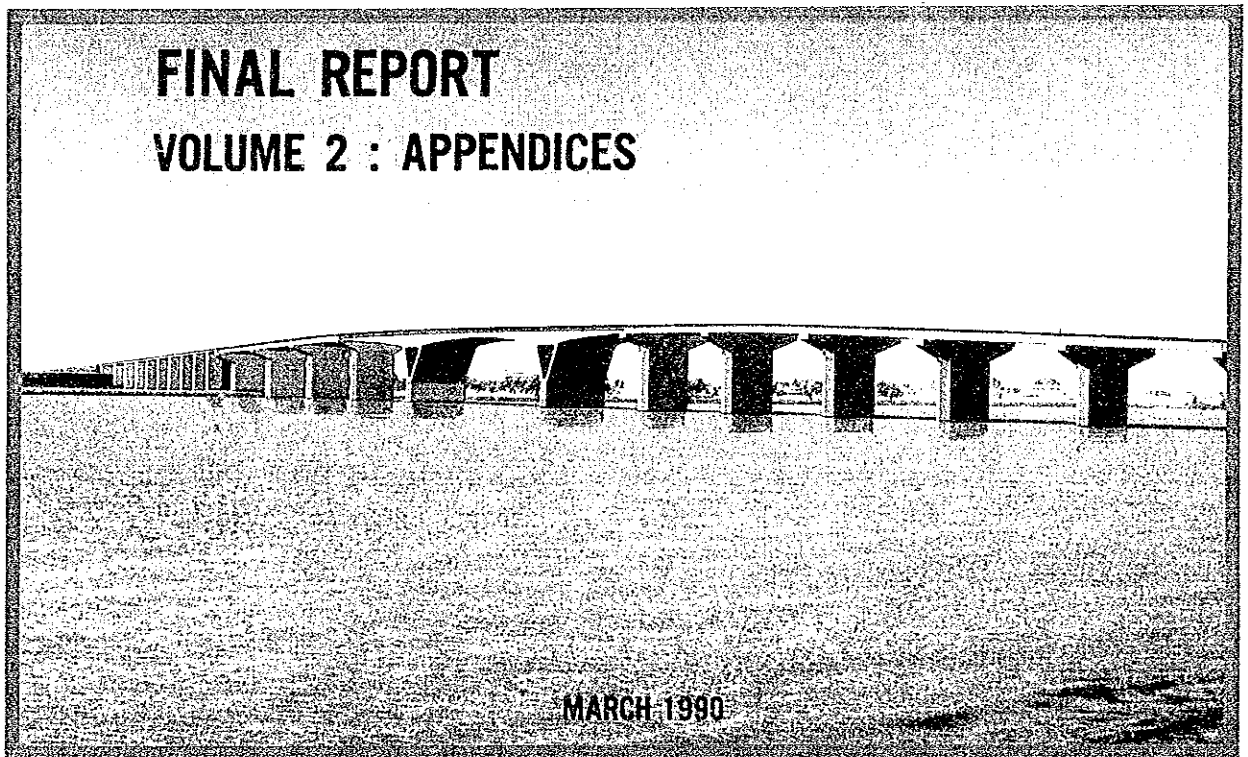


NATIONAL CAPITAL KHARTOUM
THE GOVERNMENT OF THE REPUBLIC OF THE SUDAN

THE FEASIBILITY STUDY
ON
THE CONSTRUCTION OF THE NEW WHITE NILE BRIDGE
IN
THE REPUBLIC OF THE SUDAN

FINAL REPORT
VOLUME 2 : APPENDICES



MARCH 1990

JAPAN INTERNATIONAL COOPERATION AGENCY

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THE FEASIBILITY STUDY ON THE CONSTRUCTION OF
THE NEW WHITE NILE BRIDGE IN THE REPUBLIC OF THE SUDAN

FINAL REPORT
VOLUME 2 : APPENDICES

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NATIONAL CAPITAL KHARTOUM
THE GOVERNMENT OF THE REPUBLIC OF THE SUDAN

**THE FEASIBILITY STUDY
ON
THE CONSTRUCTION OF THE NEW WHITE NILE BRIDGE
IN
THE REPUBLIC OF THE SUDAN**

**FINAL REPORT
VOLUME 2 : APPENDICES**

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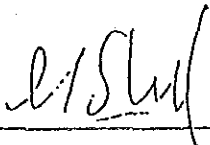
Introduction to The Project

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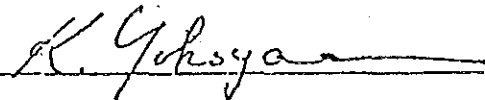
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SCOPE OF WORK
FOR
THE FEASIBILITY STUDY
ON
THE CONSTRUCTION OF THE NEW WHITE NILE BRIDGE
IN
THE REPUBLIC OF THE SUDAN
AGREED UPON BETWEEN
NATIONAL CAPITAL KHARTOUM
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Khartoum, 16 August, 1988



Mamoun A. Sherfi
Commissioner
Engineering & Health Affairs
National Capital Khartoum



Koichi Yokoyama
Leader of the Preliminary
Survey Team,
Japan International
Cooperation Agency

I. INTRODUCTION

Appendix 1.1(2)

In response to the request of the Government of the Republic of the Sudan (hereinafter referred to as "the Government of Sudan"), the Government of Japan has decided to conduct the Feasibility Study on the Construction of the New White Nile Bridge (hereinafter referred to as "the Study"), in accordance with the relevant laws and regulations in force in Japan.

Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of technical cooperation programmes of the Government of Japan, shall undertake the Study in close cooperation with the authorities of the Government of Sudan.

The present document sets forth the Scope of Work with regard to the Study.

II. OBJECTIVE OF THE STUDY

The objective of the Study is to carry out the feasibility study in order to examine the technical and economic viability for the construction of the New White Nile Bridge.

III. SCOPE OF THE STUDY

In order to achieve the objective mentioned above, the Study shall cover the following items:

1. Data Collection and Analysis
 - (1) Socio-economic data

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- (2) Traffic data
 - (3) Topographical data
 - (4) Geological data
 - (5) Hydrological data
 - (6) Development plans
 - (7) Other necessary data
2. Supplementary Surveys
 - (1) Traffic survey
 - (2) Topographical survey
 - (3) Geological survey
 - (4) Hydrological survey
 - (5) Other necessary surveys
 3. Forecast of Future Traffic Demand
 4. Preliminary Comparative Study of Alternative Routes and Locations of the Bridge
 5. Recommendation of the Route and Location of the Bridge
 6. Establishment of Design Standard
 7. Study on Alternative Plans (types, construction methods, etc. of the Bridge).
 8. Detailed Field Survey
 - Topographical survey
 - Geological survey

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9. Preliminary Engineering Study

Appendix 1.1(4)

- Preliminary design of superstructures
- Preliminary design of substructures
- Preliminary design of foundations
- Preliminary design of approach roads
- Preliminary design of river banks

10. Construction Cost Estimate

- Land acquisition cost
- Temporary works cost
- Construction cost
- Maintenance cost
- Other necessary costs

11. Evaluation of Alternative Plans

12. Economic Evaluation

13. Preparation of Implementation Program

14. Conclusion and Recommendation

IV. STUDY SCHEDULE

The Study shall be conducted in accordance with the attached tentative schedule.

V. REPORTS

JICA shall prepare and submit the following reports in English to the Government of Sudan.

1. Inception Report

30 copies.

At the commencement of the Study.

2. Interim Report (I)
30 copies.
Within five (5) months after the commencement of the Study:
3. Interim Report (II)
30 copies.
Within ten (10) months after the commencement of the Study.
4. Draft Final Report
30 copies.
Within fifteen (15) months after the commencement of the Study.
The Government of Sudan shall provide JICA with its comments within one (1) month after the receipt of Draft Final Report.
5. Final Report
50 copies.
Within one (1) month after the receipt of Sudanese Government's comments on the Draft Final Report.

VI. UNDERTAKING OF THE GOVERNMENT OF SUDAN

1. To facilitate smooth conduct of the Study, the Government of Sudan shall take necessary measures:
 - (1) To secure the safety of the Japanese study team (hereinafter referred to as "the Team").
 - (2) To permit the members of the Team to enter, leave and sojourn in the Republic of the Sudan (hereinafter referred to as "Sudan") for the duration of their assignment therein, and exempt them from alien registration requirements and consular fees.

- (3) To exempt the members of the Team from taxes, duties, fees and other charges on equipment, machinery and other materials brought into Sudan for the conduct of the Study.
 - (4) To exempt the members of the Team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Japanese study team for their services in connection with the implementation of the Study.
 - (5) To provide the necessary facilities to the Team for the remittance as well as utilization of fund introduced into Sudan from Japan in connection with the implementation of the Study.
 - (6) To secure permission for the entry into private properties or restricted areas for the conduct of the Study.
 - (7) To secure permission to take all data and documents (including photographs) related to the Study out of Sudan to Japan by the Team.
 - (8) To provide the medical services as needed and its expenses will be chargeable on the members of the Team.
2. The Government of Sudan shall bear claims, if any arises against the members of the Team resulting from, occurring in the course of, or otherwise connected with the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or wilful misconduct on the part of the members of the Team.

3. National Capital Khartoum (hereinafter referred to as "NCK") shall, act as counterpart agency to the Team and also as coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.
4. NCK shall, at its own expense, provide the Team with the followings, in cooperation with other organizations concerned.
 - (a) Available data and information related to the Study
 - (b) Counterpart personnel
 - (c) Suitable office space with necessary equipment and furniture in Khartoum
 - (d) Credentials or identification cards

VII UNDERTAKING OF JICA

For the implementation of the Study, JICA shall take the following measures;

1. To dispatch, at its own expense, study teams to Sudan.
2. To pursue technology transfer to the Sudanese counterpart personnel in the course of the Study.

VIII. MUTUAL CONSULTATION

JICA and NCK shall consult with each other in respect of any matter that may arise from or connection with the Study.

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ANNEX

TENTATIVE STUDY SCHEDULE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
REPORT PRESENTATION	1																	1
IC/R	1																	
IT/R (I)																		
IT/R (II)																		
DF/R																		
F/R																		
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WORK IN JAPAN																		

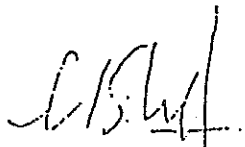
NOTE IC/R : Inception Report DF/R : Draft Final Report
 IT/R : Interim Report F/R : Final Report

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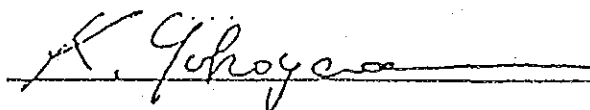
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MINUTES OF MEETING
ON
SCOPE OF WORK
FOR
THE FEASIBILITY STUDY
ON
THE CONSTRUCTION OF THE NEW WHITE NILE BRIDGE
IN
THE REPUBLIC OF THE SUDAN
AGREED UPON BETWEEN
NATIONAL CAPITAL KHARTOUM
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Khartoum, 16th August, 1988.



Hamoun A. Sherfi
Commissioner
Engineering & Health Affairs
National Capital Khartoum



Koichi Yokoyama
Leader of the Preliminary
Survey Team
Japan International
Cooperation Agency

The meetings on the Scope of the Work for the Feasibility Study on the construction of the New White-Nile Bridge in the Republic of the Sudan were held in Khartoum, Sudan on 9th through 15th August 1988 between the Japanese Preliminary Survey Team dispatched by Japan International Cooperation Agency and National Capital Khartoum.

The list of the attendants of the meetings is shown in the Appendix.

Main items discussed between both sides are as follows:

1. (1) NCK explained the Team the background and contents of the request as stated in the Terms of Reference.
(2) The Team explained NCK that the above captioned Study would be implemented separately from the construction of the New White Nile Bridge.
(3) Both sides confirmed the objective of the Study as specified in the Scope of Work.
2. (1) NCK requested the Team to shorten the duration (approximately 17 months) of the Study.
(2) The Team explained the necessity of such a period for fully examining the technical and economical viability of the Bridge construction.
(3) NCK understood the Team's explanation.
3. (1) Both sides agreed to establish a Steering Committee.
(2) The role of the Committee, placed under NCK, is to technically advise NCK concerning the Study.

Ly

LIST OF ATTENDANTSSUDANESE SIDEMINISTRY OF FINANCE & ECONOMIC PLANNING (MOFEP)

Mr. Mohamed Ali	Deputy Undersecretary	Head Office for Desk Affairs of Japan-Denmark-Finland and Socialist Countries.
Mr. Salah A. Omer	Assistant Undersecretary	"
Ms. Asma Abdel Rahman	Senior Staff	Regional Planning Sector

National Capital Khartoum (NCK)

Mr. Magzoup Taha	Deputy Governor	
Mr. Daffalla Mohamed Nasir	Secretary General	
Mr. Mamoun A Sherfi	Commissioner	Engineering & Health Affairs
Mr. Mohamed El-Amin Saeed	Director General	Engineering Commissionerate
Mr. Omer Abdel Nabi	Deputy Director General	" "
Mr. Mohammed Abdel Ghafar Fadl	Director	Planning Dept.
Mr. Osman Mohd. Abdalla	Assist. Director	"
Mr. Osman Mohamed Yahia	Senior Road Engineer	"

-C/

JAPANESE SIDE

JICA Preliminary Survey Team

Mr. Koichi Yokoyama	Team Leader
Mr. Hisamitsu Nishio	Member of Team
Mr. Yutaka Takabatake	" " "
Mr. Masahiko Kitazawa	" " "
Mr. Yutaka Hosomi	" " "
Mr. Kenji Nagasaki	" " "

Embassy of Japan

Mr. Toshio Kaneko	First Secretary
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MINUTES OF MEETING
ON
INCEPTION REPORT
FOR
THE FEASIBILITY STUDY
ON
THE CONSTRUCTION OF THE NEW WHITE NILE BRIDGE
IN
THE REPUBLIC OF THE SUDAN

AGREED UPON BETWEEN
NATIONAL CAPITAL KHARTOUM
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Khartoum, 14th January, 1989

M. Saeed

Mohamed El-Amin Saeed
Director General
Engineering Commissionerate
National Capital Khartoum
and
Chairman of Steering
Committee

H. Oshima

Hisashi Oshima
Team Leader
JICA Study Team

K. Yokoyama

Koichi Yokoyama
Team Leader
JICA Advisory Team

Joint meeting on the Inception Report for the Feasibility Study on the Construction of the New White Nile Bridge (the Study) in the Republic of the Sudan was held at the Commissionerate of Engineering Affairs, National Capital Khartoum (NCK) at 9:30 a.m. on the 11th of January, 1989 among NCK, the Sudanese Steering Committee, JICA Advisory Team (the Advisory Team) and JICA Study Team (the Study Team).

The list of the attendants of the meeting is shown in the Appendix.

- I. 1. The Study Team submitted thirty (30) copies of the Inception Report to NCK.
 2. Major items discussed among the parties are as follows:
 - (1) The Steering Committee requested to add a route crossing the river at the point about 2 km in the south of Um Shugiera Island for the location study of the new bridge. The Study Team answered that if found appropriate, this route would be considered as one of the alternatives. (Refer to Subsection 2.1.5, Alternative Bridge Location Study, page 14)
 - (2) With regard to the scale of mapping and photo mosaicking concerning the drawings for the route location study, the Steering Committee recommended to employ a scale of 1/2,500 in stead of 1/2,000 according to the usual scale practices in Sudan. (Refer to Subsection 2.1.3, Supplementary Surveys, page 11)
 3. Consequently, NCK accepted the contents of the Inception Report.
- II. In addition to above items, the following matters were also discussed:
- (1) NCK asked about the number of counterpart personnel to be trained in Japan. The Advisory Team answered that at present one trainee could be accepted to Japan in the course of the Study. The Advisory Team suggested, in view of anticipated limitation in the number of trainees, that a candidate in the position concerned of overall aspects of the Study might be preferable. NCK stated to consider an appropriate candidate for the due purpose of the Study.
 - (2) The Study Team proposed to hold a joint technical meeting with the Sudanese side when necessary, at least once a month. NCK agreed with this proposal.
 - (3) The Advisory Team requested NCK to provide office furnitures as soon as possible for the smooth conduct of the Study. NCK promised to provide them at the earliest possible date.

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APPENDIX

LIST OF ATTENDANTS

SUDANESE SIDE

Steering Committee

Mr. Mohamed El-Amin Saeed	Director General Engineering Commissionerate NCK
Mr. Modar El-Hifni Ahmed	Physical Planner Dept. of Housing, Ministry of Public Works and Physical Planning
Mr. Osman Mohamed Abdalla	Assistant Director Economic Dept., NCK
Mrs. Leila Mohamed Ahmed El-Badawi	Assistant Director Project Preparation Unit, MOFEP
Col. Salah Mohamed El-Shinnawi	Traffic Engineer Traffic Police Dept., NCK
Mr. Osman El-Obeid El-Amin	Assistant Director Roads & Bridges Public Corporation, Ministry of Public Works and Physical Planning

Counterpart

Mr. Osman Mohamed Yahid	Assistant Director Roads & Bridges Dept., Engineering Commissionerate, NCK
Mr. Ismael Eldin Fadl Elmargi	Assistant Engineer Roads & Bridges Dept., Engineering Commissionerate, NCK

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JAPANESE SIDEJICA Advisory Team

Mr. Koichi YOKOYAMA	Leader
Mr. Hisamitsu NISHIO	Member
Mr. Atsushi NITTA	Member
Mr. Masahiko KITAZAWA	Member

JICA Study Team

Mr. Hisashi OSHIMA	Leader
Mr. Katsufumi MATSUZAWA	Member
Mr. Shigeru NAKAO	Member
Mr. Takao YAMANE	Member
Mr. Hikaru NISHIMURA	Member
Mr. Makoto NAKAMURA	Member
Mr. Tadao OYAMA	Member



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THE FEASIBILITY STUDY
ON
THE CONSTRUCTION OF THE NEW WHITE NILE BRIDGE
IN
THE REPUBLIC OF SUDAN

MINUTES OF MEETING
ON
INTERIM REPORT (I)

AGREED UPON BETWEEN
NATIONAL CAPITAL KHARTOUM
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Khartoum, 23rd March, 1989



Mohamed El-Amin Saeed
Director General
Engineering Commissionerate
National Capital Khartoum
and
Chairman of the Steering
Committee



Hisashi Oshima
Leader
JICA Study Team



Shin Habara
Leader
JICA Advisory Team

Joint meeting on the Interim Report (I) for the Feasibility Study on the Construction of the New White Nile Bridge in the Republic of the Sudan (the Study) was held at the Commissionerate of Engineering Affairs, National Capital Khartoum (NCK) on the 22nd of March, 1989 among NCK, the Sudanese Steering Committee, JICA Advisory Team (The Advisory Team) and JICA Study Team (The Study Team).

The list of the attendants of the meeting is shown in the Appendix.

1. Interim Report (I)

- 1) The Study Team submitted thirty (30) copies of the Interim Report (I) to NCK.
- 2) The Study Team explained the Interim Report (I) and subsequently discussed about the most favorable route. Finally, all the attendants agreed upon the Alternative Route B-1 which was proposed in the Interim Report (I).
- 3) Consequently, NCK accepted the contents of the Interim Report (I).

2. In addition to the above, the following matter was discussed:

- NCK requested the Advisory Team for the detailed design regarding the construction of the New White Nile Bridge.

The Advisory Team confirmed that they will convey NCK's request to the Government of Japan.

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LIST OF ATTENDANTS

Appendix 1.4(3)

SUDANESE SIDE

Steering Committee

- Chairman : Mr. Mohamed El Amin Saeed
 Director General
 Commissionerate of Engineering Affairs
 National Capital Khartoum
- Member : Mr. Osman Mohamed Abdalla
 Assistant Director
 Development and Investment Administration
 National Capital Khartoum
- Member : Mr. Modar El Hifn Ahmed
 Senior Town Planner
 Physical Planning Administration
 Housing Department
 Omdurman Physical Planning Office
 Ministry of Work and Physical Planning
- Member : Mrs. Laila M.A. El Badawi
 Assistant Under Secretary
 Project Preparation Unit
 Ministry of Finance and Economic Planning
- Member : Mr. Hassan Gaafar A/El Rhman
 Senior Inspector
 Regional Development Sector
 Ministry of Finance and Economic Planning
- Member : Mrs. Amna Ahmed Saad
 Senior Inspector
 Loan and Aid department
 Ministry of Finance and Economic Planning
- Member : Dr. Mohamed El Amin Mohamed
 Under Secretary of Dams and Nile Control
 Ministry of Irrigation
- Member : Mr. Salah M. Shinnawi
 Head of Traffic Engineering Section
 Management of Traffic Police and Relief Services
 National Capital Police Headquarters
- Member : Mr. Osman Elabeid El Amin
 Deputy Director Planning
 Roads and Bridges Public Corporation
- Member : Mr. Ibrahim Hassan Babiker
 Deputy Director
 River Transport Corporation

H.O.
 M
 S.H

(to be continued)

COUNTERPARTS

- Team Leader** : Mr. Osman Mohamed Yahia
Assistant Director
Roads and Bridges Department
Commissionerate of Engineering Affairs
National Capital Khartoum
- Coordinator** : Mr. Abdel Wahid Abdel
Roads and Bridges Department
Commissionerate of Engineering Affairs
National Capital Khartoum
- Bridge Planner** : Mr. Magdi M.E. Zumrawi
Roads and Bridges Department
Commissionerate of Engineering Affairs
National Capital Khartoum
- Highway Planner** : Mr. Imad El Din F. El Margi
Omdurman Council
National Capital Khartoum
- Traffic Engineer** : Mr. Hassan Abdal Ghani Mansour
Khartoum Council
National Capital Khartoum
- Hydrologist** : Mr. Mohi El Din M.O. Gadi
Ministry of Irrigation

M. A.O. S.H

JAPANESE SIDEJICA Advisory Team

- Leader : Mr. Shin HABARA (River Engineering)
Deputy Director
Disaster Prevention and Restoration Division
River Bureau
Ministry of Construction
- Member : Mr. Toshiyuki IWAMA (Coordination)
Staff
First Development Survey Division
Social Development Cooperation Department
Japan International Cooperation Agency
- Member : Mr. Masahiko KITAZAWA (Road Planning)
Deputy Manager
Design Section
Kobe Construction Division
Hanshin Expressway Public Corporation
- Member : Mr. Atsushi NITTA (Bridge Planning)
Deputy Manager
Third Design Division
Design Department
Honshu-Shikoku Bridge Authority

JICA Study Team

Mr. Hisashi OSHIMA	Leader
Mr. Katsufumi MATSUZAWA	Member
Mr. Shigeru NAKAO	Member
Mr. Takao YAMANE	Member
Mr. Hikaru NISHIMURA	Member
Mr. Makoto NAKAMURA	Member
Mr. Masanobu SAKAMOTO	Member


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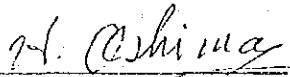
MINUTES OF MEETING
FOR
THE FEASIBILITY STUDY
ON
THE CONSTRUCTION OF THE NEW WHITE NILE BRIDGE
IN
THE REPUBLIC OF THE SUDAN

AGREED UPON BETWEEN
NATIONAL CAPITAL KHARTOUM
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Khartoum, 19th June, 1989



Mohamed El Amin Saeed
Director General
Engineering Commissionerate
National Capital Khartoum



Hisashi OSHIMA
Team Leader
JICA Study Team

Internal meeting on the work of Phase-IIA Study for the Feasibility Study on the Construction of the New White Nile Bridge in the Republic of the Sudan was held at the Commissionerate of Engineering Affairs, National Capital Khartoum (NCK) at 9:00 a.m. on the 14th of June, 1989, between NCK and JICA Study Team (the Study Team).

1. Attendants

Sudanese Side

- Mr. Mohamed El Amin Saeed: Director General, NCK
- Mr. Osman Mohamed Yahia: Leader of Counterpart
- Mr. Abdel Wahid Abdel Moniem: Coordinator
- Mr. Magdi M. E. Zumrawi: Bridge Engineer
- Mr. Imad El Din F. El Margi: Highway Engineer
- Mr. Hassan Abdal Ghani Mansour: Traffic Engineer

Japanese Side

- Mr. Hisashi OSHIMA: Team Leader
- Mr. Katsufumi MATSUZAWA: Deputy Team Leader
- Mr. Koji ENOMOTO: Bridge Engineer, Superstructure
- Mr. Shigeru NAKAO: Bridge Engineer, Substructure
- Mr. Kouichi TSUZUKI: Highway Planner
- Mr. Takashi YOKOKAWA: Engineering Surveyor
- Mr. Toshio ICHIKAWA: Construction Planner cum
Cost Estimator
- Mr. Seiju IKEDA: Geologist cum
Construction Material Engineer

2. Major items discussed are as follows:

- (1) The Study Team showed copies of instruction of Bank of Sudan to city banks, on which exchange rate of remittance from overseas was described, and explained that the Study Team proposed to carry out cost estimate on the basis of parallel market rate (\$1.0 = Ls12.2 as of now) during Phase-IIA Study period. NCK promised to contact Bank of Sudan and Ministry of Finance & Economic Planning in order to clarify this point.
- (2) The Study Team explained the identified locations for quarry sites of concrete and pavement aggregates and for borrow areas of embankment materials along with their required quantities. The Study Team requested that royalty of taking materials from these sites and areas be given to the project of the construction of the New White Nile Bridge in the Republic of the Sudan by NCK and cost estimate be done taking into consideration such privilege. NCK answered that NCK will undertake such arrangement and give royalty to the project as long as sites or areas which belong to the Government property.

- (3) The Study Team showed a proposed road alignment and explained an issue regarding electric distribution line which may pass in parallel with the proposed road in the place between military and residential areas at Al Fitaihab town. NCK assured to resolve this issue with other government organizations concerned based on the proposed road alignment.
- (4) As for longitudinal alignment of the road, the Study Team proposed to employ a grade of 4 % as maximum one and NCK agreed upon this proposal.
- (5) Typical cross section as 4-lane dual carriageway was proposed by the Study Team and accepted by NCK.
- (6) The Study Team proposed six (6) alternatives for the comparative study of bridge types, consisting of steel Lohse, steel box, steel truss, PC cantilever box with invert-T shape piers, PC box with V shape piers and PC cable stayed bridges. NCK agreed upon these alternatives proposed by the Study Team.

3. Schedule of next meeting

July 1st, 1989 at NCK among parties of NCK, the Steering Committee and the Study Team

THE FEASIBILITY STUDY
ON
THE CONSTRUCTION OF THE NEW WHITE NILE BRIDGE
IN
THE REPUBLIC OF THE SUDAN

MINUTES OF MEETING
ON
INTERIM REPORT (II)

AGREED UPON BETWEEN
NATIONAL CAPITAL KHARTOUM
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Khartoum, 17th August, 1989

M. Saeed

Mohamed El-Amin Saeed
Director General,
Engineering Commissionerate,
National Capital Khartoum

H. Oshima

Hisashi Oshima
Leader of the JICA Study Team

K. Yokoyama

Koichi Yokoyama
Chairman of the JICA Advisory
Committee

Appendix 1.6(2)

Joint meeting on the Interim Report (II) for the Feasibility Study on the Construction of the New White Nile Bridge in the Republic of the Sudan was held at the Commissionerate of Engineering Affairs, National Capital Khartoum (NCK) on the 16th of August, 1989 among NCK, Sudanese Steering Committee (the Steering Committee), JICA Advisory Team (the Advisory Team) and JICA Study Team (the Study Team).

The list of the attendants of the meeting is shown in the Appendix.

Major events in the meeting are as follows:

I. Interim Report (II)

- 1) The Study Team submitted thirty (30) copies of the Interim Report (II) to NCK.
- 2) The Study Team explained the interim report (II), and then all the attendants exchanged opinions about its contents.
- 3) Consequently, NCK and the Steering Committee agreed upon the contents of the Interim Report (II).

II. Others

- 4) NCK requested the Advisory Team and the Study Team to shorten the study period of Phase IIB Study and complete the Draft Final Report earlier than the original schedule.
- 5) The Advisory Team explained that the original schedule should be maintained in order to keep an appropriate accuracy of Phase IIB Study. Finally, the Advisory Team answered that this feasibility study is conducted according to the original schedule as shown in the Inception Report.

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Appendix

SUDANESE SIDE

1. Steering Committee

Mr. Mohamed El-Amin Saeed (Chairman of the Steering Committee)	Director General Engineering Commissionate, NCK.
Dr. Mohamed El-Amin Mohamed	Under Secretary for Dams, Ministry of Irrigation.
Mr. Modar El-Hifni Ahmed	Senior Town Planner, Physical Planning Administration Housing Department, Ministry of Public Works and Physical Planning.
Mr. Osman Mohamed Abdalla	Assistant Director, Development and Investment Administration, NCK.
Mrs. Leila Mohamed Ahmed El-Badawi	Assistant Under Secretary, Project Preparation Unit, MOFEP.
Mr. Hassan Gafar Abd El Rhman	Senior Inspector, Regional Development Sector, MOFEP.
Mr. Salah Mohamed El-Shinnawi	Colonel Engineer, Traffic Engineering Section, Management of Traffic Police and Relief Services, National Capital Police Headquarters.
Mr. Osman El-Obeid El-Amin	Deputy Director Planning, Roads & Bridges Public Corporation, Ministry of Public Works and Physical Planning.
Mr. Ibrahim Hassaan Babiker	Deputy Director, River Transport Corporation.
Mr. Mohamed Saeid Abdalla (Replacement of Mrs. Amna) Ahmed Saad)	Senior Inspector, Loans and Technical Assistance MOFEP.

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Appendix 1.6(4)

2. Counterpart

Mr. Osman Mohamed Yahia	Assistant Director, Roads and Bridges Dept., Engineering Commissionerate, NCK.
Mr. Imad Eldin Fadl Emargi	Highway Planner, Omdurman Council, NCK.
Mr. Magdi M.E. Zumrawi	Bridge Planner, Road and Bridge Dept., Engineering Commissionerate, NCK.
Mr. Hassan Abdal Ghani Mansour	Traffic Enginner, Khartoum Council, NCK.
Mr. Ahmed Omer Dafalla	Geologist, Road and Bridge Dept., Engineering Commissionerate, NCK.

JAPANESE SIDE

3. JICA Advisory Team

Mr. Koichi YOKOYAMA (Chairman of the Advisory Committee)	Head of Structure Division, Public Works Research Institute, Ministry of Construction.
Mr. Kazuo NAKAGAWA (Coordinator)	Deputy Director, First Development Study Division, Social Development Study Dept., JICA.
Mr. Shin HABARA (Member:River Engineering)	Deputy Director, Disaster Pre- vention and Restoration Division, River Bureau, Ministry of Construction.
Mr. Atsushi NITTA (Member:Bridge Planner)	Deputy Manager, Third Design Division, Design Department, Honshu-Shikoku Bridge Authority.

Handwritten signatures and initials:
A signature above "k.t."
Initials "H.O." below "k.t."

4. The Study Team

Mr. Hisashi OSHIMA : Team Leader
Mr. Katsufumi MATSUZAWA : Deputy Team Leader, Bridge Planner
Mr. Koichi TSUZUKI : Highway Planner
Mr. Toshio ICHIKAWA : Cost Estimator/Construction Planner

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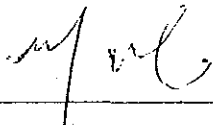
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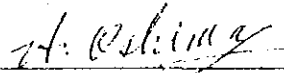
MINUTES OF MEETING
ON
DRAFT FINAL REPORT FOR THE FEASIBILITY STUDY
ON THE CONSTRUCTION OF THE NEW WHITE NILE BRIDGE
IN
THE REPUBLIC OF THE SUDAN

AGREED UPON BETWEEN
NATIONAL CAPITAL KHARTOUM
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Khartoum, 23th January, 1990

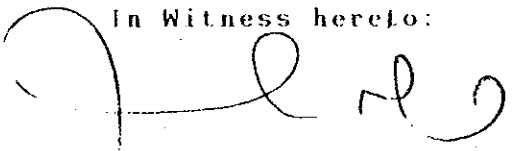


Mohamed Ibrahim Yagoub
Director General,
Engineering Commissionate,
National Capital Khartoum
and
Chairman of Steering Committee

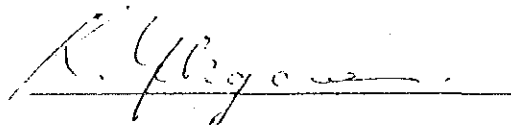


Hisashi Oshima
Team Leader of
the JICA Study Team

In Witness hereLo:



Mohamed Kheir El Zubeir
First Undersecretary
for Planning,
Ministry of Finance and
Economic Planning



Koichi Yokoyama
Chairman of
the JICA Advisory Committee



Joint meeting on the Draft Final Report for the Feasibility Study on the Construction of the New White Nile Bridge in the Republic of the Sudan was held at the Conference Room of Hilton Hotel at 9:30 a.m. on the 21st of January, 1990 among JICA Advisory Committee Team (the Advisory Team), JICA Study Team (the Study Team), National Capital Khartoum (NCK) and the Sudanese Steering Committee (the Steering Committee).

The list of the attendants of the meeting is shown in the Appendix attached hereto.

- I-1. The Study Team submitted copies to make the total copies 30 of the Draft Final Report to NCK.
- I-2. NCK expressed their appreciation to the Advisory Team for the Japanese technical assistance extended to the examination of the viability of the construction of the New White Nile Bridge. And NCK commended the Study Team for the efforts they made in all stages of the Study.
- I-3. Regarding the contents of the Draft Final Report, major items discussed were as follows:
- (1) The Steering Committee raised the question how the navigational requirements set by the River Transport Corporation were considered in the Study.

The Study Team answered that:

- Vertical and horizontal clearance was determined as discussed on pages 7-6 and 7-7 in the Main Report.

- Navigational route was decided on the basis of the existing one directed by the navigator from River Transport Corporation (RTC) during the joint survey among NCK, the Study Team and RTC in July 1989. This location was confirmed as the deepest riverbed and following the existing navigational route by the results of the subsequent water depth survey by the Study Team as shown in Sheet No.15/32 of the Drawings.

The Steering Committee agreed on the Study Team's answer.

- (2) The Steering Committee raised the question if expansion joints were considered in the Study.

The Study Team answered to the expansion joints referring to Sheet No.26 of the Drawings.

The Steering Committee agreed on the Study Team's answer.

- (3) The Steering Committee asked the Study Team to use a higher loading in the preliminary design of the bridge based on experiences met with in other bridges.

The Study Team answered that very high live load BSF HB-30 unit was considered along with impact as discussed on pages 7-8 and 7-9 of the Main Report and it was thought sufficient for the heavy vehicles at present.

The Steering Committee agreed on the Study Team's answer.

- (4) The Steering Committee requested the Study Team to consider adopting longer spans and repetition of V-shaped piers from the viewpoints of aesthetics and sport-sailing.

The Study Team answered that the span arrangements were decided taking into consideration the construction cost, construction method and river hydrological aspects referring to pages 7-16 to 7-22 of the Main Report.

The Steering Committee agreed on the Study Team's answer.

- (5) The Steering Committee requested the Study Team to reconsider the protection of piers in the navigational route to add elastic materials such as used rubber tires to reduce the impact of collision in case of accident.

The Study Team answered that the pier protection facilities against ship collision forces could be designed incorporating the above in the detailed design stage.

The Steering Committee agreed on the Study Team's answer.

- (6) The Steering Committee requested the Study Team to consider the data of earthquakes in Khartoum area obtained recently.

The Study Team promised to examine the said data and take into consideration if necessary.

- (7) The Steering Committee raised the question of whether the public utilities and road lightings were considered in the preliminary design.

The Study Team answered referring to page 7-8 for public utilities and page 7-34 for road lightings in the Main Report.

The Steering Committee agreed on the Study Teams's answer.

- (8) The Steering Committee suggested using 100 km/h design speed instead of 80 km/h.

The Study Team explained that design speed of 80 km/h was chosen as discussed on pages 8 2 and 8 3 in the Main Report.

The Steering Committee agreed on the Study Team's answer.

- (9) The Steering Committee explained that the exchange rate of Ls4.5 to US\$1.0 should be applied in the Study, however, this exchange rate could be discussed before the implementation of the Project.

- (10) The Steering Committee requested the paragraph from line 25 to line 36 on page 11-1 of the Main Report should be read as:

"The former is the fixed official rate determined by the government and the latter is also determined by the government for policy and strategic purposes. In fact, the two rates do not reflect the actual economic situation due to the imperfection of the money market and as a result, a shadow exchange rate has been estimated by the Study Team".

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And also, the Steering Committee suggested the Study Team to correct the shadow exchange rate on page 11-2 of the Main Report.

The Study Team agreed on the above two points.

I-4 Consequently, NCK stated that the contents of the Draft Final Report were accepted.

II. The Advisory Team and the Study Team requested NCK to review again the contents of the Draft Final Report and convey their comments to JICA headquarter not later than 20th February 1990 (within one (1) month after this meeting) through the Embassy of Japan.

III. NCK agreed that the detailed design takes 6 months but requested the Advisory Team and the Study Team to commence the detailed design earlier suggesting July 1990.

The Advisory Team answered that they are not in a position to reply to the request from Sudanese side, because the detailed design is not included in the Scope of Work signed on 16th August, 1988 by both sides.

And also they explained that other official procedure is necessary for the next step.

Finally, they answered that they will convey this request verbally to the authorities concerned.

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ATTENDANTS

SUDANESE SIDE

Steering Committee

Mr. Mohamed Ibrahim Yagoub (Chairman)	Director General, Commissionerate of Engineering Affairs, National Capital Khartoum
Colonel Salah Eishinnawi	Traffic Engineer, Traffic Police Department, National Capital Khartoum
Mr. Ibrahim Hassan	Deputy Director, River Transport Corporation
Mr. Modar Elhifni Ahmed	Senior Town Planner, Physical Planning Administra- tion, Housing Department, Omdurman Physical Planning Office, Ministry of Works and Physical Planning
Mr. Osman Mohamed Abdalla	Assistant Director, Development and Investment Administration, National Capital Khartoum
Mr. Osman Elobeid Elamin	Deputy Director, Roads and Bridges Public Corporation
Mrs. Leila M.A. Elbadawi	Deputy Undersecretary, Project Preparation Unit, Ministry of Finance and Eco- nomic Planning
Mr. Hassan Gaafar	Assistant Undersecretary, Regional Development Depart- ment, Ministry of Finance and Eco- nomic Planning
Mr. Mohamed Saied Abdalla	Inspector, Loan and Technical Assistance Administration, Ministry of Finance and Eco- nomic Planning

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NCK and Counterpart

Mr. Omer Abdel Nabi	Director General, Roads and Bridges Department, National Capital Khartoum
Mr. Osman Mohamed Yousif	Assistant Director, Roads and Bridges Department, National Capital Khartoum
Mr. Abdel Wahid Abdel Moniem A/Aziz	Engineer, Roads and Bridges Department, National Capital Khartoum
Mr. Magdi Mohamed Eltayeb Zumrawi	Engineer, Roads and Bridges Department, National Capital Khartoum
Mr. Hassan Abdalghani Mansour	Engineer, Roads and Bridges Department, National Capital Khartoum
Mr. Imad Eldin Fadi Elmargi Hamza	Engineer, Roads and Bridges Department, National Capital Khartoum
Mr. Ahmed Musa Siyam	Engineer, Roads and Bridges Department, National Capital Khartoum

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JAPANESE SIDE

Advisory Committee Team

Mr. Koich Yokoyama (Chairman of the Advisory Committee)	Head of Structure Division, Public Works Research Insti- tute, Ministry of Construction
Mr. Kazuo Nakagawa (Coordinator)	Deputy Director, First Development Study Divi- sion, Social Development Study Department, JICA
Mr. Masahiko Kitazawa (Member: Road and Transport Planner)	Deputy Manager, Kobe Construction Division, Hanshin Expressway Public Corporation
Mr. Atsushi Nitta (Member: Bridge Planner)	Deputy Manager, Third Design Division, Design Department, Honshu-Shikoku Bridg Authori- ty

Embassy of Japan

Mr. Keiji Tomoi	Secretary, Embassy of Japan
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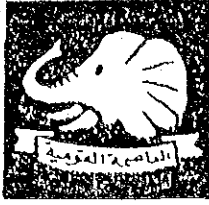
Study Team

Mr. Hisashi Oshima	Team Leader
Mr. Katsufumi Matsuzawa	Deputy Team Leader, Bridge Planner
Mr. Koichi Tsuzuki	Member, Highway Planner
Mr. Takao Yamane	Member, Transport Planner/Economist

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ
 العاصمة القومية
 مدير عام مفوضية الشؤون الهندسية
 تليفون : ٧٠٠٩٠ تالكس : ص ٣٠٤ الخرطوم

THE REPUBLIC OF THE SUDAN

NATIONAL CAPITAL

COMMISSIONERATE OF ENGINEERING AFFAIRS

Ref : 58/A/4/1

Date : 7/Feb./1990

The President

Japan International Co-operation Agency
 Tokyo, Japan

Thro. : First under - Secretary For Planning M.O.F.E.P.

Thro. : Under - Secretary, Ministry of Foreign Affairs

Thro. : H.E. The Ambassador of Japan, Khartoum

Sir,

Subject : Draft Final Report on the
 Feasibility study on the
 construction of the new
White Nile Bridge

Reference to the minutes of meeting on the Draft Final Report for the Feasibility Study on the Construction of the New White Nile Bridge Signed at Khartoum on the 23rd of Jan., 1990 by JICA Study Team Leader and the Director general, Commissionerate of Engineering Affairs and witnessed by the chairman of JICA Advisory committee and the First Under - Secretary for M.O.F.E.P.



بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ
 العاصمة القومية
 مدير عام مفوضية الشؤون الهندسية

تليفون : ٧٠٠٩٠ تلکس ص.ب: ٣٠٤ الخرطوم

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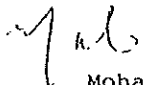
Please be informed that we have thoroughly reviewed the above mentioned Report and we have no significant additional comments regarding the Feasibility Study besides those discussed in the meetings and summarised in the signed minutes.

We find the study very commendable and we are satisfied that the construction of the New White Nile Bridge as proposed by the study Team, Feasible.

We would like to express our deepest gratitude and appreciation to the Friendly Government of Japan for the generous and continuous assistance extended to the People of the Sudan in general and to the National Capital Khartoum in particular.

We also wish to commend on the JICA Advisory Team and the Feasibility Study Team for all the great efforts they made during all the stages of the study inspite of the hard condition of our weather and other hardships which they indured with patience, tolerance and inguity.

We look forward to the continued assistance of JICA for the construction of the New White Nile Bridge at the earliest possible date.

 Yours Truly
 Mohamed Ibrahim Yagoub
 Director General
 Commissionerate of Engineering Affairs

Copy to : Commissioner General, National Capital
 Commissioner for Engineering Affairs
 Director General, Roads and Bridges Department

Existing Traffic Characteristics

Table of Contents

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3.3 Present OD Table : Year 1989 (Vehicle Type : All Vehicle by PCU)	A- 44

ROADSIDE 00 SURVEY QUESTIONNAIRE

Station No.	Sheet No.	Direction	Survey Date	Time	Name of Interviewer	Volume
Vehicle Type	Origin	Destination	Trip Purpose	Number of passengers including driver	Commodity Types (Multiple Choices)	
1. Passenger Car 2. Taxi 3. Boks & Pick-up 4. Mini-Bus 5. Large Bus 6. Truck 7. Trailer	Name and address of the Place where you start this trip by vehicle. (nearby well-known building, which part of the area, etc.)	Name and address of the Place where you stop this trip. (nearby well-known building, which part of the area, etc.)	1. To work 2. To school 3. Business 4. Business (Telephone insufficiency) 5. Shopping 6. Private Matter 7. Go home 8. Others		1. Vacant 2. Agriculture or Fishery 3. Timber or Wood Product 4. Minerals (Sand, Laterite, etc.) 5. Metal Product & Machinery 6. Consumer Goods 7. Chemical Products (Gas, Oil, etc.) 8. Miscellaneous	1. Full 2. 3/4 Full 3. 1/2 Full 4. 1/4 Full
1 2 3 4 5	Zone No. [][]	Zone No. [][]	1 2 3 4 5		1 2 3 4 5	1 2 3
6 7	Zone No. [][]	Zone No. [][]	6 7 8		6 7 8	4
1 2 3 4 5	Zone No. [][]	Zone No. [][]	1 2 3 4 5		1 2 3 4 5	1 2 3
6 7	Zone No. [][]	Zone No. [][]	6 7 8		6 7 8	4
1 2 3 4 5	Zone No. [][]	Zone No. [][]	1 2 3 4 5		1 2 3 4 5	1 2 3
6 7	Zone No. [][]	Zone No. [][]	6 7 8		6 7 8	4
1 2 3 4 5	Zone No. [][]	Zone No. [][]	1 2 3 4 5		1 2 3 4 5	1 2 3
6 7	Zone No. [][]	Zone No. [][]	6 7 8		6 7 8	4
1 2 3 4 5	Zone No. [][]	Zone No. [][]	1 2 3 4 5		1 2 3 4 5	1 2 3
6 7	Zone No. [][]	Zone No. [][]	6 7 8		6 7 8	4
1 2 3 4 5	Zone No. [][]	Zone No. [][]	1 2 3 4 5		1 2 3 4 5	1 2 3
6 7	Zone No. [][]	Zone No. [][]	6 7 8		6 7 8	4

CONFIRMATION OF THE SAMPLING RATE

Since it is important to confirm the reliability of the OD data obtained from the roadside OD survey by sampling basis, the confidence limit of collected samples are calculated.

The confidence limit of sampling rate can be calculated by the following equation:

$$LP_1 = P_1 \pm w \sqrt{\frac{P_1 * P_2}{s * r} (1 - r)}$$

where, LP_1 : the confidence limit of P_1
 P_1 : the ratio of one specific OD
 P_2 : $(1 - P_1)$
 r : sampling rate
 s : total number of trips in the area
 w : the coefficient of statistics

By using this equation, the confidence limit of P_1 under the confidence degree of 90% at each roadside OD survey station is calculated as shown in a table below.

Table Confidence Limit of OD Data at Each Survey Station

Survey Station	Sampling Rate	Confidence Limit	Relative Error
OD-1 White Nile	4.3%	0.0185±0.05446	29%
OD-2 Blue Nile	6.8%	0.0322±0.00715	22%
OD-3 Burri	7.3%	0.0322±0.00713	22%
OD-4 Shambat	7.0%	0.0444±0.00819	18%

Generally speaking, a relative error of 35% or less is acceptable for the case of OD survey. Hence, sampling rates of roadside OD survey at every survey station in the course of the Study are considered to be acceptable figures.

PRESENT OD TABLE : YEAR 1988
VEHICLE TYPE : ALL VEHICLE BY DOJ

DRYADES	1	2	3	4	5	5	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	TOTAL	
1	151	345	193	116	116	83	589	587	482	833	818	973	868	203	335	347	107	47	66	46	183	299	522	88	360	169	911	453	44	55	0	0	18365	
2	345	762	435	263	266	187	1331	1329	1520	2752	3580	3499	4760	1694	2361	1263	65	358	371	820	485	605	5734	802	1483	759	4667	2101	456	195	37	50	45235	
3	193	435	242	147	147	104	741	740	607	1053	1033	1230	416	211	198	325	75	68	205	168	166	215	583	169	155	199	1150	568	0	72	0	0	11719	
4	116	263	147	89	89	64	449	448	368	638	626	746	512	397	420	319	110	56	182	136	104	86	432	75	294	210	697	345	0	14	42	0	8436	
5	116	263	147	89	89	64	449	448	370	641	627	747	575	361	251	387	53	157	85	53	123	151	522	32	230	151	697	345	44	20	0	0	8301	
6	117	266	148	90	90	5	38	38	30	54	53	64	240	263	374	109	49	55	54	136	65	87	298	236	303	35	54	26	0	55	0	0	3434	
7	839	1907	1060	643	644	38	276	275	224	330	382	455	1019	409	904	265	82	96	178	179	215	174	448	328	270	252	391	194	17	65	32	27	12572	
8	837	1895	1058	642	643	38	275	275	222	388	380	452	747	820	648	521	64	241	34	135	340	361	749	777	578	214	388	194	16	70	154	0	13578	
9	697	2011	881	524	536	35	245	245	184	319	312	373	530	733	581	302	15	25	120	37	47	133	186	148	208	30	322	159	0	46	0	0	10002	
10	1210	3600	1522	925	929	61	435	432	319	552	542	645	58	137	294	79	16	13	15	0	20	34	153	149	20	27	558	277	0	0	10	0	13028	
11	1185	4414	1497	908	913	60	424	423	312	542	531	632	357	335	822	37	17	27	99	187	63	28	368	1143	112	156	549	272	0	42	0	0	18455	
12	1412	4490	1862	1080	1083	70	505	504	373	645	632	753	141	267	444	91	20	0	177	31	0	201	54	32	16	42	652	325	15	58	0	0	15505	
13	797	4185	550	303	343	283	458	1066	512	97	188	107	1336	751	1974	1430	1781	716	336	115	20	795	4017	893	743	218	10	58	1708	2113	70	10	28323	
14	152	2458	410	388	384	151	525	528	838	141	249	315	751	422	868	560	516	93	61	151	15	177	699	504	422	254	102	321	716	732	55	45	13932	
15	209	1958	229	331	66	159	550	369	292	127	333	108	2289	1051	1603	1139	1027	0	34	26	25	10	0	120	29	0	118	293	1327	1397	0	0	16249	
16	544	2171	371	497	564	463	218	783	274	101	59	113	1430	560	940	746	886	370	184	87	81	312	1133	217	402	193	27	158	951	936	66	0	15577	
17	76	1414	55	110	43	88	185	188	52	16	11	44	1800	585	997	775	641	50	44	84	30	43	238	219	56	290	79	20	861	873	75	0	10149	
18	86	456	43	183	191	115	196	305	31	0	33	0	587	356	0	344	71	225	112	210	119	143	530	82	712	657	0	0	252	0	514	226	8629	
19	0	351	100	37	79	66	99	361	80	15	99	177	218	145	34	134	44	112	58	105	62	71	266	38	357	330	0	0	44	0	257	113	4055	
20	174	420	285	98	78	126	245	283	107	0	125	53	197	95	26	37	43	294	147	259	156	188	1123	106	275	920	0	28	112	0	530	734	7514	
21	116	816	202	143	58	76	253	196	72	20	49	0	286	0	25	146	30	119	62	111	64	78	282	41	378	348	37	0	43	0	270	120	4451	
22	168	572	159	98	87	189	196	391	146	25	256	201	518	286	10	287	163	143	71	132	78	99	335	54	452	417	24	0	137	0	326	145	6365	
23	399	5826	549	399	157	403	945	400	338	181	465	159	4124	722	0	555	337	530	266	923	282	335	1243	191	2972	3703	128	204	374	0	1637	535	29222	
24	50	915	50	114	0	415	511	37	38	118	583	24	515	220	158	145	153	82	39	76	41	54	191	28	257	237	36	44	271	0	185	81	5750	
25	535	2265	497	446	304	664	405	555	162	37	36	56	966	1311	16	391	108	960	680	872	510	608	3547	346	2914	2781	0	141	195	0	2396	541	25096	
26	182	1824	120	142	197	407	443	147	108	99	100	100	466	216	96	120	70	924	665	820	490	587	4330	334	2747	2573	64	40	60	0	1977	889	29247	
27	1051	5186	1229	804	808	46	339	338	217	478	459	558	87	142	512	34	29	0	0	0	0	31	24	148	18	15	83	509	251	19	0	0	13565	
28	521	2257	656	399	399	24	170	168	136	237	234	277	265	185	1088	100	20	0	42	54	317	41	60	213	117	123	251	125	0	95	0	0	8578	
29	44	456	0	0	44	0	44	0	44	0	0	23	1977	858	1327	1152	856	36	34	104	0	56	198	64	155	307	0	0	1096	1157	25	0	10669	
30	23	569	111	227	84	142	348	224	46	0	135	91	2276	295	1387	1056	813	0	0	0	0	0	0	0	0	0	0	74	130	1123	1190	28	0	10992
31	25	83	0	63	0	0	0	58	48	0	0	0	47	54	0	46	57	690	346	626	364	439	2051	250	2095	1963	0	46	25	0	1507	677	11561	
32	0	60	0	0	0	0	0	27	0	0	0	0	0	45	0	0	0	319	160	284	172	202	750	113	948	289	0	0	0	0	682	306	4557	
TOTAL	12420	54240	18444	10238	9581	4629	12119	12271	8569	10500	12419	12577	30748	14639	18353	13247	8228	6756	4529	6871	4668	6482	31300	7314	20716	18390	12647	7128	9905	9153	10555	4449	421586	

Traffic Volume in Greater Khartoum

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Appendix 4.1

POPULATION

LOW CASE							HIGH CASE								
ZONE	1963	1989	1995	2000	2005	2010	2015	ZONE	1963	1989	1995	2000	2005	2010	2015
1	0.	0.	0.	0.	0.	0.	0.	1	0.	0.	0.	0.	0.	0.	0.
2	10057.	12039.	15048.	17862.	19957.	22652.	26219.	2	10057.	11719.	14930.	18601.	21225.	23920.	33730.
3	10057.	12039.	15048.	17862.	19957.	22652.	26219.	3	10067.	11719.	14930.	18601.	21225.	23920.	33750.
4	10159.	12148.	15185.	18024.	20179.	22858.	26458.	4	10159.	11825.	15035.	18972.	21418.	23265.	34087.
5	10159.	12148.	15185.	18024.	20179.	22858.	26458.	5	10159.	11225.	15035.	18972.	21418.	23265.	34587.
6	0.	0.	0.	0.	0.	0.	0.	6	0.	0.	0.	0.	0.	0.	0.
7	69188.	82739.	103419.	122750.	137433.	155681.	180199.	7	69188.	80541.	102401.	129215.	145874.	165558.	232153.
8	69188.	82739.	103419.	122750.	137433.	155681.	180199.	8	69188.	80541.	102401.	129215.	145874.	165558.	232153.
9	57657.	69946.	86183.	102300.	114528.	129734.	150166.	9	57657.	67117.	85334.	107579.	121552.	154748.	193459.
10	57657.	78948.	98183.	112300.	124528.	139734.	160166.	10	57657.	77117.	95334.	117579.	131552.	164748.	213459.
11	98017.	117212.	146511.	173910.	194597.	220549.	255281.	11	98017.	114699.	145059.	183055.	206956.	263072.	328897.
12	74954.	99633.	122038.	142950.	158986.	176555.	205215.	12	74954.	97252.	120535.	149583.	169031.	211173.	261510.
27	31483.	37649.	47059.	55859.	61253.	67336.	77035.	27	31483.	35548.	45595.	56876.	65677.	78457.	95560.
28	58755.	70252.	87824.	104249.	117229.	130206.	150326.	28	58755.	68956.	86950.	105730.	123878.	157596.	197154.
13	100774.	128687.	154124.	177803.	197292.	220925.	251121.	13	100774.	126541.	153127.	184124.	205639.	250259.	301978.
14	12597.	28086.	32255.	32255.	34574.	37617.	41390.	14	12597.	25016.	29141.	33015.	35785.	41282.	47735.
15	119569.	203199.	233481.	261670.	284990.	353018.	398954.	15	119569.	238644.	292094.	315195.	344009.	357928.	509375.
16	28178.	112501.	134758.	155577.	172713.	193319.	219731.	16	85178.	110723.	132986.	151105.	173934.	218977.	264142.
17	36124.	95683.	108305.	117254.	124875.	133561.	145001.	17	38124.	37871.	407929.	118655.	127795.	148575.	154212.
29	131966.	166519.	201829.	232837.	258489.	285320.	328849.	29	131966.	169700.	200520.	241115.	269290.	327720.	385314.
30	104640.	133624.	250039.	334533.	454983.	473410.	510754.	30	104640.	131395.	309001.	341187.	513529.	559859.	863455.
18	45791.	52101.	55119.	77301.	86534.	95708.	110454.	18	45791.	50718.	54475.	81318.	91849.	116929.	145188.
19	22895.	28051.	32559.	38551.	43087.	49013.	55792.	19	22895.	25359.	32238.	40659.	45825.	58465.	70094.
20	36532.	55581.	76094.	95841.	93227.	102421.	114771.	20	36532.	64574.	75590.	83054.	121430.	141544.	164951.
21	24228.	27567.	34454.	40900.	45785.	51656.	60034.	21	24228.	25695.	34114.	43025.	45558.	51867.	77580.
22	29195.	33218.	41517.	49235.	55171.	62498.	72341.	22	29195.	32236.	41107.	51645.	58560.	74550.	93205.
23	76318.	89825.	109529.	129235.	144224.	163376.	189108.	23	75918.	84529.	107459.	135529.	155082.	194882.	243647.
24	0.	0.	0.	0.	0.	0.	0.	24	0.	0.	0.	0.	0.	0.	0.
25	137372.	155304.	195359.	231904.	259502.	294378.	340391.	25	137372.	152153.	193426.	240653.	275548.	350728.	439555.
26	183162.	206405.	260471.	309205.	345136.	392102.	453854.	26	183162.	200071.	257901.	325271.	367282.	457718.	594752.
31	53422.	110781.	125871.	140185.	153356.	164354.	182374.	31	53422.	109171.	125221.	144871.	207159.	235418.	270553.
32	39685.	71154.	82435.	92994.	100996.	110555.	124935.	32	39685.	69955.	81679.	95475.	131603.	153839.	176596.
K	557351.	685500.	1052100.	1309500.	1527100.	1824100.	2171600.	K	557351.	713600.	994900.	1282900.	1755100.	2515900.	3290200.
KN	595248.	871430.	1121900.	1312900.	1527900.	1717200.	1895800.	KN	595248.	859700.	1165000.	1399400.	1770100.	2040700.	2545100.
O	648700.	838100.	1022500.	1195100.	1325900.	1488700.	1707400.	O	648700.	918500.	1015400.	1252000.	1501200.	1656500.	2271200.
T	1802299.	2355030.	3197500.	3816600.	4580900.	5600000.	5774800.	T	1802299.	2692100.	3174300.	4012300.	5076300.	6413100.	8107300.

LEGEND

- K : Khartoum
- KN: Khartoum North
- O : Omdurman
- T : Total

Appendix 4.2(1)

SECONDARY EMPLOYMENT

ZONE	LOW CASE							HIGH CASE							
	1983	1989	1995	2000	2005	2010	2015	1983	1989	1995	2000	2005	2010	2015	
1	0.	0.	0.	0.	0.	0.	0.	1	0.	0.	0.	0.	0.	0.	
2	10561.	10349.	14952.	23101.	26447.	35064.	43213.	2	10561.	10349.	14952.	22995.	35169.	53350.	80357.
3	10561.	10350.	14241.	21069.	25550.	31095.	37923.	3	10561.	10350.	14241.	20981.	31183.	46419.	69050.
4	5280.	5171.	7518.	11670.	14395.	17767.	21919.	4	5280.	5171.	7518.	11617.	17821.	27085.	40847.
5	5280.	5164.	7518.	11670.	14395.	17767.	21919.	5	5280.	5164.	7518.	11617.	17821.	27085.	40847.
6	8800.	11520.	15300.	16250.	17500.	18750.	20300.	6	8800.	11520.	15600.	17500.	20000.	22500.	25000.
7	2464.	2410.	3406.	5155.	6303.	7723.	9472.	7	2464.	2410.	3406.	5133.	7746.	11648.	17445.
8	2426.	2382.	3006.	4083.	4789.	5664.	6740.	8	2426.	2382.	3006.	4069.	5677.	8080.	11648.
9	2008.	1972.	2480.	3356.	3931.	4643.	5519.	9	2008.	1972.	2480.	3345.	4654.	6609.	9513.
10	2008.	1937.	2951.	4700.	5847.	7268.	9017.	10	2008.	1937.	2951.	4677.	7290.	11193.	16990.
11	3409.	3344.	4259.	5837.	6873.	8154.	9732.	11	3409.	3344.	4259.	5817.	8175.	11696.	16926.
12	2407.	2321.	3532.	5619.	6989.	8685.	10772.	12	2407.	2321.	3532.	5593.	8712.	13370.	20289.
27	995.	959.	2974.	6646.	9056.	12038.	15710.	27	995.	959.	2974.	6599.	12085.	20279.	32450.
28	1511.	1459.	5843.	13881.	19156.	25663.	33721.	28	1511.	1459.	5843.	13778.	25787.	43722.	70364.
13	8017.	7850.	11552.	18111.	22415.	27741.	34300.	13	8017.	7850.	11552.	18026.	27825.	42460.	64198.
14	14173.	18552.	30925.	34543.	37776.	41184.	44802.	14	14173.	18552.	30925.	34528.	38698.	43693.	49897.
15	2729.	2630.	4915.	8970.	11631.	14924.	18980.	15	2729.	2630.	4915.	8918.	14977.	24025.	37466.
16	2098.	1966.	2569.	3609.	4292.	5137.	6178.	16	2098.	1966.	2569.	3596.	5151.	7472.	10921.
17	755.	731.	1853.	3890.	5226.	6880.	8917.	17	755.	731.	1853.	3863.	6906.	11451.	18201.
29	2999.	2932.	5365.	9756.	12637.	16202.	20593.	29	2999.	2932.	5365.	9699.	16259.	26055.	40608.
30	2498.	2417.	5660.	11526.	15376.	20140.	26007.	30	2498.	2417.	5660.	11451.	20216.	33396.	52751.
18	1177.	1156.	1451.	1961.	2295.	2709.	3219.	18	1177.	1156.	1451.	1954.	2716.	3853.	5542.
19	626.	615.	773.	1044.	1222.	1442.	1713.	19	626.	615.	773.	1040.	1445.	2051.	2950.
20	940.	917.	1776.	3326.	4344.	5603.	7153.	20	940.	917.	1776.	3306.	5623.	9082.	14221.
21	645.	634.	796.	1075.	1259.	1486.	1765.	21	645.	634.	796.	1072.	1489.	2113.	3039.
22	721.	708.	891.	1207.	1414.	1670.	1986.	22	721.	708.	891.	1203.	1674.	2379.	3425.
23	10914.	10677.	15734.	24678.	30547.	37810.	46754.	23	10914.	10677.	15734.	24563.	37925.	57881.	87525.
24	13850.	18240.	30000.	32500.	35000.	37500.	40000.	24	13850.	18240.	30000.	32500.	35000.	37500.	40000.
25	3523.	3416.	6882.	13116.	17206.	22267.	28501.	25	3523.	3416.	6882.	13035.	22548.	35256.	56915.
26	4726.	4619.	6702.	10367.	12773.	15750.	19415.	26	4726.	4619.	6702.	10320.	15797.	23976.	36125.
31	1370.	1308.	3649.	7877.	10651.	14084.	18312.	31	1370.	1308.	3649.	7822.	14139.	23572.	37585.
32	1019.	993.	1924.	3603.	4706.	6070.	7749.	32	1019.	993.	1924.	3582.	6091.	9639.	15406.
K	57709.	59339.	67682.	133039.	163231.	200300.	245658.	K	57709.	59339.	67682.	133720.	202120.	303036.	451727.
KN	33180.	37077.	62840.	90406.	109353.	132209.	159775.	KN	33180.	37077.	62840.	90682.	130032.	168462.	274041.
O	39512.	43284.	70578.	100755.	121415.	146391.	176567.	O	39512.	43284.	70578.	100398.	144248.	208502.	302732.
T	130400.	139700.	221100.	324200.	394000.	478500.	582000.	T	130400.	139700.	221100.	324200.	476400.	700000.	1028500.

LEGEND

K : Khartoum
 KN: Khartoum North
 O : Omdurman
 T : Total

Appendix 4.2(2)

TERTIARY EMPLOYMENT

LOW CASE							HIGH CASE								
ZONE	1983	1989	1995	2000	2005	2010	2015	ZONE	1983	1989	1995	2000	2005	2010	2015
1	30189.	32085.	39702.	47888.	58036.	70624.	86241.	1	30189.	31972.	39382.	49820.	65012.	90061.	118393.
2	60378.	64184.	76911.	91136.	108772.	130648.	157789.	2	60378.	53958.	76354.	94495.	122634.	164428.	213666.
3	30189.	32085.	39702.	47888.	58036.	70624.	86241.	3	30189.	31972.	39382.	49820.	65012.	90061.	118393.
4	15094.	16079.	19757.	23769.	28742.	34912.	42566.	4	15094.	16020.	19600.	24716.	32652.	44438.	58324.
5	15094.	16139.	19757.	23769.	28742.	34912.	42566.	5	15094.	16077.	19500.	24716.	32652.	44438.	58324.
6	0.	0.	0.	0.	0.	0.	0.	6	0.	0.	0.	0.	0.	0.	0.
7	7043.	7529.	9007.	10636.	12791.	15390.	18614.	7	7043.	7500.	8940.	11095.	14438.	19403.	25252.
8	6934.	7330.	8143.	9183.	10473.	12073.	14058.	8	6934.	7306.	8102.	9429.	11487.	14543.	18144.
9	5740.	6062.	6724.	7571.	8620.	9922.	11537.	9	5740.	6043.	6691.	7771.	9445.	11532.	14862.
10	5740.	6363.	7704.	9394.	11489.	14088.	17312.	10	5740.	6345.	7638.	9793.	13136.	18101.	23949.
11	9745.	10325.	11517.	13041.	14931.	17276.	20185.	11	9745.	10290.	11457.	13401.	16417.	20897.	26174.
12	6880.	7647.	9224.	11241.	13742.	16843.	20692.	12	6880.	7602.	9145.	11717.	15707.	21633.	28614.
27	2843.	3160.	6967.	10515.	14913.	20370.	27139.	27	2843.	3141.	6828.	11352.	18371.	28795.	41075.
28	4319.	4790.	13345.	21111.	30739.	42683.	57500.	28	4319.	4762.	13041.	22945.	38307.	61125.	88005.
13	22918.	24429.	30283.	36620.	44476.	54221.	66311.	13	22918.	24339.	30035.	38116.	50551.	69269.	91202.
14	922.	1015.	2178.	3258.	4596.	6257.	8318.	14	922.	1010.	2135.	3513.	5649.	8822.	12560.
15	7802.	8699.	12356.	16274.	21131.	27157.	34632.	15	7802.	8646.	12202.	17199.	24949.	36461.	50022.
16	5740.	6122.	6909.	7914.	9161.	10767.	12625.	16	5740.	5099.	5869.	8152.	10140.	13094.	16573.
17	2159.	2378.	4446.	6414.	8654.	11880.	15634.	17	2159.	2365.	4359.	6879.	10771.	16553.	23363.
29	8573.	9177.	13503.	17745.	23004.	29528.	37621.	29	8573.	9141.	13337.	18747.	27139.	39601.	54284.
30	7140.	7866.	13728.	19396.	26424.	35140.	45955.	30	7140.	7823.	13506.	20735.	31947.	48600.	68219.
18	3364.	3551.	3936.	4429.	5039.	5795.	6735.	18	3364.	3540.	3917.	4545.	5519.	6965.	8669.
19	1790.	1890.	2095.	2357.	2682.	3085.	3565.	19	1790.	1884.	2085.	2419.	2937.	3707.	4614.
20	2688.	2900.	4429.	5927.	7784.	10087.	12945.	20	2688.	2868.	4370.	6260.	9244.	13645.	18829.
21	1845.	1947.	2159.	2429.	2763.	3178.	3654.	21	1845.	1941.	2148.	2492.	3026.	3820.	4754.
22	2062.	2178.	2416.	2721.	3099.	3568.	4150.	22	2062.	2171.	2404.	2793.	3396.	4292.	5348.
23	31198.	33325.	41241.	49883.	60596.	73884.	90371.	23	31198.	33199.	40993.	51923.	69016.	94404.	124314.
24	0.	0.	0.	0.	0.	0.	0.	24	0.	0.	0.	0.	0.	0.	0.
25	10070.	11034.	17070.	23092.	30558.	39820.	51310.	25	10070.	10977.	16834.	24514.	35427.	54121.	74956.
26	13510.	14472.	17626.	21168.	25559.	31005.	37762.	26	13510.	14415.	17488.	22004.	29010.	39415.	51674.
31	3917.	4477.	8665.	12750.	17814.	24096.	31889.	31	3917.	4444.	8505.	13714.	21794.	33796.	47934.
32	2912.	3142.	4798.	6421.	8432.	10928.	14024.	32	2912.	3128.	4734.	6804.	10014.	14782.	20399.
K	200188.	213797.	268461.	327203.	400028.	490363.	602438.	K	200188.	212990.	266159.	341072.	457271.	629855.	833175.
KN	55256.	59686.	83403.	107622.	137546.	174869.	221095.	KN	55256.	59424.	82454.	113339.	161246.	232399.	316224.
O	73356.	78916.	104435.	131175.	164326.	205448.	256466.	O	73356.	78587.	103387.	137488.	190384.	268946.	361501.
T	328800.	352400.	456300.	566000.	702000.	870700.	1080300.	T	328800.	351000.	452000.	591900.	808900.	1131200.	1510900.

LEGEND

- K : Khartoum
- KH: Khartoum North
- O : Omdurman
- T : Total

Appendix 4.3

HOUSE HOLD

LOW CASE							HIGH CASE								
ZONE	1983	1989	1995	2000	2005	2010	2015	ZONE	1983	1989	1995	2000	2005	2010	2015
1	0.	0.	0.	0.	0.	0.	0.	1	0.	0.	0.	0.	0.	0.	0.
2	1624.	2006.	2551.	3080.	3508.	4045.	4767.	2	1624.	1953.	2525.	3242.	3724.	4825.	6142.
3	1624.	2006.	2551.	3080.	3508.	4045.	4767.	3	1624.	1953.	2525.	3242.	3724.	4825.	6142.
4	1639.	2025.	2574.	3108.	3540.	4082.	4811.	4	1639.	1971.	2548.	3271.	3758.	4869.	6198.
5	1639.	2025.	2574.	3108.	3540.	4082.	4811.	5	1639.	1971.	2548.	3271.	3758.	4869.	6198.
6	0.	0.	0.	0.	0.	0.	0.	6	0.	0.	0.	0.	0.	0.	0.
7	11159.	13790.	17529.	21166.	24111.	27800.	32763.	7	11159.	13423.	17356.	22278.	25592.	33160.	42211.
8	11159.	13790.	17529.	21166.	24111.	27800.	32763.	8	11159.	13423.	17356.	22278.	25592.	33160.	42211.
9	9300.	11491.	14607.	17638.	20093.	23167.	27303.	9	9300.	11186.	14463.	18565.	21327.	27634.	35176.
10	9300.	13158.	16302.	19362.	21647.	24952.	29121.	10	9300.	12853.	16158.	20289.	23081.	29419.	36994.
11	15809.	19535.	24832.	29984.	34157.	39384.	46415.	11	15809.	19016.	24588.	31561.	36255.	46977.	59799.
12	12089.	16605.	20684.	24653.	27875.	31903.	37312.	12	12089.	16209.	20497.	25859.	29419.	37709.	47547.
27	5078.	6275.	7492.	8593.	9728.	10964.	12502.	27	5078.	6036.	7172.	8308.	9444.	10680.	12117.
28	9476.	11710.	13835.	15836.	17835.	19834.	22641.	28	9476.	11399.	13688.	15781.	17909.	19948.	22683.
13	16254.	21448.	26123.	30656.	34630.	39453.	45658.	13	16254.	21090.	25954.	31746.	36977.	44689.	54887.
14	2032.	4348.	4960.	5556.	6083.	6717.	7525.	14	2032.	4303.	4939.	5692.	6264.	7372.	8679.
15	19350.	33866.	39573.	45116.	49998.	64825.	72537.	15	19350.	33441.	39372.	55034.	60493.	71059.	92614.
16	14222.	18767.	22857.	26824.	30301.	34521.	39951.	16	14222.	18454.	22709.	27777.	31567.	39103.	48026.
17	6149.	16447.	18357.	20218.	21873.	23854.	26364.	17	6149.	16312.	18293.	20630.	22420.	25835.	29855.
29	21285.	28087.	34208.	40144.	45349.	51664.	59791.	29	21285.	27618.	33987.	41572.	47244.	58521.	71875.
30	16877.	22270.	44073.	57694.	79819.	85610.	92864.	30	16877.	21900.	52374.	58825.	107636.	117832.	156392.
18	7386.	8684.	11037.	13328.	15181.	17505.	20630.	18	7386.	8453.	10928.	14020.	16114.	20880.	26580.
19	3693.	4342.	5518.	6664.	7591.	8752.	10315.	19	3693.	4226.	5464.	7010.	8057.	10440.	13290.
20	5908.	10947.	12897.	14800.	16356.	18289.	20868.	20	5908.	10762.	12810.	15354.	21312.	25275.	29991.
21	3908.	4594.	5840.	7052.	8032.	9262.	10915.	21	3908.	4472.	5782.	7418.	8526.	11048.	14063.
22	4709.	5536.	7037.	8497.	9679.	11160.	13153.	22	4709.	5389.	6967.	8939.	10274.	13312.	16946.
23	12309.	14473.	18395.	22213.	25302.	29174.	34383.	23	12309.	14088.	18213.	23367.	26856.	34800.	44299.
24	0.	0.	0.	0.	0.	0.	0.	24	0.	0.	0.	0.	0.	0.	0.
25	22157.	26051.	33111.	39983.	45544.	52514.	61889.	25	22157.	25359.	32784.	42061.	48342.	62641.	79739.
26	29543.	34734.	41147.	53312.	60726.	70018.	82519.	26	29543.	33812.	43712.	56081.	64456.	83521.	106319.
31	8616.	18464.	21351.	24170.	26484.	29351.	33159.	31	8616.	18195.	21224.	24978.	36344.	42217.	49191.
32	6401.	11859.	13972.	16034.	17718.	19814.	22606.	32	6401.	11659.	13878.	16634.	23088.	27382.	32490.
K	89896.	114416.	178493.	225674.	267912.	325732.	394836.	K	89896.	119758.	168624.	234636.	314932.	449268.	598218.
KN	96169.	145233.	190151.	226208.	268053.	306644.	344690.	KN	96169.	143118.	197628.	241276.	311701.	364411.	462928.
O	104630.	139684.	173305.	206053.	232613.	265839.	310437.	O	104630.	136415.	171762.	215862.	263369.	331516.	412908.
T	290695.	399333.	541949.	657935.	768578.	898215.	1049963.	T	290695.	399331.	538014.	691774.	890002.	1145195.	1474054.

LEGEND

- K : Khartoum
- KN: Khartoum North
- O : Omdurman
- T : Total

Appendix 4.4

CAR REGISTRATION

LOW CASE							HIGH CASE								
ZONE	1983	1989	1995	2000	2005	2010	2015	ZONE	1983	1989	1995	2000	2005	2010	2015
1	0.	0.	0.	0.	0.	0.	0.	1	0.	0.	0.	0.	0.	0.	0.
2	589.	1011.	1453.	1881.	2202.	2581.	3059.	2	589.	997.	1431.	1964.	2476.	3146.	4020.
3	589.	1011.	1453.	1881.	2202.	2581.	3059.	3	589.	997.	1431.	1964.	2476.	3146.	4020.
4	595.	1020.	1466.	1898.	2222.	2605.	3087.	4	595.	1007.	1444.	2002.	2499.	3175.	4056.
5	595.	1020.	1466.	1898.	2222.	2605.	3087.	5	595.	1007.	1444.	2002.	2499.	3175.	4056.
6	0.	0.	0.	0.	0.	0.	0.	6	0.	0.	0.	0.	0.	0.	0.
7	2880.	4943.	7313.	9512.	11156.	13106.	15558.	7	2880.	4877.	7201.	10038.	12555.	16006.	20428.
8	2880.	4943.	7313.	9512.	11156.	13106.	15558.	8	2880.	4877.	7201.	10038.	12555.	16006.	20428.
9	2442.	4190.	6135.	7958.	9338.	10963.	13007.	9	2442.	4134.	6042.	8406.	10512.	13380.	17114.
10	1849.	3538.	5550.	7296.	8581.	10090.	11956.	10	1849.	3489.	5460.	7702.	9691.	12304.	15704.
11	3033.	5283.	8028.	10507.	12359.	14557.	17321.	11	3033.	5211.	7902.	11099.	13947.	17826.	22876.
12	2403.	4316.	6564.	8549.	10014.	11738.	13889.	12	2403.	4260.	6463.	9013.	11278.	14278.	18181.
27	709.	1217.	5173.	8585.	9772.	13307.	17250.	27	709.	1672.	3596.	8900.	13234.	24962.	33236.
28	1324.	2272.	7024.	11051.	16961.	23753.	31369.	28	1324.	2241.	6910.	11513.	25955.	39253.	60250.
13	3601.	6354.	9386.	12014.	14012.	16311.	19076.	13	3601.	6293.	9269.	12534.	15559.	19095.	23553.
14	514.	1182.	1798.	2297.	2652.	3044.	3495.	14	514.	1171.	1773.	2386.	2941.	3502.	4221.
15	3404.	6819.	10817.	13876.	16116.	21067.	24196.	15	3404.	6756.	10664.	16501.	20362.	24240.	32021.
16	3151.	5635.	8566.	11026.	12895.	15947.	17634.	16	3151.	5580.	8447.	11512.	14343.	17653.	21919.
17	957.	2525.	4537.	5843.	6747.	7724.	8825.	17	957.	2503.	4469.	6069.	7501.	8844.	10552.
29	3745.	6576.	10152.	13063.	15274.	17822.	20883.	29	3745.	6513.	10012.	13638.	16988.	20904.	25953.
30	2627.	4750.	11222.	16570.	23756.	26913.	30342.	30	2627.	4702.	12582.	17203.	34043.	38601.	53134.
18	1469.	2469.	3669.	4791.	5614.	6591.	7819.	18	1469.	2437.	3633.	5052.	6320.	8043.	10289.
19	1340.	2253.	3209.	4136.	4929.	5651.	6685.	19	1340.	2224.	3162.	4356.	5423.	6873.	8763.
20	1095.	2415.	3844.	5005.	5828.	6767.	7903.	20	1095.	2386.	3784.	5254.	7895.	9530.	11642.
21	841.	1407.	2086.	2704.	3166.	3714.	4403.	21	841.	1389.	2055.	2851.	3562.	4529.	5788.
22	1013.	1696.	2514.	3259.	3815.	4475.	5305.	22	1013.	1674.	2476.	3435.	4292.	5457.	6974.
23	2447.	4115.	6148.	7984.	9356.	10984.	13031.	23	2447.	4061.	6054.	8420.	10533.	13406.	17147.
24	0.	0.	0.	0.	0.	0.	0.	24	0.	0.	0.	0.	0.	0.	0.
25	4810.	7721.	11141.	14293.	16630.	19415.	22918.	25	4810.	7685.	10981.	15028.	18643.	23558.	29959.
26	5272.	9043.	13789.	18017.	21173.	24921.	29633.	26	5272.	8921.	13574.	19018.	23882.	30495.	39107.
31	1204.	2916.	5708.	7523.	8788.	10212.	11910.	31	1204.	2881.	5612.	7899.	12679.	15147.	18324.
32	1186.	2617.	4165.	5422.	6313.	7331.	8561.	32	1186.	2584.	4099.	5692.	8553.	10324.	12612.
K	19888.	34765.	58936.	80560.	98183.	120992.	148210.	K	19888.	34968.	56524.	84679.	119698.	166657.	224490.
KN	17998.	33841.	56478.	74688.	91451.	107928.	124452.	KN	17998.	33518.	57308.	79844.	111738.	132838.	171464.
O	20677.	36710.	56292.	73124.	85510.	100059.	118168.	O	20677.	36242.	55429.	77003.	101780.	127363.	160606.
T	59564.	105317.	171706.	228352.	275144.	328960.	390830.	T	58564.	104728.	169261.	241526.	333216.	426858.	556559.

LEGEND

K : Khartoum
 KN: Khartoum North
 O : Omdurman
 T : Total

TRIP ENDS BY ZONE IN 1989

ZONE	LOW CASE						HIGH CASE									
	PASSENGER CAR		MINI BUS		LARGE BUS		TRUCK		PASSENGER CAR		MINI BUS		LARGE BUS		TRUCK	
	G	A	G	A	G	A	G	A	G	A	G	A	G	A	G	A
1	8137.	9812.	744.	1027.	0.	565.	613.	8137.	9812.	744.	1027.	0.	565.	613.	8137.	9812.
2	24203.	30912.	4540.	4522.	4054.	1492.	2495.	24203.	30912.	4540.	4522.	4054.	1492.	2495.	24203.	30912.
3	9091.	11654.	953.	1226.	0.	675.	822.	9091.	11654.	953.	1226.	0.	675.	822.	9091.	11654.
4	5554.	8108.	647.	744.	0.	479.	578.	6654.	8108.	647.	744.	0.	479.	578.	6654.	8108.
5	6612.	7467.	623.	725.	0.	420.	521.	6612.	7467.	623.	725.	0.	420.	521.	6612.	7467.
6	2866.	3395.	161.	366.	0.	213.	400.	2866.	3395.	161.	366.	0.	213.	400.	2866.	3395.
7	9610.	8381.	822.	913.	11.	49.	1296.	9610.	8381.	822.	913.	11.	49.	1296.	9610.	8381.
8	10542.	9377.	850.	904.	0.	1033.	907.	10542.	9377.	850.	904.	0.	1033.	907.	10542.	9377.
9	7124.	6307.	690.	560.	144.	811.	514.	7124.	6307.	690.	560.	144.	811.	514.	7124.	6307.
10	8795.	6918.	1001.	759.	288.	1093.	953.	8795.	6918.	1001.	759.	288.	1093.	953.	8795.	6918.
11	9902.	7715.	1163.	877.	732.	778.	948.	9902.	7715.	1163.	877.	732.	778.	948.	9902.	7715.
12	10521.	8500.	1206.	887.	444.	1315.	1096.	10521.	8500.	1206.	887.	444.	1315.	1096.	10521.	8500.
27	7088.	5860.	883.	726.	936.	1489.	1700.	7088.	5860.	883.	726.	936.	1489.	1700.	7088.	5860.
28	3619.	3112.	487.	375.	373.	599.	373.	3619.	3112.	487.	375.	373.	599.	373.	3619.	3112.
13	16332.	18480.	3456.	3672.	1291.	1705.	1795.	16332.	18480.	3456.	3672.	1291.	1705.	1795.	16332.	18480.
14	8407.	9230.	1269.	1429.	103.	2959.	1599.	8407.	9230.	1269.	1429.	103.	2959.	1599.	8407.	9230.
15	7978.	8769.	1013.	1044.	228.	2924.	4153.	7978.	8769.	1013.	1044.	228.	2924.	4153.	7978.	8769.
16	11828.	9487.	1248.	1077.	144.	813.	987.	11828.	9487.	1248.	1077.	144.	813.	987.	11828.	9487.
17	4579.	3922.	743.	716.	611.	1503.	1346.	4579.	3922.	743.	716.	611.	1503.	1346.	4579.	3922.
29	3843.	4030.	570.	575.	285.	2544.	2350.	3843.	4030.	570.	575.	285.	2544.	2350.	3843.	4030.
30	5087.	4222.	990.	896.	328.	1971.	1612.	5087.	4222.	990.	896.	328.	1971.	1612.	5087.	4222.
18	4535.	4505.	766.	756.	0.	636.	524.	4535.	4505.	766.	756.	0.	636.	524.	4535.	4505.
19	3143.	3453.	327.	384.	0.	247.	272.	3143.	3453.	327.	384.	0.	247.	272.	3143.	3453.
20	4484.	3788.	875.	789.	144.	684.	532.	4484.	3788.	875.	789.	144.	684.	532.	4484.	3788.
21	3415.	3301.	435.	363.	0.	214.	435.	3415.	3301.	435.	363.	0.	214.	435.	3415.	3301.
22	4854.	4958.	456.	577.	0.	463.	369.	4854.	4958.	456.	577.	0.	463.	369.	4854.	4958.
23	14776.	15852.	3252.	3677.	2153.	2042.	1732.	14776.	15852.	3252.	3677.	2153.	2042.	1732.	14776.	15852.
24	3091.	3802.	596.	681.	157.	253.	422.	3091.	3802.	596.	681.	157.	253.	422.	3091.	3802.
25	14839.	11864.	2552.	2506.	707.	526.	2306.	14839.	11864.	2552.	2506.	707.	526.	2306.	14839.	11864.
26	10583.	9147.	2297.	2063.	742.	720.	2183.	10583.	9147.	2297.	2063.	742.	720.	2183.	10583.	9147.
31	5865.	5489.	1599.	1484.	144.	1557.	1346.	5865.	5489.	1599.	1484.	144.	1557.	1346.	5865.	5489.
32	2602.	2338.	728.	651.	0.	607.	607.	2602.	2338.	728.	651.	0.	607.	607.	2602.	2338.
	255185.	255185.	37952.	37952.	13839.	38884.	38884.	255185.	255185.	37952.	37952.	13839.	38884.	38884.	255185.	255185.

G:Generation
A:Attraction

TRIP ENDS BY ZONE IN 1995

ZONE	LOW CASE						HIGH CASE									
	PASSENGER CAR		MINI BUS		LARGE BUS		TRUCK		PASSENGER CAR		MINI BUS		LARGE BUS		TRUCK	
	G	A	G	A	G	A	G	A	G	A	G	A	G	A	G	A
1	10301.	12449.	1191.	1505.	257.	230.	730.	1230.	10306.	12453.	1192.	1506.	267.	230.	732.	1230.
2	28450.	36046.	5420.	5460.	4346.	4500.	1840.	3801.	28463.	36057.	5423.	5462.	4346.	4500.	1842.	3800.
3	11319.	14328.	1416.	1716.	256.	231.	871.	1499.	11324.	14332.	1417.	1719.	256.	232.	872.	1499.
4	7795.	9457.	885.	956.	127.	116.	592.	915.	7798.	9459.	886.	956.	127.	116.	593.	915.
5	7753.	8836.	861.	977.	127.	156.	533.	856.	7756.	8838.	862.	977.	127.	156.	534.	856.
6	3399.	4111.	272.	505.	73.	79.	391.	799.	3402.	4114.	273.	506.	74.	79.	392.	801.
7	10543.	9229.	1022.	1115.	72.	114.	1328.	1449.	10540.	9228.	1031.	1114.	72.	114.	1327.	1449.
8	11425.	10165.	1060.	1095.	55.	59.	1277.	1043.	11423.	10164.	1059.	1095.	55.	59.	1275.	1044.
9	7856.	6959.	856.	718.	189.	193.	1014.	727.	7855.	6959.	855.	718.	189.	193.	1012.	727.
10	9815.	7770.	1235.	978.	341.	350.	1411.	1085.	9814.	7770.	1235.	978.	341.	350.	1410.	1085.
11	11152.	8830.	1446.	1147.	809.	862.	1825.	1142.	11150.	8830.	1445.	1147.	810.	862.	1823.	1142.
12	11734.	9516.	1485.	1149.	508.	506.	1692.	1254.	11733.	9515.	1484.	1148.	508.	506.	1691.	1254.
13	8101.	6713.	1127.	953.	986.	997.	1837.	1827.	8100.	6710.	1127.	953.	986.	996.	1838.	1826.
14	5409.	4508.	848.	720.	468.	465.	2162.	1620.	5402.	4499.	847.	718.	467.	464.	2162.	1618.
15	18560.	20876.	3953.	4180.	1490.	1490.	2154.	2312.	18562.	20878.	3954.	4181.	1490.	1410.	2154.	2312.
16	9910.	10989.	1594.	1811.	266.	370.	2575.	2437.	9885.	10864.	1533.	1754.	265.	364.	2468.	2440.
17	9895.	10187.	1409.	1414.	315.	366.	3471.	4369.	9894.	10185.	1402.	1414.	315.	366.	3472.	4368.
18	12795.	10279.	1471.	1285.	192.	201.	1123.	1103.	12795.	10280.	1471.	1285.	192.	201.	1123.	1103.
19	5344.	4632.	971.	925.	645.	348.	1865.	1476.	5313.	4499.	914.	876.	643.	341.	1756.	1425.
20	5473.	5440.	942.	927.	388.	393.	3025.	2586.	5470.	5437.	941.	927.	388.	392.	3024.	2585.
21	7014.	5814.	1434.	1312.	425.	403.	2587.	1857.	7477.	5073.	1548.	1410.	428.	416.	2810.	1856.
22	5047.	4922.	878.	862.	27.	37.	785.	590.	5045.	4922.	878.	862.	27.	37.	784.	590.
23	3396.	3670.	385.	439.	14.	16.	322.	307.	3395.	3670.	385.	438.	14.	16.	321.	307.
24	5062.	4275.	1008.	914.	175.	324.	862.	710.	5060.	4274.	1007.	913.	175.	324.	862.	710.
25	3879.	3527.	495.	420.	15.	17.	293.	471.	3879.	3527.	495.	420.	15.	17.	292.	471.
26	5162.	5228.	527.	643.	16.	19.	557.	409.	5161.	5228.	526.	643.	17.	19.	557.	410.
27	17489.	19856.	3837.	4272.	2421.	2294.	2125.	2236.	17490.	19858.	3831.	4272.	2421.	2294.	2125.	2235.
28	4157.	5233.	819.	960.	304.	385.	1178.	1809.	4164.	5240.	820.	961.	305.	386.	1180.	1813.
29	16518.	13489.	2952.	2892.	824.	550.	2775.	2189.	16509.	13482.	2950.	2890.	823.	550.	2777.	2188.
30	12658.	10950.	2769.	2511.	862.	854.	2787.	2407.	12651.	10946.	2768.	2510.	862.	854.	2783.	2407.
31	6905.	6396.	1836.	1709.	205.	212.	1862.	1505.	6901.	6391.	1835.	1708.	204.	211.	1861.	1504.
32	3228.	2866.	872.	786.	34.	39.	870.	591.	3227.	2865.	871.	785.	33.	38.	870.	591.
	297546.	297546.	47288.	47288.	17243.	17243.	48722.	48722.	297546.	297546.	47288.	47288.	17243.	17243.	48722.	48722.

G:Generation
A:Attraction

TRIP ENDS BY ZONE IN 2005

ZONE	LOW CASE						HIGH CASE									
	PASSENGER CAR		MINI BUS		LARGE BUS		TRUCK		PASSENGER CAR		MINI BUS		LARGE BUS		TRUCK	
	G	A	G	A	G	A	G	A	G	A	G	A	G	A	G	A
1	14286	17233	2086	2452	759	677	1187	2800	14824	17876	2215	2601	829	741	1283	3095
2	36039	45078	7129	7279	5268	5341	2748	6811	37006	46228	7362	7528	5392	5455	2928	7141
3	15415	19173	2341	2700	748	682	1393	3009	15962	19821	2472	2841	818	745	1496	3304
4	9882	11888	1359	1495	372	341	864	1662	10155	12210	1425	1566	406	373	940	1807
5	9840	11287	1335	1476	372	381	825	1605	10113	11589	1401	1547	406	413	881	1750
6	4179	5135	449	724	184	180	712	1448	4293	5284	476	758	202	195	778	1585
7	12188	10709	1434	1500	185	236	1878	1780	12358	10876	1478	1543	200	251	1955	1842
8	12913	11455	1427	1442	148	163	1805	1308	13047	11579	1462	1476	159	174	1876	1353
9	9089	8026	1160	1006	266	279	1453	944	9200	8127	1189	1034	275	288	1512	981
10	11241	9071	1583	1313	443	458	1878	1385	11400	9230	1623	1353	457	472	1946	1445
11	13267	10665	1967	1640	943	1010	2574	1521	13459	10844	2017	1689	958	1026	2677	1585
12	13507	11105	1918	1564	628	637	2290	1613	13701	11301	1968	1613	647	655	2376	1684
13	10528	8721	1731	1520	1122	1154	2797	2240	11079	9155	1877	1655	1151	1190	3096	2345
14	9324	8042	1809	1645	739	757	3531	2480	10275	8852	2058	1881	800	825	3969	2705
15	22825	25159	4946	5167	1874	1785	3158	3470	23309	25694	5066	5291	1928	1838	3308	3697
16	11922	13493	2056	2346	528	612	3340	3862	14816	13511	2030	2333	544	621	3308	4016
17	13064	12983	2247	2201	505	587	4781	4935	18546	13415	2374	2321	538	624	5032	5861
18	14358	11575	1873	1657	276	301	1764	1337	14530	11695	1907	1691	285	311	1843	1377
19	6892	5773	1393	1239	724	439	2371	1659	6817	5803	1285	1229	738	447	2340	1728
20	8500	8139	1684	1638	592	614	4075	3202	8849	8500	1772	1727	627	648	4219	3339
21	11147	9278	2454	2280	654	677	4200	2578	12620	10314	2848	2626	715	752	4957	2752
22	5876	5606	1085	1055	73	140	1106	717	5949	5670	1105	1073	78	146	1149	738
23	3622	4025	491	538	38	44	483	375	3859	4059	501	547	41	47	505	386
24	6124	5210	1289	1163	244	400	1240	919	6316	5374	1319	1211	257	414	1335	967
25	4125	3897	606	524	40	46	453	541	4164	3931	617	533	42	49	486	553
26	5684	5655	657	765	45	52	761	488	5729	5695	669	776	48	56	788	501
27	2453	25296	4980	5455	2940	2785	3077	3814	23079	26007	5133	5615	3014	2855	3238	4124
28	5718	7283	1172	1397	526	587	1820	3107	5772	7353	1187	1415	535	596	1877	3229
29	20150	16804	3808	3726	1092	930	3893	3014	20619	17296	3926	3845	1140	976	4066	3204
30	16342	14127	3679	3372	1091	1109	4124	3071	16719	14487	3777	3457	1123	1142	4311	3200
31	8980	8336	2339	2200	361	375	2529	1996	9411	8728	2450	2387	393	409	2717	2116
32	4378	3878	1155	1056	109	121	1280	918	4587	4057	1209	1108	122	136	1382	970
	374101	374101	65543	65543	23900	23900	70419	70419	384564	384564	68200	68200	24869	24869	74580	74580

G:Generation
A:Attraction

TRIP ENDS BY ZONE IN 2015

ZONE	LOW CASE						HIGH CASE									
	PASSENGER CAR		MINI BUS		LARGE BUS		TRUCK		PASSENGER CAR		MINI BUS		LARGE BUS		TRUCK	
	G	A	G	A	G	A	G	A	G	A	G	A	G	A	G	A
1	19160.	22980.	3304.	3777.	1400.	1267.	1894.	4909.	23210.	27705.	3776.	4264.	1634.	1486.	2304.	5736.
2	45088.	55667.	9395.	9714.	5441.	5424.	4116.	10448.	52331.	64062.	10216.	10556.	5843.	6802.	4849.	11871.
3	20415.	24989.	3596.	4047.	1590.	1276.	2191.	5118.	24535.	29750.	4074.	4538.	1624.	1496.	2615.	5945.
4	12415.	14794.	1998.	2176.	689.	636.	1374.	2702.	14475.	17153.	2235.	2419.	803.	744.	1539.	3107.
5	12373.	14173.	1974.	2157.	689.	676.	1265.	2645.	14433.	16532.	2211.	2403.	803.	784.	1480.	3050.
6	4911.	5078.	833.	954.	295.	282.	1083.	2135.	5400.	6695.	679.	1004.	320.	305.	1170.	2271.
7	14105.	12421.	1954.	2004.	329.	391.	2858.	2733.	15432.	13665.	2093.	2134.	378.	440.	2834.	2402.
8	14574.	12862.	1882.	1876.	258.	287.	2542.	1644.	15820.	13776.	1982.	1965.	287.	318.	2686.	1743.
9	10463.	9187.	1537.	1365.	357.	381.	2066.	1219.	11325.	9937.	1619.	1438.	380.	406.	2184.	1300.
10	12941.	10618.	2042.	1751.	576.	600.	2545.	1810.	14167.	11796.	2175.	1887.	626.	549.	2707.	1981.
11	15635.	12677.	2617.	2250.	1101.	1188.	3622.	2003.	17136.	13995.	2761.	2389.	1143.	1232.	3828.	2150.
12	15614.	12999.	2489.	2119.	790.	809.	3141.	2120.	17120.	14427.	2652.	2272.	849.	868.	3343.	2325.
27	13188.	11148.	2445.	2223.	1332.	1377.	3859.	2932.	16813.	14101.	3013.	2735.	1447.	1515.	4867.	3308.
28	15259.	13342.	3419.	3213.	1187.	1239.	5007.	3953.	21920.	19092.	4438.	4150.	1435.	1518.	7643.	4779.
13	27770.	30230.	6239.	6483.	2375.	2279.	4573.	5093.	31451.	34177.	6639.	6882.	2557.	2452.	4963.	5734.
14	14004.	15015.	2586.	2971.	812.	877.	4266.	5448.	14732.	16985.	2574.	2954.	825.	885.	4175.	5432.
15	16690.	16213.	3233.	3156.	775.	879.	6291.	5691.	19715.	18988.	3608.	3508.	894.	1002.	6824.	6208.
16	16161.	12987.	2362.	2117.	375.	421.	2625.	1640.	17486.	13868.	2449.	2194.	405.	450.	2738.	1738.
17	8227.	7852.	1659.	1594.	844.	561.	2838.	2065.	9109.	8090.	1735.	1679.	902.	611.	2886.	2273.
29	12193.	11503.	2681.	2613.	883.	923.	5536.	4141.	14906.	14204.	2975.	2901.	1009.	1044.	5847.	4582.
30	15210.	13689.	3846.	3612.	1023.	1073.	6395.	3740.	21876.	18372.	4723.	4407.	1205.	1290.	7862.	4337.
18	5802.	6352.	1343.	1296.	126.	204.	1554.	878.	7373.	6325.	1386.	1343.	140.	219.	1636.	925.
19	4297.	4413.	622.	662.	67.	77.	709.	460.	4591.	4659.	650.	686.	74.	85.	751.	485.
20	7408.	6375.	1616.	1502.	344.	506.	1754.	1244.	3591.	7447.	1774.	1649.	390.	555.	1986.	1400.
21	4622.	4300.	744.	663.	59.	80.	702.	629.	4930.	4556.	773.	679.	77.	88.	745.	655.
22	6266.	6120.	819.	916.	78.	92.	1046.	587.	5624.	6416.	853.	946.	86.	101.	1098.	616.
23	28469.	31814.	6526.	7064.	3617.	3453.	4478.	6026.	33232.	37054.	7089.	7610.	3866.	3659.	5008.	6909.
24	7180.	9169.	1541.	1856.	747.	790.	2563.	4481.	7388.	9669.	1517.	1817.	729.	775.	2517.	4351.
25	24681.	21116.	5018.	4927.	1425.	1335.	5526.	4302.	28345.	24534.	5453.	5355.	1656.	1510.	6005.	4931.
26	20856.	17831.	4860.	4503.	1386.	1438.	8015.	3993.	23617.	20521.	5170.	4790.	1490.	1544.	6425.	4350.
31	11560.	10944.	3051.	2913.	605.	623.	3452.	2806.	14358.	13553.	3425.	3276.	731.	751.	3960.	3238.
32	5770.	5140.	1531.	1423.	217.	237.	1836.	1270.	7051.	6302.	1702.	1583.	267.	289.	2090.	1439.
465202.	465202.	89567.	89908.	32660.	32660.	100476.	100476.	539206.	539206.	98410.	98410.	35885.	35885.	111558.	111558.	

G:Generation
A:Attraction

FUTURE OD TABLE : YEAR 1985
VEHICLE TYPE : ALL VEHICLE BY POU

ORIG/DES	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	31	32	TOTAL
1	195	1427	691	356	355	159	557	650	542	910	921	1066	1003	315	415	390	147	69	79	74	196	225	712	190	459	278	957	531	172	154	56	28	14349
2	1451	922	1595	805	826	365	1509	1496	1658	2932	3820	3716	5096	1953	2248	1363	176	413	398	981	515	639	6171	1038	1709	1010	4977	2285	641	398	160	131	53297
3	701	1553	307	396	403	180	819	816	570	1194	1142	1327	558	328	328	375	116	92	220	194	179	231	877	276	258	312	1197	650	83	168	57	37	15942
4	365	808	403	105	213	101	482	485	397	578	676	793	581	456	461	340	130	70	166	153	108	91	577	127	342	284	721	384	41	59	59	16	10640
5	361	832	405	210	106	104	488	485	399	681	677	792	639	414	289	408	73	171	89	68	127	156	676	88	278	217	719	384	82	64	25	16	10463
6	156	436	223	128	130	1600	48	48	36	64	67	76	260	283	385	115	52	56	55	138	66	88	326	257	317	51	60	37	11	66	6	2	5683
7	557	2161	1176	699	704	54	2064	287	235	403	403	476	1048	437	919	273	89	101	179	185	216	176	488	357	793	276	399	212	35	85	40	33	15460
8	952	2141	1173	693	697	53	287	1953	231	400	400	471	774	846	661	528	71	246	35	141	341	302	788	305	598	236	396	206	31	90	142	5	18194
9	791	2220	975	578	580	50	260	258	1575	330	327	395	554	755	592	308	19	28	121	40	48	134	216	166	223	46	330	170	11	58	7	3	12159
10	1347	3685	1682	985	995	79	450	447	332	2450	584	663	93	171	301	87	23	20	16	6	21	36	198	178	44	52	567	293	16	18	21	5	16041
11	1351	4773	1651	986	991	87	446	443	327	563	2905	656	395	370	844	48	27	33	101	194	66	31	423	1176	132	186	560	290	22	65	12	7	20175
12	1515	4845	1950	1159	1160	99	521	520	366	666	557	3013	179	303	466	132	30	6	179	38	2	204	116	67	42	71	663	345	36	81	14	7	19508
13	992	4584	844	395	729	314	485	1090	532	124	201	138	6016	904	2076	1485	1830	732	344	135	27	803	420	972	809	789	73	161	1813	2230	103	21	35361
14	382	2785	563	451	303	178	546	648	353	162	275	338	881	4403	938	601	552	104	67	167	21	183	798	574	470	307	146	407	790	786	79	61	19749
15	383	2292	385	406	139	186	569	387	306	147	381	133	2433	1172	4788	1180	1064	11	40	40	31	17	99	188	79	54	163	370	1996	1483	26	14	20342
16	629	2359	459	530	605	480	278	793	281	113	73	126	1503	631	981	2529	705	327	166	94	83	316	1185	254	431	225	55	198	992	980	80	7	19439
17	168	1613	158	157	88	104	195	198	59	28	25	57	1974	861	1040	796	2366	56	46	91	32	54	282	255	121	318	54	61	904	916	89	7	12881
18	130	592	37	203	211	121	202	311	37	5	40	6	817	374	11	350	75	1143	114	217	121	145	572	113	798	587	5	3	261	11	525	232	8274
19	21	358	171	47	85	77	100	362	81	16	103	179	427	154	40	136	45	114	532	108	63	72	288	55	389	345	2	6	50	6	265	117	4783
20	284	530	332	123	103	134	351	289	113	6	132	60	221	118	38	44	49	301	150	1340	159	191	126	146	907	854	7	39	123	14	645	293	9222
21	140	864	226	153	68	79	254	197	73	21	53	2	307	11	31	148	31	121	63	115	558	79	308	57	392	363	39	6	49	6	278	123	5216
22	187	732	187	111	190	192	200	395	147	27	261	286	829	298	17	290	166	146	17	135	79	660	360	69	457	433	27	6	143	7	394	151	7245
23	624	6323	772	446	258	436	975	429	362	211	506	198	4232	818	62	590	366	563	284	965	300	354	6857	334	3116	3861	155	266	437	73	1735	581	37491
24	165	1184	163	169	55	436	625	51	51	134	583	41	568	372	184	162	167	97	47	94	52	65	314	3223	319	299	55	12	300	32	221	100	10280
25	749	2623	658	525	393	693	429	598	177	66	63	81	978	1382	57	413	127	984	493	899	522	820	3726	444	6339	2930	23	179	224	43	2145	971	30436
26	379	1459	313	236	293	441	470	171	124	124	133	129	554	304	144	148	95	951	477	852	503	604	4541	440	2853	6487	91	86	106	51	2038	923	26520
27	1146	5391	1424	851	855	61	351	347	284	489	483	572	173	227	558	60	48	6	2	7	33	29	205	56	44	116	2454	296	54	48	15	7	16705
28	581	2564	798	458	458	44	186	183	148	253	257	298	395	306	1159	138	52	8	48	65	323	47	150	271	159	169	298	3158	58	175	23	12	13340
29	189	774	745	72	114	25	62	31	14	16	25	45	2106	985	1393	1188	918	44	40	115	6	63	298	124	137	356	42	69	4172	1234	48	12	14913
30	201	956	290	316	171	172	370	244	61	21	166	117	2430	942	1441	1100	909	11	6	15	7	7	107	69	50	58	123	213	1204	4772	57	15	16621
31	120	289	96	108	45	14	12	68	56	11	15	14	88	94	23	57	68	702	353	641	372	446	2160	317	2146	2024	12	69	48	24	3480	694	14667
32	55	182	55	26	28	10	33	6	6	6	7	7	27	70	12	7	4	326	163	293	115	209	819	157	982	926	7	12	12	13	701	1475	5813
TOTAL	17666	64498	20296	12912	12273	7123	14697	14686	10654	13184	16341	16182	37139	20758	22852	15761	10590	8052	5185	8500	5351	7277	39861	12943	25691	24000	15379	11470	14297	14211	13477	6104	595936

FUTURE OD TABLE - YEAR 2005
VEHICLE TYPE - ALL VEHICLE BY PDI

ORIGDES	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	31	32	TOTAL
1	283	3501	1692	835	825	282	815	788	651	1043	1113	1231	1258	489	586	486	214	112	101	133	219	250	1088	358	687	491	1079	760	293	372	183	95	22311
2	3564	1175	3824	1841	1890	640	1838	1779	1898	3226	4238	4082	5665	2345	2626	1533	330	507	449	1010	564	597	701	1410	2211	1483	5247	2785	1017	888	444	271	88596
3	1728	3720	432	903	917	309	97	350	782	1264	1336	1499	837	516	460	454	186	136	240	257	203	255	1267	449	490	529	1327	885	259	397	188	99	24251
4	365	1351	910	139	458	165	582	547	452	742	772	873	713	544	378	162	87	199	181	122	106	106	719	213	456	370	782	498	123	169	132	45	14882
5	847	1914	924	455	141	167	584	546	451	745	770	871	770	500	373	445	108	191	102	96	141	171	804	170	390	320	780	495	164	174	89	46	14725
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7	1194	2652	1401	806	818	76	5449	312	257	427	437	508	1106	480	953	292	103	109	184	197	221	181	589	396	336	318	423	254	56	128	69	47	20787
8	1158	2588	1369	794	745	80	314	4864	251	424	429	498	327	883	593	543	85	252	40	149	345	309	883	339	842	276	417	247	59	129	158	15	20971
9	975	2601	1161	666	663	78	292	278	4096	351	350	408	591	780	617	322	28	33	126	48	53	140	216	197	254	78	346	198	35	88	25	12	16126
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18	214	770	171	246	262	133	212	319	42	14	52	17	651	403	34	358	83	2785	119	234	127	151	682	159	786	734	23	40	284	39	557	250	10931
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20	324	740	434	173	153	145	363	298	121	15	149	76	269	162	68	58	58	315	155	3576	164	198	1306	202	978	920	28	75	151	49	690	313	12668
21	179	953	263	175	90	86	260	202	78	27	59	7	328	29	42	159	37	127	65	121	1449	82	354	85	422	391	48	23	60	23	298	133	6649
22	248	845	240	139	128	201	206	400	152	32	269	211	653	318	30	295	170	151	78	146	82	1998	406	96	500	463	38	27	157	25	356	159	8919
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26	768	2772	697	426	480	487	517	210	159	165	187	180	720	436	248	190	133	986	502	918	530	629	4945	602	3060	13971	163	219	208	178	2175	995	38396
27	1387	5898	1663	855	989	94	380	373	307	512	516	601	386	388	687	118	101	24	11	31	142	38	353	130	125	192	7385	450	163	204	62	32	24588
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30	627	1857	722	521	368	231	426	287	96	66	226	171	2785	1208	1660	1190	983	37	18	52	23	25	355	196	193	191	270	491	1408	13171	134	54	30042
31	324	720	298	205	143	42	37	90	73	33	46	39	175	158	76	80	88	725	367	690	387	462	2388	422	2272	2144	51	137	99	88	7872	730	21451
32	168	418	166	82	79	22	50	16	14	16	25	24	75	104	43	21	20	341	171	313	183	216	950	223	1056	995	29	51	40	51	741	3847	10550
TOTAL	28009	83944	30784	18140	17470	11945	19682	18981	14122	17460	22474	21458	51278	30028	32465	20230	14490	10366	6403	11645	6522	8741	56605	20146	36571	34691	22324	23362	26131	16696	9511	768255	

FUTURE 00 TABLE - YEAR 2015
VEHICLE TYPE - ALL VEHICLE BY POU

ORTYDES	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	31	32	TOTAL
1	391	6147	3016	1476	1456	413	1807	944	779	1217	1340	1450	1615	565	804	560	303	166	125	214	243	281	1596	529	1013	766	1247	1139	528	687	374	183	37694
2	8264	1465	6681	3153	3248	918	2241	2110	2175	3600	4730	4545	6428	2764	3693	1731	519	618	504	1182	620	767	8095	1783	2916	2069	5602	3596	1515	1559	857	464	87833
3	3083	6480	585	1655	1597	435	1163	1113	917	1446	1572	1725	1202	725	685	549	279	189	266	338	227	290	1784	628	827	811	1495	1282	501	724	388	188	35059
4	1524	3172	1582	182	782	228	549	622	516	828	983	980	887	645	652	423	210	115	211	218	133	123	972	303	618	504	862	684	240	325	231	89	20393
5	1488	3300	1606	775	186	783	653	620	513	831	878	974	930	596	476	486	148	216	113	133	152	188	1052	257	550	452	860	676	271	322	183	89	20214
6	456	972	474	249	257	6514	77	72	60	89	106	111	319	328	420	131	69	68	60	153	71	94	415	295	369	96	87	94	49	116	38	19	12828
7	1498	3264	1693	944	962	100	9713	339	282	458	477	547	1777	573	998	306	119	120	188	211	225	188	674	435	402	370	453	323	113	189	107	63	27462
8	1439	3137	1662	917	918	107	345	8590	270	452	462	529	886	923	727	558	99	284	44	165	350	314	962	375	696	322	446	304	97	177	202	31	26760
9	1204	3065	1389	772	773	94	310	297	7067	375	380	434	640	810	644	331	43	40	128	61	54	143	348	226	302	114	365	247	55	132	52	24	20926
10	1820	4870	2119	1220	1226	126	503	493	372	9215	628	728	199	244	369	117	50	35	25	28	30	45	349	242	132	131	611	391	86	109	75	31	26620
11	2067	6245	2364	1320	1322	157	523	504	380	633	12368	736	553	477	936	89	64	55	113	225	77	44	644	1271	270	300	625	418	112	189	91	47	35214
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13	1801	6320	1591	796	1101	411	594	1178	607	224	333	257	26514	1368	2532	1681	2016	786	374	222	62	840	4676	1199	1143	585	428	906	2293	2864	300	115	66217
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22	320	983	305	170	158	207	213	407	158	41	277	221	880	338	49	332	177	158	79	159	85	2953	463	119	542	500	53	54	176	49	363	175	10954
23	1682	8924	1813	955	774	550	1112	544	454	331	665	342	4707	1123	364	714	484	694	349	1168	368	429	32086	777	3884	4530	382	727	741	465	2174	809	74721
24	545	1945	534	348	239	472	672	86	78	171	632	88	729	391	283	201	206	136	69	161	71	87	699	13245	543	488	122	217	400	154	364	174	24556
25	1619	4409	1513	940	796	785	534	671	249	147	182	190	1343	1628	282	506	214	1079	545	1056	575	682	4647	777	24138	3306	182	523	462	332	2465	1134	57911
26	1278	3304	1194	668	722	539	576	261	198	217	255	243	934	574	378	241	182	1050	530	1005	558	661	5464	758	3393	23464	250	434	341	348	2378	1091	53489
27	1665	6465	1936	1697	1102	116	411	395	323	540	549	633	630	538	828	176	158	38	20	55	54	48	522	197	228	273	13376	677	331	396	120	56	33957
28	1707	4706	1846	359	949	157	306	275	225	361	391	414	1298	900	1693	365	264	74	80	160	357	87	794	545	542	499	660	24711	599	875	241	113	47143
29	878	2197	838	398	432	104	147	100	66	94	117	130	2686	1358	1710	1338	1057	89	62	180	30	91	709	310	448	578	284	599	18733	1685	188	79	37725
30	1197	3017	1295	790	633	286	491	341	136	130	298	240	3245	1496	1934	1295	1077	70	35	107	40	43	683	327	394	360	476	956	1689	24436	249	108	47874
31	613	1305	579	343	279	72	71	119	97	65	83	79	297	234	149	111	115	760	380	732	403	483	2707	538	2462	2309	103	256	172	185	14054	785	30944
32	316	722	315	153	153	38	86	32	25	34	44	38	137	146	79	35	32	358	181	338	193	229	1125	286	1163	1083	53	110	79	99	802	6974	15436
TOTAL	41406108516	44323	24855	24212	14977	25775	24121	18379	22990	29797	28219	68431	40106	44069	25516	19010	13189	7638	15825	8120	10494	78261	28033	51724	48191	31032	42557	35342	42206	26018	14036	1060538	

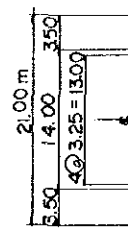
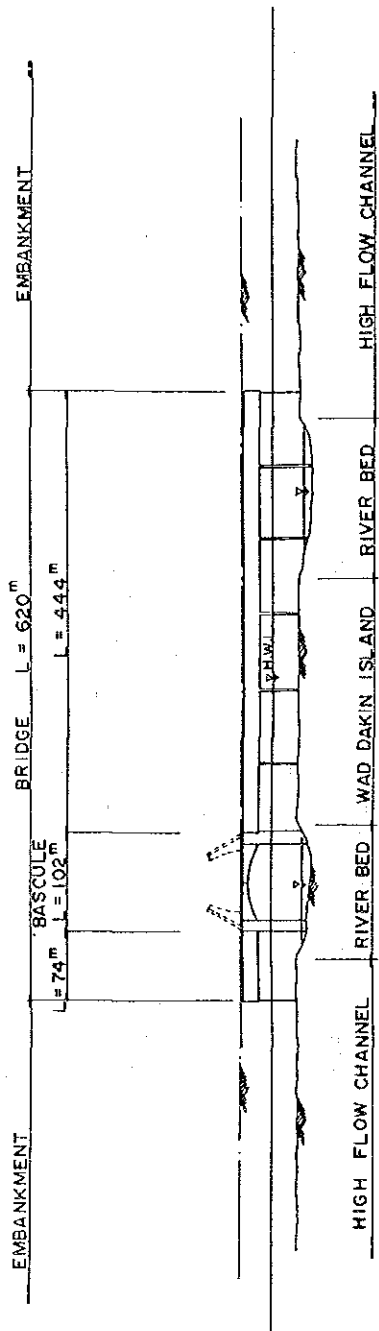
Relation between 32 Traffic Zones and 8 Macro Zones

Macro Zones	Traffic Zones
KRT-CE	1, 2, 3, 4, 5
KRT-SW	6, 7, 10, 11, 27
KRT-SE	8, 9, 12, 28
KRTN-W	12, 16, 17, 30
KRTN-E	14, 15
ODM-CE	18, 19, 21, 22, 23, 24
ODM-SW	25, 31
ODM-NO	26, 32

Bridge Location and Route Study

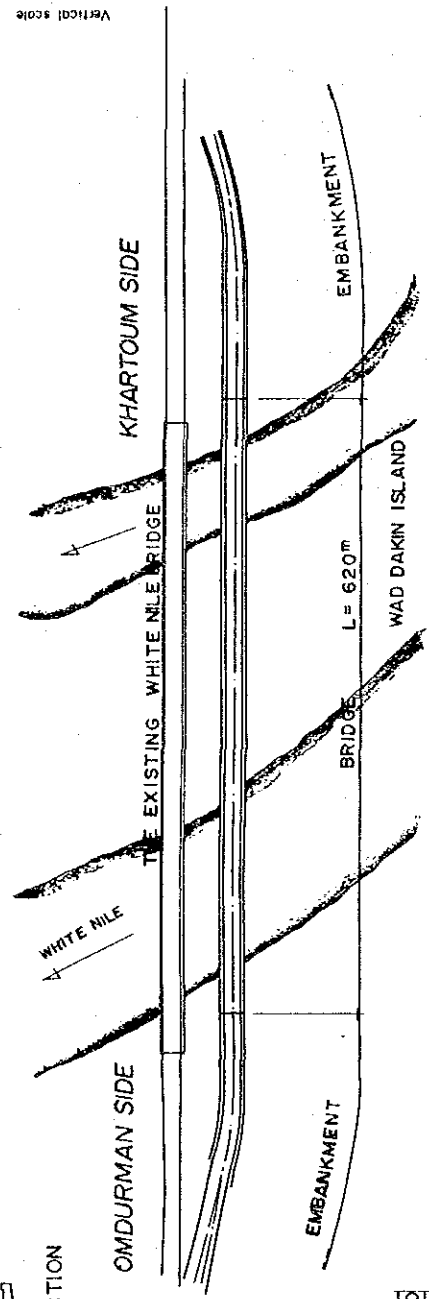
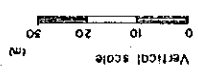
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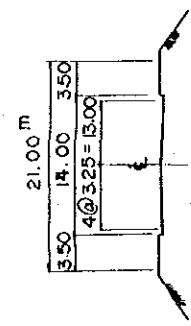


BRIDGE CROSS SECTION

LONGITUDINAL SECTION



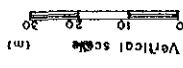
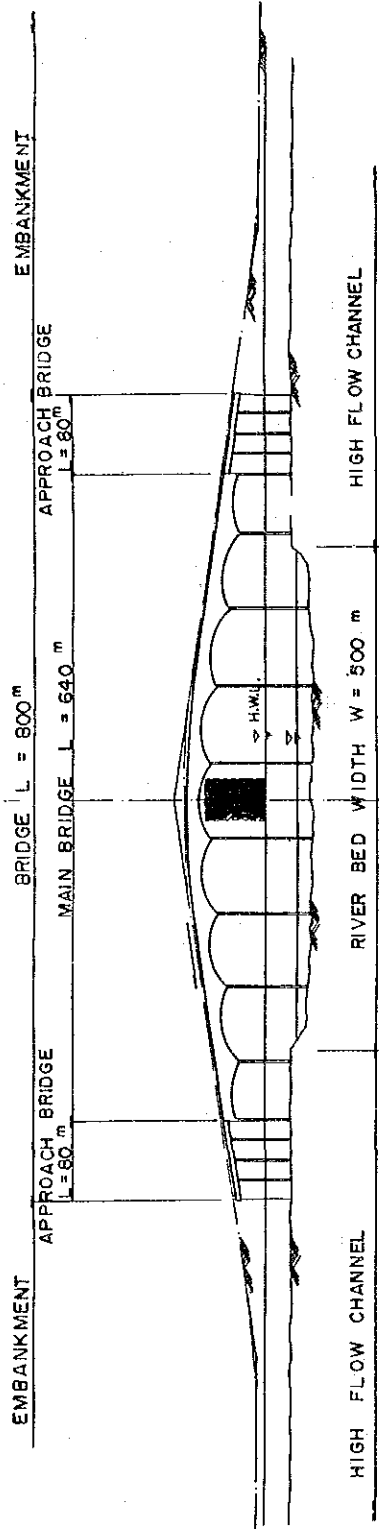
PLAN



Geometric Design Criteria

Design Speed	60 km/h
Minimum Horizontal Radius	150 m
Maximum Vertical Grade	5 %

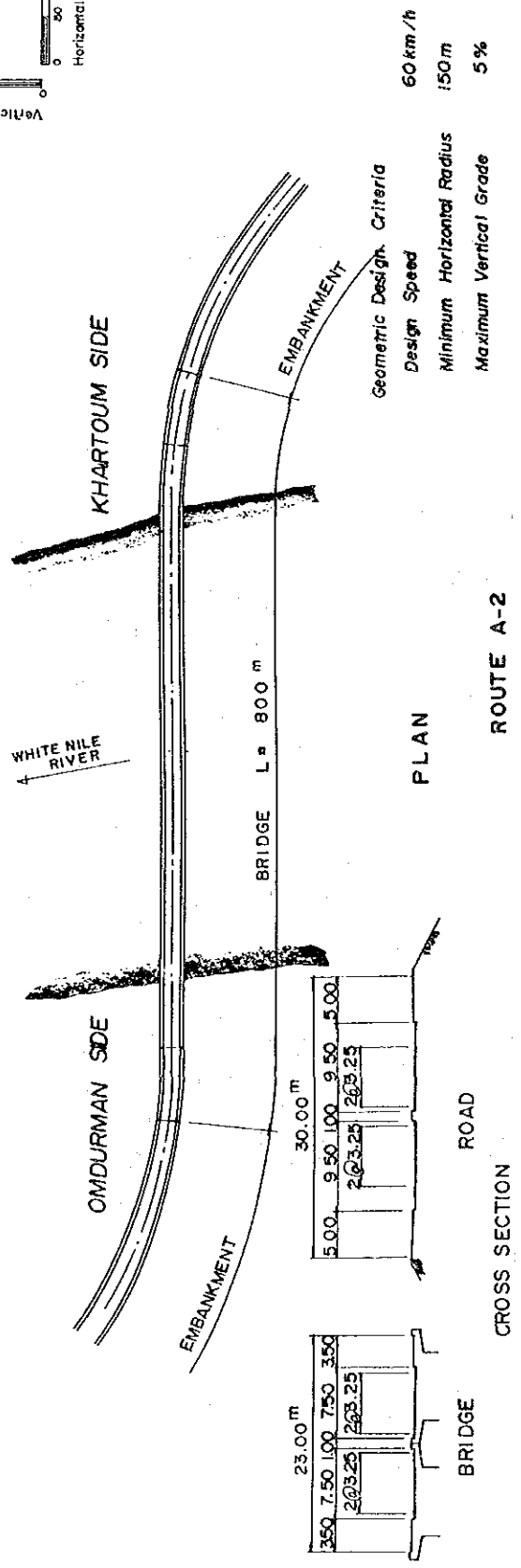
ROUTE A - I



LONGITUDINAL SECTION



A-61



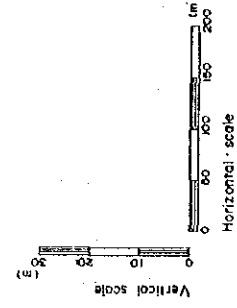
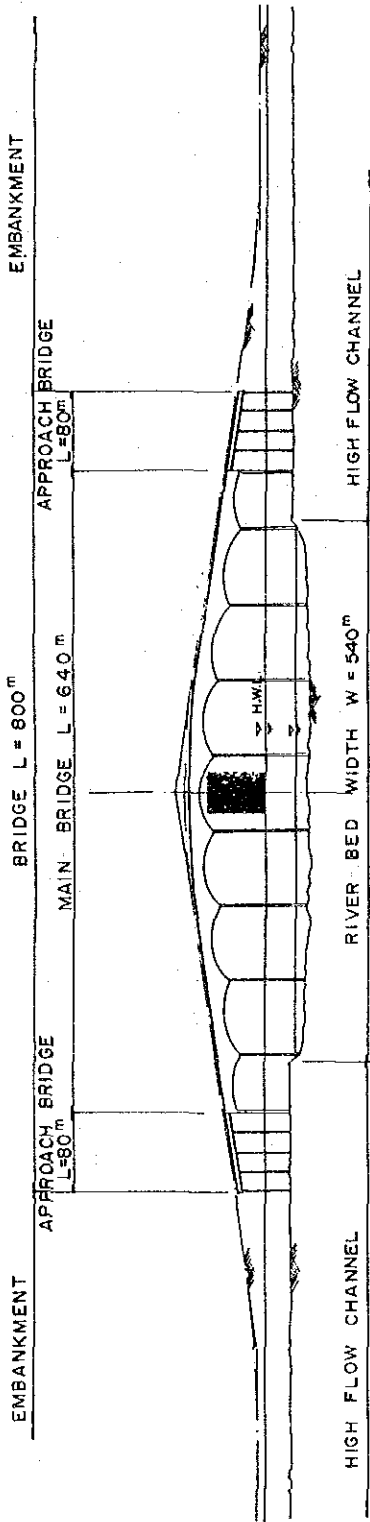
Geometric Design Criteria

Design Speed 60 km/h

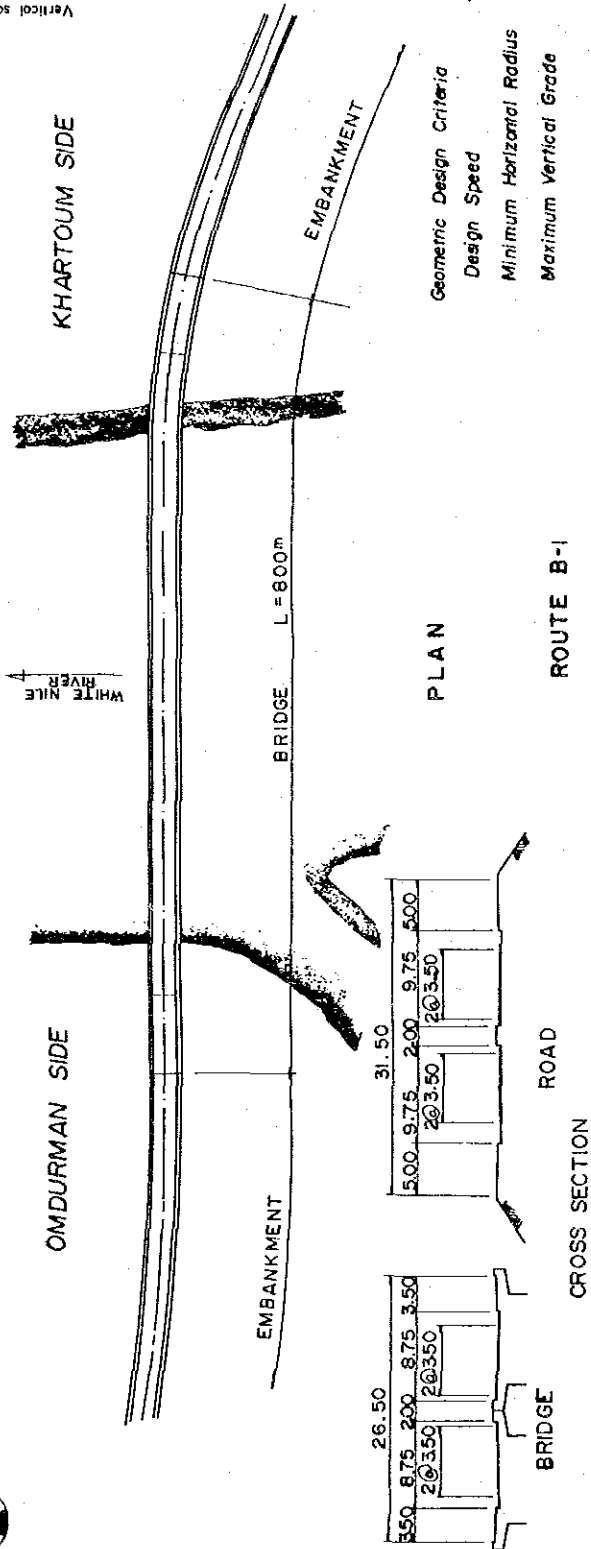
Minimum Horizontal Radius 150 m

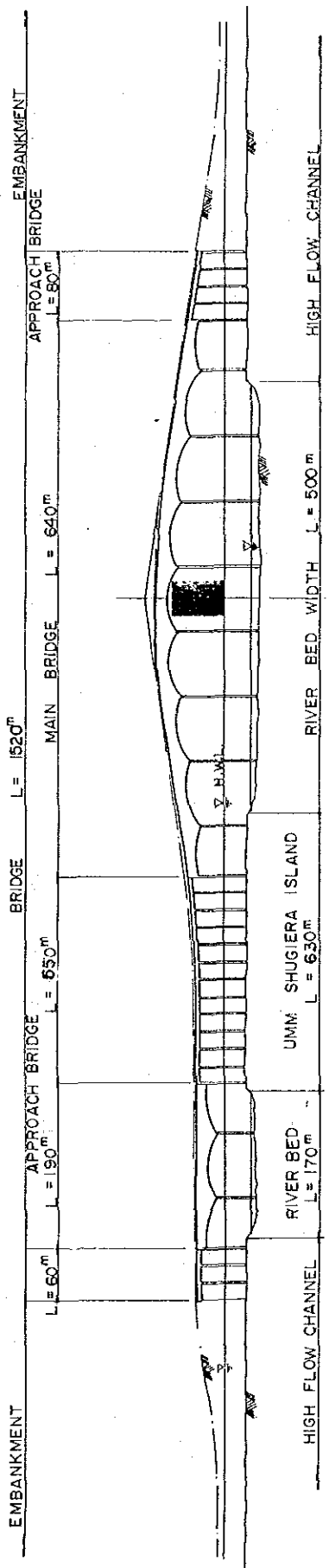
Maximum Vertical Grade 5%

ROUTE A-2

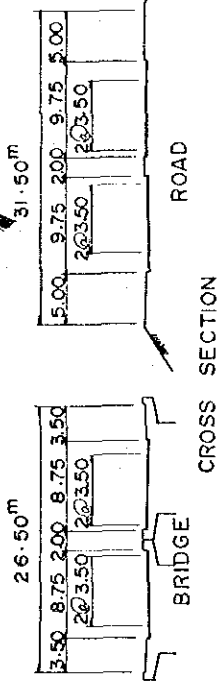
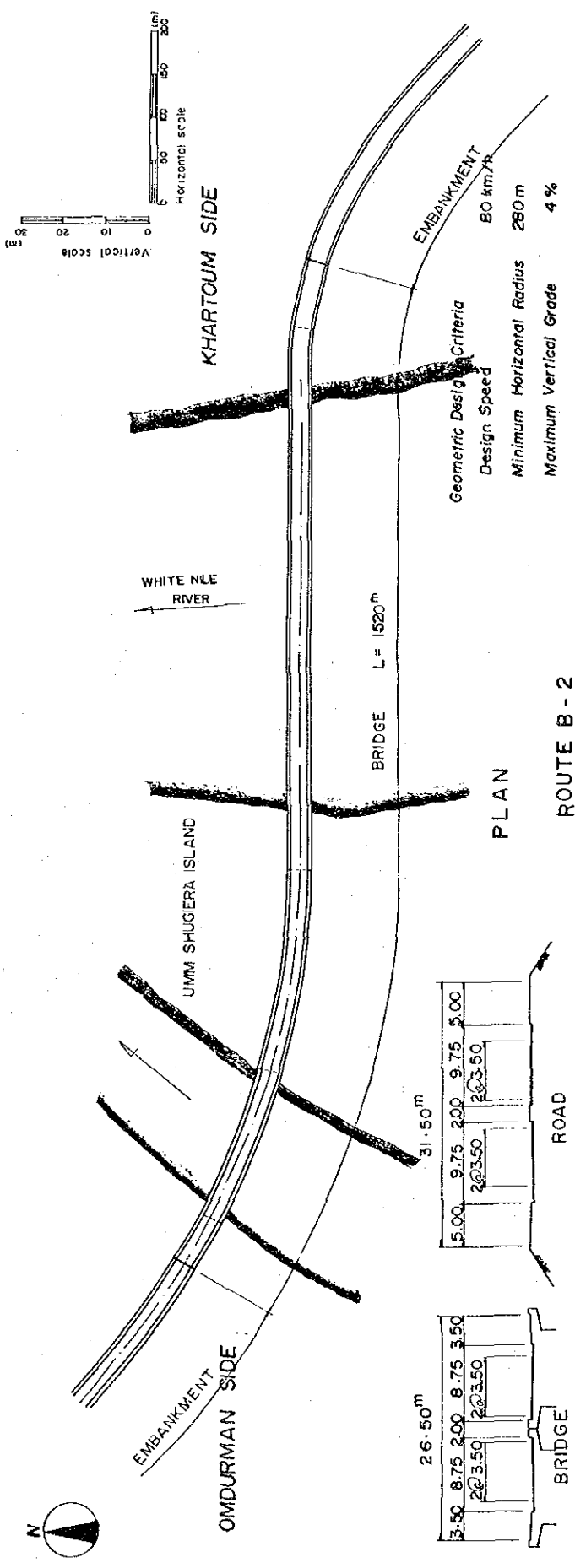


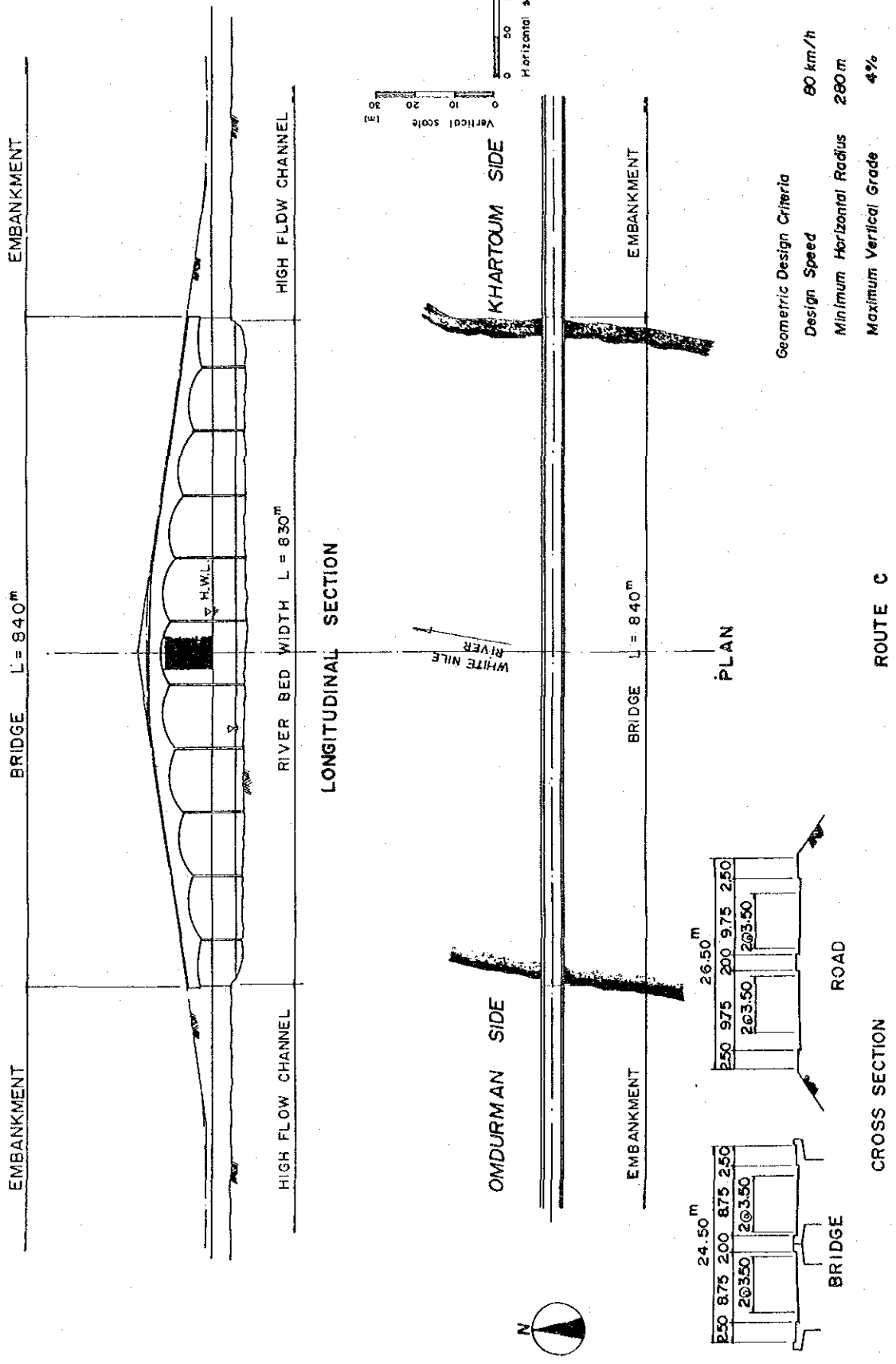
LONGITUDINAL SECTION



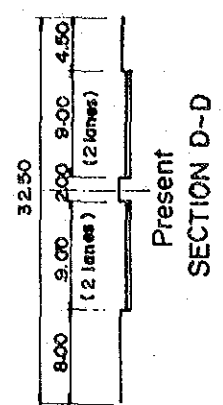
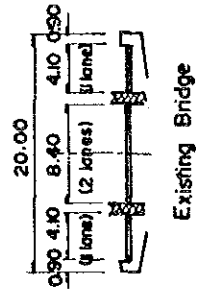
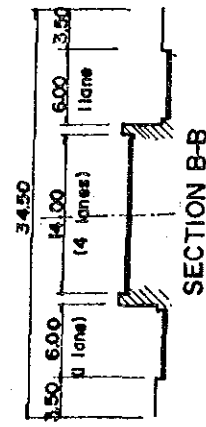
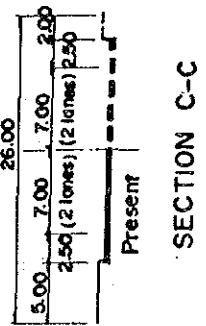
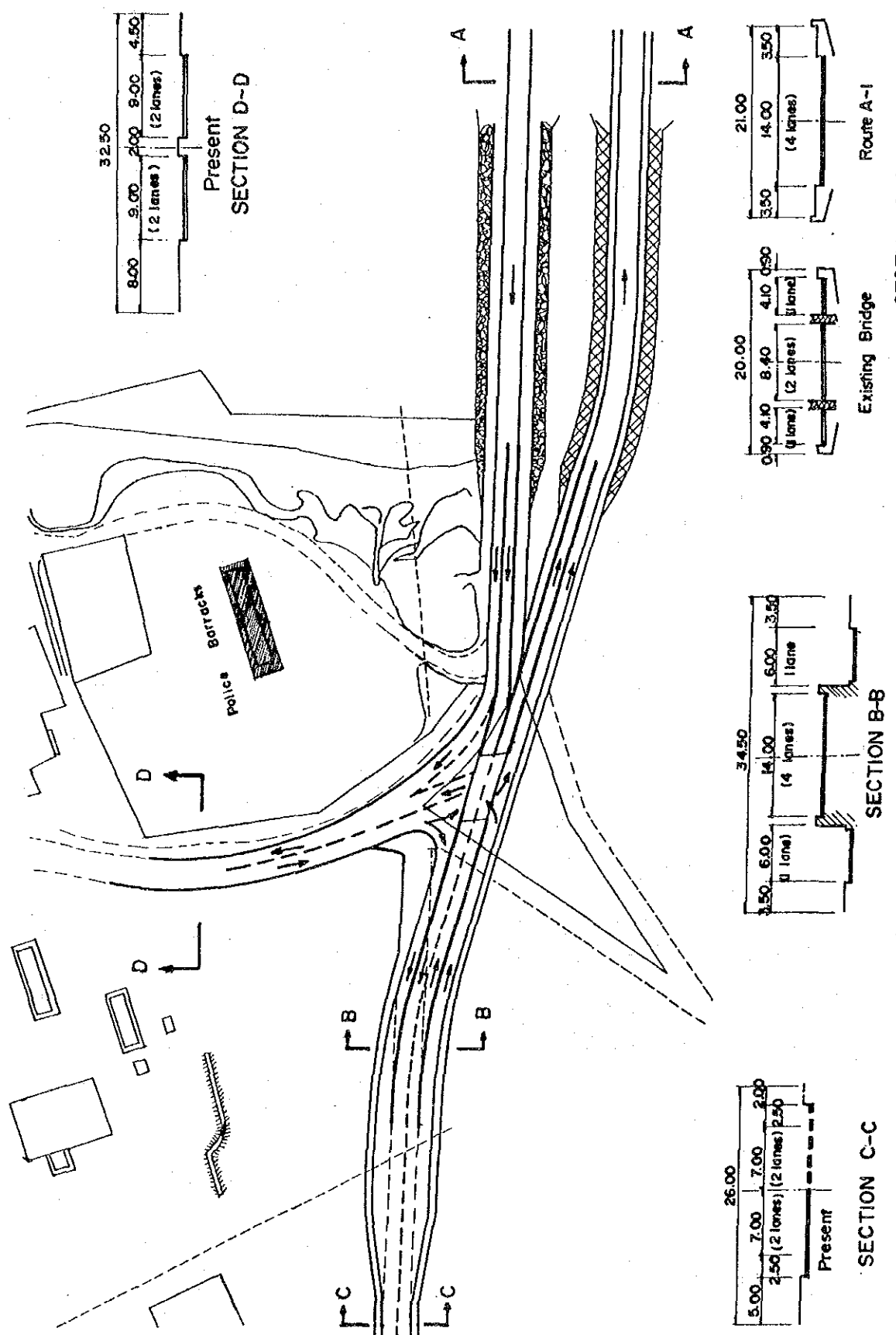


LONGITUDINAL SECTION

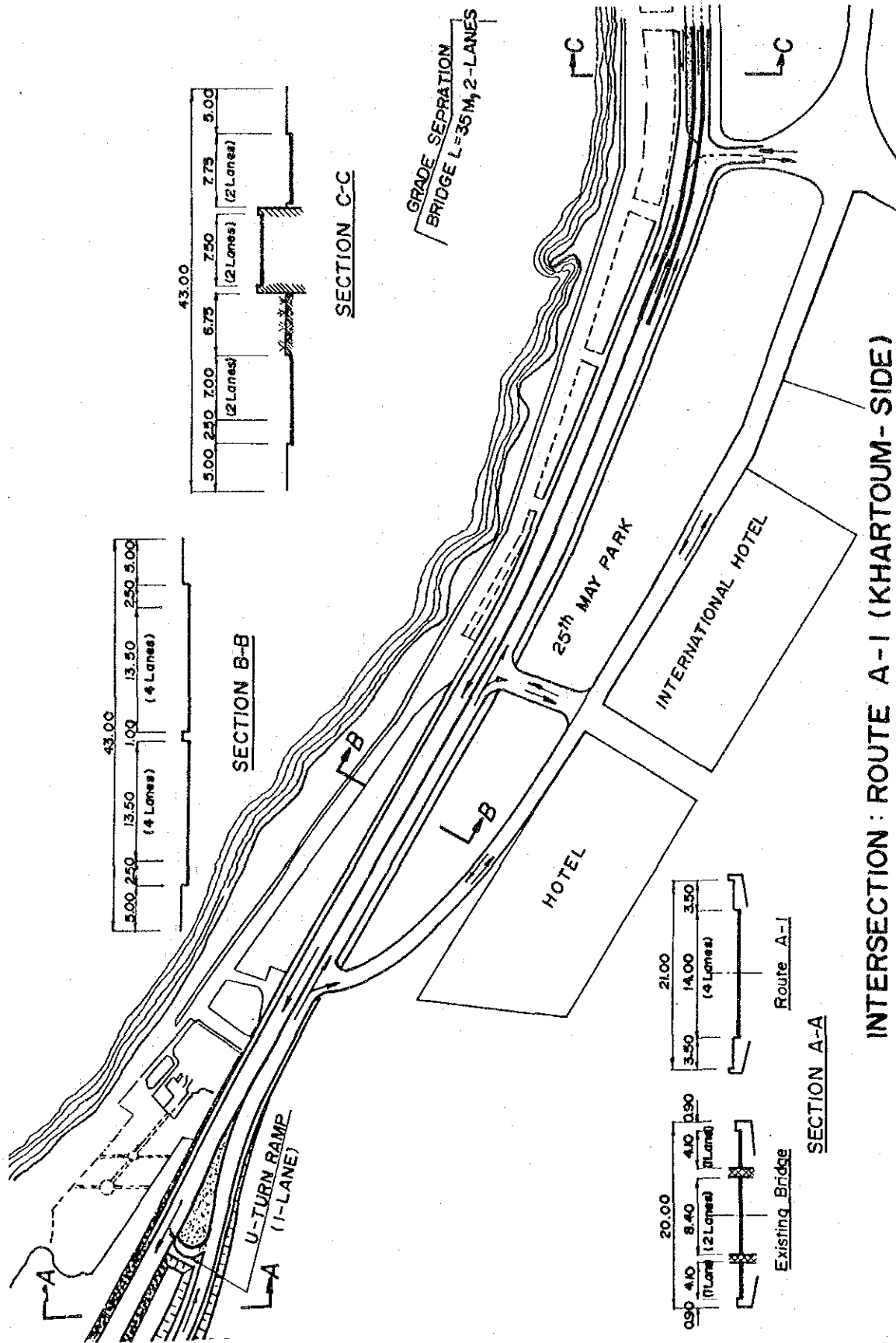




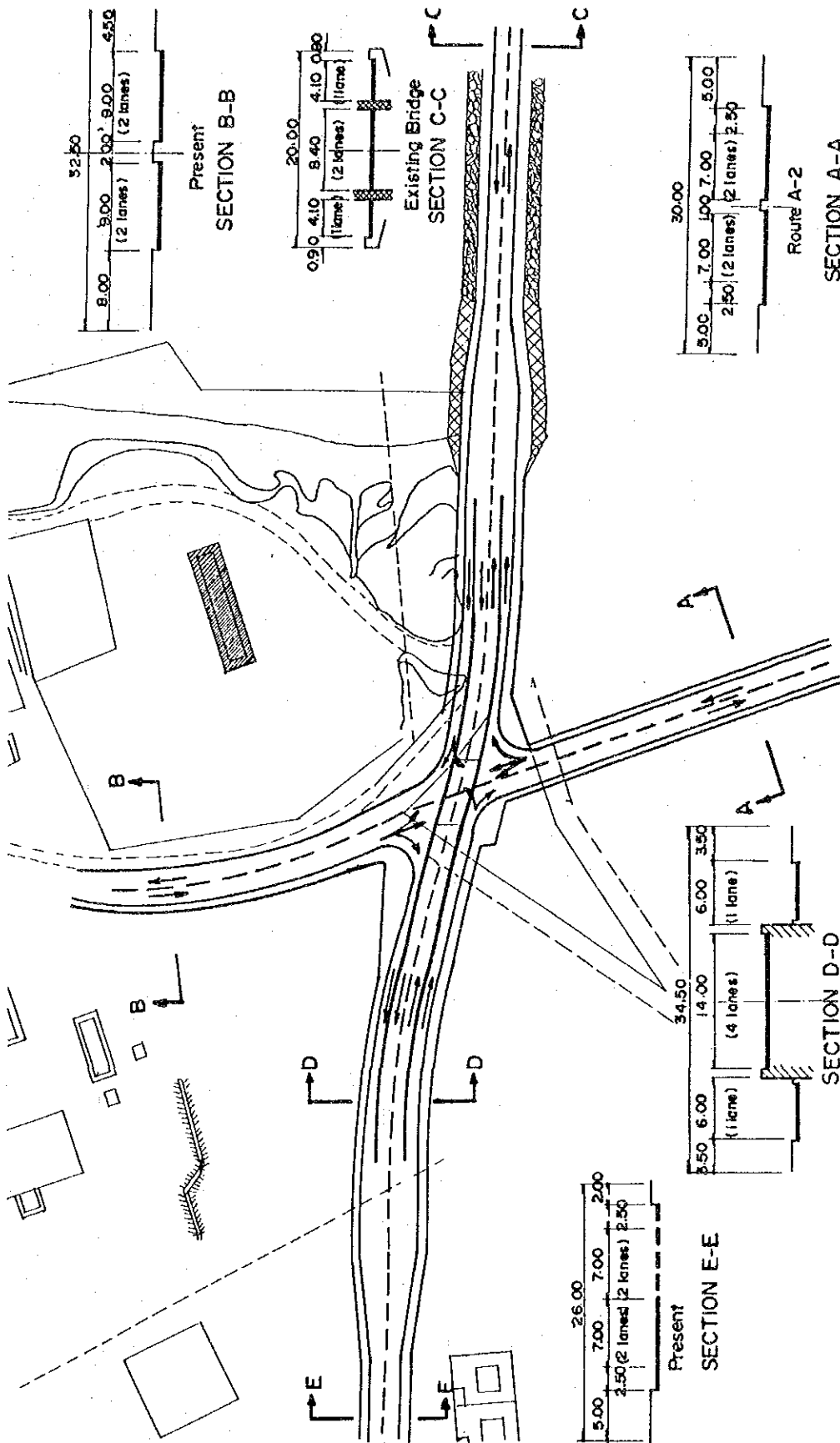
ROUTE C



INTERSECTION : ROUTE AH (OMDURMAN SIDE)

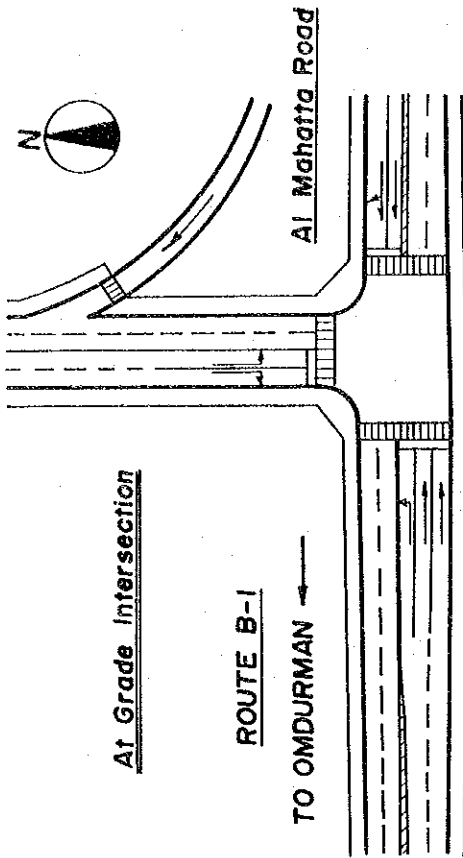


INTERSECTION : ROUTE A-I (KHARTOUM- SIDE)

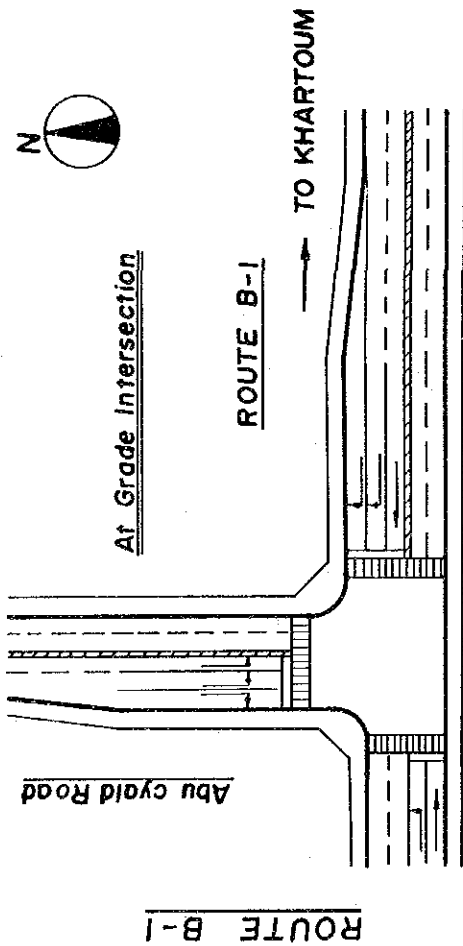


INTERSECTION : ROUTE A-2 (OMDURMAN SIDE)

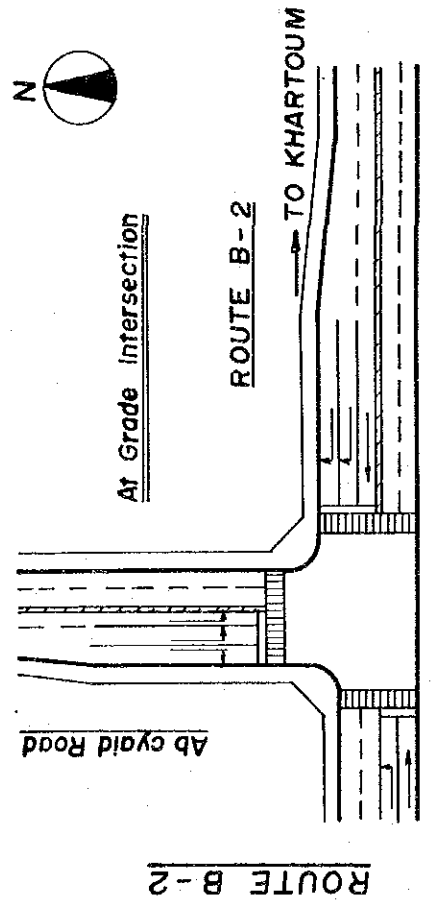
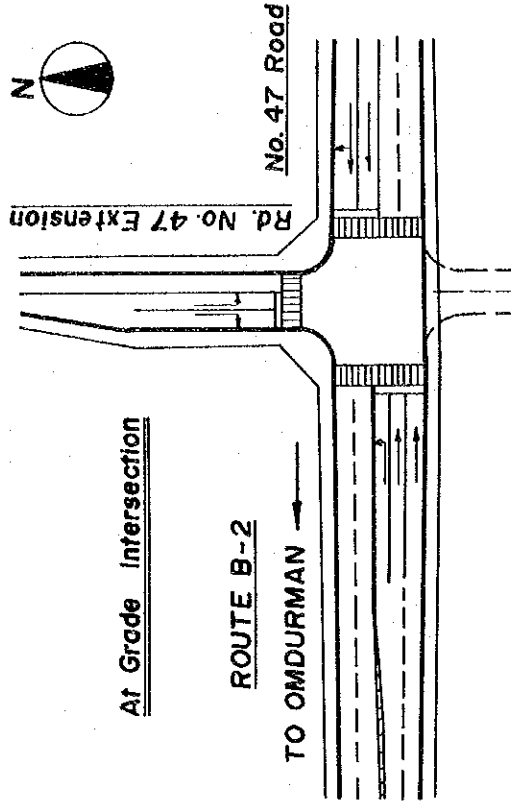
KHARTOUM SIDE



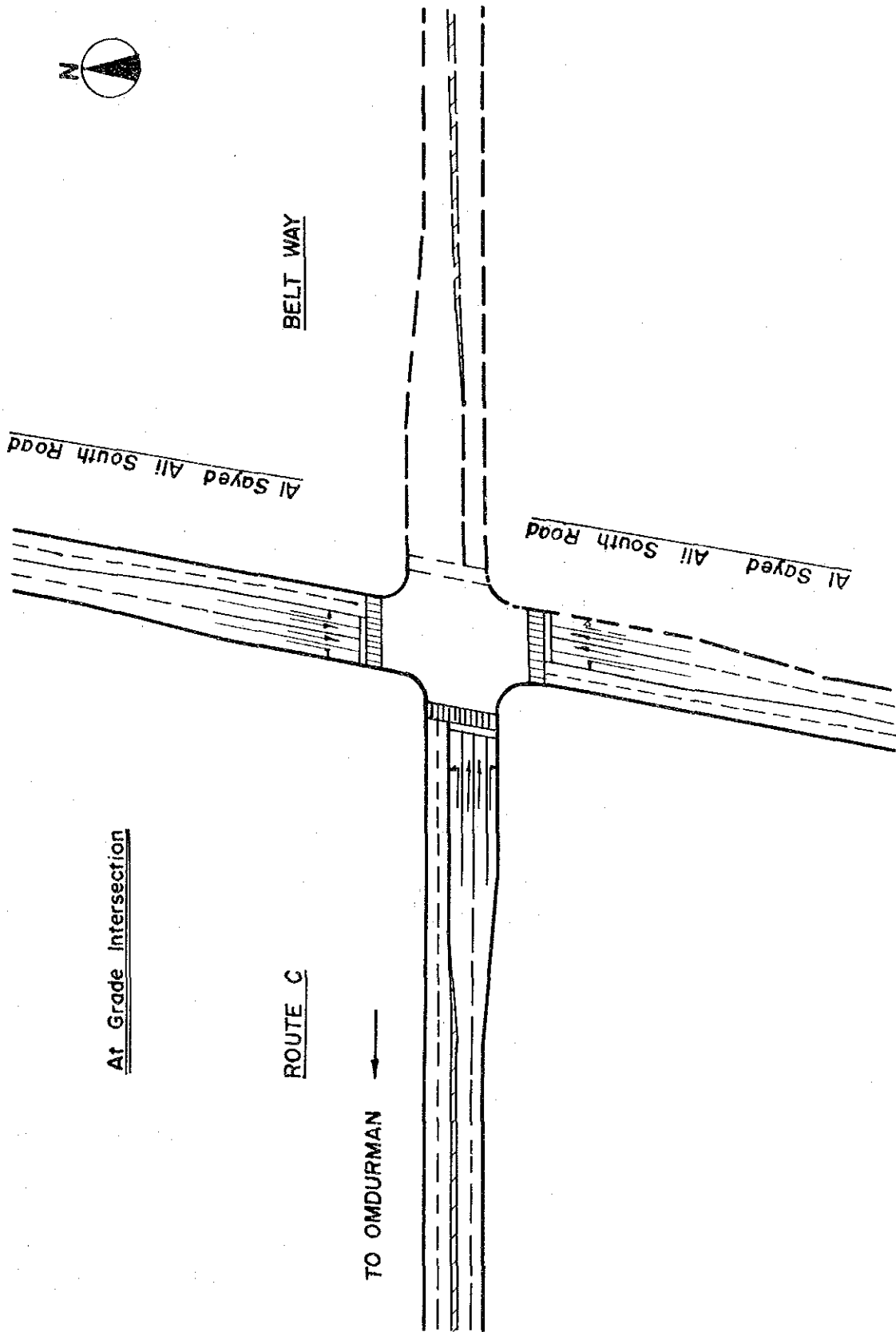
OMDURMAN SIDE



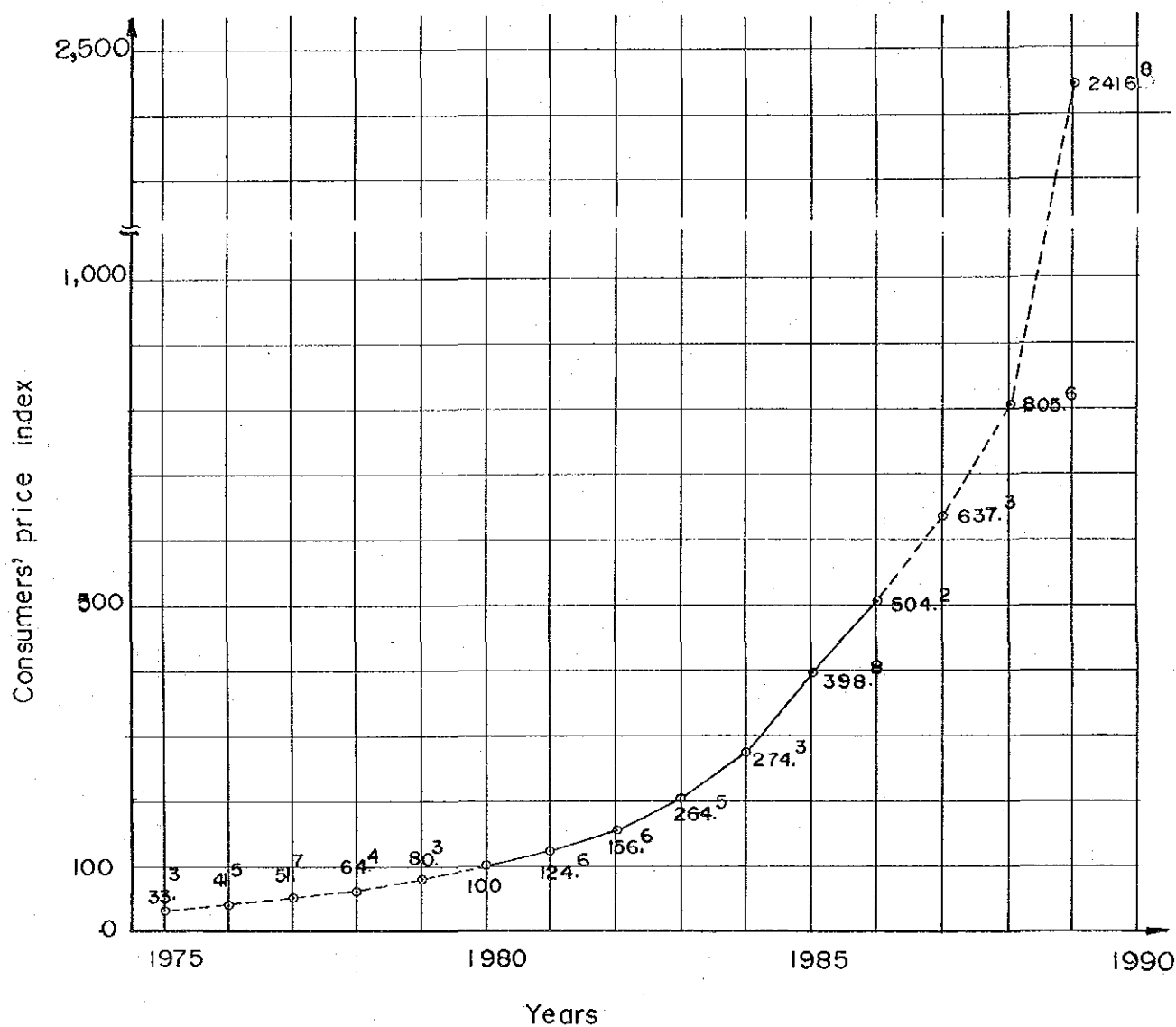
Appendix 5.2(4)



INTERSECTION : ROUTE B-1 AND B-2



INTERSECTION: ROUTE C (KHARTOUM SIDE)

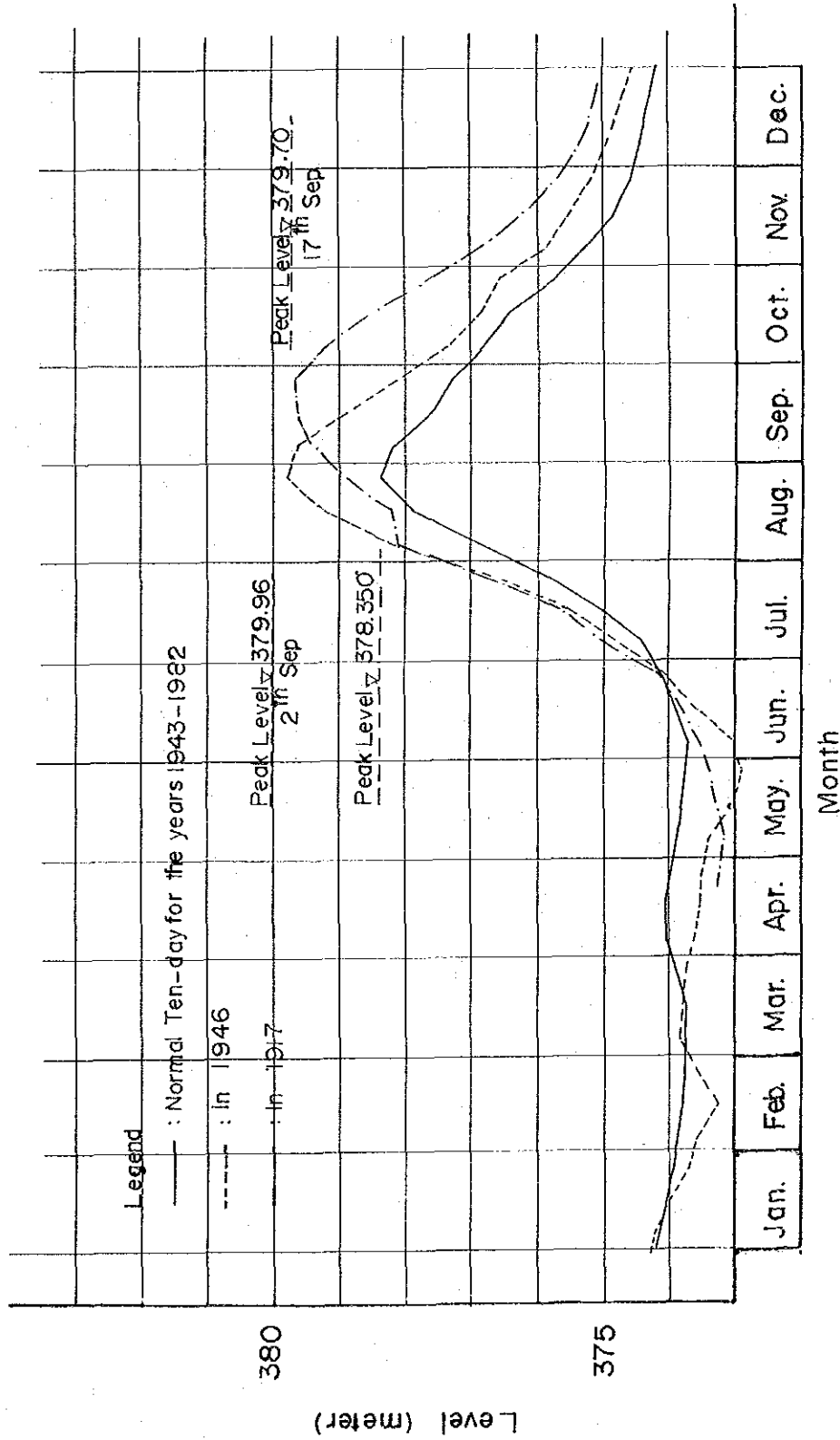


- Notes: (1) The consumers' price index in 1980 is 100.
 (2) Indices between 1980 and 1986 are quoted from International Financial Statistics 1988, OECD.
 (3) Indices between 1975 and 1980 are estimated to be equal to the growth 1980 and 1981.
 (4) Indices between 1986 and 1988 are estimated to be equal to the growth 1985 and 1986.
 (5) Index in 1989 is estimated three (3) times as many as index in 1988.

Source : The Study Team

Changes of Consumers' Price Indices in the Sudan

River Water Level at Mogren, G.S. (White Nile River)



notes : The level of the zero (0) is indicated mean sea level at Alexandria
 Data Source : Ministry of Irrigation

River Water Level

River Water Level at Mogren G.S. (White Nile)
 Note: Level of gauge zero equal 362.700 meters
 (1). Normal for the years 1943 - 1982

	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1 - 10	10.45	11.13	11.00	11.29	11.12	10.98	11.68	14.17	15.43	14.08	12.51	11.77
Date 11 - 20	11.33	11.06	10.99	11.30	11.06	11.15	12.31	15.12	14.85	13.70	12.12	11.67
21 - End	11.20	11.02	11.16	11.20	11.02	11.34	13.11	15.65	14.53	13.03	11.87	11.53
Month	11.32	11.07	11.06	11.27	11.07	11.16	12.39	15.00	14.93	13.58	12.16	11.65

(2). In 1946

	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1 - 10	11.50	10.83	11.08	10.87	10.66	10.30	12.03	15.43	(17.26) 16.89	14.57	13.12	12.24
Date 11 - 20	11.28	10.50	11.04	10.78	10.28	10.89	12.81	16.48	16.11	14.10	12.78	12.08
21 - End	10.98	10.88	10.99	10.74	10.14	11.30	13.92	17.05	15.37	13.84	12.48	11.90
Month	11.24	10.72	11.04	10.80	10.35	10.83	12.95	16.34	16.12	14.16	12.80	12.07

(3). In 1917

	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1 - 10	12.18	11.85	11.54	10.70	10.41	10.81	12.29	15.38	16.69	16.51	14.08	12.70
Date 11 - 20	12.09	11.74	11.27	10.52	10.55	11.08	12.92	15.49	16.92	15.79	13.47	12.53
21 - End	11.94	11.62	10.97	10.30	10.62	11.36	14.04	16.20	16.94 (17.00)	14.89	12.99	12.38
Month	12.07	11.75	11.25	10.57	10.53	11.08	13.11	15.71	16.85	15.70	13.51	12.53

Data Source : Ministry of Irrigation

Engineering Investigation and Site Assessment

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Topographic Survey

The surveys conducted in the Study were divided into the following four (4) works:

- (1) Photogrammetric mapping
- (2) River cross sectional survey
- (3) Alignment survey which includes center-line, profile and cross section surveys for the planning road
- (4) Detailed topographic mapping for designing the new bridge, its approach road and intersections.

In Phase I Study, a control survey for orientation of the photogrammetric mapping was carried out by a local survey team under the supervision of the Study Team. Secondary control survey for planning the road alignment was conducted by the Study Team, using the established control points. As for the coordinate system, map projection in Sudan is used for the Universal Transverse Mercator (UTM) system. Following the control point survey, topographic map was conducted by using the existing aerial photographs at a scale 1:20,000 taken in February 1984 by Sudan Survey Department. The map scale is 1:2,500.

Water depths were measured at several river sections including the section along the selected route of by using echo-sounder in February. The section along the selected route was re-measured in July 5th based on the center-line of the proposed road.

Prior to Phase IIA Study, calculation of all the elements related to horizontal alignment was conducted in Japan. Topographic surveys in Phase IIA Study, consisting of center-line, profile, cross sections and plane table surveys, were conducted from the beginning of June to the mid July by the local survey team under supervision of the Study Team.

1 Photogrammetric Survey

Photogrammetry involves obtaining information about an object indirectly by measuring photographs taken of the ground surface.

Thus, photogrammetry requires the following operations:

- (1) To take photographs newly (or utilize existing photographs) and to process these photographs
- (2) To conduct a control survey for orientation of photographs
- (3) To measure the photographs and to conduct mapping
- (4) In special case, to produce a photo-mosaic.

In the Study, existing photographs were utilized. These had been taken at an appropriate scale 1:20,000 by the Sudan Survey Department in February, 1984.

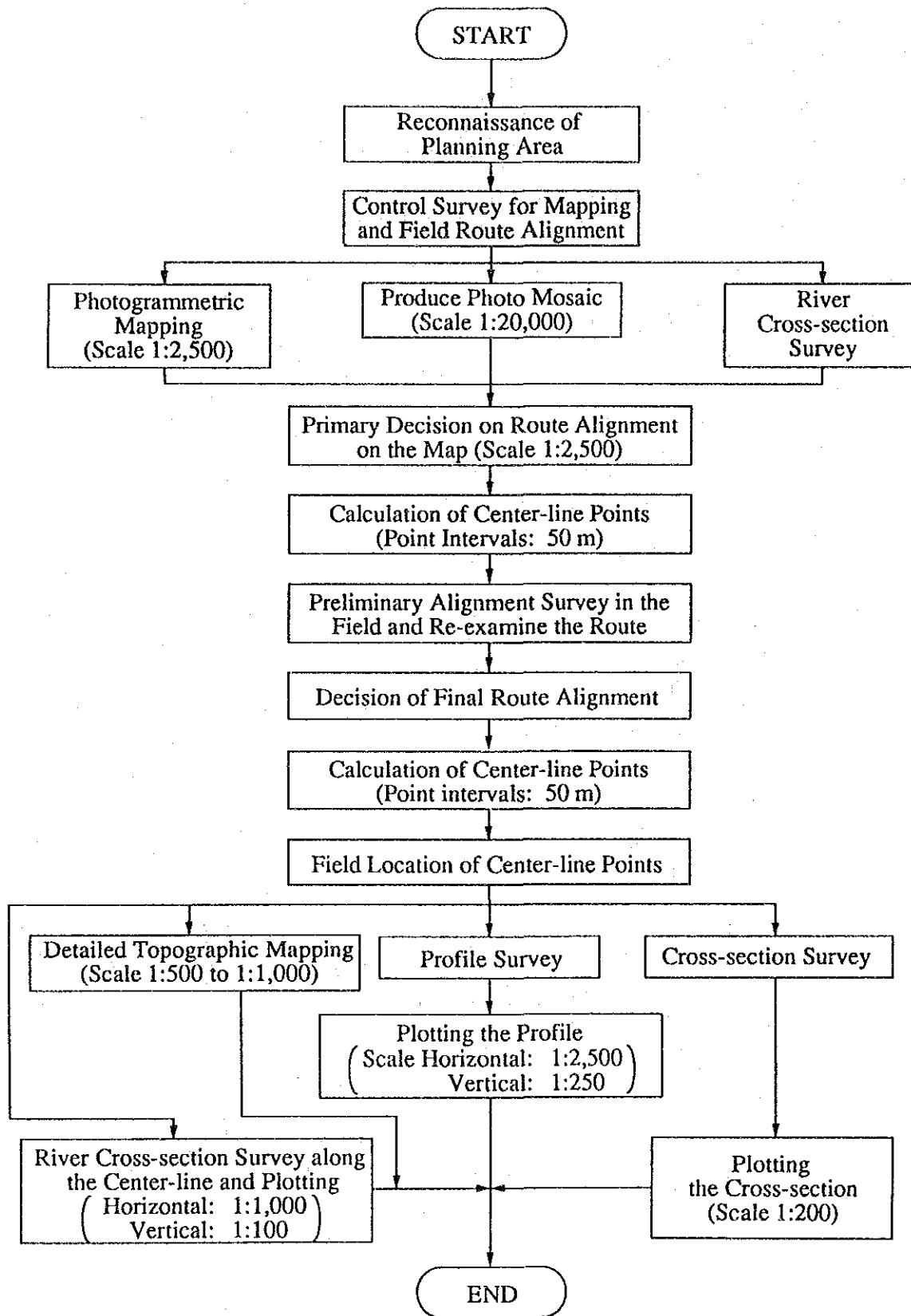
Control survey were conducted as follows:

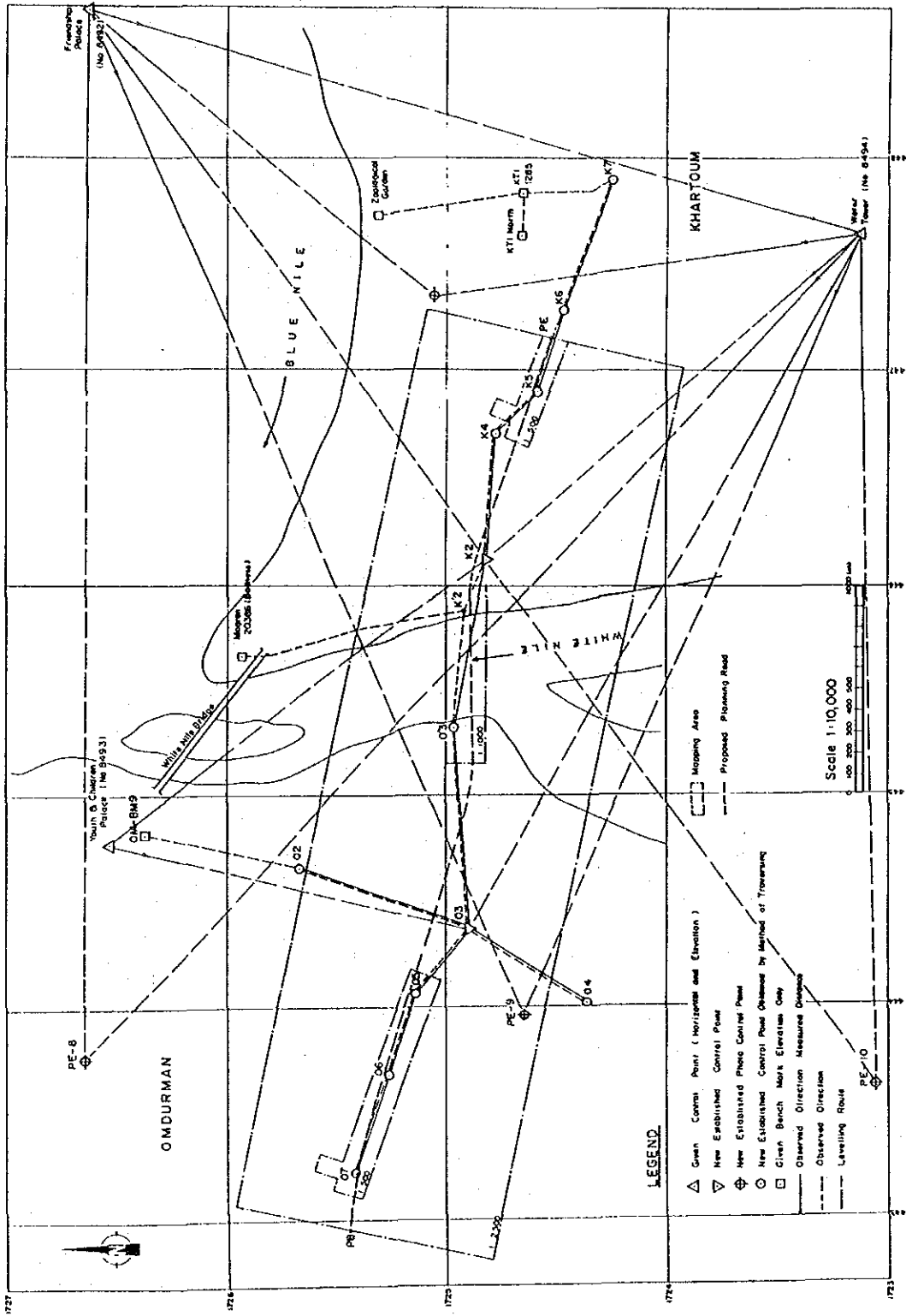
- (1) Horizontal control points were located by triangulation and transversing methods based on the authorized controls.
- (2) Vertical control points were located by leveling method based on the authorized controls.

Correlation of elevations between left and right river banks of the White Nile were checked by means of reciprocal leveling and water level observation at both the sides. As a result, the difference measured were less than 15 millimeters. The Following figure represents the locations and networks related to the field work, i.e. triangulation points, traverse points and bench marks (elevation points). The results of the surveys are as tabulated in the following figure.

The topographic map was produced by photogrammetric mapping device, Stereo plotter A-8 instrument owned by the Sudan Survey Department at 1:2,500 scale with a 1.0 meter contour interval. The map covers 18 km² in a total area.

Prior to the photogrammetry, a photo-mosaic was assembled from the adjacent aerial photographs to obtain a continuous pictorial display in the terrain concerned. Thus, an uncontrolled mosaic covering the Study Area was produced using the same existing photographs as the photogrammetry.



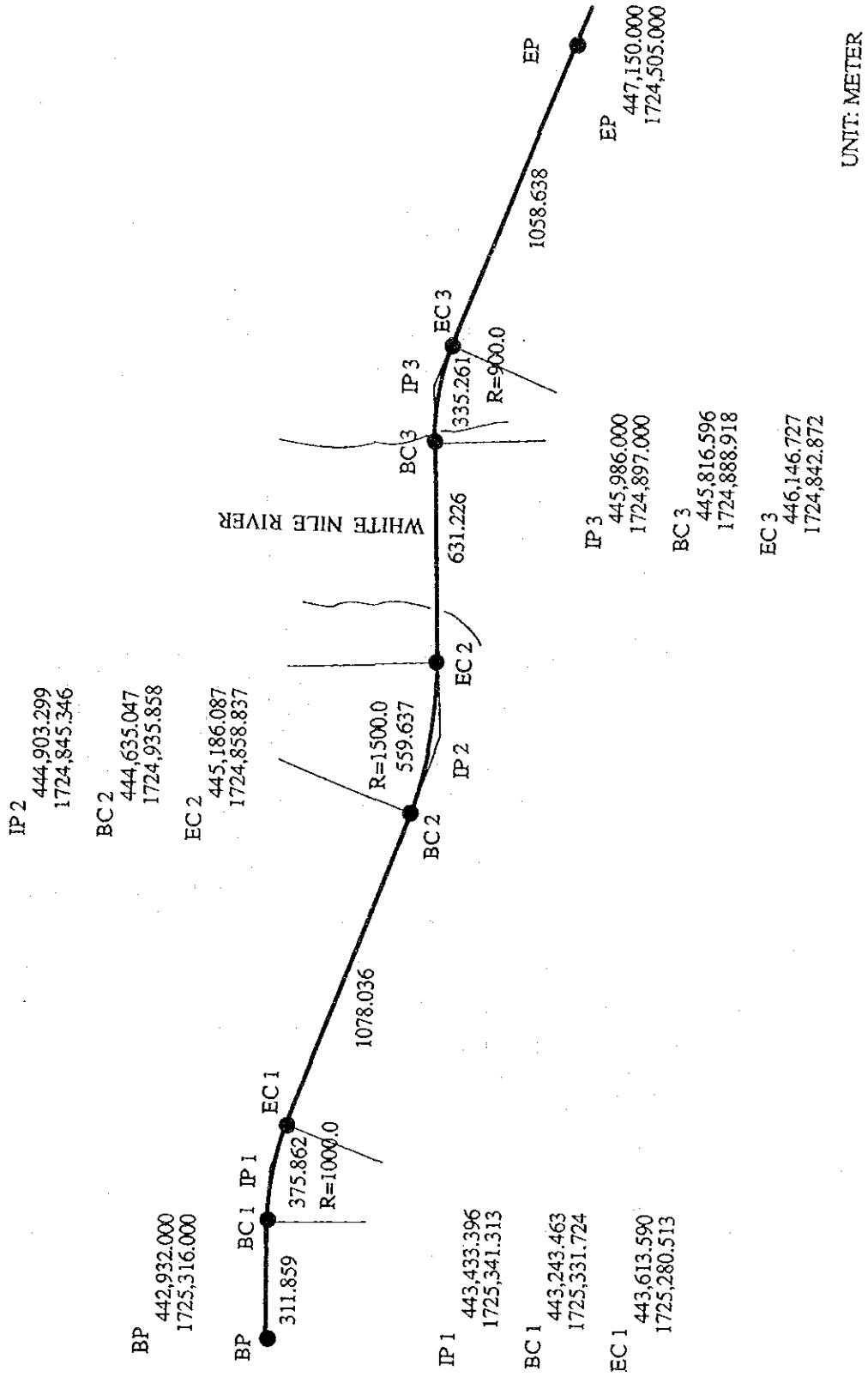


2 Center-Line Survey

Horizontal alignment of the proposed road was finalized by the beginning of June, 1989. The center-line survey was set out at that time with stakes placed at 50 meter intervals into the ground.

All the stations were designated at 100 meter intervals from the starting point (Station-0) at Al Fittaihab Town in Omdurman to the end point (Station-43 + 50.527 m) in Khartoum. Curves were staked out by the use of deflection angles turned at the curve point (BC or EC) from the tangent to stations along the curve together with the use of chords measured from station to station along the curve. Several located points were checked from other control points by traversing. As a result, an error less than 5 cm was obtained.

The following figure represents a schematic plan of the final alignment of the proposed road.



3 Profile and Cross-section Surveys

(1) Profile Survey

A process which determines the elevations of the measuring points at appropriate intervals is called profile surveying.

Elevations were obtained by taking level-rod reading on the ground at each stake and at intermediate points where marked changes in slope occur.

After field surveys were completed, a profile was plotted on the profile sheet at the specified scales; 1:2,500 horizontal and 1:250 vertical scales.

(2) Cross-section Survey

The center-line was set on the ground, and then cross-sections were taken along lines passing through each station and at right angles to the center-line. The elevation along these crosslines and respective distance to the left and right constituted terrain cross-section data. The cross-section data were obtained by field method (leveling) with a maximum distance of 100 meters from the center. Cross-section was plotted on the cross-section sheets at a scale 1:200.

(3) Detailed Topographic Survey

Two (2) methods were carried out for detailed topographic mapping in the field.

(A) Controlling-point Method

Field surveys were conducted by employing a transit and electronic distance instrument. Details were plotted in the office to a scale 1:500, to which cover the area 300,000 m².

(B) Plane Table Method

Details were located in the field directly using a plane table, alidade, scale gage and electronic distance instrument in a scale 1:1,000. The area covered 500,000 m² in total.

4 River Cross-section Survey

In Phase I Study, water depths of the White Nile were measured by using echo-sounder in February, 1989. Location points were as follows:

- (1) Under the existing White Nile Bridge
- (2) At the northern edge of Sunt Wood
- (3) At the northern tip of Um Shugiera Island
- (4) Under the Shambat Bridge, across the Nile.

In Phase IIA Study, water depths were measured on the 5th of July, 1989 by direct method along the center-line and its neighboring cross-sections at 100 meter intervals.