includes the preparation of the Inception Report and preliminary study on field survey methods and locations.

Step 2: Data Collection, Review of Feasibility Study and Field Survey in Oman.

The purpose of this step is to prepare necessary data for the detailed design work. Study activities included in this step are the collection and analysis of various data; the review of the feasibility study; field reconnaissance of present conditions; the establishment of design criteria; basic planning of flyovers and pedestrian underpasses; planning and execution of supplemental traffic surveys; survey of construction materials and machinery resources; topographic survey, and soil/material survey. A progress report is prepared at the end of this step.

Step 3: Detailed Design Study in Japan

This step is to carry out the detailed design work of four flyovers and six pedestrian underpasses, which are the highest priority among 8 flyovers and 12 pedestrian underpasses. Their priority is to be confirmed based on the results of previous study step.

In addition, costs of their construction will be estimated and the results will be reported in the Interim Report.

Step 4: Environmental Survey in Oman and Detailed Study in Japan

At the beginning of this step, the Interim Report will be submitted to DGR and discussion of this report shall be conducted in Oman..

This step also aims at preparing the Environmental Impact Statement in Oman and therefore will include executing of environmental field survey; extracting environmental impact factors; forecasting environmental impacts, assessing these and environmental impacts..

Detailed design of the remaining 4 flyovers and 6 pedestrian underpasses will be carried out in Japan as a part of this step.

Step 5: Detailed Design and Preparation of Tender Documents in Japan

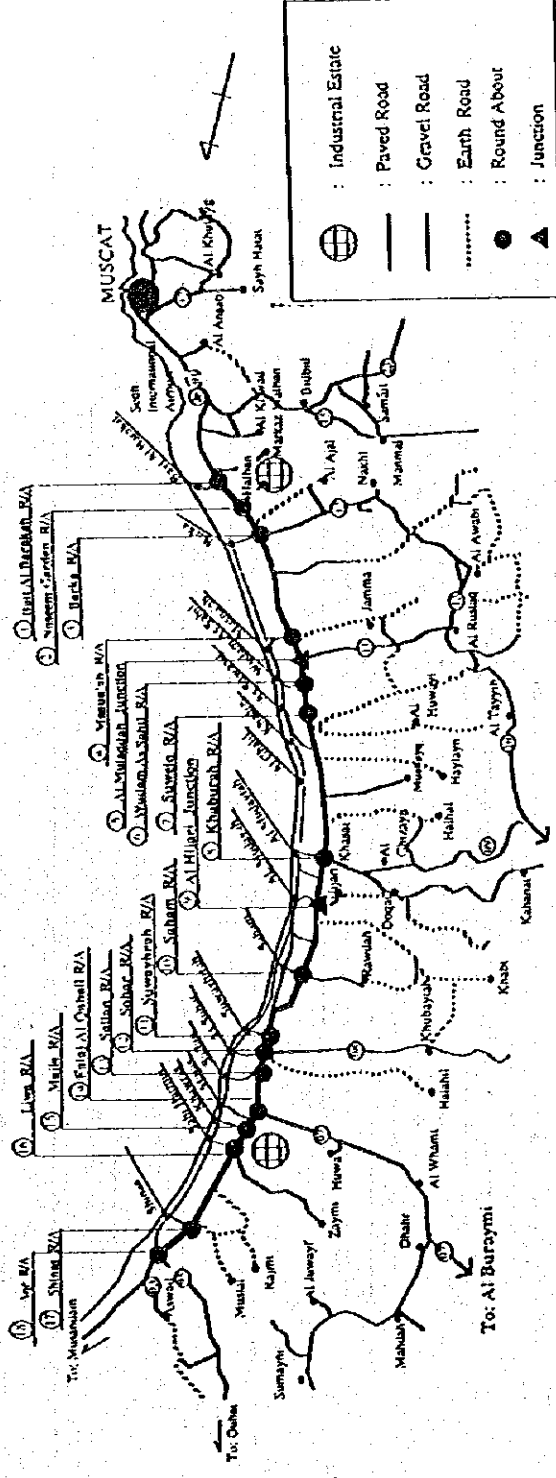
Study activities to be accomplished in this step include finishing detailed design work from Step 4; project construction planning project cost estimation; preparation of project implementation programme; and preparation of necessary tender and contract documents and drawings. The Draft Final Report will be prepared at the end of this step.

Step 6: Submission of Draft Final Report

The Draft Final Report will be presented to DGR in Oman.

Step 7: Submission of Final Report

The Final Report will be prepared taking into account comments on the Draft Final Report and submitted to DGR, Government of the Sultanate of Oman.



Criteria for Evaluation	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
Number of R/A	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
Name of R/A or Junction	Al Siba R/A	Al Qabail R/A	Al Siba R/A	Al Qabail R/A	Al Siba R/A	Al Qabail R/A	Al Siba R/A	Al Qabail R/A	Al Siba R/A	Al Qabail R/A	Al Siba R/A	Al Qabail R/A	Al Siba R/A	Al Qabail R/A	Al Siba R/A	Al Qabail R/A	Al Siba R/A	Al Qabail R/A	Al Siba R/A	Al Qabail R/A	Al Siba R/A	Al Qabail R/A	Al Siba R/A	Al Qabail R/A	Al Siba R/A	Al Qabail R/A	Al Siba R/A	Al Qabail R/A	Al Siba R/A	
Station	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	
Length (km)	7.00	28.75	9.5-8	2.702	10.30	6.048	5.402	22.05	17.766	11.734	38.07	10.33	7.46	25.832	15.76	5.09														
Cross Road Access	N.R. 5	Dubai																												
Traffic Volume	1994	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	
V/C Ratio	0.29	0.31	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	
Relation with Road Network	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Local community Integration	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Reason with technical Development	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Priority	16	18	17	14	9	15	12	5	7	6	13	11	4	10	1	3	8	2	1	5	1	1	1	1	1	1	1	1	1	1

THE STUDY ON ROAD DEVELOPMENT PROJECT JAPAN INTERNATIONAL COOPERATION AGENCY Table 1.1 Previous Priority of Flyover on Roundabout

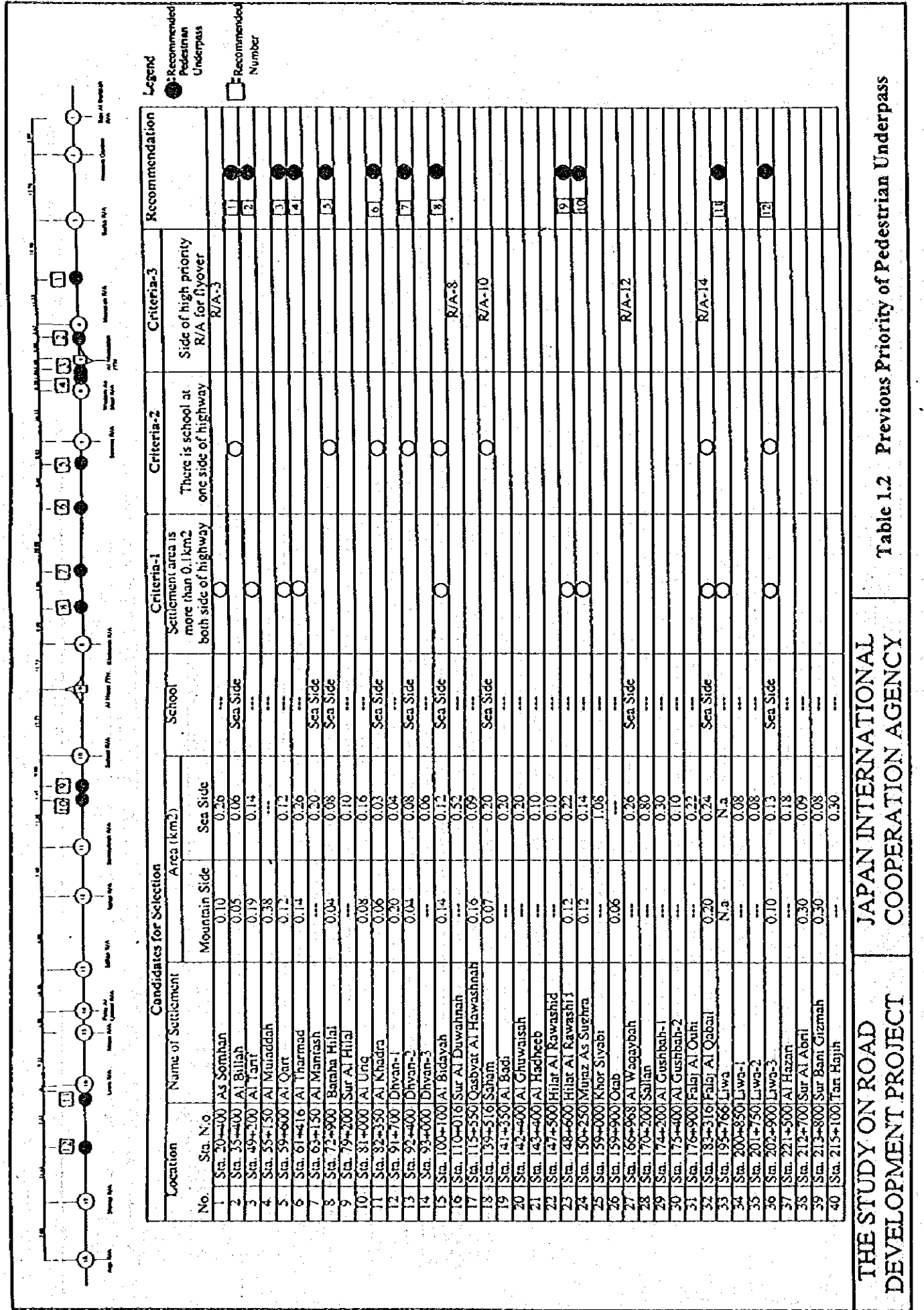
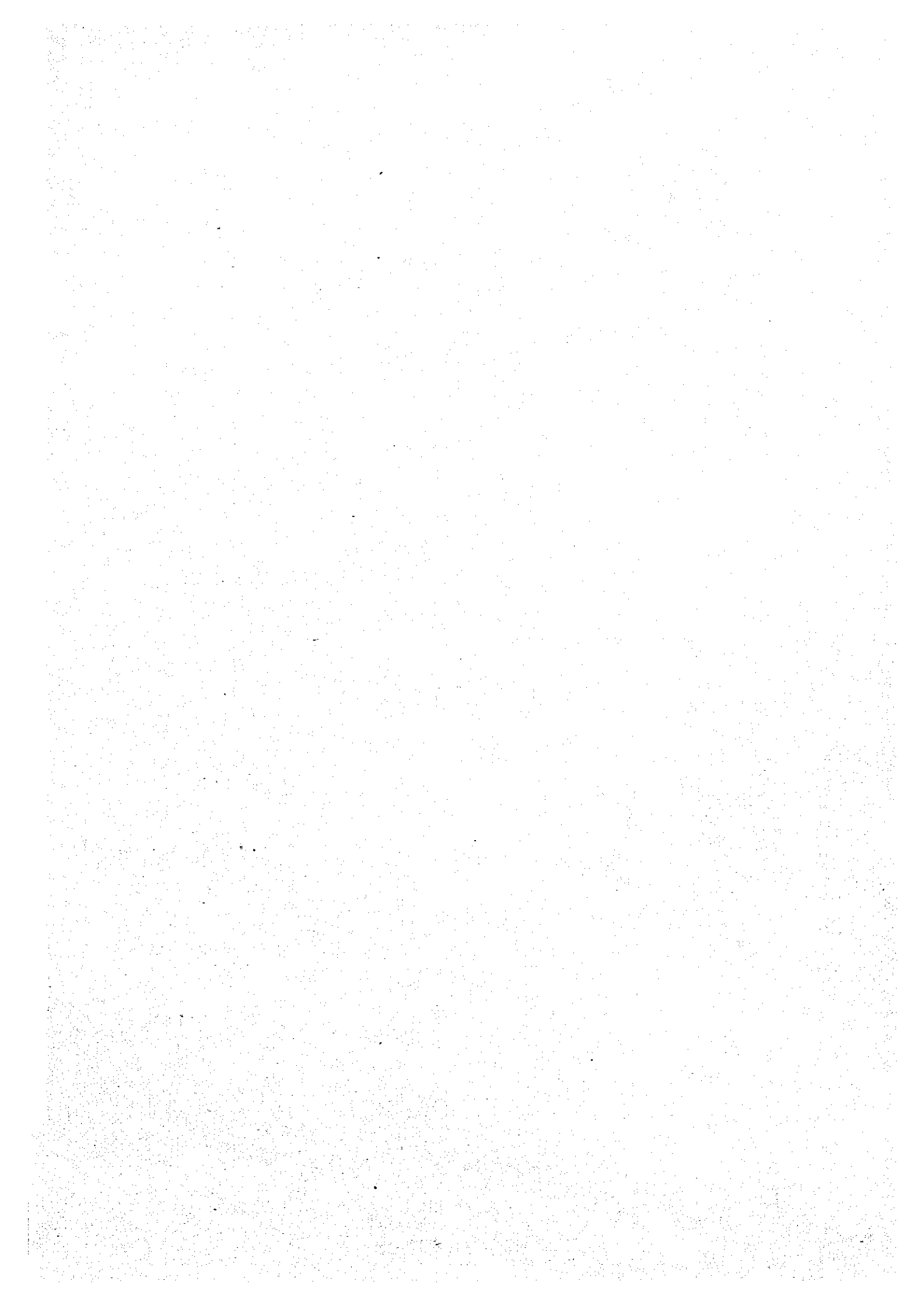
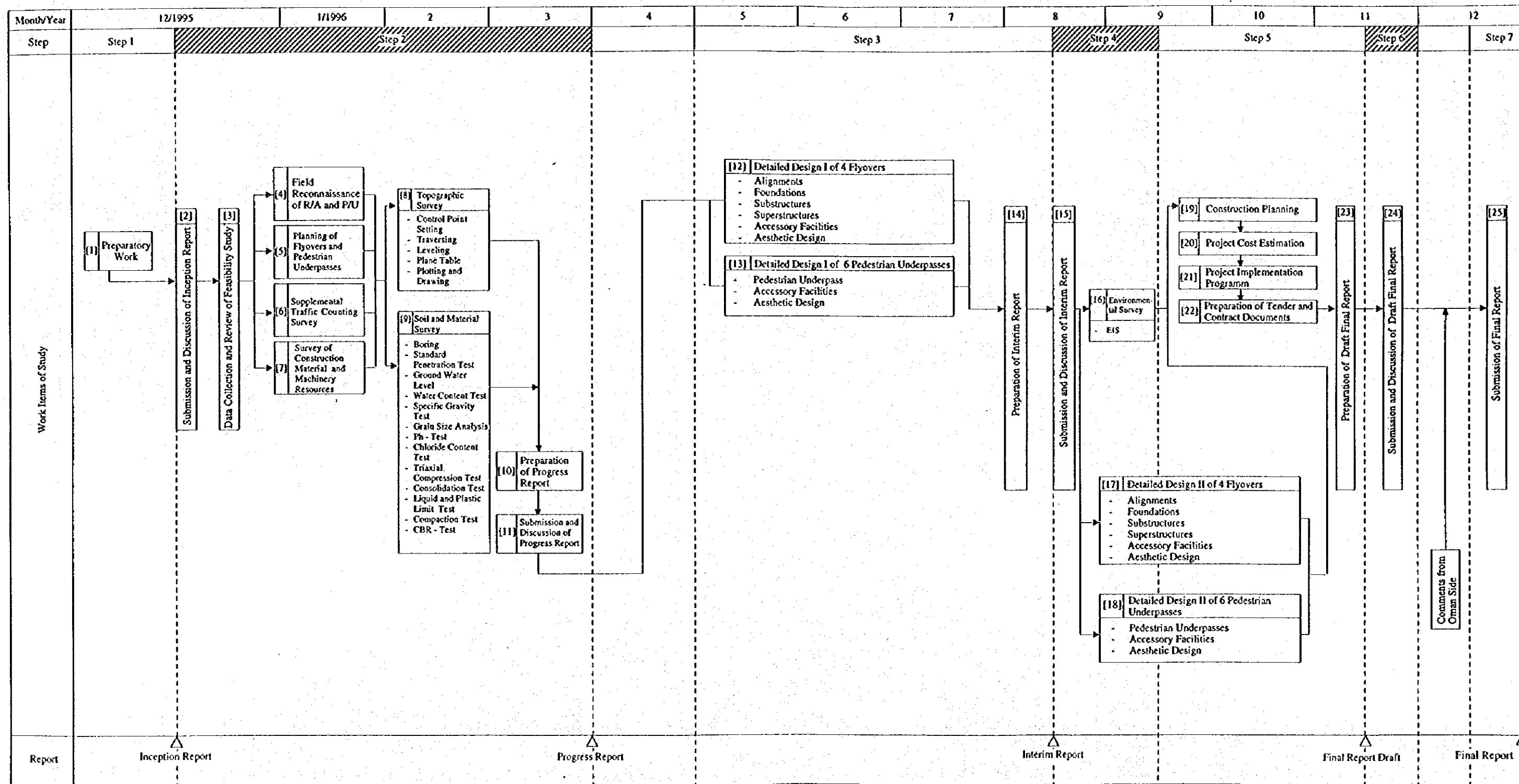


Table 1.2 Previous Priority of Pedestrian Underpass

JAPAN INTERNATIONAL COOPERATION AGENCY

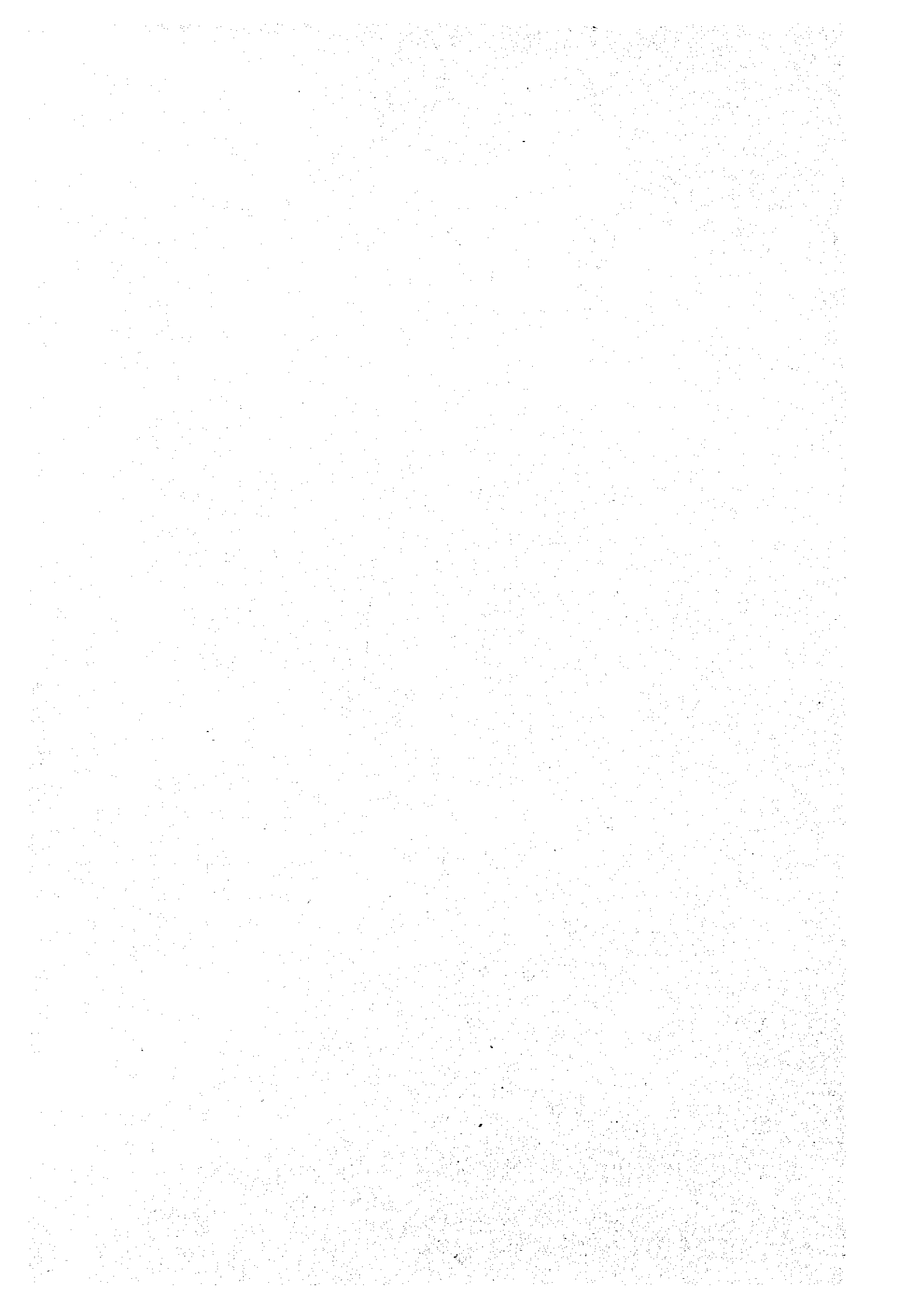
THE STUDY ON ROAD DEVELOPMENT PROJECT





Legend: Step Work in Oman
 Step Work in Japan

Figure 1.1 Study Flowchart



1.5 Study Organization

The study organization is shown in Figure 1.2, and a member chart of the Study Team is shown in Figure 1.3 .

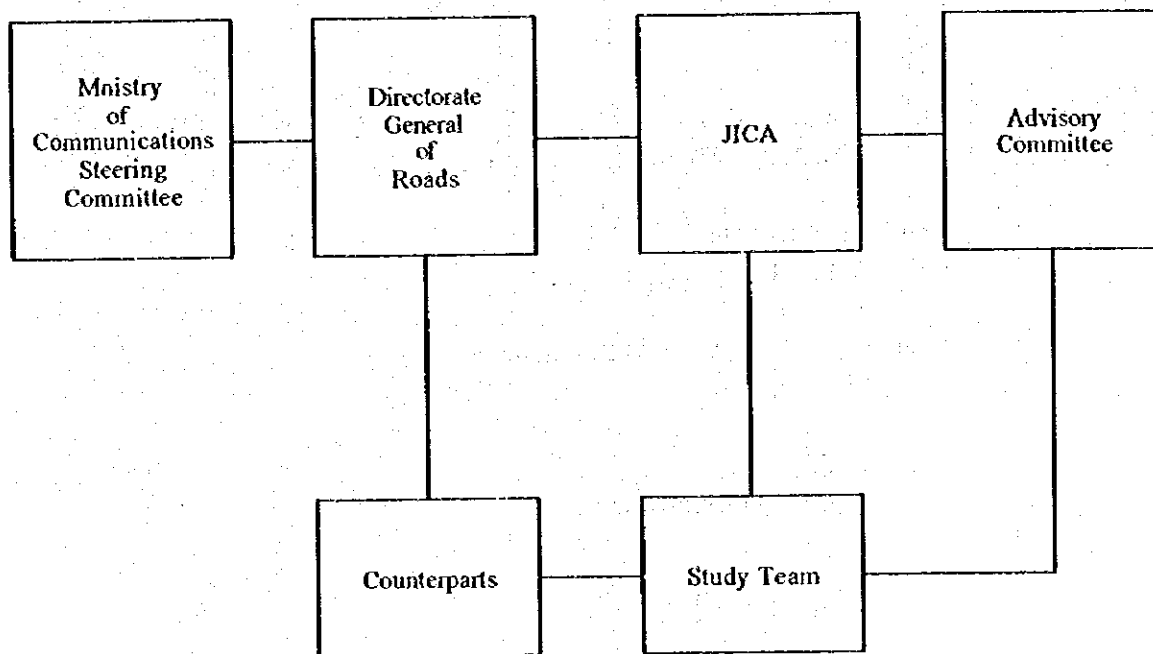


Figure 1.2 Study Organization

Members of the Study Organization are as follows:

The MOC Technical Committee

1. Engr. Khalid Bin Abdullah Bakathir
Director General of Roads
2. Engr. Hilmi Bin Amor Al Barwani
Deputy Director General, Technical Affairs
3. Engr. Salameh Khoury
Technical Advisor to H.E. the Minister
4. Engr. Abdullah Bin Suleiman Al Sharji
Director of Studies and planning
5. Engr. Saif Bin Abdullah Al Sa'adi
Acting Director of Surveying
6. Engr. Hamad Bin Saud Al Ramadhani
Civil Engineer
7. Engr. Abdul Ghani
Highway Design Engineer
8. Engr. abdullah Al khiyari
Road Engineer
9. Mr. Ahmed Abdul Aziz
Quantity Surveyor
10. Mr. Victor Bin Basil Rizkallah
Quantity Surveyor

JICA Advisory Committee

1. Mr. Hiroshi Fujii
Leader of JICA Advisory Committee
2. Mr. Shinobu Koyama
JICA Advisory Committee
3. Mr. Masahiro Ono
JICA Staff

JICA Study Team

1. Mr. Yoshimi Takai
Team Leader / Highway Bridge Planner
2. Mr. M.Y. Chua
Traffic Engineer
3. Mr. Kazuo Mizukoshi
Highway Engineer
4. Mr. Satoshi Watabe
Bridge Engineer (1)
5. Mr. Toru Irisawa
Bridge Engineer (2)
6. Mr. Tatsuo Mukoyama
Bridge Engineer (3)
7. Mr. Shunji Yoshihara
Structural Engineer
8. Mr. Hiroshi Tanaka
Environmental study/Bridge Artist
9. Mr. Yasufumi Watanabe
Construction Planner
10. Mr. Tatsuhiko Kono
Cost Estimate Engineer
11. Mr. Hiroo Takeda
Tender Document Specialist
12. Mr. Shogo Shibata
Survey/Soil/Material Engineer

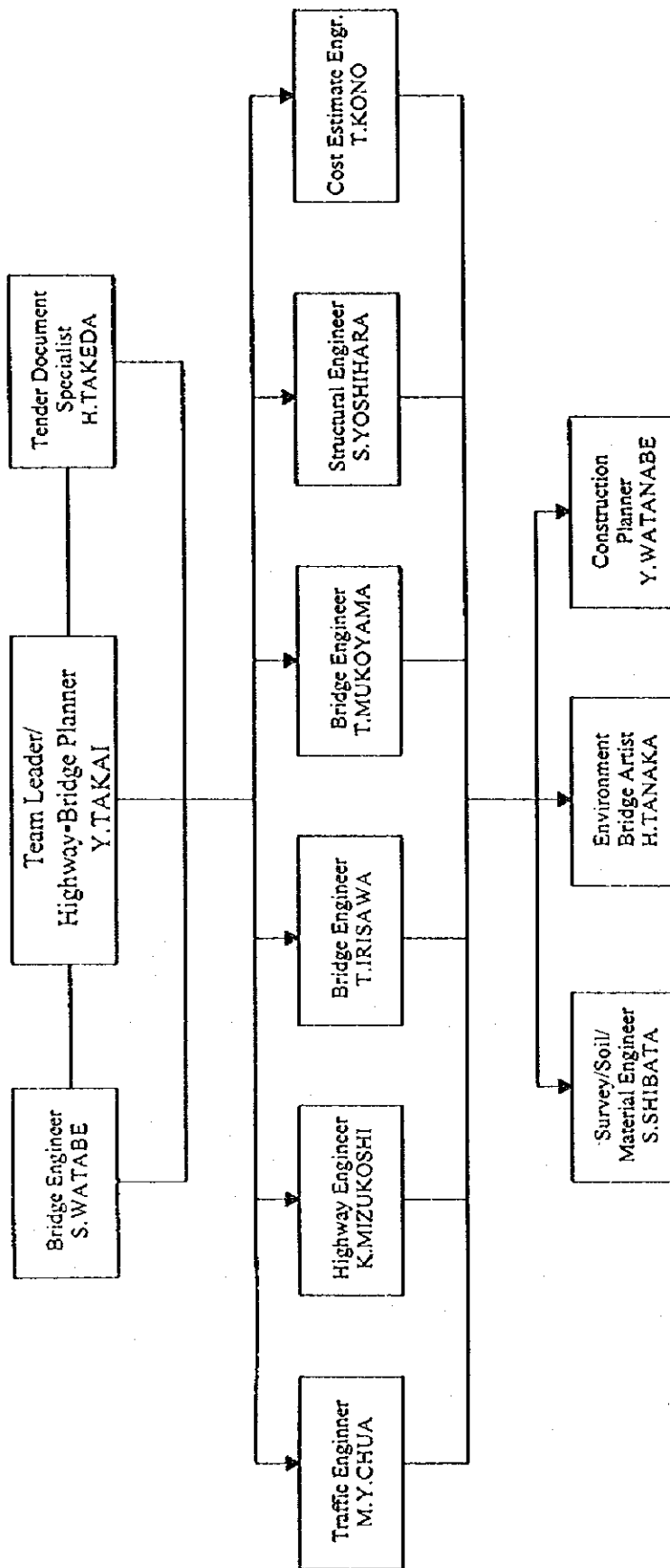


Figure 1.3 Organization of Study