

**YEMEN ARAB REPUBLIC**  
**URBAN TRANSPORT STUDY**  
**IN**  
**YEMEN ARAB REPUBLIC**  
**FINAL REPORT**  
**VOLUME 1, MAIN**

**NOVEMBER 1988**

**JAPAN INTERNATIONAL COOPERATION AGENCY**





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18636

**JAPAN INTERNATIONAL COOPERATION AGENCY**

国際協力事業団

18636

Yemen Arab Republic

MINISTRY OF MUNICIPALITIES  
& HOUSING

PHISICAL PLANING DEPARTMENT  
TRAFFIC SECTION

الجمهورية العربية اليمنية

وزارة البلديات والامكان

الادارة العامه للتخطيط الطبيعي

ادارة المرور

دراسة النقل الحضري في ج . ع . ي .

URBAN TRANSPORT STUDY IN Y. A. R.

التقرير النهائي

FINAL REPORT

الجزء الأول ، الأساس

VOLUME 1, MAIN

NOVEMBER 1988

نوفمبر ١٩٨٨

Japan International  
Cooperation Agency

منظمة التعاون الدولي  
اليابانية





P R E F A C E

In response to a request from the Government of the Yemen Arab Republic, the Government of Japan decided to conduct a survey on urban transport in the Yemen Arab Republic and entrusted the survey to the Japan International Cooperation Agency (JICA).

JICA sent to the Yemen Arab Republic a survey team, headed by Mr. Teruhiko HORIE, comprised of experts from the Pacific Consultants International Co., Ltd. and the Yachiyo Engineering Co., Ltd. three times: from October 1987 to March 1988; in June, and in August 1988.

The team had discussions with the officials concerned of the Government of the Yemen Arab Republic and conducted field surveys.

After the team returned to Japan, further studies were made and the present report was prepared.

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

I wish to express my sincere appreciation to the officials concerned of the Government of the Yemen Arab Republic for their close cooperation extended to the team.

November 1988



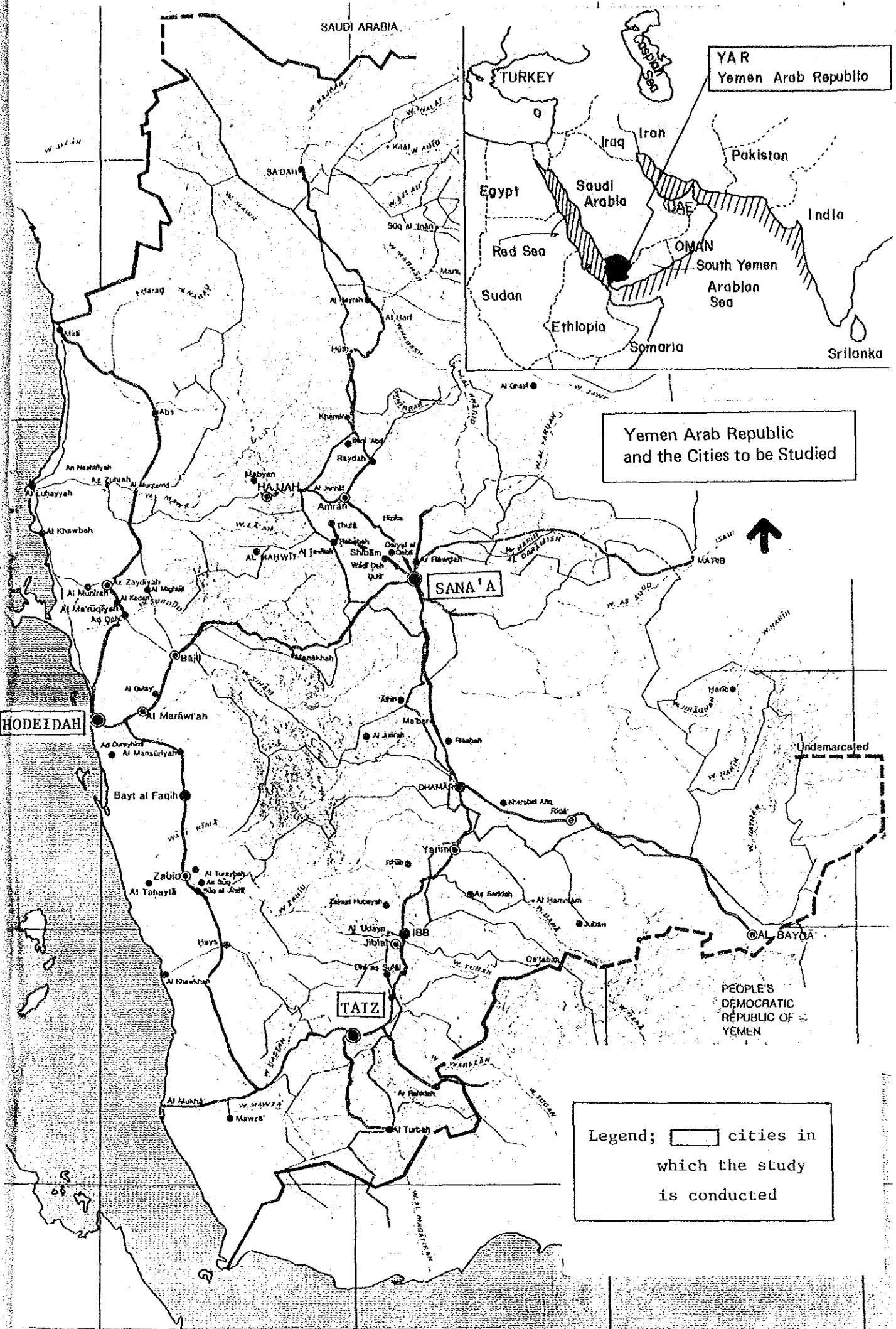
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Kensuke Yanagiya

President

Japan International Cooperation Agency





YAR  
Yemen Arab Republic

Yemen Arab Republic  
and the Cities to be Studied

HODEIDAH

SANA'A

TAIZ

PEOPLE'S  
DEMOCRATIC  
REPUBLIC OF  
YEMEN

Legend;  cities in  
which the study  
is conducted



## SUMMARY AND RECOMMENDATIONS



## Summary and Recommendations

### 1. Background of the Study

Urbanization has shown a rapid growth in recent years in Yemen Arab Republic. Urban population in Sana'a, Taiz and Hodeidah has grown with an annual rate of more than 7% during the eleven years from 1975 to 1986. Such a rapid development has brought in a number of problems which the Government has to mitigate. In the transport sector problems are formed through such phenomena as congestion, discomfort of passengers, drivers, residents, and accidents.

Under the circumstances this study has been conducted to recommend action plans which make full use of the existing road facilities in order to realize smoother traffic flows and less accidents.

### 2. Objectives

The objectives of this study are to raise the efficiency of the existing transport facilities in such ways as improvement of main intersections, signal system, and traffic management. The study should be concentrated in Sana'a, Taiz and Hodeidah and projects should be formulated to be completed by 1991.

### 3. Development Prospect

#### 3.1 Population

##### 3.1.1 Sana'a

The population of Sana'a grew at an average rate of 11% per annum from 1975 to 1986. The population is forecast to increase more than the Master Plan Study conducted in 1978. The revised forecast is:

(1975)	(1987)	(1991)	(2000)
136,000	465,000	650,000	1,080,000
	11.0%	9.0%	6.0%

### 3.1.2 Taiz

The population in Taiz developed at an average rate of 7.6% per annum from 1975 to 1986. The growth was a little less than the forecast of the Master Plan in 1978. The revised forecast is:

(1975)	(1987)	(1991)	(2000)
79,700	189,000	238,000	403,000
7.6%	6.0%	6.0%	

### 3.1.3 Hodeidah

The population in Hodeidah grew at an average rate of 7.1% per annum in the same period of 1975 - 1986. The growth was considerably less than the Master Plan in 1978. A revised forecast is made as follows:

(1975)	(1987)	(1991)	(2000)
73,000	164,000	208,000	351,000
7.1%	6.0%	6.0%	

## 3.2 Urban Expansion

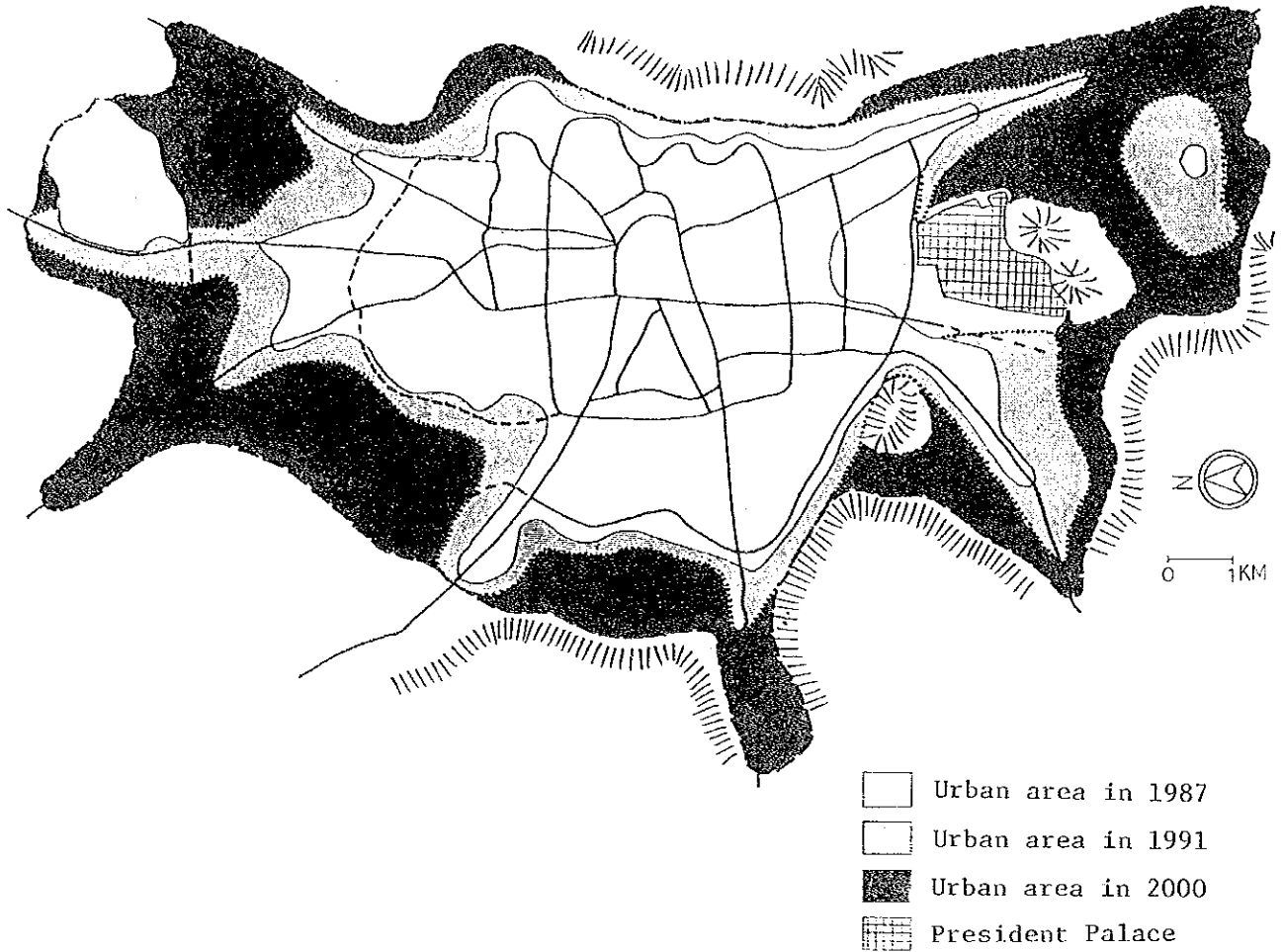
### 3.2.1 Sana'a

The Master Plan of 1978 proposed urban expansion rather toward north and south because there are steep mountains on the east side and the west. It is found the urban area expansion toward the north is less extensive than the Master Plan of 1978 while development toward the south is much larger than the plan. Specifically the southern side of Mt. Al Nohdyn is being developed with large scale housing projects which were not included in the Plan of 1978.

A characteristic feature of the urban development is the new locations of shops, restaurants and houses along major streets toward the outskirts. The secondary road network connecting those major streets could not develop as fast as the expansion of housing areas, thus resulting in concentrated traffic on major streets in recent years. Urban area expansion is forecast as in Fig. 3.1.



Fig. 3.1 Growth of Urban Area, Sana's 1987 - 2000



### 3.2.2 Taiz

The city's whole area is on a rugged terrain with terraces and valleys. Heavy rain storms along the wadi accompanied by steep slopes cause severe damage due to rapid drainage, with a resulting large rehabilitation cost. The Plan of 1978 proposed the northward expansion toward relatively flat terrain. However, the actual development in the past ten years was less extensive in the northern direction than the Plan. Instead housing areas have developed scattered on the southern steep hill slopes. The city will only expand to northern areas gradually together with the development of roads and other infrastructures. It is shown in Fig. 3.2.

### 3.2.3 Hodeidah

Urban area expansion is not rapid as was forecast by the Plan of 1978. The city has expanded on both sides of Sana'a street, the back-bone street of the city. Particularly on the northern side of the street, spatial development went to the half ring road, Zaid street, which links the eastern part of the city to the port of Hodeidah without passing the busy central area.

Outside the half circle of Zaid street, urban areas are not expected to expand to a large extent, because of the influence of shifting sand dunes. The development of port area by encouraging the construction of factories and warehouses is under study. It is expected when the plan is finalized and implemented, the city will grow further. The expansion is forecast as in Fig. 3.3.

Fig. 3.2 Growth of Urban Area, Taiz 1987 - 2000

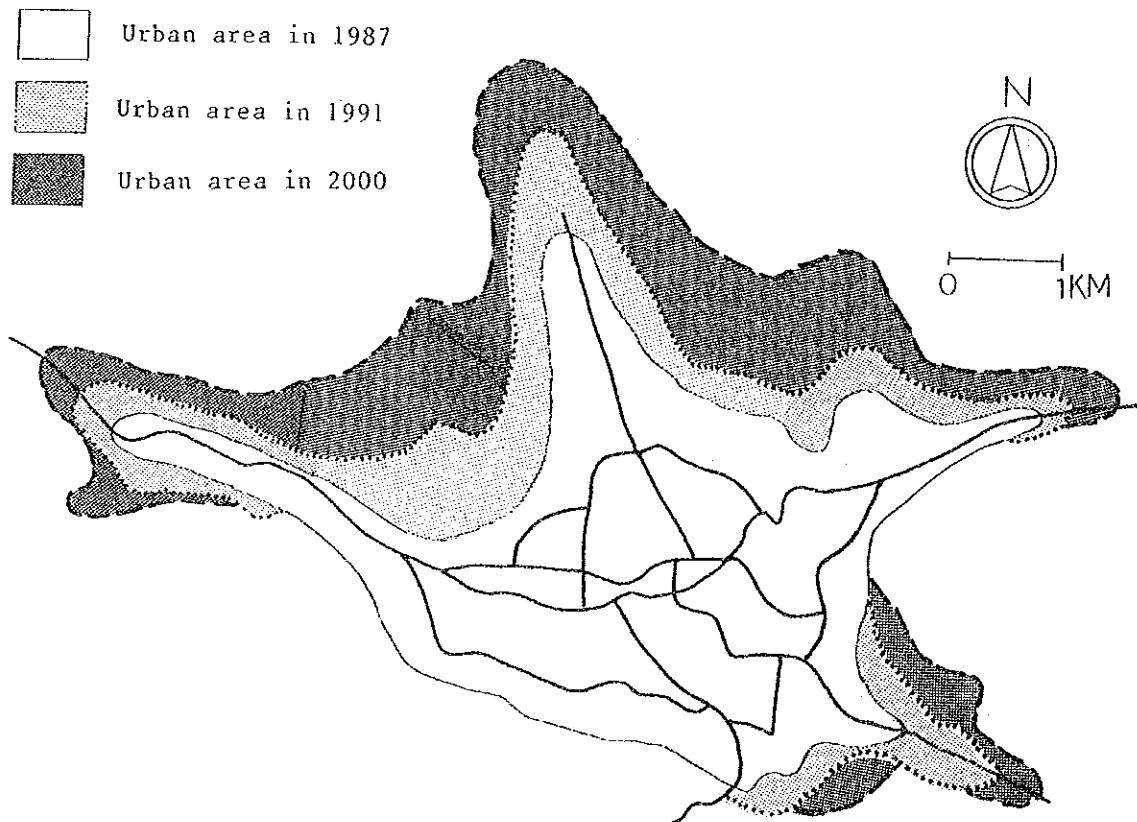
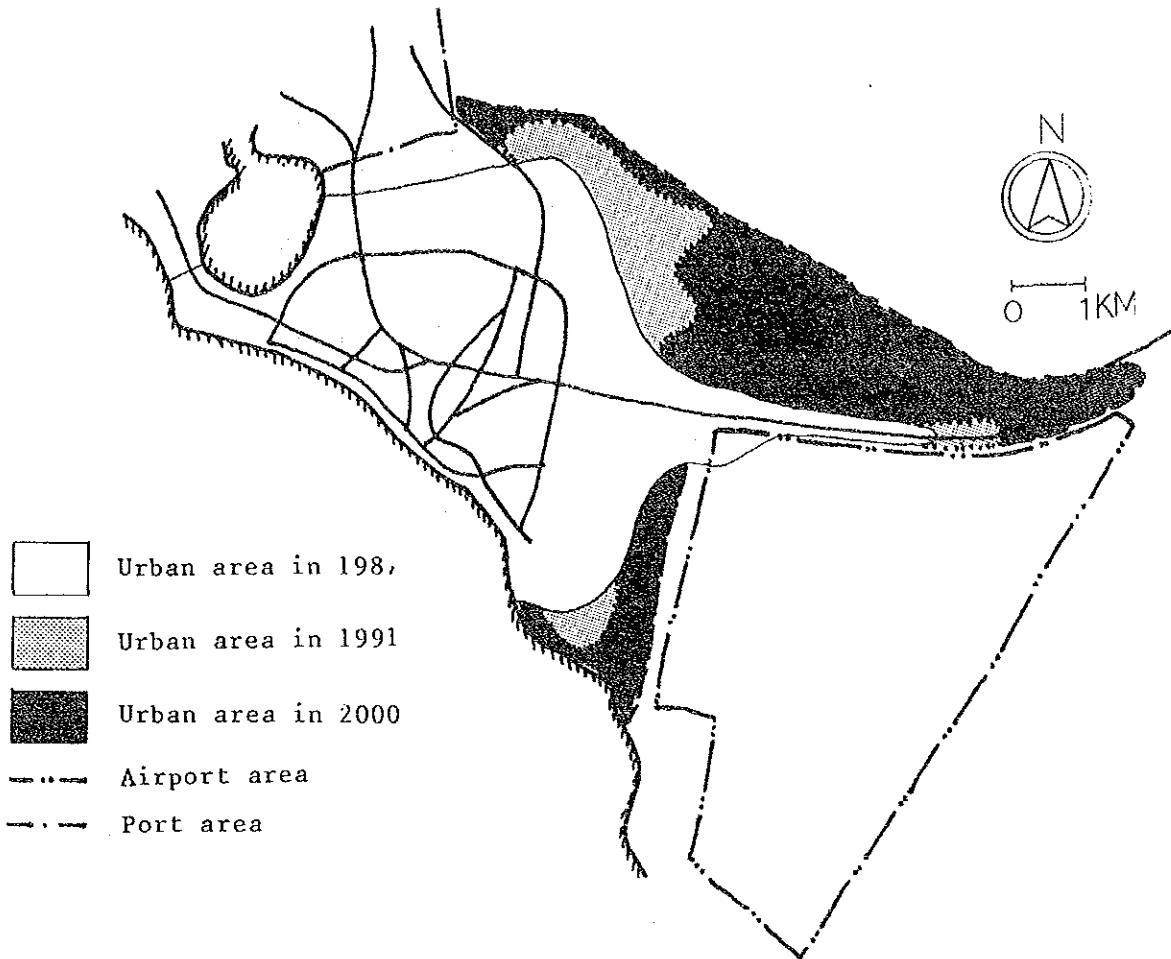


Fig. 3.3 Growth of Urban Area, Hodeidah 1987 - 2000



#### 4. Roads and Traffic

##### 4.1 Sana'a

###### 4.1.1 Roads

The main road network is composed of seven radial roads and two ring roads. Two other roads which have right of ways of 45 m and 60 m are partly completed. Most of these roads are two, four or six lane paved, some with a median mounted and planted. Lane marks are worn off, a uniform width is not maintained on some sections and side walks are narrowed at various points.

Intersections are not well designed: unnecessarily wide, the lane-marks are worn off, left turn lanes are not sufficient in length and width, and the right turn lanes often neglect the safety of pedestrians. Pedestrians' crossing facilities are not provided.

#### 4.1.2 Traffic

Traffic volumes are counted on those main roads through which a traffic flow chart is developed as in Fig. 4.1. The heaviest volumes are found on Ali Abdul Mughni Street with 46,000 - 48,000 vehicles per 16 hour day in 1987.

The percentage ratio of public passenger transport vehicles accounts for 40 - 55% on most of the counted points. Hourly change of the volume shows mostly same pattern in both directions. Pedestrians cross the roadway at any point conflicting with running vehicles.

### 4.2 Taiz

#### 4.2.1 Roads

The main roads of the city are Jamal and the combination of Al Jaynai and the 26th September streets, which run parallel in the east-west direction. However, radial roads in northern areas have been constructed gradually in accordance with the expansion of urban area. While physical conditions are mostly same as those in Sana'a, hilly, winding and narrow streets are quite common. The roads suffer from flood damage at various sections.

#### 4.2.2 Traffic

Traffic volumes were counted at selected points on Jamal, Jaynai /26th September streets. The Jamal street registered the volume of 15,900 - 37,300 vehicles per 16 hours, while Jaynai/26th September streets had 6,200 - 16,000 vehicles. Volumes are shown in Fig. 4.2. Taxis shares are high on the streets. The percent share of taxis and micro-buses was around 40% on most of the counted stations.

Fig. 4.1 Traffic Volume on the Roads, Sana'a

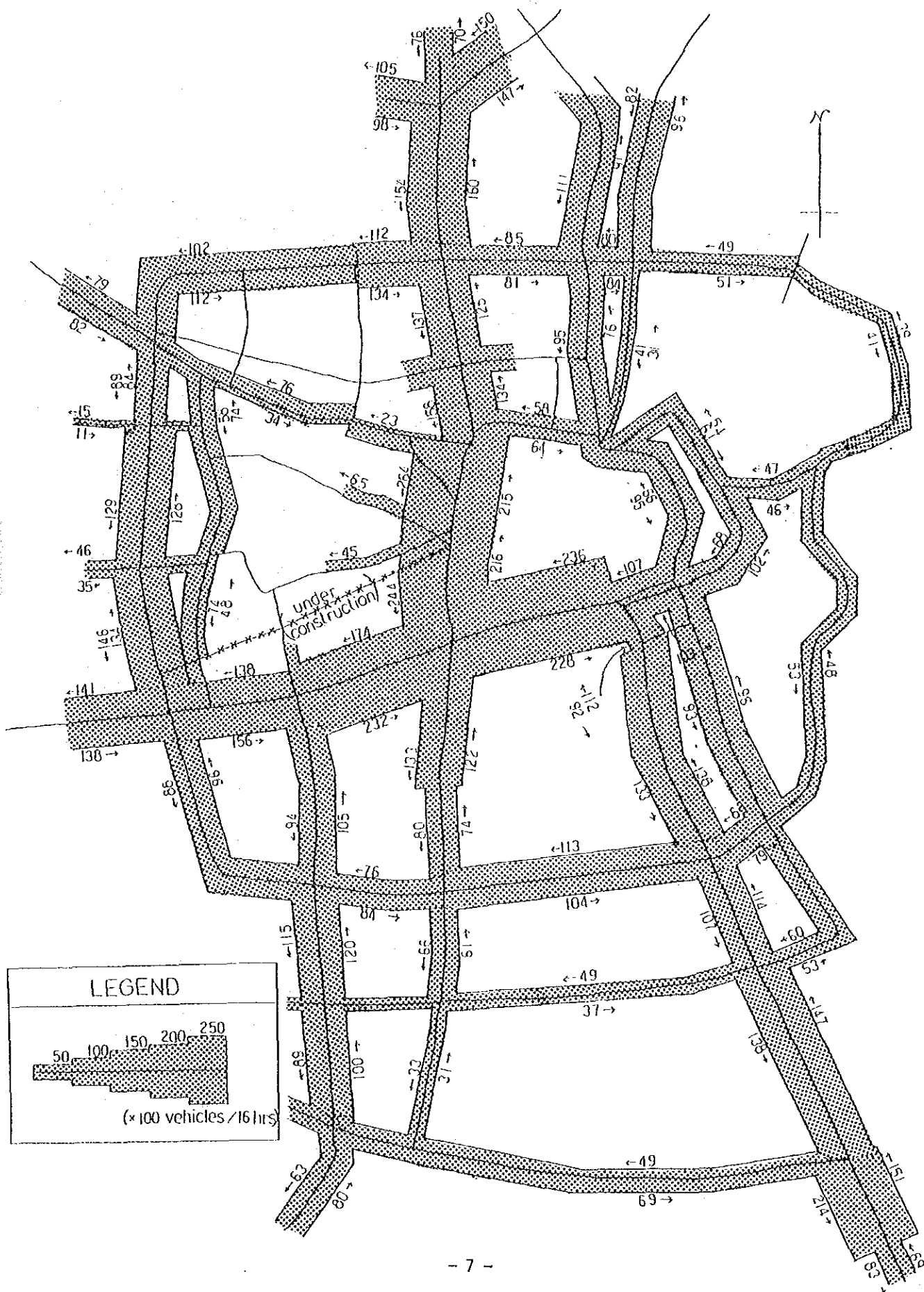


Fig. 4.2 Traffic Volume on Roads Taiz

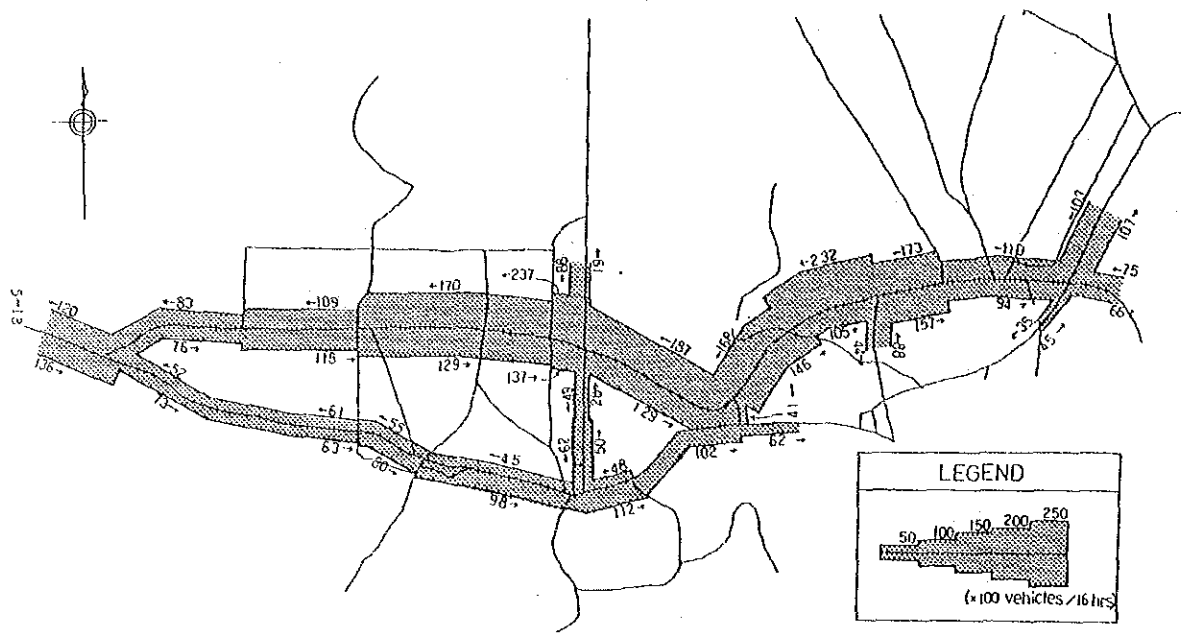
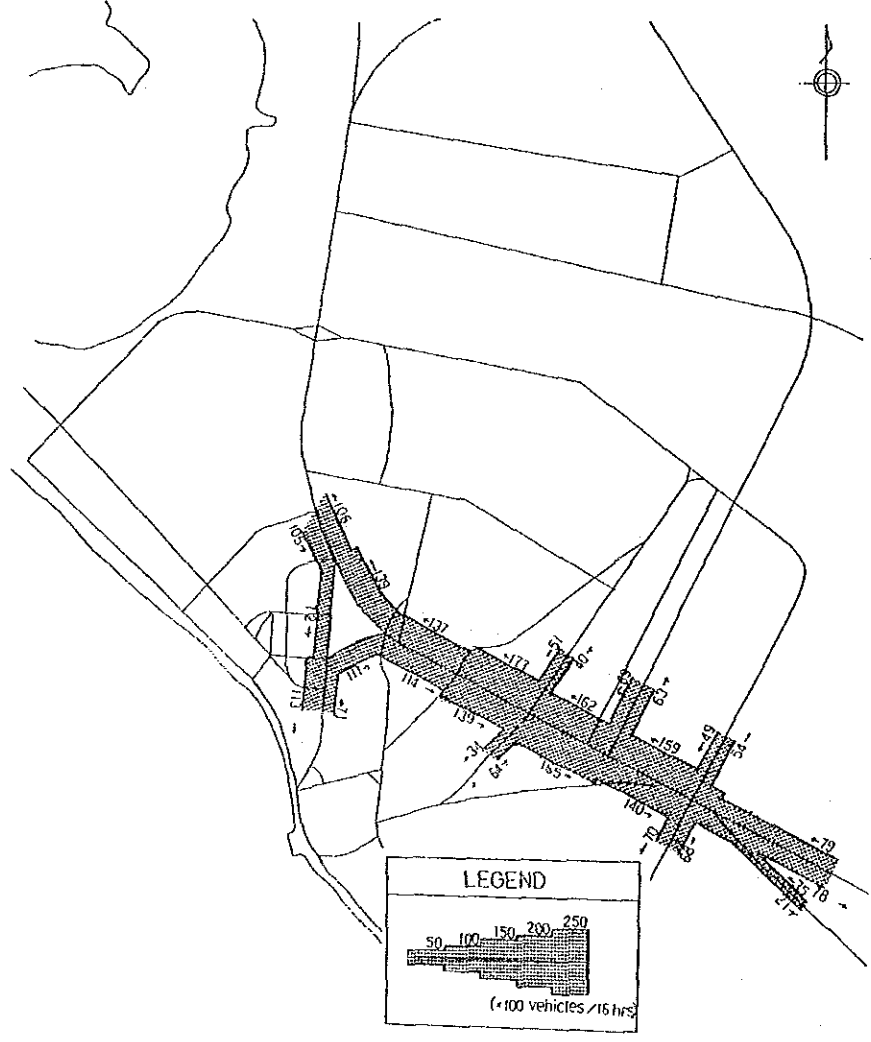


Fig. 4.3 Traffic Volume on Roads, Hodeidah



## 4.3 Hodeidah

### 4.3.1 Roads

Sana'a street is the main road, paved with 4 lanes, and passes through the center of this port city. The approach roads to the international port of Hodeidah are Zaid street and Port road through which heavy vehicles mostly pass. Physical conditions of the main streets are mostly same as those in Sana'a. The road network is well developed in accordance with urban area development, except in the old parts of the city.

### 4.3.2 Traffic

Traffic volumes counted at Sana'a street resulted in 15,700 - 32,700 vehicles per 16 hours. The volume on Zaid street was 10,000 per 16 hours. Motorcycles, often used as taxis, had a share of 15 - 23% on those streets. Roads and traffic are shown in Fig. 4.3.

## 5. Traffic Management and Accidents

### 5.1 Traffic Management

Traffic police manages the daily traffic flows at main urban intersections. There is limited use of traffic sign boards and pavement marking. No-parking zones, one-way roads, etc. are also found, but often neglected by drivers. Violation of rules are ticketed only occasionally by traffic police.

Traffic signals are located at 23 intersections of which 14 are currently working in Sana'a. There are no signals for pedestrians. A typical signal post is rather low in height and not easily seen by drivers. It works on a fixed cycle and is set to allow only one directional flow to enter the intersection in one time.

There are 10 signalized intersections, of which 4 are working in Taiz. The type and cycle system are same as in Sana'a. There are 5 signalized intersections of which 4 are working in

Hodeidah. The type is same as in Sana'a, but they are operating in two phase signal cycles. Signals for pedestrian crossing are not posted in those cities.

Lane marking, crossing zones for pedestrians, and others marks on roads and curbs are often worn out or missing in those cities. Parking lots are not sufficiently supplied. Drivers park often on the shoulder in spite of no-parking signs.

## 5.2 Accidents

Accidents in 1987 were 2.3 times as frequent as in 1982 in Sana'a. Causes of accidents are found in poor road facilities, poor driving habits, and indiscriminate road crossing by pedestrians. Micro-buses and taxis, which stop any place under the request of users, also contribute to a high occurrence of accidents.

## 6. Public Passenger Transport Service

Passenger service for public is supplied by taxis, micro buses and medium buses in those cities. They are privately owned. Fixed route operation is provided by medium buses among the terminals of Tahrir square, Bab Al Yemen, Al Qa, Bab Shuub, etc. in Sana'a. Those routes cover only heavy traffic demand areas.

It is considered the registered taxis were 3,400, micro buses 2,600 and medium buses 120 in Sana'a in 1987. Also it is estimated that daily person trips using those public service vehicles were 207,000 (56%) and those in private vehicles 162,000 (44%) in the same year.

Frequent and irregular stops by micro buses and taxis often cause accidents and congestion. They neither follow normal traffic rules nor obey the keep lane principle. Disorderly driving is often seen even in congested areas.

Urban expansion is prominent in Sana'a with residences, schools, and factories spreading into suburban areas. The expansion requires transport services to the outskirts, which



owners/drivers find not attractive because of low demand density when compared with inner city areas. Actions are considered necessary in keeping some minimum of social service in those outskirts.

## 7. Action Plans

### 7.1 Growth Forecast

Traffic growth is forecast by using the population growth estimate. The following is an overall forecast of vehicle traffic growth from 1987 - 2000.

	2000/1987	p.a. ratio
Sana'a	2.3	6.7%
Taiz	2.1	6.0%
Hodeidah	2.1	6.0%

The above tendency of increase in vehicle traffic should be considered when the mitigation of current traffic problems is studied.

### 7.2 Projects

Projects formulated in this study are programmed to be completed in 1991, i.e. in the 3rd five year plan period. Project components of this Action Plan are classified as follows:

- Intersection improvement in order to realize effective traffic flows with less accidents.
- Signal replacement and new placement including those for pedestrians.
- Traffic sign boards: no-stop, no-park, stop, etc.
- Paint marks on lane, stop line, curb, etc. including zones for pedestrian crossing.
- Reflectors for lanes and median.
- Installation of guard fence.
- Construction of pedestrian bridges.

Fig. 7.1 Location of Short Term Action Plan in Sana'a

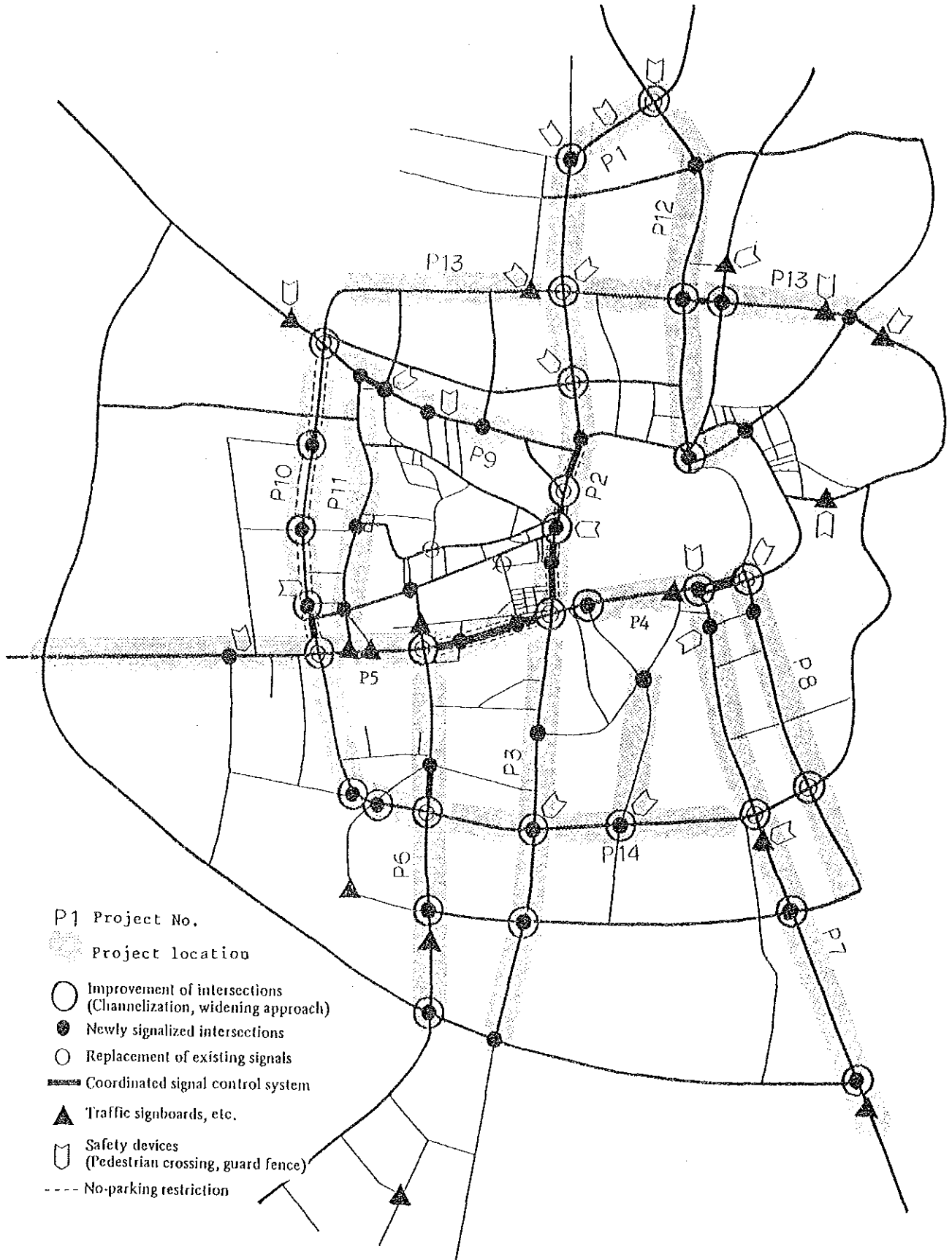


Fig. 7.2 Location of Short Term Action Plan in Taiz

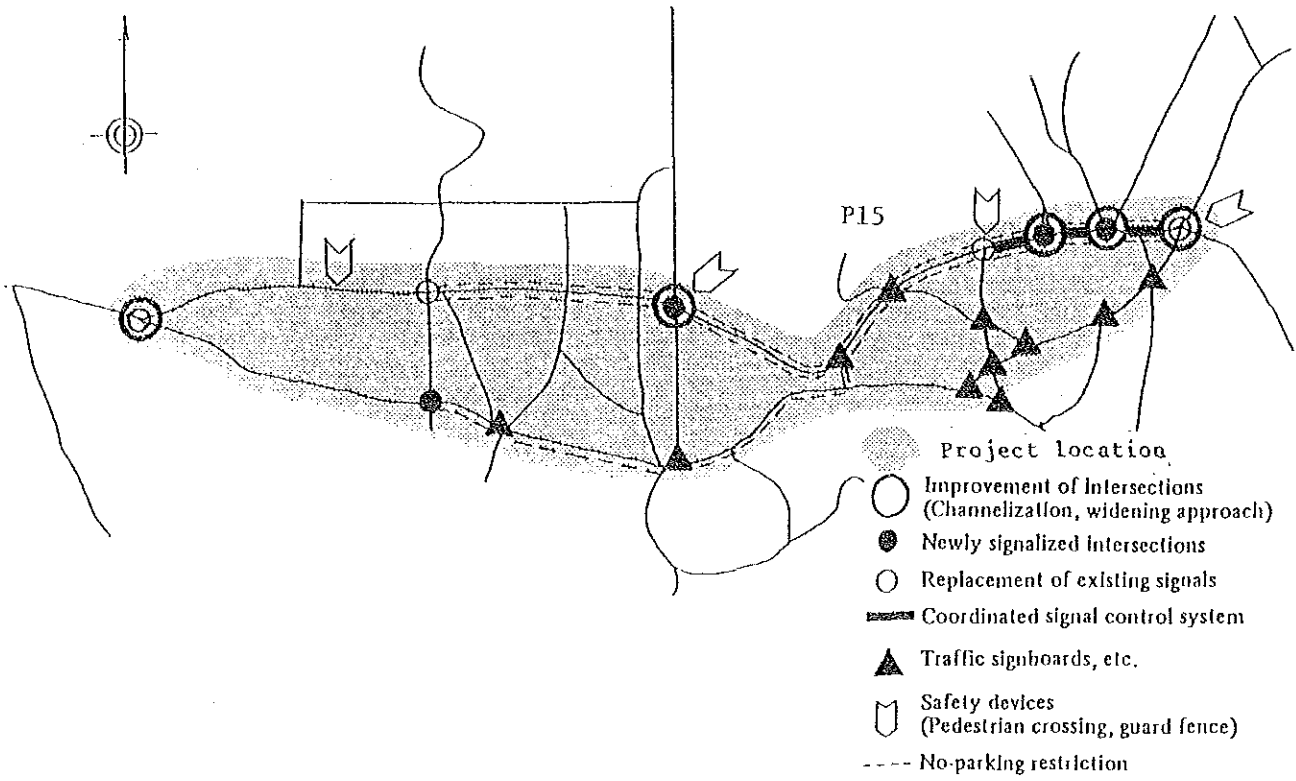
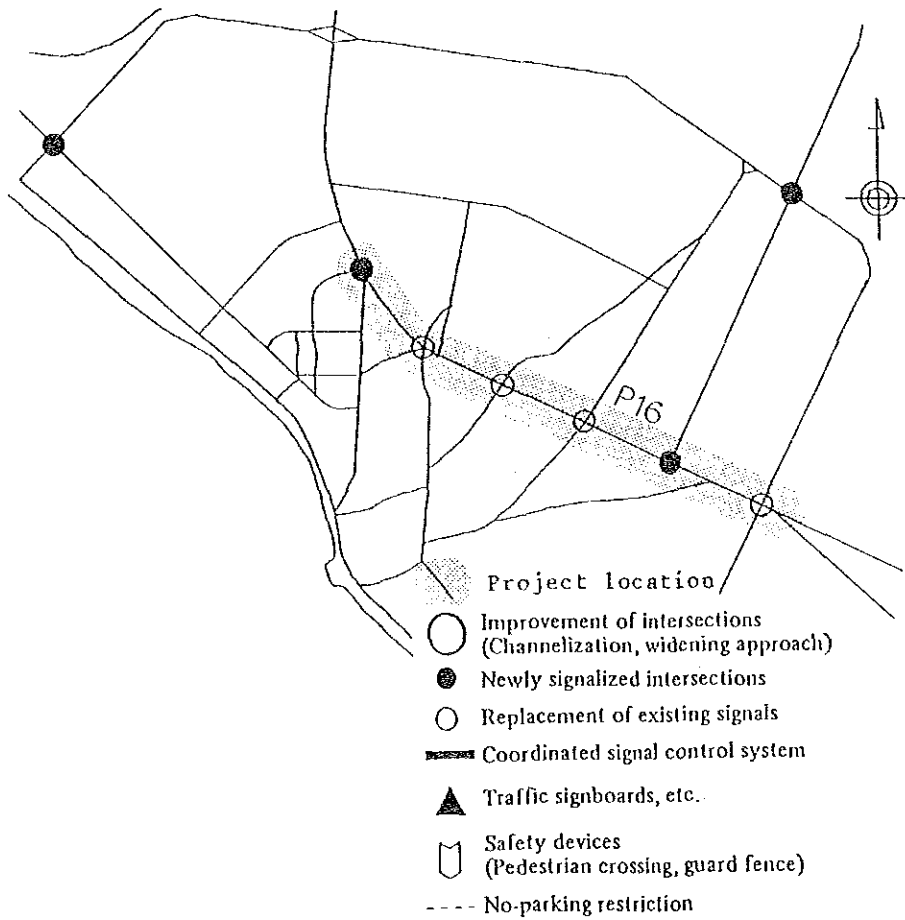


Fig. 7.3 Location of Short Term Action Plan in Hodeidah



- Development of off-road parking lots.
- Regular passenger service using large buses.

Those components may differ among the roads because of differences in traffic volume, road conditions and physical features of intersections. These components are grouped into Projects: No. 1 -No. 14 in Sana'a (Fig. 7.1) and one unit each in Taiz (Fig. 7.2) and Hodeidah (Fig. 7.3).

## 8. Engineering Studies and Cost

### 8.1 Engineering Studies

#### 8.1.1 Sana'a

Preliminary engineering studies on the plan of intersection improvement were conducted on 32 intersections. Signals will be replaced or newly installed at a total of 44 intersections, including those for pedestrians. Guard fences, traffic sign posts, reflectors will be placed at appropriate points. Marks for lane separation, stop line, etc. will be painted on the main road network.

#### 8.1.2 Taiz and Hodeidah

In Taiz, improvement of the intersection is studied for 5 locations and signal is proposed to be installed at 8 intersections. In Hodeidah, intersection improvement is not proposed, while signals are proposed to be placed at 8 locations in total. Traffic sign boards and other facilities are planned in those two cities as the same way as in Sana'a.

### 8.2 Cost

The cost is estimated in 1988 prices excluding customs duties and tax, but including engineering service, indirect cost and contingencies assuming a contract after tendering. It is summarized in the following Tables 8.1 and 8.2:

Table 8.1 Project cost

(In YR million of 1988 prices)				
	Sana'a	Taiz	Hodeidah	Total
1. Project				
-1. Engineering services	16.8	1.4	1.4	19.6 [ 10%]
-2. Construction				
a. Signals	59.9	6.3	7.4	73.6 ( 49%)
b. Intersections	45.2	0.9	-	46.1 ( 31%)
c. Guard fences	14.4	1.5	1.2	17.1 ( 11%)
d. Marking	5.1	0.7	0.8	6.6 ( 5%)
e. Traffic signboards	1.5	0.4	0.2	2.1 ( 1%)
f. Reflectors	3.0	0.5	0.5	4.0 ( 3%)
g. Total	129.1	10.3	10.1	149.5 (100%) [ 75%]
-3. Contingencies	26.4	2.1	2.1	30.6 [ 15%]
-4. Total	172.3 [ 86%]	13.8 [ 7%]	13.6 [ 7%]	199.7 [100%]
2. Ped. bridges	20.0	-	-	20.0
3. Park lots	19.4	4.8	-	24.2
4. Land for lots	76.9	86.8	-	163.7
G. Total	288.6 [ 71%]	105.4 [ 26%]	13.6 [ 3%]	407.6 [100%]

### 8.3 Currency Composition

In the case of currency composition, the total cost is divided into local and foreign portions as shown below:

Table 8.2 Currency Component

(In million of 1988 prices)			
Projects	Foreign	Local	Total
Construction	12.4 (YR118.5) (79%)	YR31.0 (21%)	YR149.5 (100%)
Engineering	\$1.6 (YR15.5) (79%)	YR4.1 (21%)	YR19.6 (100%)
Confingencies	2.1 (YR23.5) (77%)	YR7.1 (23%)	YR30.6 (100%)
Total net cost	\$16.1 (YR157.5) (79%)	YR42.2 (23%)	YR199.7 (100%)
Total Includ. Ped. Bri.	\$17.5 (YR170.2) (77%)	YR49.7 (23%)	YR219.9 (100%)
Total Includ. Ped. Bri. and Park lots	\$19.1 (YR186.2) (46%)	YR221.3 (54%)	YR407.6 (100%)

(US\$ 1.00 = YR9.75)

#### 8.4 Implementation Schedule

Periods for detailed engineering studies, calling for tender and evaluation, mobilization and implementation are proposed as under.

Fig. 8.1 Implementation Schedule

	1988	1989	1990	1991
This Transport study	—			
Funds prepa.	—	—		
Detail Engr. & F/S		—	—	
Tender & Eval.			—	
Mobilization			—	
Implementation				—

### 9. Economic Evaluation

#### 9.1 Economic Benefit

Projects in the Action Plan will increase the capacity of intersections which in turn dominate the capacity of road sections in those cities. If the capacity increases, vehicles will be able to travel through the intersections at higher average speeds, resulting in savings in vehicle operation cost and passenger time cost. Vehicle operation cost (VOC) is estimated by studying the use of vehicles in those cities, while passenger time cost is estimated by referring to average income, average occupants and trip purpose composition.

Accident cost is determined by using the standard compensation in traffic court. It is assumed that the accident ratio will decrease by 25% when the proposed projects are completed.

#### 9.2 Economic Cost

Currently, the economy of Yemen controls the use of foreign exchange and imports are limited. In the labour market under-employment seems to be prevalent in urban areas. These factors are shadow priced in the project cost and VOC.

### 9.3 Benefit Cost Analysis

A benefit cost analysis is conducted with the following conditions:

- Cost disbursement      1989          1990          1991  
                                 5%          50%          45%
- Maintenance cost      : (Total project cost - Land cost) x  
                                 5.9%
- Periodic maintenance   : Marking cost in every 3 years
- Residual value         : Land cost 100% at the end of the 5th  
                                 year of benefit  
                                 : Others are assumed to have no residual  
                                 value.
- Discount rate          : 11% p.a. (used for B/C ratio)

The total projects indicate the following results.

	Sana'a		Taiz		Hodeidah		Total	
	B/C	IRR	B/C	IRR	B/C	IRR	B/C	IRR
1) Projects without pedestrian bridges and parking lots.	1.66	32%	1.70	33%	1.42	26%	1.65	32%
2) Projects with pedestrian bridges but no parking lots	1.48	27%	1.70	33%	1.42	26%	1.49	27%
3) Projects with pedestrian bridges and parking lots	1.23	18%	0.53	4%	1.42	26%	1.13	14%

### 9.4 Conclusion

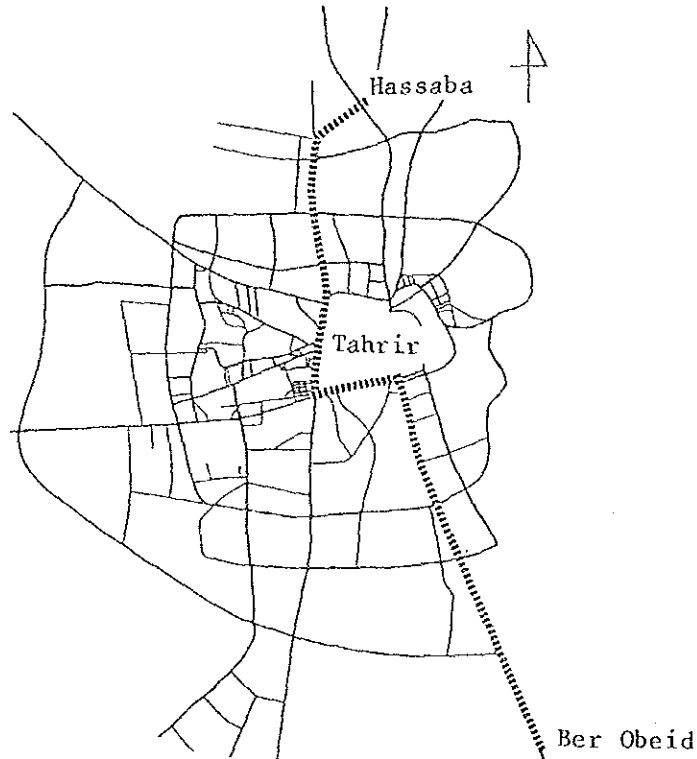
It is found Projects of 1) indicate the economic internal rate of return (IRR) of 32% in Sana'a, 33% in Taiz and 26% in Hodeidah. The overall projects of 1) will have a B/C ratio of 1.65 at the discount rate of 11% and IRR of 32%. It is concluded projects of 1) proposed in those cities are technically and economically feasible solutions for mitigating traffic problems.

When pedestrian bridges are included in some projects as in 2), it is certain they will realize safer and better movement of vehicles and people, although no quantification in economic benefit is conducted. The problem in this case is the uncertainty of the response of pedestrians. If it is certain people are cooperative in using the bridges in order to realize safer and disciplined traffic flows, they should be included in the project.

## 10. Regular Bus Service

### 10.1 Route and Service

Considering the prevailing services by private owners/drivers of buses, a pilot case of one line operation by CLTC is proposed for in-city service. The operation on a selected route competing with the private owners/drivers in one or two years would disclose a number of problems to be solved. By assessing the performance and influence of the pilot case, the second route operation should be prepared.

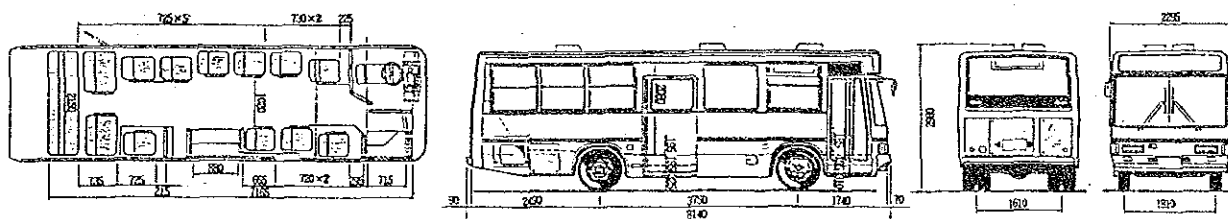


The pilot case is proposed on the heavily congested route of Hasaba-Ber Obeid Qat Market (11 km), on which financial and managerial viability are studied.



The new service on the route is assumed to run by using 18 large buses from 6 a.m. to 10 p.m. They must use pre-determined bus stops which are posted at 400 m intervals. The flat fare of YR3.00 per ride is adopted.

Other facilities of an office, a workshop and a parking depot are considered necessary. The total of 110 persons including conductors is estimated. A typical bus type is shown below:



A capacity of 53 passengers including standing

## 10.2 Financial Analysis

By assuming the 1st year for preparation and training, the project cycle is assumed in the subsequent 8 years from 1990 to 1997. Revenues, expenditures and depreciation are forecast resulting in the following:

- Initial cost of YR 23.1 million including the bus cost of YR 11.2 million
- Income accumulated during 1989 - 1997 = YR6,638,000
- Cash balance accumulated during 1989 - 1997 = YR-1,411,000  
(At the initial investment, land area for a depot for 50 vehicles is assumed. Although the cost burden results in a negative value in the eight year operation, it can be solved when the next route is added into operation.)
- Financial rate of return = 15.6%

## 10.3 Conclusion

The operation of one route by using 18 large buses between Hasaba and Ber Obeid qat market (11 km) from 1990 is recommended because it will be financially viable. The management of such a modest

scale will not be difficult for GLTC.

#### 10.4 Recommendations for Public Transportation

- Large buses should be used for public service on a regular time table using pre-determined bus stops and terminals.
- In order to avoid the risk of financial loss in the bus corporation, a step by step expansion strategy should be followed:
- Micro buses should be organized to serve on feeder routes which are connected to larger buses on main roads. Their fleet should not be increased from the present level for the time being.
- Medium buses should be assigned to run on main roads together with large buses of GLTC. Their fleet should be increased to serve the passenger demand.
- Taxi vehicles also should not be increased for the time being.
- Urban development seems to continue and demand for public service will grow simultaneously. When substantial growth is recognized, the fleet should be increased.

#### 11. Recommendations

While this study proposes the implementation of urgent action plans on the existing road system, studies and staff strengthening are necessary in the following subjects in order to develop appropriate road and transport service in the rapidly growing urban areas.

##### 11.1 Road Network Development Plan

The study should be closely related to the formulation of the urban development master plan. And the study should present the following plans:

- Staged development of road network, including by-pass, grade-separated intersection, toll road, etc.

- Classification of roads in a hierarchy system in a block or a city.
- Surfacing and betterment of service roads and community streets.

## 11.2 Parking Facilities

Parking and restriction rules should be enforced on the whole streets of those cities. In addition the following actions should be studied and implemented.

- The establishment and enforcement requiring parking space provision within a building or compound.
- Public parking space construction either by government or by private sector.

## 11.3 Traffic Flow Management (mostly by traffic police)

- Check and enforce rules of parking and non-parking, one-way, stop at the stop sign, no passing over zones, the maintenance of keep lane principle, priority rule at the intersection, etc.
- Ordered crossing by pedestrians.
- Maintenance of traffic signals and other devices.

## 11.4 Campaign & Training through Mass Media and Schools.

- Safe and ordered manner in vehicle driving
- Safe and ordered crossing of the road by pedestrians and children

## 11.5 Administrative System

- Road maintenance and rehabilitation: organization, facilities, staffing and practice
- Traffic police: organization & staff training on vehicle registration, periodic mechanical checks, license issue,

statistical filing of accidents, and the traffic flow management.

- Traffic & planning: organization & staff training on field surveys and analysis such as vehicle counting, travel speed survey, origin-destination survey, study on increase/decrease of vehicles registered, traffic forecast and assignment on road network, together with road inventory study and updated filing of road conditions.

Studies and planning of roads and traffic management should be initiated by this group of Traffic and planning.

#### 11.6 Public Passenger Transport Service

- Administrative system responsible for licensing taxis, bus routes & frequencies, fares, etc.
- Determine the share in operation and routes of private operators and publicly owned operators (GLTC) in the whole city area.

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## Abbreviations used in the Study Report

ADT	Average daily traffic
B/C ratio	Benefit cost ratio
Bri	Bridge
CAMA	Civil Aviation and Meteorology Authority
CPO	Central Planning Organization
FIRR	Financial internal rate of return
F/S	Feasibility study
GDP	Gross domestic product
GLTC (GTC)	General Land Transport Corporation
GNP	Gross national product
GSTA	General Secretariat for Transport Affairs
H (hr. hrs.)	Hour(s)
HA (YHA)	(Yemen) Highway Authority
IRR	Internal rate of return
JICA	Japan International Cooperation Agency
LDA	Local Development Association
MMH	Ministry of Municipalities and Housing
N.A.	not available
p.a.	per annum
PCU	Passenger car unit
Ped.	Pedestrian
PMAC	Port and Marine Affair Corporation
Pub	Public
Q/C	Quantity/capacity
Rd.	Road
SCF	Standard conversion factor
St.	Street
Trans	Transportation
US\$	United States Dollar
V/C	Volume/capacity
Veh.	Vehicle
VOC	Vehicle operation cost
YAR	Yemen Arab Republic
YESCO	Yemen Sea Transport Company
YLTC	Yemen Land Transport Company
YR	Yemenese Rial



## CHAPTER 1 INTRODUCTION





## CHAPTER 1 INTRODUCTION

### 1.1 Background

Urbanization has been a factor through a period of the 1970s and 1980s in Yemen Arab Republic with rapid urban development found particularly in large cities such as Sana'a, Taiz, and Hodeidah. The annual average growth of population from 1975 to 1986 was 11% in Sana'a, with 7% in Taiz and in Hodeidah. Such a rapid urban development has brought in a number of problems which government agencies have to solve or mitigate. They include urban transportation problems of increasing of congestion and discomfort, in spite of a number of projects completed which aim to mitigate these problems. However, these efforts are rather going behind the rapid traffic growth.

The Government of Yemen Arab Republic (YAR) requested the Government of Japan to conduct a study on urban transportation planning which would recommend short term projects for implementation by 1991. A series of preparatory discussions to define the scope of study in urban transportation planning were conducted between YAR and Japan, which resulted in the agreement of the scope of work in June 1987. This study has been carried out since October 1987 under the agreed scope of work.

The study was carried by Japan International Cooperation Agency (JICA), the official agency responsible for the implementation of technical cooperation programs of the Government of Japan, in cooperation with Ministry of Municipalities and Housing (MMH) of Yemen Arab Republic.

## 1.2 Objectives

Objectives of the study were determined in the Scope of Work agreed by the representatives of both governments. They are summarized as follows:

### 1) Sana'a

Improvements of Sana'a urban transport concern:

- (1) major important intersections;
- (2) pedestrian traffic, particularly on the problems related to high-activity points;
- (3) parking, on-and off-street in the most important areas;
- (4) public transport development including buses and other existing means of transportation

### 2) Taiz

Improvement of Taiz urban transport concern:

- (1) traffic management system in the central commercial area.

### 3) Hodeidah

Improvement of Hodeidah urban transport concern:

- (1) traffic management system on Sana'a/Al Mina street;
- (2) traffic management system within the central business district.

Plans should be prepared to be implemented by the end of the 3rd 5 year Development Plan, 1991.

### 1.3 Studies

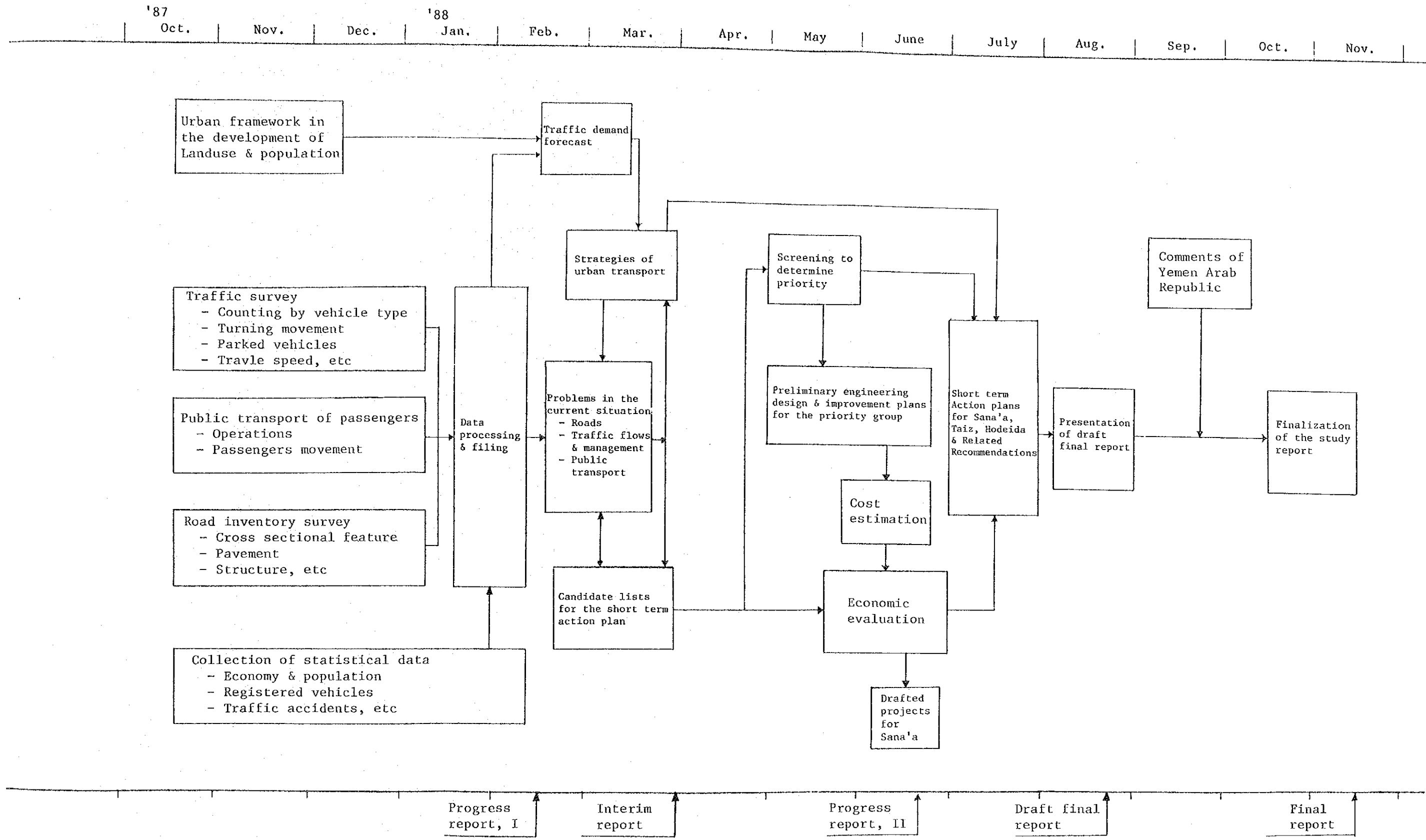
The overall studies conducted from October 1987 to November 1988 are phased as follows.

* Early-October 1987	Preparation & Mobilization in Japan
* Mid-October 1987 - Late March 1988	Studies in Yemen
* April 1988 - August 1988	Studies in Japan
* September 1988 - November 1988	Edition of Final Report

The schematic flow of those studies is shown in Fig. 1.3.1. Reports were submitted to the Yemenese side as under:

- Inception report, October 1987
- Progress report No.1, February 1988
- Interim report, March 1988
- Progress report No.2, June 1988
- Draft Final Report, August 1988
- Final Report, due in November 1988

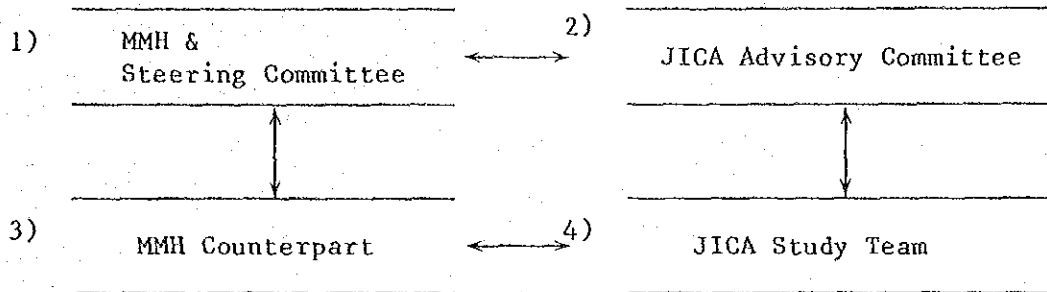
Fig. 1.3.1 Schematic Flow of the Study





## 1.4 Organization of the Study

The study has been carried out jointly by JICA and MMH in coordination with other agencies. The organization and the list of the members concerned are stated as follows:



### 1) Steering Committee, YAR

Lutfi Hugayra,  
Chairman, Director General Physical  
Planning Department,  
Ministry of Municipalities and Housing

Mohamed Abdo Hamadi,  
Physical Planning Department,  
Ministry of Municipalities and Housing

Yehia Ahmed Al Kohlani  
General Land Transport Cooperation

Hamood Al-Sheik,  
Sana'a Traffic Police

Izzi Al-Mansoob,  
Projects Department, Central Planning  
Organization

Abdo Saeed Adobhani,  
Planning and Traffic Department,  
Highway Authority

Ahmed Al Grumzi,  
City of Sana'a

### 2) Advisory Committee, JICA

Hirohide Konami,  
Chairman of the Committee  
Manager, Urban Planning Division  
Aichi-Ken

Kazuo Ishii,  
Bureau of Urban Planning, Ministry of  
Construction

Morihiro Kawada,  
Transport Bureau of Kinki Region,  
Ministry of Transport

Kunio Iwanaga,  
Planning Department, Tokyo Metropolitan  
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### 3) MMH counterpart staff

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Hossein M. Al Aini,  
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### 4) JICA study team

Teruhiko Horie  
Team Leader

Keiichiro Odaira  
Urban Framework

Tsutomu Kudo  
Transport Planning/Traffic Survey

Shinsuke Tsuruta  
Public Transport Planning

Hidetsune Ishii  
Highway Planning

Toshihiro Hotta  
Highway and Traffic Facility Planning

Hiroshi Shimamura  
Traffic Management (1)

Kimio Kaneko  
Traffic Management (2)

Masaru Mizukami  
Systems Analysis

## 1.5 Outline of This Report

The report is edited in accordance with the progress of the study. Chapter 2 summarizes the economic development and population of the country, and Chapter 3 presents the review of urban development in Sana'a, Taiz and Hodeidah and an overall prospect for their development up to the year 2000.

A number of surveys were conducted in those cities. They are classified and edited in Chapters 4 through 7. Chapter 4 covers the inventory study of the existing main roads and Chapter 5 summarizes the results of surveys on various traffic and accident data on those roads. Management of traffic is in Chapter 6. Chapter 7 is the existing status of public transport service for passengers, particularly bus and taxi service in Sana'a.

Traffic growth is forecast in Chapter 9, where population, urban area and economic development are taken into account.

Chapter 8 discusses traffic problems and their locations, and Chapter 10 indicates countermeasure plans to mitigate those problems. Countermeasure plans are classified into project groups and the engineering studies and cost estimate of them are conducted. Chapter 11 is for preliminary engineering and Chapter 12 is for cost estimates.

Economic analysis is conducted in Chapter 13 where benefits are compared with cost in economic terms. Economic justification is shown in IRR and B/C ratio.

A plan to introduce regular bus service using large body buses is studied including financial analysis. The plan is discussed in Chapter 14.

Chapter 15 presents the conclusion of the study and the related recommendations.

Volume II is filed separately for appendix tables and figures, while Volume III is for plans and drawings.