

**CHAPTER 6 TRAFFIC MANAGEMENT AND CONTROL**

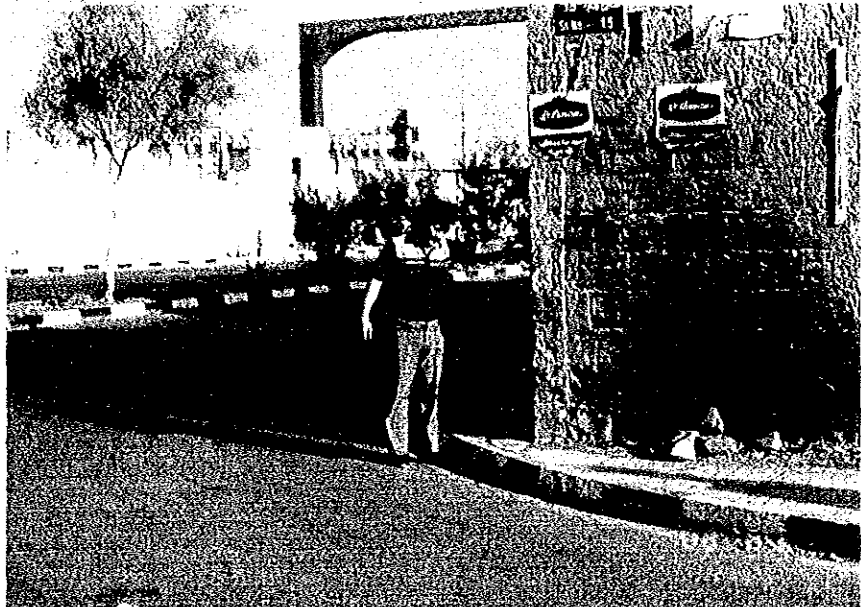


Pictures in Sana'a



A  
A signal, but no signboards nor painted mark on the road surface.

B  
Neglected side-walk for pedestrians. The corner should be enlarged to have a 90° degree turn, with which vehicles may go slow for the right turn.



C  
Parked vehicles neglecting the no-stop signboard.



Pictures in Sana'a

D

The signal post is low in height and placed not in good position. Vehicles on the inside lanes are hard to identify the signal sign.

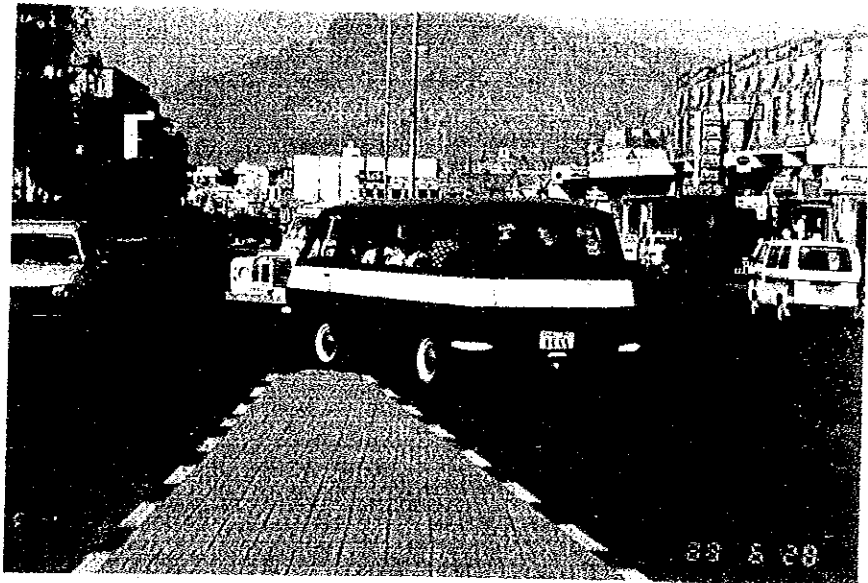


E

A narrowed median with the left turn lane. No painted marks for pedestrians.

F

A median and the left turn vehicles. The vehicle stopping at the corner disturbs the following vehicles which go straight. The median should be narrowed and a left turn lane with full width should be placed.



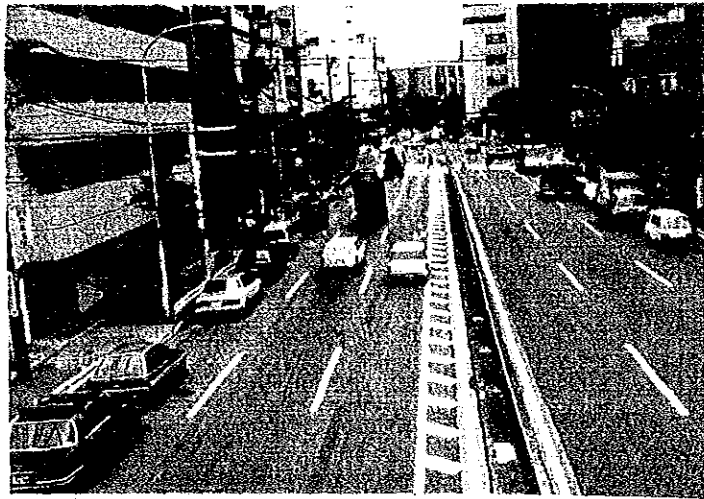


Pictures in Tokyo

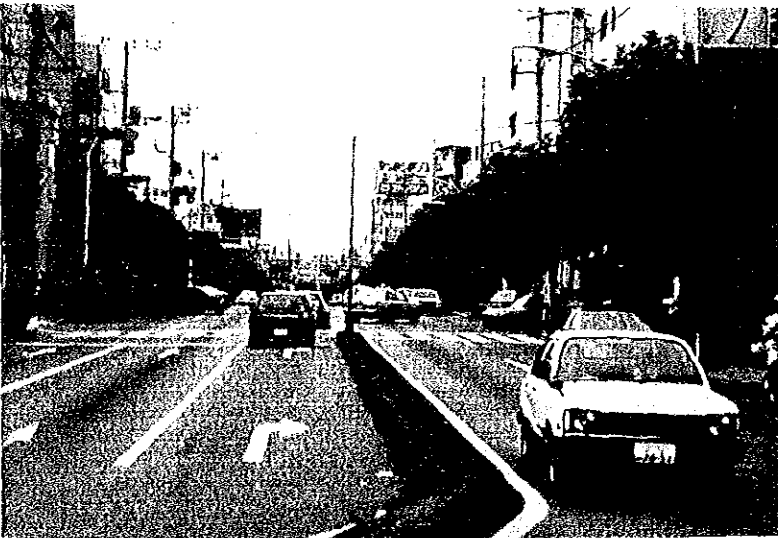
Non signalized intersection in a residential area. Painted mark and signboards are installed.



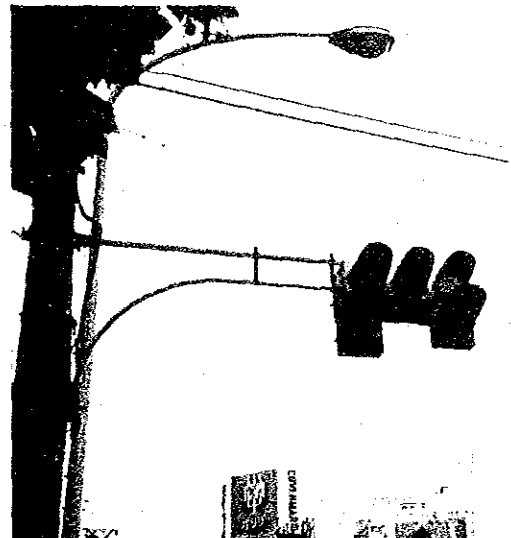
A zebra mark crossing zone for pedestrians.



Former lane marks (gray) with 3.65 m width and new ones (white) with a width of 3.00 m. Vehicles parking on the left side lane and neglecting the traffic rule reduce the capacity of one lane.



A marked right turn lane with the arrow signal.







## CHAPTER 6 TRAFFIC MANAGEMENT AND CONTROL

### 6.1 Traffic Regulation and Law

#### 6.1.1 One-way streets

##### 1) Sana'a

As shown in Fig. 6.1.1, a few streets located in the central area are one-way streets. Those one-way streets are concentrated in the area bordered by Az Zubayri, Ziraah, Shuub, and Wadi Dahr road. The streets designated as one-way are 26th September, Bawniyah, Jamal Abdul Nasser, As Salam - No. 23 street and so on.

##### 2) Taiz

One-way streets are found in the vicinity of the southern part of Jamal street, due to the dense construction in the old city area and its surroundings.

Of the one-way streets, those related to the main thoroughfare of Jamal street are shown in the Fig. 6.1.2.

##### 3) Hodeidah

The streets forming the triangle bordering of Hodeidah Park are all one-way. There is no one-way ruled street on the northern side of Sana'a street, while there are several one-way routes on the southern side. Fig. 6.1.3 indicates the one-way streets in Hodeidah.

#### 6.1.2 Car-parking control

##### 1) Sana'a

The streets where no-parking is marked are shown in Fig. 6.1.4. Currently, no-parking streets are enforced strictly at near government and army facilities. Other no-parking streets are seen inside the boundary of Ring road.

Marks of no-parking areas are seen on Az Zubayri and Ali Abdul Mughni streets.





2) Taiz

Fig. 6.1.5 shows the no-parking streets in Taiz. No-parking streets are designated in commercial area along the arterial streets as Jamal, 26th September and As Samil streets.

3) Hodeidah

Fig. 6.1.6 shows the no-parking sections on streets in Hodeidah. The locations of no-parking streets are limited on Sana'a, Al Matorak and Al Ulufi streets.

### 6.1.3 Traffic law

Rules on vehicle registration, mechanical inspections, issuance of driving license and ticketing for the violation of traffic rules are defined in the following booklet (in Arabic language).

"Traffic rules (91)", concerned with Transport Facilities and Traffic Regulations, 1983. (Legal Office, Ministry of Interior).

It can be summarized as follows:

1) Vehicle classification

- a. Light vehicles (less than 3.5 tons vehicle-weight)
  - Private
  - Public (Taxi and micro-bus)
  - General (commercial)
- b. Good Vehicles (more than 3.5 tons vehicle-weight)
  - Private
  - General (commercial)
- c. Bus (more than 15 passengers seats)
  - Private
  - General (commercial)
- d. Tractors
  - Light tractor (less than 7.5 tons vehicle-weight)
  - Heavy tractor (more than 7.5 tons vehicle-weight)
- e. Motorcycles

## 2) Registration

Vehicles should be registered at Traffic Police Department in the Governorate. The certificate issued by the registration is valid for one year and subject for renewal every year upon the visual inspection and payment of fee at the Traffic Police Department. The certificate should be fixed at the front face of a vehicle's glass, and a vehicle license is issued to the owner. The fees currently charged by Traffic Police are shown in Table 6.1.1.

Table 6.1.1. Vehicle Registration Fee (Jan. 1988)

Classification	The first Registration	Veh. License fee	Renewal fee
Private	670	270	370
Public No. of passengers x YR 100 (Taxi, Micro-Bus, Medium-Bus, Large-Bus)		270	370
Trucks No. of load-tons x YR 300		270	370
Gov. Vehicles			
Small	605	-	370
Large	1000	-	370

Source: General Traffic Office & Sana'a Traffic Police Dept.

Vehicles belonging to the following categories are exempted from the license fee payment.

- a. Vehicles owned by governmental organizations
- b. Vehicles owned by army
- c. Vehicles owned by foreign diplomats
- d. Ministry of Interior's decisions

## 3) Driving license

Driving licenses are issued by License Section in Traffic Police Department, after passing the following tests:

- a. Visual examination
- b. Medical check (only in the cases considered necessary)
- c. Understanding traffic rules
- d. Understanding mechanical system

e. Driving techniques on the streets

License issues and fees are classified into the following 3 types:

a. Private	- 5 years	YR 620
b. Taxi, Micro Bus, Medium Bus	- 3 years	YR 420
c. Commercial Truck (large & small)	- 3 years	YR 420

4) Vehicle's mechanical check

Traffic Police Department in Governorates is responsible to conduct the mechanical check of vehicles. Currently, visual checks of mechanical functions are conducted by the Traffic Police in the case of registration and renewal.

Checking will cover the following points:

- a. Seat specification
- b. Brakes
- c. Front and rear lights
- d. Engine
- e. If the vehicle has two doors, no taxi number plate is granted.
- f. Tyre size and reserve tyre
- g. Mirrors are fixed at appropriate positions, etc.

It is said the compound to inspect vehicles in the Traffic Police Department will be rehabilitated/improved in 6 months, late 1988, in the cities of Sana'a, Taiz, Hodeidah, according Sana'a Traffic Police.

5) Fines on violation of traffic rules

Traffic police may issue a ticket if they find the vehicle is against the traffic rules. Table 6.1.2 is an example of the ticket written by policemen and handed over to the driver of the vehicle. The violation is classified into the following items according to the ticket.

- a. Exceeding the speed limit
- b. Against the direction and turning

- c. Negligence of traffic signals and police manual control
- d. Operation without lights during the night time
- e. Intoxication (Liquor or drug)

If a driver is given the ticket showing the violation of traffic, he should pay the fine at Traffic Police, ranging from YR 15-50 in five days. If the payment is after the five day limit, the fine increases YR 15 per day, according to Sana'a Traffic Police.

Table 6.1.2 Ticket for the Record of Violation in Traffic Rule

الجمهورية العربية اليمنية وزارة الداخلية إدارة عام المرور		بسم الله الرحمن الرحيم نموذج مخالفات مرور	
رقم الملف	رقم السيارة	رقم الساعة	التاريخ
اسم السائق		تاريخ الميلاد (العمر)	
العنوان			
رقم رخصة القيادة وجدة اصدارها			
رقم رخصة التسيير			
نوع السيارة			
سائق السيارة المذكور له مخالف نظام وقواعد المرور على الطرق للجمهورية العربية اليمنية			
اسم موقع المخالفة			
اسم الطريق			
منطقة			
ظروف الطريق		السرعة أعلى من	
<input type="checkbox"/> مطر <input type="checkbox"/> زوال <input type="checkbox"/> رياح		<input type="checkbox"/> ١١ - ٢٠ كم / ساعة	
الأضواء		<input type="checkbox"/> أكثر من ٢٠ كم / ساعة	
<input type="checkbox"/> ليلا <input type="checkbox"/> ضباب		<input type="checkbox"/> ٢٠ - ٣٠ كم / ساعة	
تصادم		<input type="checkbox"/> كم / ساعة للمخالفة	
<input type="checkbox"/> سيارة أخرى <input type="checkbox"/> مشور تاري		توقف	
<input type="checkbox"/> مع <input type="checkbox"/> عرض ثابت		<input type="checkbox"/> غير نظامي	
<input type="checkbox"/> حيرافات <input type="checkbox"/> دوس		<input type="checkbox"/> مفاجئ	
<input type="checkbox"/> جروح بالغة <input type="checkbox"/> اماتة		<input type="checkbox"/> عكس اتجاه الطريق	
<input type="checkbox"/> جروح طفيفة <input type="checkbox"/> جرح		<input type="checkbox"/> على شكل جرح أو دوران غير نظامي لليمين	
<input type="checkbox"/> انقلاب <input type="checkbox"/> حريق		<input type="checkbox"/> دوران غير نظامي لليمن	
<input type="checkbox"/> خروج عن الطريق		<input type="checkbox"/> عدم التنبؤ باشارات المرور	
<input type="checkbox"/> أسباب أخرى (أذكرها)		<input type="checkbox"/> عدم إعطاء أولوية المرور للمركبات	
		<input type="checkbox"/> أضرار السيارة لا تشمل ليلا	
		<input type="checkbox"/> عند تقاطع	
		<input type="checkbox"/> من اليمين	
		<input type="checkbox"/> نظامي	
		<input type="checkbox"/> على مركبات	
		<input type="checkbox"/> على مرتفع	
		<input type="checkbox"/> على انحناء	
		<input type="checkbox"/> تخطى المسارب (الخطوط) المرورية	
		<input type="checkbox"/> مسرب (خط) خاطئ	
		<input type="checkbox"/> السائق تحت تأثير مخدر	
		<input type="checkbox"/> أسباب أخرى (أذكرها)	
المنطقة		الرتبة	
<input type="checkbox"/> صناعية <input type="checkbox"/> سكنية <input type="checkbox"/> زراعية		التوقييع	
<input type="checkbox"/> مدارس <input type="checkbox"/> تجارية <input type="checkbox"/> ريفية		التاريخ	
نوع الطريق		رقم	
<input type="checkbox"/> ذو مسرتين (خطين) <input type="checkbox"/> ذو ثلاثة مسارب (خطوط)		م ١١	
<input type="checkbox"/> طريق سريع <input type="checkbox"/> طريق شبي			
يقوم الضابط والمستوف بملء حقوق هذه البطاقة والتوقيع عليها			
أخي السائق احتفظ بهذه البطاقة وقدمها عند الطلب			
تعليمات للسائق المخالف: تذكر دائما أن المادة من قانون المرور تنص على أن تدفع غرامة المخالفة خلال خمسة أيام من تاريخ وقوعها وفي نطاق مركز المرور الذي وقعت فيه أو يتعرض المخالف إلى مضاعفة الجزاء.			



## 6.2 Traffic Control Devices

### 6.2.1 Traffic signals

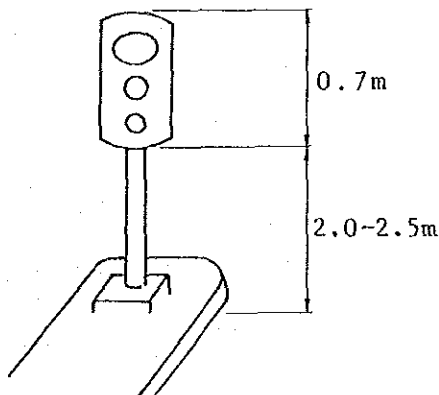
#### 1) Sana'a

Locations of signalized intersections and the types of signal phases are shown in Fig. 6.2.1 and Table 6.2.1.

Signalized intersections are located on main streets (arterial and semi-arterial roads). The majority of traffic signal lights installed are multiphase fixed-cycle system and one phase of the signal is set only one directional flow to enter into intersection in one time. The cycle lengths are set between 60 and 105 seconds, and the clearance (yellow) intervals are fixed at 3 seconds.

Traffic signal lights are placed at 23 locations in Sana'a of which 14 are currently working, eight non-working and one partially destroyed. In most cases, the traffic is directed by traffic policemen at these signaled intersections from 7 am to 7 pm who work in four shifts.

Many of the signal lights are hard to see because of weak illumination and short supporting poles. In addition, some intersections do not have enough signals to ensure that all drivers can see a traffic signal easily regardless of the viewing angle. (See the picture A and D in this chapter)



The signal lights of green, yellow, red is installed vertically on the steel pole of 2-2.5 m height. The pole (5-10cm diameter) is placed at the end of median of the approach section. Some intersections have another signal pole on the right side also.

There are no signal lights for pedestrians at signalized intersections.

Fig. 6.2.1 Locations of Traffic Control Intersections in Sana'a

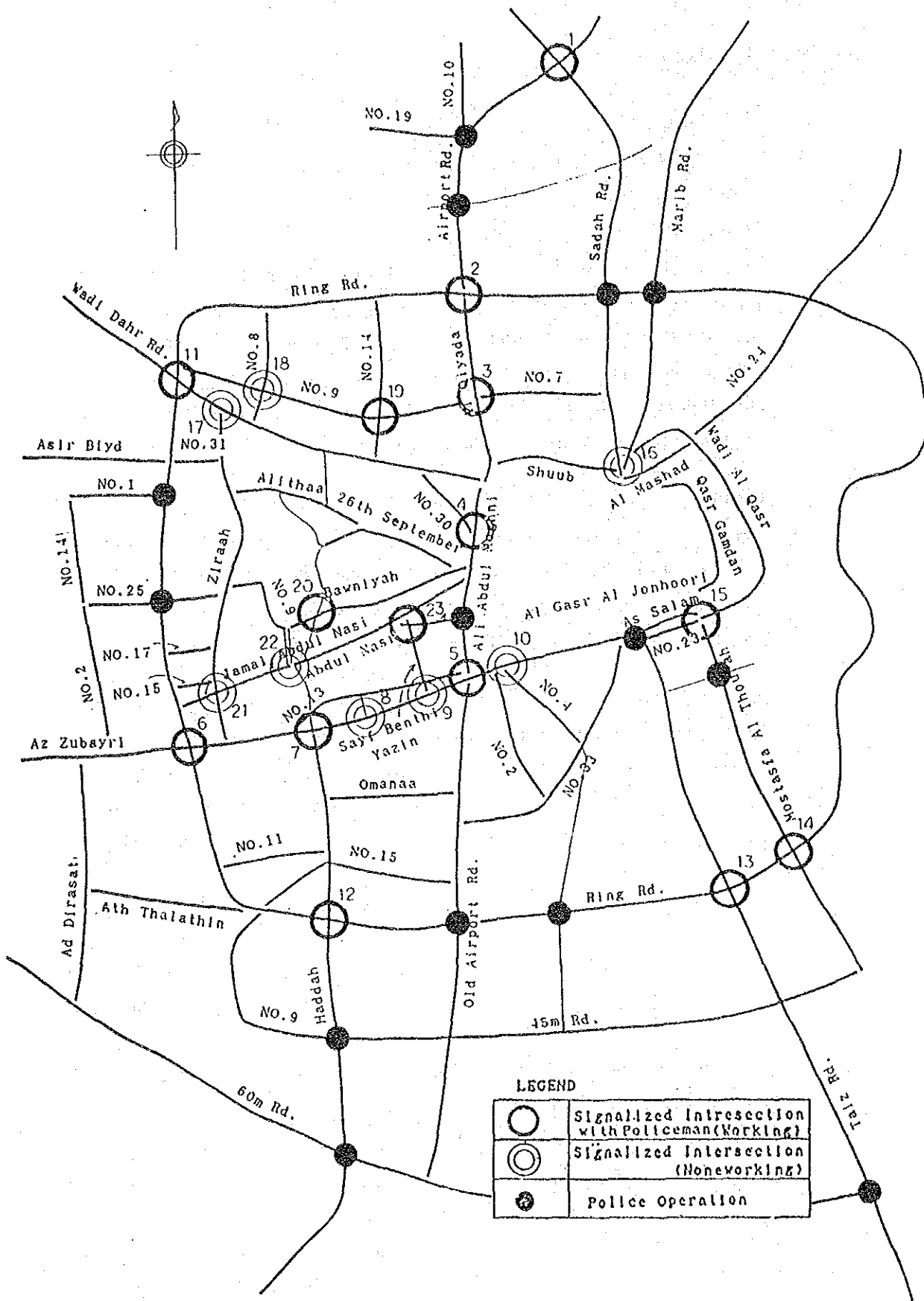
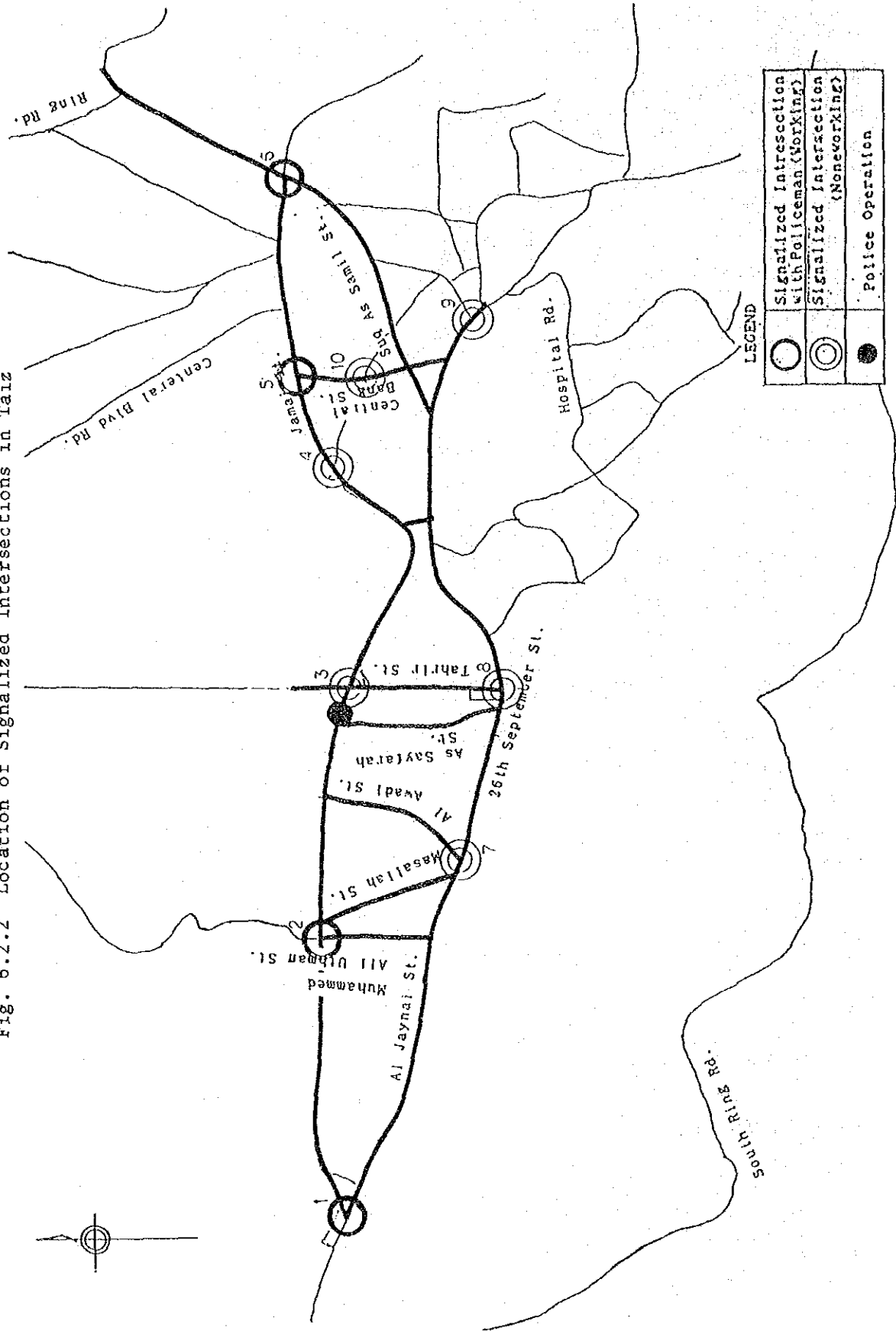


Table 6.2.1 Location of Traffic Signals in Sana'a, Taiz and Hodeidah

SANA'A				TAIZ				HODEIDAH			
NO.	LOCATION	CYCLE (Sec)	PHASE NO.	No.	LOCATION	CYCLE (Sec)	PHASE NO.	NO.	LOCATION	CYCLE (Sec)	PHASE NO.
1	AIR PORT-SADAH	100	4	*1	JAMAI-AL YAYNAI	60	2	1	SANA'A AL MATARI	60	2
2	AIR PORT-RING RD.	100	4	2	JAMAI-HUHAMMED AL UHMEN	60	2	2	SANA'A AL MOASLA	60	2
3	AIR PORT-NO.7,NO.9	95	4	3	JUAMI-TAHARIR	-	-	3	SANA'A-AL HUKUMI	60	2
*4	ALI ABDUL MUGHNI-NO.30	60	2	4	JAMAI-WEST OF NO.5 INTER.	-	-	4	SANA'A-TAIZ	60	2
5	ALI ABDUL MUGHNI-AIRPORT-AZ ZUBAYRI	60	2	*5	JAMAI-CENTRAL BANK	80	3	5	26TH SEPTEMBER-TAIZ	-	-
6	AZ ZUBAYRI-RING RD.	100	4	6	JAMAI-SUQ. SAMILI	95	4				
*7	AZ ZUBAYRI-HADDAH	80	3	7	AL. JAMAI-AL WADA	-	-				
*8	AZ ZUBAYRI-NO.30	-	-	8	26TH SEPTEMBER-TAHAR	-	-				
*9	AZ ZUBAYRI-SAYF BENTHIYAZIN	-	-	9	26TH SEPTEMBER-HOSPITAL	-	-				
10	AZ ZUBAYRI-NO.4	-	-	10	CENTRAL BANK	-	-				
11	WADI DAHR-RING RD.	95	4								
12	HADDAH-RING RD.	95	4								
13	TAIZ-RING RD.	100	4								
14	MOSTASFA AL THOURAH-WADI AL QASR	60	2								
15	MOSTASFA AL THOURAH-WADI AL QASR	60	2								
16	SHUUB-SADAH	-	-								
17	WADI DAHR-ZIRAAH	-	-								
18	NO.9-NO.8	-	-								
19	NO.9-NO.14	35	4								
20	BAWNIYAH(ONE-WAY)-NO.56	60	2								
21	JAMAL ABDUL ANSI-ZIRAAH	-	-								
22	JAMAL ABDUL-AL QA SQUARE	-	-								
23	SAYT BENTHI YAZIN-AL GASR ALJOMHOORI	60	-								

\* : Three leg intersection  
 - : No working

Fig. 6.2.2 Location of Signalized Intersections in Taiz



Makes of lights and control units are found as follows, but the date of installation, record of repair, and locations of each make are not shown by Traffic Police.

- Plessy Controls Ltd. (England)
- Signalbau Huber GMBH (West Germany)

2) Taiz

Locations are shown in Fig. 6.2.2. Although traffic signals are placed at 10 locations, only four inter-sections on Jamal Street are working currently. Four other locations are not working and two are partially deteriorated.

The standard signal control system at signalized intersections is multiphase fixed-cycle system as in Sana'a city. The cycle lengths are between 60 and 95 seconds.

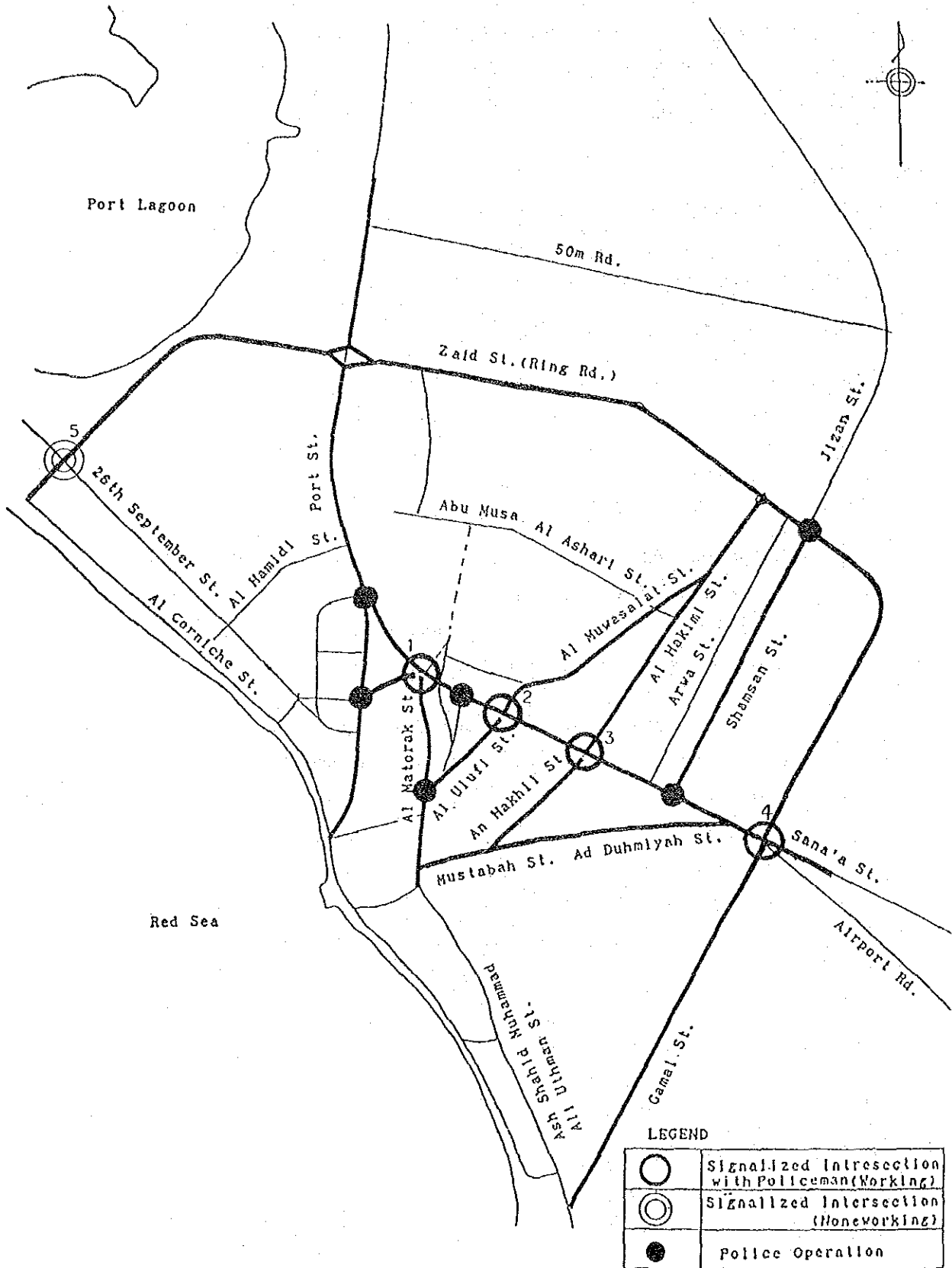
3) Hodeidah

Locations of traffic signal control are shown in Fig. 6.2.3. There are five traffic-signalized intersectins and four are placed on Sana'a street, which are working at present. Another is in the residential area but not working now.

Traffic signal control system on signalized intersections is two phased fixed-cycle system, and the cycle length is 60 seconds.

Policemen also stand and operate at those signalized intersections from 7 am to 7 pm, quite in a similar way as in Taiz and Sana'a. There are two intersections with no signal on Sana'a street in the center of the town which has policemen's guidance usually from 7 am to 7 pm.

Table 6.2.3 Locations of Signalized Intersections in Hodeidah



### 6.2.2 Traffic sign boards

Fig. 6.2.4 shows the comparison of types between existing traffic signs and international signs. The existing traffic signs are mostly similar to the international signs. The following is placement of sign boards.

#### 1) Sana'a

About 70 guide signs giving route designations, distances and other information were installed early 1988. But sign boards indicating road and street name are attached to buildings or placed on poles at the corner of major roads. It seems the location of these plates are not enough, and the plates should be standardized. Regulatory signs: "stop signs", "no-parking" signs and "right turn" signs, etc. are seen only occasionally in commercial and business areas. In general, the traffic signs are insufficient in number and kinds, and poorly maintained, and the enforcement of regulations is inadequate. (See the picture C in this chapter)














#### 2) Taiz

Some kinds of regulatory signs as "no-parking" and "do not enter" are seen on main roads. An insufficient number of sign board and their poor maintenance are the same as the present status of Sana'a.

#### 3) Hodeidah

The situation of traffic sign in Hodeidah is similar to Taiz.

Fig. 6.2.4 Comparison between Existing Traffic Signs and International Traffic Signs

Existing traffic signs in YAR	International traffic signs No. 1)
<b>1. Danger warning signs</b>	
	Roundabout A,25
	D,3
	Other danger A,20 b
	Cross road, Junction ahead A,21
	Children / School A,12
	Pedestrian crossing A,11 a
<b>2. Regulatory signs, Priority signs</b>	
 	Stop B,2 a
<b>3. Restriction signs</b>	
	No entry C,1 a
	No parking C,18
	No stopping C,10
<b>4. Mandatory signs</b>	
	D,1 a
	D,1 a

1) Annex 9. UN Convention on Road Signs and Signals (1953)



## 6.3 Organization and Administration

### 6.3.1 Administration of transport sector in YAR

The organization of the government of YAR is shown in Appendix Fig. 6.3.1 and the organization of YAR transport sector is shown as Appendix Fig. 6.3.2. Various public agencies making up the transport sector have to report to the Ministry of Public Works and Transport under the new cabinet system of July 1988. The new relationship among organizations and the situation are as follows:

It was decided in July 1988 that Ministry of Public Works and Transport administers all the following agencies: YLTC, GLTC, YESCO, CAMA, Yemenia, YHA and PMAC. (See Appendix Fig. 6.3.3 and Fig. 6.3.4)

The Central Planning Organization (CPO) runs the planning process throughout the YAR. In particular, it formulates five year plans and monitors their implementation.

The General Secretariat for Transport Affairs (GSTA) was established in 1980 to provide a central function of coordination in the transport sector. However, it was hard to find little coordinating activities of GSTA among governmental agencies over the transport management. The newly organized Ministry of Public Works and Transport is said to incorporate the functions of GSTA into the ministry, but no organizational information was obtained in August 1988.

### 6.3.2 Administrations related to Urban Transportation Activities

Appendix Fig. 6.3.5 shows administrations related to urban transportation activities. Ministry of Interior has a department named General Traffic Office. They are responsible for the activities which are related to a traffic management and law enforcement. Traffic Police Department is organized in every Governorate under General Traffic Office.

Ministry of Communication and Transport had General Secretariat for Transport Affairs (GSTA). Taxi, micro-bus and medium-bus in

the cities had not been directly administered by GSTA. The situation is likely same under the new Ministry of Public Works and Transport (MPWT). At present, MPWT seems not active in controlling activities of those public service vehicles even in the new ministry system.

Ministry of Municipalities and Housing (MMH) is responsible for the development of urban facilities including infrastructure and housing projects (see Appendix Fig. 6.3.7). In the case of transport facilities, it covers activities such as preparation of road development plans, construction and improvement of roads in urban areas, maintenance and repair works of these roads. Recently MMH is planning to organize a special Department for the improvement and maintenance of urban roads. It should have functions of the data collection for road conditions and work system of the road maintenance.

#### 6.3.3 Fares on public service

Government pricing policies through cabinet approval determine the level of passenger fares of taxi, micro-bus, medium-bus in urban areas. Currently the fares for micro-bus and medium-bus are fixed in accordance with the distances of passenger travel in the city. Fare rates of those service are approved by a cabinet meeting and announced by Traffic Police. Fares for taxi use are negotiable.

#### 6.3.4 Local administration

Organization of municipalities of Taiz, Hodeidah and Sana'a are shown in Appendix Fig. 6.3.8 through Fig. 6.3.10.

#### 6.3.5 Traffic Department in MMH

MMH has organized in early 1988 a new administrative section in Physical Planning Department. It is named Traffic Planning Department, however its works are not yet systematized and education/training of the staff are urgently needed.

A review of the Japanese system is done on the definition and responsibility of the works of division/section in the administration in charge of traffic study and planning. It is found the written definition and responsibility of the work in central government organizations and local prefectural ones were determined many years ago. They show only a generalized basic framework but no detailed framework. Emphatical points of daily work have changed in order to meet requirements of growth and development in urban traffic. No worthy reference is found in the Japanese Government organization system.

Reminding the following conditions in MMH, the organization and main activities are proposed as follows:

1) Conditions

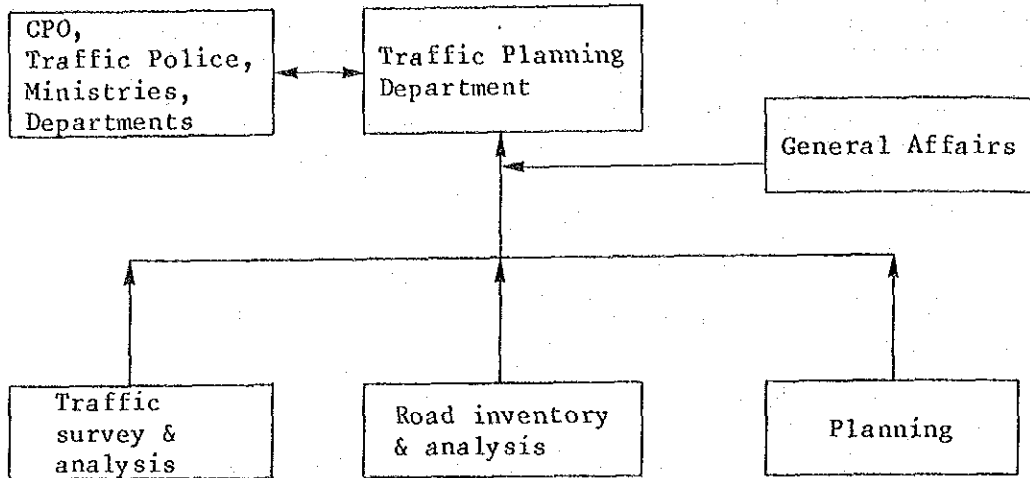
- The Department is newly established and any of their supposed traffic studies has not been conducted in any other departments of MMH.
- There are graduates of Civil Engineering Dept. of Sana'a University. However, it is hard to find persons studied Traffic Engineering in the University. Also it is difficult to have those qualified with traffic engineering and transport economic who studied abroad. On-the-job-staff-training should be conducted to raise the professional background of the staff in the new Department.
- A rapid growth is quite likely for the coming years in urban area and economy, road traffic and registered vehicles in YAR. Studies and policies to find the most effective use of transport facilities should be proposed by the new Department.

2) Staffing

It is urgent to strengthen the staff in the Department by giving educational training course and on the job training. Experienced experts shall be posted as advisory group for 3 - 5 years. They should provide the training on the job to the original MMH staff in the Department.

### 3) Organization

The organization of the Department should be divided into the following three sections, each having main functions.



#### General affairs

- Coordinating administrative matters and messages to/from other Dept., Ministries and so on.
- Accounting files of expenditures, travel expense, etc.
- Controlling the use of stationary, vehicles, counting machines, etc.
- Edition of annual report.

#### Traffic survey and analysis

- Determine and implement the program of traffic volume countings: regular and nonregular
  - Points
  - Timing
  - Vehicle type & pedestrians
- Survey on travel conditions and travel speed
- Survey on origin-destination of vehicles and persons
- Survey on parking status
- Data filing concerned with registered vehicles
- Data filing of accidents.

Road inventory  
and analysis

- Network and its component by route.
- Cross section, route, right of way, lighting, etc.
- Intersection & signal
- Parking space, no-stopping and non-parking zones.

Planning

- Coordinated with urban planning
  - Road development program
  - Plan of improvement and rehabilitation of the existing roads.
- Coordinated with Traffic Police
  - Facilities of traffic flow management including signals and pedestrian protection
  - Actions to reduce accidents
- Studies and researches on road users



**CHAPTER 7 PUBLIC PASSENGER TRANSPORT**





## CHAPTER 7 PUBLIC PASSENGER TRANSPORT

### 7.1 Transport Service and Related Organizations

#### 7.1.1 Intra-city service

Transport service can be divided into two categories: Private and Public. Private transport service is provided by those who own the vehicle and use it exclusively for their own purpose. The public service is an economic activity who receives money for the service of transportation. It is divided into passenger service and cargo service.

In Yemen, public passenger transport service is classified into inter-city service and in-city service. This study concentrates on the intra-city passenger service in Sana'a where rapid urban expansion has resulted in serious transport problems. The intra-city cargo transport service is conducted mostly by private small trucks. It is found that market and commercial operators in charge of "in city cargo transport" are yet developed. At this development stage, movement of these small trucks can be studied in the traffic flow analysis.

#### 7.1.2 Administrative system and operators

Main organizations concerned with public transport and their administrative activities are as follows:

##### 1) Administrative organizations

###### a. Traffic Police of Ministry of Interior

- Vehicle registration, operation certificate and their renewal
- Mechanical inspection
- Issue of driving license

Currently the traffic police do not control the number of vehicle fleets and the operation of public transport service such as micro-buses, medium buses and taxis.

b. Ministry of Public Works and Transport

The former administration of General Secretariat for Transport Affairs is incorporated into the new MPWT in July 1988. But no information of the new system is shown yet in August 1988. Supposed activities to be covered by the new Ministry are: -

- Filing of statistical data
- Study for development and projects
- Advice and supervision on road, sea and air transport
- Coordination among government agencies concerned with transport

2) Operators

a. Private owner/driver

The public passenger transport service in Sana'a city is totally operated by the private sector and there is no governmental control over the number of vehicles, hours of operation and routes/areas. Taxis and buses are run by individual owners/drivers who register the vehicle and receive operational certificate at Traffic Police Department.

b. General Land Transport Corporation (GLTC)

GLTC is a public corporation under the Ministry of Public Works and Transport under the new system July 1988. Currently GLTC operates inter-city regular bus services along main highways, where no private large bus operators are competing. The corporation is authorized to enter into intra-city bus services according to its establishment minutes. However, it has not joined in any intra-city service including Sana'a yet.

A letter was sent on 15th February 1988 from Prime Minister to Minister of Communications and Transport asking the Ministry to submit a plan of regular bus operation in Sana'a. Under the request of the Ministry, GLTC has to study and recommend a plan of service in Sana'a. The study will access this JICA report together with other studies conducted in the past.

## 7.2 Operational Service

### 7.2.1 Medium buses

#### 7.2.1.1 Vehicle fleet

Currently Traffic Police are renewing all vehicle license plates in Sana'a city, and it is likely that most public transport vehicles have already renewed the plates by January, 1988. According to the Traffic Police, the number of renewed plates of the medium buses in February 1988 is 186, and the majority of them are the public medium buses in Sana'a city.

It is found that, approximately 120 medium buses are in operation for general public use accounting for 65% of the total medium buses. The rest is for other uses such as chartered buses for tourists, etc. Majority of the vehicle make are Toyota Coasters and Daihatsu Light Buses having seat capacity of 24 passengers. Ages of most vehicles are in range of 5 to 8 years.

#### 7.2.1.2 Operation

The medium buses operate on 5 fixed routes as under:-

- (i) Tahrir Square -- Bab Al Yemen
- (ii) Tahrir Square -- Bub Shuub
- (iii) Tahrir Square -- Al Qa
- (iv) Al Qa - Tahrir Square - Bab Al Yemen - Al Qa
- (v) Bab Al Yemen -- Ber Ubayd. The only route connecting inner city and a suburb.

There are no passenger service facilities such as shelters and ticket/information corners at the terminals. Buses wait for passengers in line. Passengers are guided to get on the first bus and wait for other seats to be occupied. Payment of YR1.00 for a ride is directly to the driver or conductor, while no ticket is issued. The bus leaves whenever the seats are occupied mostly. There are no standing passengers because of the bus size. There is no regular time schedule.

There is no fixed stop on the routes. Buses stop anywhere they find passengers getting on or off. Some common stops of Bab Al Yemen -- Ber Ubayd route are near intersections of Taiz Road with Ring road, 45 m road, and 60 m road. Frequent stops of inner city routes are near intersections of Ali Abdul Mughni street with No. 7 street, Shuub street and Az Zubayri street in front of the Central Bank, etc. Operation hours are from 6 or 7 a.m. to 9 or 10 p.m.

Table 7.2.1 shows the summary of medium bus operation on a weekday of late December, 1987. The service frequencies in the peak hour are observed within a 3 minute interval. Fig. 7.2.1 shows the volume of passengers in the total of both directions carried by medium buses.

In general there seems no problem in the service along the existing bus routes. Rather it is found there are excessive medium buses on the limited routes. Based on the data of the vehicle fleet, service frequencies and travel time, it is estimated that most buses travel less than 5 hours a day and even in the peak hour most buses have to wait for their turn.

The total daily passengers of the medium buses are approximately 66,000 based on the following estimation:

- Total inner-city frequencies = 810 round trips
- Total inner-city passengers  
= (810 x 2) trips x 24 passengers = 38,880 passengers
- Frequencies of Bab Al Yemen -- Ber Ubayd route = 430 round trips
- Total Bab Al Yemen -- Ber Ubayd route passengers  
= (430 x 2) trips x 21 passengers x 1.5 turn over  
= 27,090 passengers
- Total medium bus passengers = 65,970 passengers
- Total medium bus person trips  
= 65,970 passengers x 0.9  
= 59,373 person trips

Where 0.9 is the ratio of number of person trips to number of passengers estimated by the public transport passenger survey. Bab Al Yemen - Ber Ubayd route carries the largest passengers.

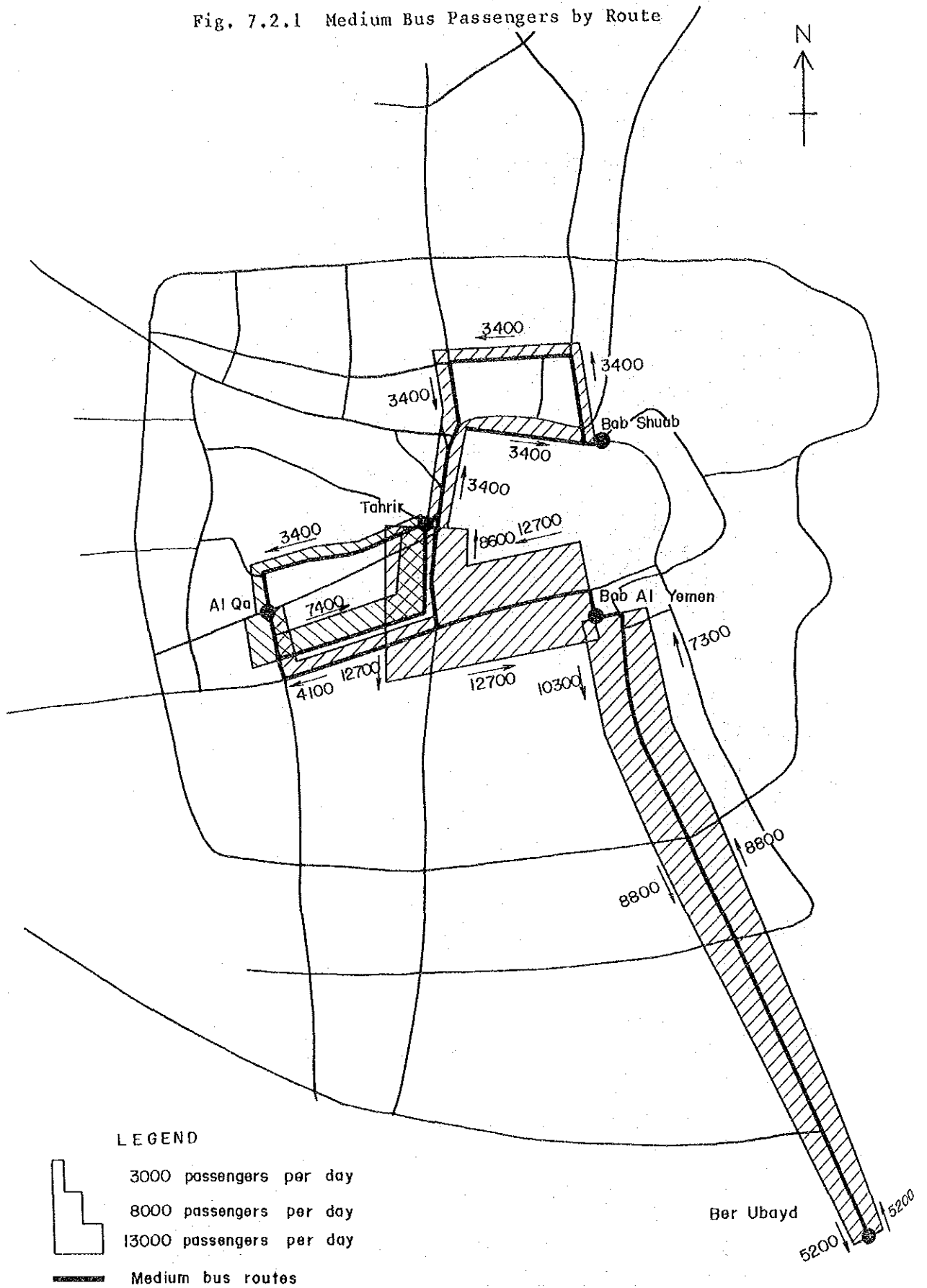
Table 7.2.1 Basic Characteristics of Medium Bus Daily Operation

Routes	Route length (Km)	Travel time (minutes)	Operation speed (Km/h)	Service frequencies (round trips/day)	Peak hour* (o'clock)	Peak ratio* (%)
Tahrir Sq. → Bab Al Yemen	1.7	9	11.3		12 - 13	17
Tahrir Sq. ← Bab Al Yemen	1.7	7	14.6	360	9 - 10	18
Tahrir Sq. → Bab Shuub	1.9	9	12.7		12 - 13	10
Tahrir Sq. ← Bab Shuub	2.5	7	21.4	140	7 - 8	14
Tahrir Sq. → Al Qa	1.5	6	15.0		12 - 13	17
Tahrir Sq. ← Al Qa	1.8	7	15.4	140	-----	--
Al Qa → Tahrir Sq. → Bab Al Yemen	3.5	16	13.1		-----	--
Al Qa ← Bab Al Yemen	2.5	12	12.5	170	12 - 13	14
Bab Al Yemen → Ber Ubayd	5.0	20 - 25	13.3		12 - 13	11
Bab Al Yemen ← Ber Ubayd	5.0	20 - 25	13.3	430	7 - 8	11

Source: Study Team, a weekday in December 1987

\*Note: The peak hour and peak ratio are calculated only for medium buses, from the results of traffic counting.

Fig. 7.2.1 Medium Bus Passengers by Route



### 7.2.1.3 Maintenance and parking

There is no common facility for maintenance work of the buses. Buses are maintained at various workshops in the city. At night most buses park at the driver's house or on road nearby.

### 7.2.1.4 Fares, earnings and expenses

The fare is YR 1 for one ride. It is generally thought to be reasonable by users. Concerning earnings and operation cost, interviews to the drivers were conducted. However, they were not cooperative in answering. No statistical data were collected. Daily earnings of a bus is approximated at around YR 550. Daily operation cost for petrol and oil is approximately YR 200 according to the limited number of answers, and the balance is for wage, depreciation, repair, etc.

## 7.2.2 Micro buses

### 7.2.2.1 Vehicle fleet

According to Traffic Police, the number of renewed number plates of the micro buses and taxis is 5714 in February 1988. By adding old number plates to it the total fleet of the operating micro buses and taxis is estimated at approximately 6,000.

The micro buses and taxis have the same type of yellow number plates, and no statistical data is available to separate the number into two groups. But the traffic counting survey results indicate that the ratios of micro buses and taxis are approximately 44% and 56% in Sana'a city. Thus the number of the micro buses is estimated at 2600, accounting for 7% of the estimated total vehicle fleet in Sana'a city in 1987.

The majority of the vehicles are Daihatsu 850 Cab Van and Suzuki Van, remodeled for passenger transport. Micro buses in use are in the range of 5 - 8 years old.

#### 7.2.2.2 Operation

There are no fixed routes of operation. Most of micro buses carry passengers on the roads to Bab Al Yemen and Tahrir Square. They travel on the trunk roads by picking up passengers. The travel route and terminus are the driver's decision. Fig. 7.2.2 shows main roads where micro-buses often travel, with the number of counted micro-buses and its percent share in the total volume.

Main points where many passengers get on and off are in front of Ministry of Public Works on Az Zubayri street, in front of Haddah Cinema of Haddah street, Hasaba intersection, Al Qa, and so on.

The daily total of micro bus passengers is approximately 200,000 as estimated by the following calculation:-

$$\begin{aligned} & \text{Passengers per bus} \\ & = \text{YR } 275 / \text{YR } 3.5 \\ & = 79 \text{ persons} \end{aligned}$$

Where YR 275 is estimated daily earnings and YR3.5 is the average payment of a passenger

$$\begin{aligned} & \text{Total passengers} \\ & = 79 \times 2600 \\ & = 205,400 \end{aligned}$$

Where 2600 is the micro bus fleet.

The estimated number of passengers on major roads are shown in Figure 7.2.3 based on the traffic counting survey and occupancy rate. Az Zubayri street, Taiz road and Ali Abdul Mughni street within Ring road have over 20,000 passengers. Among the major roads, Taiz road has the highest occupancy ratio of passengers as in Table 7.2.2. Typical operation hours of the micro buses are from 6 or 7 a.m. to 9.p.m. Hours of operation and resting time depend on the decision of drivers.

#### 7.2.2.3 Maintenance and parking

Maintenance and repair work are conducted at various workshops in the city at the driver's choice. Most buses are parked on road or the drivers' house at night.



Fig. 7.2.2 Micro Bus Traffic Volume on Main Roads and Main Routes

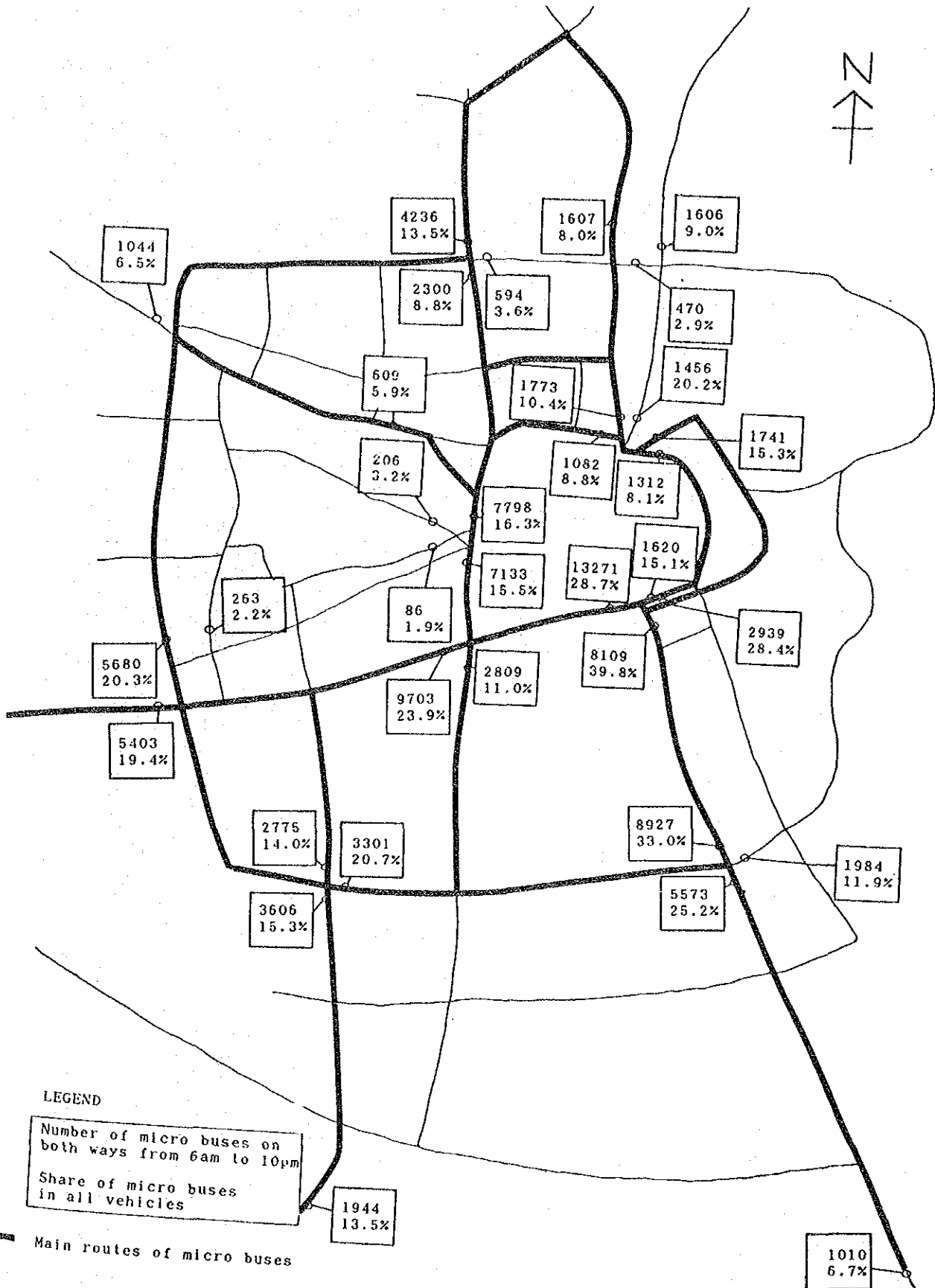


Fig. 7.2.3 Micro Bus Passengers on Main Roads

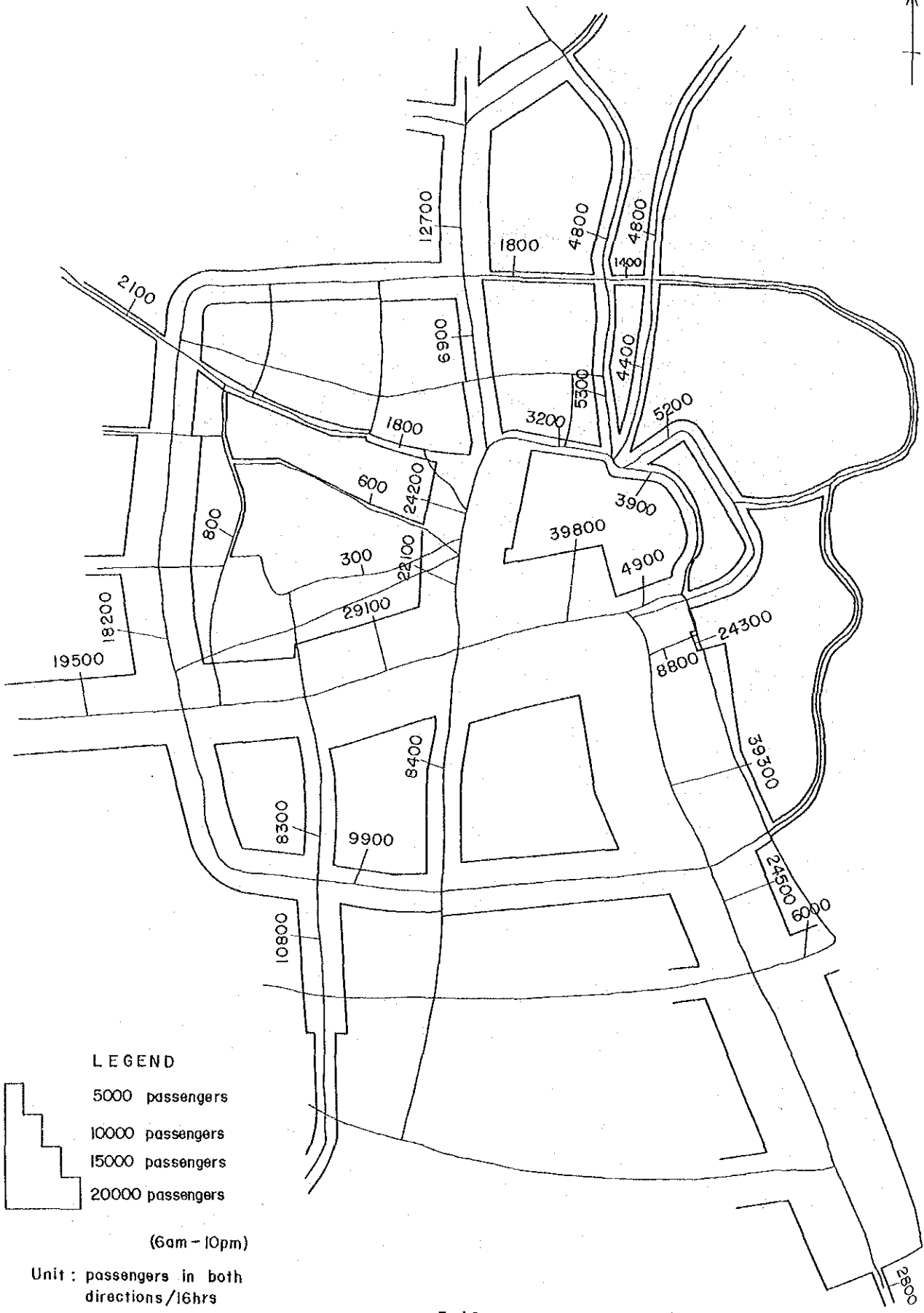


Table 7.2.2 Occupancy Survey Results of Micro Buses

Location	Number of vehicles	Number of passengers	Passengers per vehicle
West of Cable and Wireless station on Sadah road	53	115	2.2
East of Cable and Wireless station on Airport road	59	184	3.1
Al Bir Maafa on Marib road	146	316	2.2
At New Sana'a University on Wadi Dahr road	32	63	2.0
In front of Tahrir square on Ali Abdul Mughni street	201	628	3.1
In front of Old Sana'a University on Ring road	163	525	3.2
West of Dirasat Street on Az Zubayri street	158	579	3.7
South of Ring road on Taiz road	197	868	4.4
North of New Residential Town of Haddah on Haddah street	169	425	2.5
South of Ber Ubayd Qat Market on Taiz road	82	222	2.7
Total/Average	1260	3925	3.1

Notes

- 1) Passengers do not include drivers.
- 2) Number of vehicles and passengers are the total of both directions.
- 3) The survey was conducted during 7 a.m.-9 a.m., 10:30 a.m.-12:30 p.m. and 3 p.m.-5 p.m. on a week day in February 1988

#### 7.2.2.4 Fares, earnings and expenses

Efforts were made to interview drivers on their operational revenue and expense. They were too cautious to answer and limited data were gathered. According to these data, the following points are clarified (see also Table 7.2.3):

- fares are YR 2. - for a ride of less than 2 km  
YR 3. - for a ride of 2-4 km  
YR 5. - for a ride of more than 4 km
- Revenue per day YR 250 - 300
- Expenses Petrol and oil YR 80 - 90  
(If a driver rent a micro-bus, he has to pay YR 150 per day).
- Travel distance 150 - 250 Km per day

#### 7.2.3 Taxis

##### 7.2.3.1 Vehicle fleet

The taxi fleet in Sana'a city is estimated at 3400 or 56% of the total fleet of small public service vehicles. The share of taxis in the estimated total vehicle fleet of the city is approximately 9%. Taxis have a capacity of 4 passengers besides the driver except that van type taxis are of 6 passengers besides the driver. As in the case of micro buses, majority of taxis have been in use for over 5 years.

##### 7.2.3.2 Operation

Taxi service is divided into ordinary chartering and sharing ride. A taxi becomes either of them according to the demand of passengers. Taxis with sharing ride serve on the routes among Tahrir Square, Bab Al Yemen, Bab Shuub, etc. However, in addition to those, sharing rides are often seen on other streets.

Road sections with taxi volume of over 5000 per day are Ali Abdul Mughni street, Az Zubayri street and Airport road followed by Sadah road as in Fig. 7.2.4. The share of taxis is comparatively low on Taiz road and Haddah street.

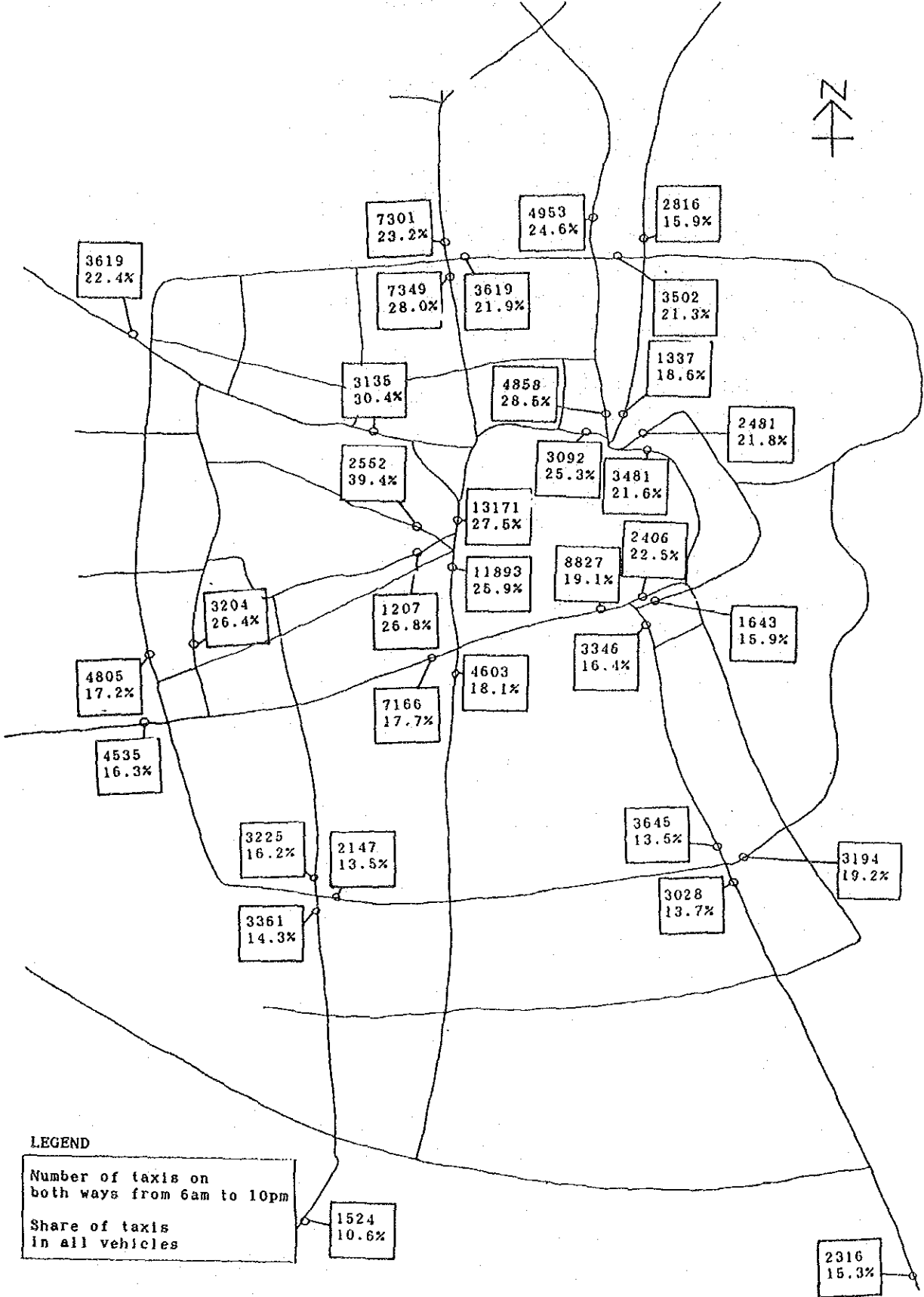
According to drivers, the typical daily operation distance is 50 km to 150 km. The total of the passengers carried by taxi

Table 7.2.3 Expense of a Micro Bus

Item	Expenses (YR)	Remarks
Petrol	70 - 75/day	23-25 liters/day
Oil	75 - 100/week	3-4 liters/week
Tyre	2400 - 2800/year	once a year
Maintenance except for engine replacement	3000 - 5000/year	

Source: Interviews to drivers by the Study Team

Fig. 7.2.4 Taxi Traffic Volume on Main Roads



can be estimated at 60,000 to 70,000 by the calculation as follows:

Daily earnings of a taxi = YR 250 - YR 300  
Average fare = YR 15  
Daily passengers =  $(250 - 300) \div 15 = 17 - 20$   
Taxi fleet = 3400  
Total passengers =  $3400 \times (17 - 20) = 58,000 - 69,000$

The estimated number of passengers on major roads are calculated by using average occupants in Table 7.2.4. They are shown in Fig. 7.2.5. Ali Abdul Mughni street, Al Qiyada street, Airport road, and Az Zubayri street have over 10,000 taxi passengers per day.

Table 7.2.4 shows average occupants of taxis. The high occupancy around the Ber Ubayd Qat market on Taiz road is due to a large share of van type inter-city taxis to and from the south.

At the airport and some international hotels, registered taxis operate exclusively for higher fares, for example, YR 150 between the city center and the airport.

#### 7.2.3.3 Maintenance and parking

Taxis are maintained at various workshops in the city and parked at night on the road or the driver's house as in the case of micro buses.

#### 7.2.3.4 Fares earnings and expenses

The fares are decided by negotiation between passengers and a driver. In case of sharing taxis, the fares are usually slightly higher than micro buses, that is, YR 2 for a less than 2 km ride or YR 4-5 for a 4 km ride. In case of ordinary chartered taxis, the fares are usually YR 10 - YR 20 for a ride up to 4-5 km distance. Drivers were generally reluctant to answer questions of income and expenditure. According to some interviews to drivers, daily earnings of a taxi are estimated at YR 250 to YR 300, and, if they do not own taxis, they mostly pay YR 150 to the owners per day.

Daily expenses on petrol and oil are around YR 100.

Table 7.2.4 Occupancy Survey Results of taxis

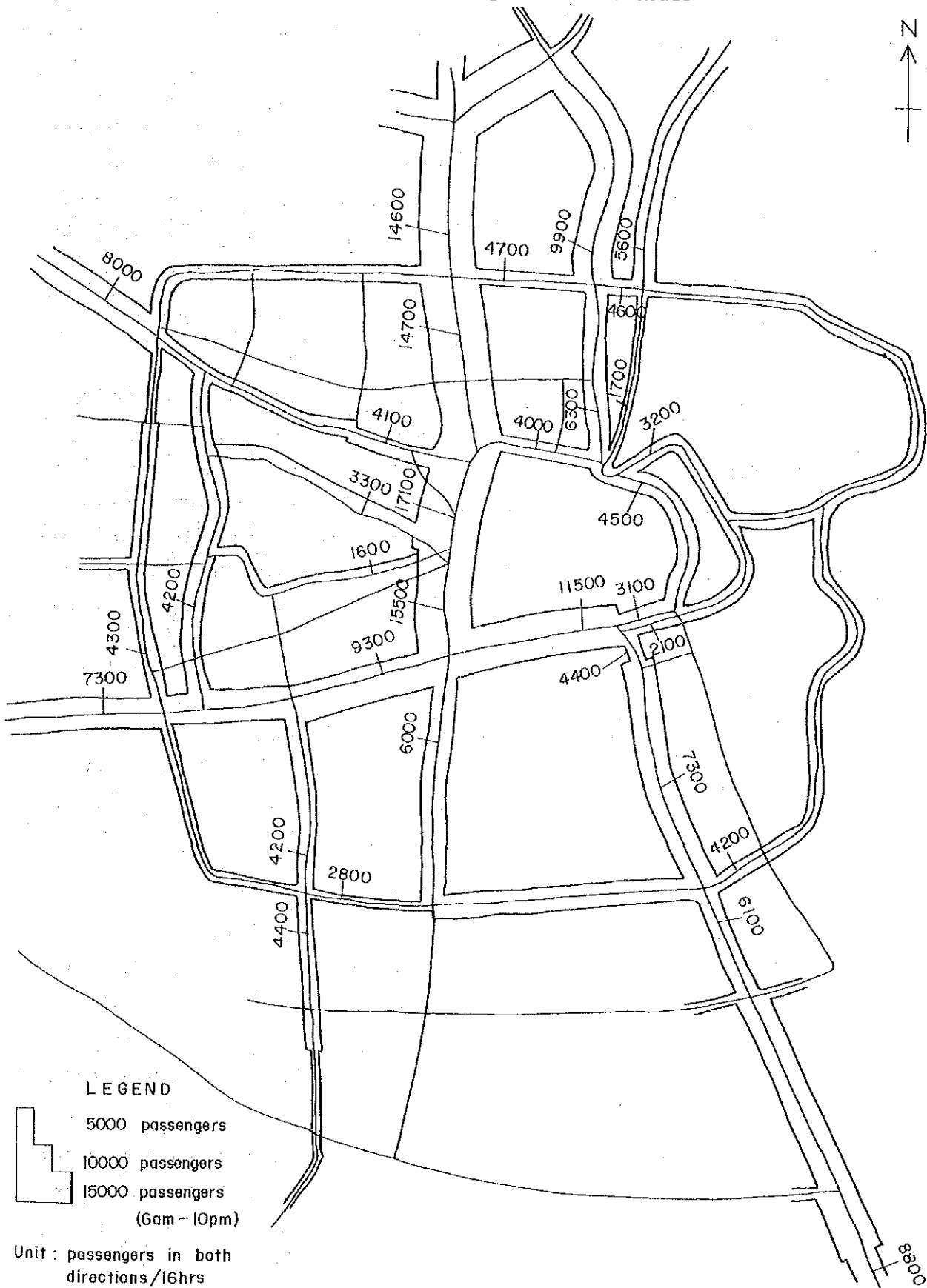
Location	Number of vehicles	Number of passengers	Passengers per vehicle
West of Cable and Wireless station on Sadah road	164	402	2.5
East of Cable and Wireless station on Airport road	168	436	2.6
At Bir Al Maafa on Marib road	146	280	1.9
At New Sana'a University on Wadi Dahr road	168	375	2.2
In front of Tahrir square on Ali Abdul Mughni street	202	247	1.2
In front of Old Sana'a University on Ring road	137	130	0.9
West of Dirasat Street on Az Zubayri street	121	189	1.6
South of Ring road on Taiz road	153	311	2.0
North of New Residential Town of Haddah on Haddah street	112	167	1.5
South of Ber Ubayd Qat Market on Taiz road	129	492	3.8
Total/Average	1500	3029	2.0

Notes

- 1) Passengers do not include drivers.
- 2) Number of vehicles and passengers are the total of both directions.
- 3) The survey was conducted during 7 a.m. - 9 a.m., 10:30 a.m. -12:30 p.m. and 3 p.m. - 5 p.m. on a week day in February 1988



Fig. 7.2.5 Taxi Passengers on Main Roads



### 7.3 Passenger Trip Characteristics

#### 1) Overall trips

The overall trips of Sana'a in 1987 are discussed in Chapter 9, from which Table 7.3.1 is prepared. It is considered that person trips using public commercial service of taxis, micro buses and medium buses are 207,000 which share 56% of trips using vehicles, while those using private vehicles are 162,000 (44%) in 1987.

#### 2) Interviewed trips

1443 passengers of public service in Sana'a were interviewed as in Appendix Fig. 7.3.1 and Appendix Table 7.3.1. The results were used to produce the origin-destination (OD) table shown in Appendix Table 7.3.2 based on the zoning in Appendix Fig. 7.3.2. The total trips are 148,000 who use public passenger service. They are approximately 70% of the figure shown in Table 7.3.1 since the interviewing could not cover the whole area.

#### 3) Range of passenger trips

The trip pattern is summarized into Table 7.3.2 and Fig. 7.3.1. It is found that of the total trips using public service vehicles 32% are within Ring road and 56% are trips between inside and outside Ring road.

#### 4) Modal shares of public transport passenger trips

Modal shares of public transport passenger trips are summarized in Table 7.3.3. The table shows that the major public transport mode is the micro bus, and that the majority 58% of public transport passengers use more than one ride. For example some passengers of sharing taxis use two or three taxis for a trip.

Fig. 7.3.2 shows public transport passenger trips classified into single ride trips and double or triple ride trips. Single ride trips are seen in short distant movement and concentrated on the two central zones.

Double and triple ride trips are seen between the central zones and suburban areas of Airport road areas, Ber Ubayd, etc.

5) Public transport passengers on major roads

Fig. 7.3.3 shows the passenger flow of private and public transport on major roads. A large number of passengers are seen on Az Zubayri street, Taiz road, Ali Abdul Mughni street, Al Qiyada street, Airport road followed by western sections of Ring road, Haddah road, etc.

A large number of public transport passengers are seen on Taiz road, the east-most section of Az Zubayri street, Ali Abdul Mughni street and Airport road. On the contrary Haddah street and Old Airport road have a low share of the public transport.

Fig. 7.3.4 shows the passenger flow using taxis, medium buses and micro buses. It is found that the medium bus routes such as Taiz road, a part of Az Zubayri street and Ali Abdul Mughni street have a high share of passengers using micro and medium buses. It is also found that Al Qiyada street and Airport road as well as Sadah road have a high share of taxis, where many sharing taxis are operating.

Table 7.3.1 Overall Trips in Sana'a 1987

Modes	Person trips	%
Total	587,000	100 %
Walk	218,000	37 %
Vehicle use	369,000	63 %
(Public)	(207,000)	(56 %)
(Private)	(162,000)	(44 %)

From Table 9.2.2.

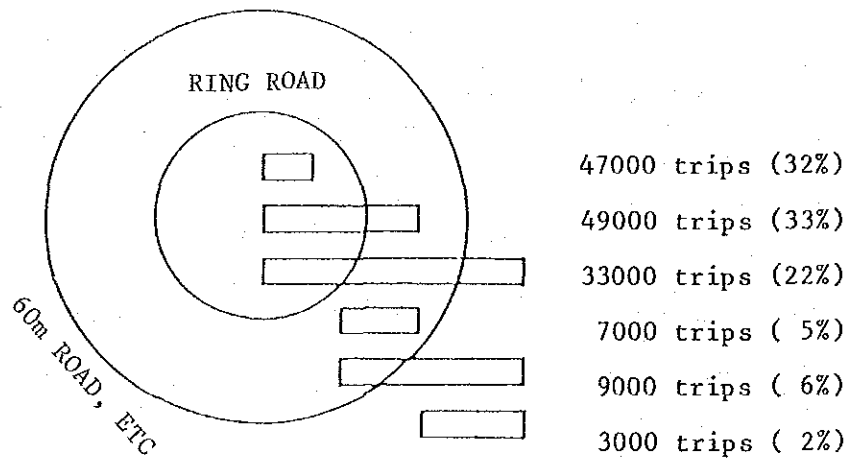
Table 7.3.2 Range of Public Transport Person Trips

	Within Ring road	Between Ring road and 60m road etc*	Outside 60m road etc*	Total
Within Ring road	47,043 (31.7)	49,325 (33.3)	32,995 (22.3)	129,363 (87.3)
Between Ring road and 60 m road, etc*	-	6,954 (4.7)	8,815 (5.9)	15,769 (10.6)
Outside 60 m road, etc*	-	-	3,113 (2.1)	3,113 (2.1)
Total	47,043 (31.7)	56,279 (38.0)	44,923 (30.3)	148,245 (100.0)

\* 60 m road, Ring road extension and the boundary of the peripheries of the eastern section of Ring road are shown in Fig. 7.3.1.

Source: Weighted and expanded results through the public transport passenger survey by the study team

Fig. 7.3.1 Pattern of Public Transport Person Trips



Source: Weighted and expanded results through the public transport passenger survey by the study team

Table 7.3.3. Person Trips Using Public Service Vehicles

Mode	Number of trips	Share (%)
Medium bus	15294	10.3
Micro bus	39215	26.5
Taxi	8010	5.4
Single ride total	62519	42.2
Medium bus & medium bus, micro bus, taxi or other	23312	15.7
Micro bus & micro bus, taxi or other	39833	26.9
Taxi & taxi or other	5276	3.6
Double rides total	68421	46.2
Triple rides total	17305	11.6
Total	148245	100.0

Source: Weighted and expanded results through the public transport passenger survey by the study team

Fig. 7.3.2 Public Transport Person Trips of Single Ride and Multiple Rides

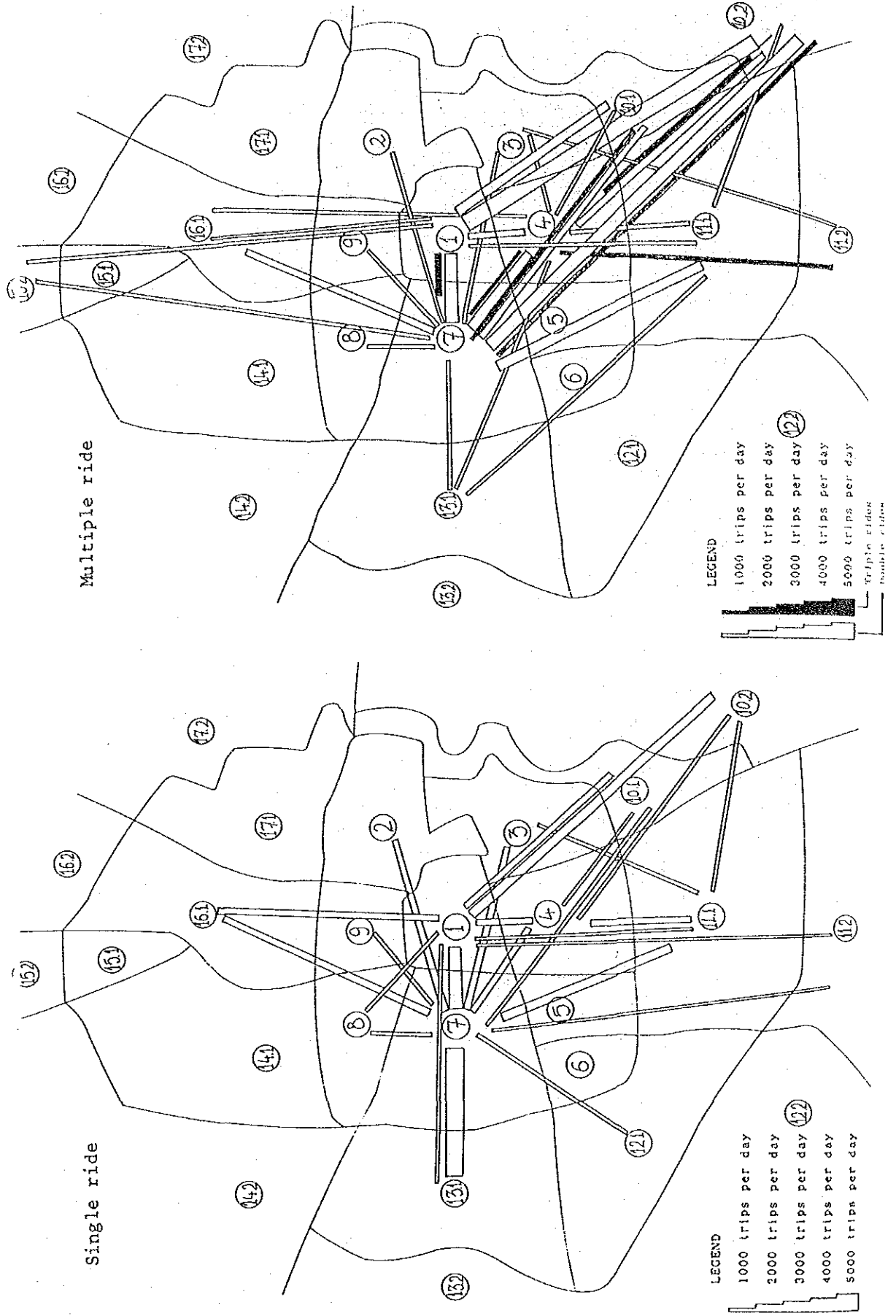


Fig. 7.3.3 Passenger Flow of Private and Public Transport on Main Roads

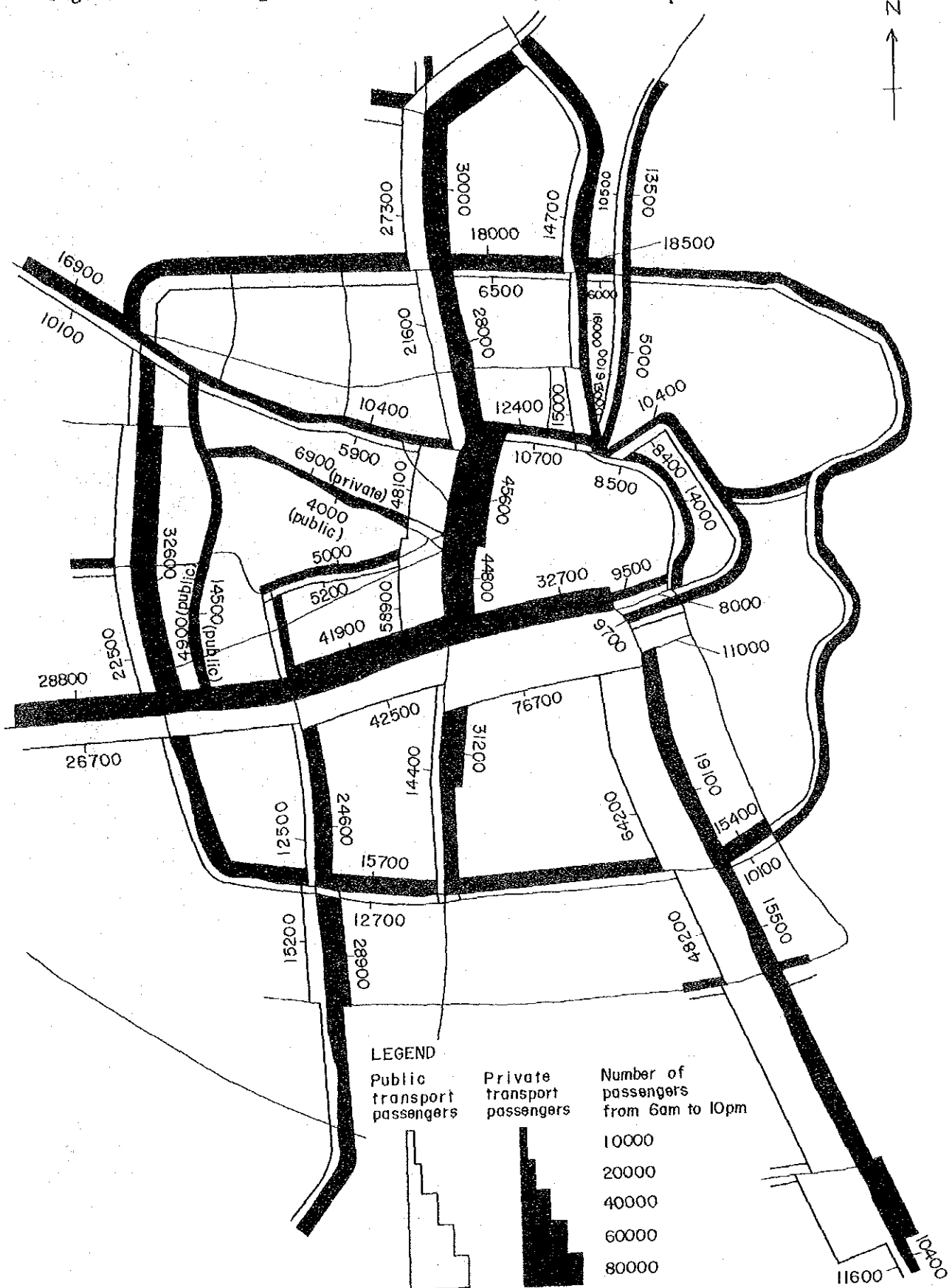
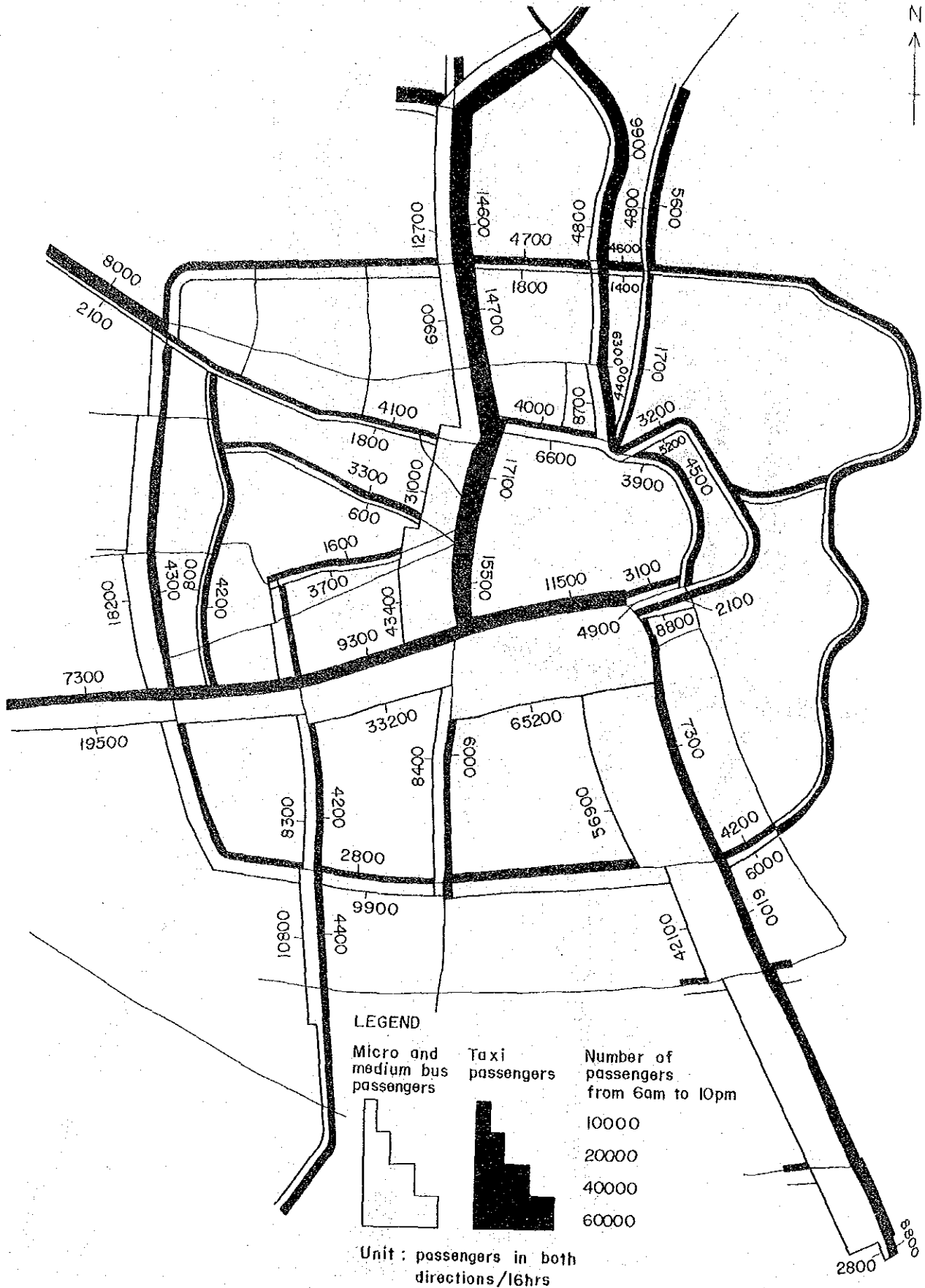


Fig. 7.3.4 Passenger Flow of Taxis and Buses on Main Roads





6) Trip purposes

Table 7.3.4 shows share of passenger trip purposes using public service vehicles. The distribution shows that 18% is for business, which includes movement of persons associated with small scale shops and stores. Students going to schools occupy 14% because few school buses are in operation. Hourly distribution shows large shares of trips to go home from 11 a.m. to 2 p.m. reflecting the work and school closure time.

7) Transport efficiency by vehicles

Table 7.3.5 shows the average passengers per vehicle resulted from the survey, and average passengers per pcu. These figures indicate the efficiency of large size vehicles on roads.

Table 7.3.4 Trip Purpose Distribution of Public Transport Passengers

Trip purpose Time	To work	To school	For Business	Shopping and others	To go home
AM					
7-8	41.1	35.1	13.1	6.5	4.2
8-9	38.9	20.7	22.2	11.1	7.1
9-10	34.5	15.0	21.8	13.6	15.1
10-11	25.8	10.1	21.8	18.3	24.0
11-12	18.7	6.3	17.4	18.8	38.8
PM					
12-1	14.4	8.1	16.7	16.2	44.6
1-2	11.1	7.4	7.9	16.4	57.2
Total	25.9	13.9	17.5	14.8	27.9

Source: Public transport passenger survey by the study team

Table 7.3.5 Passengers per PCU

Type of vehicle	PCU	Passengers per vehicle	Passengers per PCU	Remarks
Motorcycle	0.3	1.1	3.7	including a driver
Passenger car	1.0	2.0	2.0	including a driver
Taxi	1.0	2.0	2.0	excluding a driver
Micro bus	1.3	3.1	2.4	excluding a driver
Medium bus	1.5	20	13.3	excluding a driver
Other bus	1.6	12.0	7.5	excluding a driver
Light truck	1.3	0	0	excluding a driver
Heavy truck	2.0	0	0	excluding a driver

Source: Vehicle Occupancy Survey by the study team for Micro bus and taxi, see Table 7.2.2 and Table 7.2.4.

**CHAPTER 8 CURRENT PROBLEMS**



## CHAPTER 8 CURRENT PROBLEMS

### 8.1 Roads, Intersections and Parking

#### 8.1.1 Roads and intersections

As explained in Chapter 4, existing conditions of roads, the maintenance and rehabilitation system, the pavement of collector streets, the sidewalks and crossings of pedestrians, intersections in terms of geometric elements and traffic safety in each city are not satisfactory. Current problems related to roads and intersections are shown as follows:

- a. There is no road maintenance organization nor annual program at the Municipal level nor in MMH. Accordingly, it is necessary to establish a high-quality road maintenance and repair system for marking, pavement and other structures.
- b. Most of intersections in each city are in poor conditions in terms of geometric elements and traffic safety; for instance, installation of traffic signal control at major points should be considered together with clear markings on the pavement such as the lane, the width of carriage way, the side strip, the stopping position of vehicles, and pedestrian crossing. Some intersections are too large to control traffic flows.
- c. Sidewalks are provided along most of the main roads in each city, but their condition is not satisfactory for pedestrian movement. The surface is deteriorated partially, and not repaired. The width is not uniform because private structures such as footsteps, fences, buildings, etc. are not evacuated yet from the planned right of way.

#### 8.1.2 Parking spaces

- a) Parking space is inadequate in the areas where commercial and business activities are concentrated.
- b) Off road parking lots are found at only a few locations. They are often occupied by taxis and medium buses, thus excluding the parking of other vehicles.

- c) Many of the roadside parking is not marked separately from the road-way. Vehicles park angle and in double lines in inappropriate locations, thus reducing the capacity of streets. This capacity reduction is a major cause of congestion of traffic flows.
- d) Accidents at the road-side parking spaces are seen frequently.
- e) The road-way with narrow shoulders is reduced in capacity if there are vehicles parked on this narrow shoulder.

## 8.2 Traffic Flows and Management

Traffic in Sana'a tends to concentrate in the central areas, where commercial and business activities are high. Traffic congestion is limited to several points on arterials leading to the central area and narrow streets linked to those arterials.

In Taiz, traffic congestion occurs on two arterial roads as Jamal St. and Al Jaynai-26th September St. On the other hand, traffic congestion in Hodeidah is not serious as found by traffic survey.

Traffic congestion in Sana'a is partially caused by the inadequate road capacity, but mainly caused by poor driving habits, pedestrians, and by the lack of well-developed traffic management through traffic signal control, traffic signs and rules. Congestion and conflict are found also at uncontrolled intersections. Traffic congestion in Taiz is caused mainly by the inadequate road capacity.

The number of traffic accidents in each city has increased during past 5 years along with the increase in vehicle ownership. There are many locations of high occurrence of accidents in Sana'a. It is caused mainly by unsignalized intersections, vehicles changing lane suddenly, obstruction by stopping micro buses, indiscriminate crossing of pedestrians and lack of discipline in driving behavior. Current problems related to traffic flows and management are shown as follows:

a. Vehicle traffic

- \* Traffic congestion at signalized intersections
- \* Traffic congestion caused by micro bus stopping and slow-moving at road side
- \* Obstruction of traffic flow caused by left-turning vehicles
- \* Traffic congestion at unsignalized intersection caused by merging and diverging traffics.
- \* Traffic congestion by road-side parked vehicles often neglecting rules of parking.
- \* Traffic congestion caused by stopping for parking and leaving out of parked lot.

b. Pedestrian traffic

- \* Obstruction of passenger movement by curb parking
- \* High frequency of traffic accidents
- \* No signals are found for pedestrians.
- \* No protective facilities are installed for pedestrians.

c. Public vehicles

- \* Frequent and irregular stops by micro-buses, taxis and other vehicles neglecting traffic rules and signboards have caused accidents and traffic flow congestion. Disordered flows are prominent particularly in major terminals in the central area.

d. Signals and signboards

- \* Traffic signal lights are weakly illuminated. Supporting poles too short in height.
- \* There are eight signals not working out of 23 signals.
- \* Signboards of stop, no-parking, no-entrance, etc. are few in number. Pavement markings are worn out and hard to confirm by drivers and pedestrians. (See the pictures A, D and E in chapter 6)

Problems in Taiz and Hodeidah are mostly same. But those in Hodeidah are quite modest. Problems in Taiz have characteristics caused by the terrain conditions and Wadi streams, which will require a large amount of investment for solution.

### 8.3 Public Passenger Transport Service

In general, the public transport demand can be met by the existing fleet of micro buses, medium buses and taxis. They operate on a commercial basis and tend to concentrate on busy built up areas while service in suburban areas tend to remain rather low. Current problems related to public transport are as follows:

- a. The medium bus routes are limited to the inner city and Taiz road. Micro buses do not have fixed routes nor regular operation. Suburban areas have less frequent services of taxis and micro buses. Some passengers away from common routes of buses need more than one ride. There is a real need for more systematic operations and a clearly defined public transport network.
- b. Traffic around bus/taxi terminals does not run in an ordered manner. It prevents a smooth flow of passenger users, pedestrians and vehicles, thus causing congestion and accidents. Inter-city bus/taxi terminals also cause traffic congestion in similar manner. The problem should be also considered in traffic flow management.
- c. Passenger service facilities such as shelters, signs on vehicles and information boards are poor.
- d. Fares of taxis and micro buses are not clearly fixed nor shown explicitly.
- e. Due to an excessive supply of vehicles in large cities, the operation efficiency and/or occupancy is low.
- f. Traffic congestion reduces the operator speed of public service vehicles, and they again increase congestion.
- g. At present the public transport is operated mostly by individual drivers and there is no integrated organization nor overall rules of operation.



- h. Disorderly movement such as frequent and sudden stops and lane change by buses and taxis cause traffic congestion and accidents.
- i. It is said the government is banning import of micro bus, intending to reduce the fleet size. However, a target in fleet size is not shown.
- j. Some government offices have medium sized buses transporting their own employees. This is a management matter of each office in order to maintain comuting system of own employees. If a systematic public bus service network is developed, the office may not need to maintain its own bus system.

#### 8.4 Assessment of Current Problems

##### 8.4.1 Criteria for evaluation

In order to make an evaluation of current traffic problems on major roads, evaluation standards must be established. Problems are classified in such items as traffic flow at intersections (signalized/unsignalized), pedestrian crossing, micro bus stopping, traffic movement to and from minor streets, left-turning traffic, traffic accident frequency, parking condition on street. The standards of evaluation are shown as follows:

- a. Frequency of accidents per year
- b. Average travel speed during peak hour on the street.
- c. Parking density on streets (demand/capacity).
- d. Traffic congestion rate (traffic volume/capacity) at intersection.
- e. Lateral clearance and width of sidewalk.

Table 8.4.1 shows the classification of problems methods of measurement, criteria for evaluation. Accidents are evaluated as serious when the occurrence is more than 5 accidents per year and tolerable when the number is less than 4. Observed average travel speed is classified into two categories: less than 10 km/hr and from 10 km/hr.

The percent ratio of stop time caused by one item of problems (identified through the field survey) over the total stop time is calculated in Appendix Table 5.2.1.1. Those ratios of more than 50% are evaluated together with the average speed less than 10 km/hr, resulting in the "serious" while the percentages more than 50% and the average speed of 20 - 10 km/hr are earmarked "tolerable".

Due to the fact that the data studied in the Table 8.4.1 are rather limited and leave some causes and problematic sections not assessed thoroughly, repeated field observations were conducted to diagnose the traffic problems. The locations of problematic intersections/road sections were determined thus and shown in Fig. 8.4.1 through 8.4.3.

#### 8.4.2 Current traffic problems

The sections of major roads evaluated to be in poor conditions based on the above-mentioned criteria are given in Appendix Tables 8.4.1 and 8.4.2. Fig. 8.4.1, Fig. 8.4.2 and Fig. 8.4.3 show the problem locations. In Sana'a city, the central area bordered by Ring road and the northern commercial district near Airport road and Sadah road are found to be problem areas with regard to traffic congestion. Ali Abdul Maghni-Al Qiyada and Az Zubayri streets have especially large traffic volume consequently with serious problems.

In Taiz city, traffic problems are especially heavy on Jamal St. and 26th September St. because other arterial roads are not developed yet. Streets in the built-up area are narrow, hilly and winding, with low capacity. They are physically not suitable for vehicle traffic. Minor improvements of those streets will not be effective for vehicles. An area-wide redevelopment and rehabilitation plan should be adopted in the area. Studies for the plan have recently begun in MMH, which in turn is said to be included in the World Bank's Third Urban Project Loan.

On the other hand, traffic problems in Hodeidah are not serious, mainly due to the fact that traffic volume on roads is not heavy.

Table 8.4.1 Criteria for Evaluation of Traffic Condition by Section

Causes of Existing Traffic Problems	Measurement 1	Measurement 2	Criteria 1) 1	Criteria 4) 2	Evaluation
1. High Frequency of Occurrence of Accidents	Accidents at Intersection (1987) 1)		> 5.0 < 4.0		Serious Tolerable
2. Waiting at Intersections	Average Travel Speed (KM/H) 3)	Percent Ratio of Classified Stop Time/Total Stop Time	< 10KM/H < 20KM/H	> 50% > 50%	Serious Tolerable
3. Indiscriminate Crossing of Pedestrians	- do -	- do -	< 10KM/H < 20KM/H	> 50% > 50%	Serious Tolerable
4. Stopping Caused by Micro-buses & Taxis	- do -	- do -	< 10KM/H < 20KM/H	> 50% > 50%	Serious Tolerable
5. Traffic Merging from Minor Road	- do -	- do -	< 10KM/H < 20KM/H	> 50% > 50%	Serious Tolerable
6. Traffic Diverging to Minor Road	- do -	- do -	< 10KM/H < 20KM/H	> 50% > 50%	Serious Tolerable
7. Influence of Cars Turning to the Left	- do -	- do -	< 10KM/H < 20KM/H	> 50% > 50%	Serious Tolerable
8. Enter & Leave on Streetside Parking Space	- do -	- do -	< 10KM/H < 20KM/H	> 50% > 50%	Serious Tolerable
9. High Parking Density & Heavy Traffic	- do -	Parking Density in % (Parked Veh/Capacity)	< 10KM/H < 20KM/H	> 50% > 50%	Serious Tolerable
10. Congestion at Signalized Intersection		Congestion Ratio at Intersection		less than 1.0 more than 1.0	Serious Tolerable
11. Physical Condition 2)		Lateral Clearance Side Walk		less than 1.0 more than 1.0	Serious Tolerable

Notes: 1) Accident data are studied in Appendix Table 5.4.1

2) Speed on inventory study of Chapter 4

3) Studied in Appendix Table 5.2.1.1

4) > 5.0 means more than 5.0  
 < 4.0 means less than 4.0  
 > 50% means more than 50%  
 > 100% means more than 100%  
 < 10KM/H means less than 10KM/H  
 < 20KM/H means between 20KM/H and 10KM/H

Fig. 8.4.1 Locations of Current Traffic Problems in Sana'a

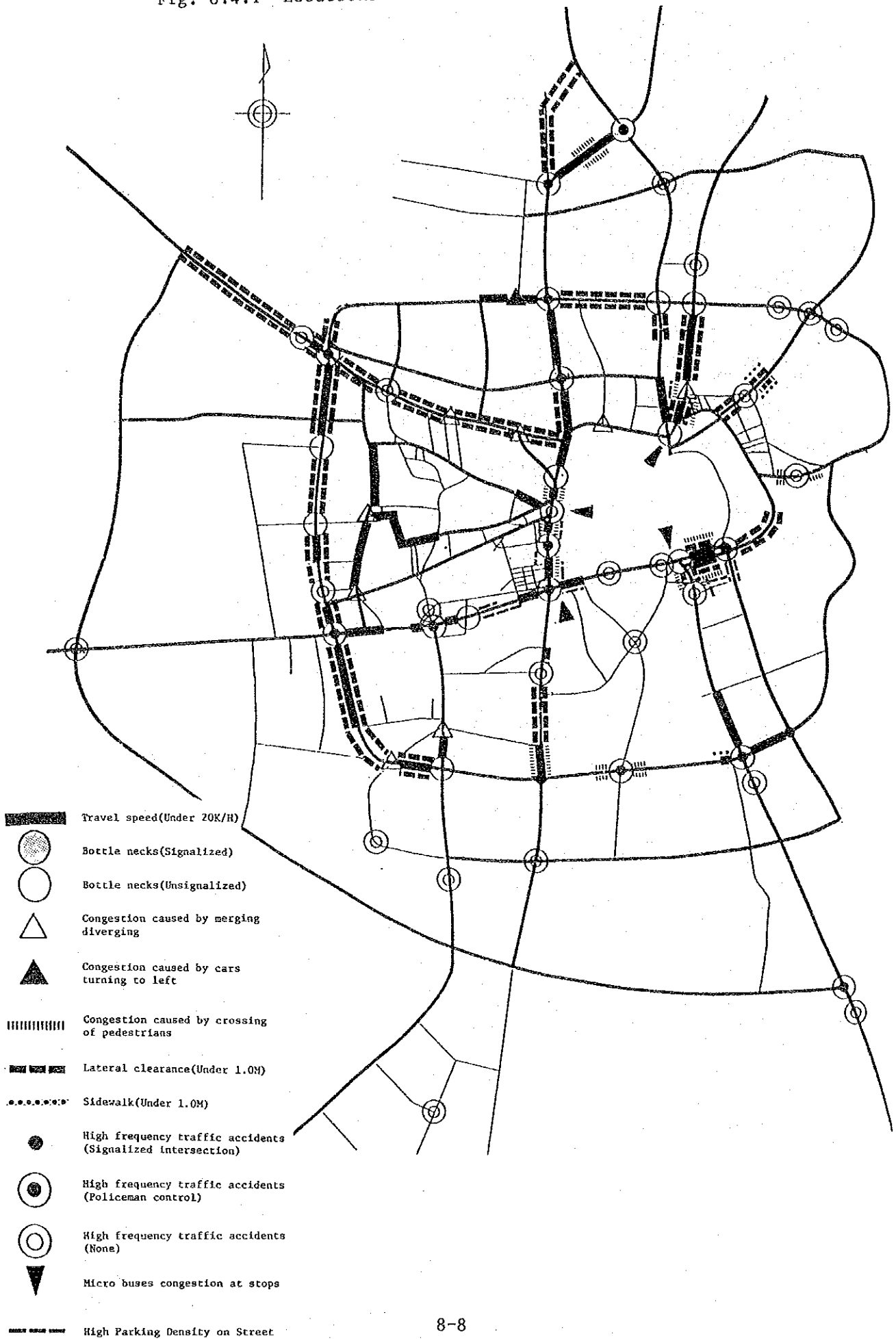
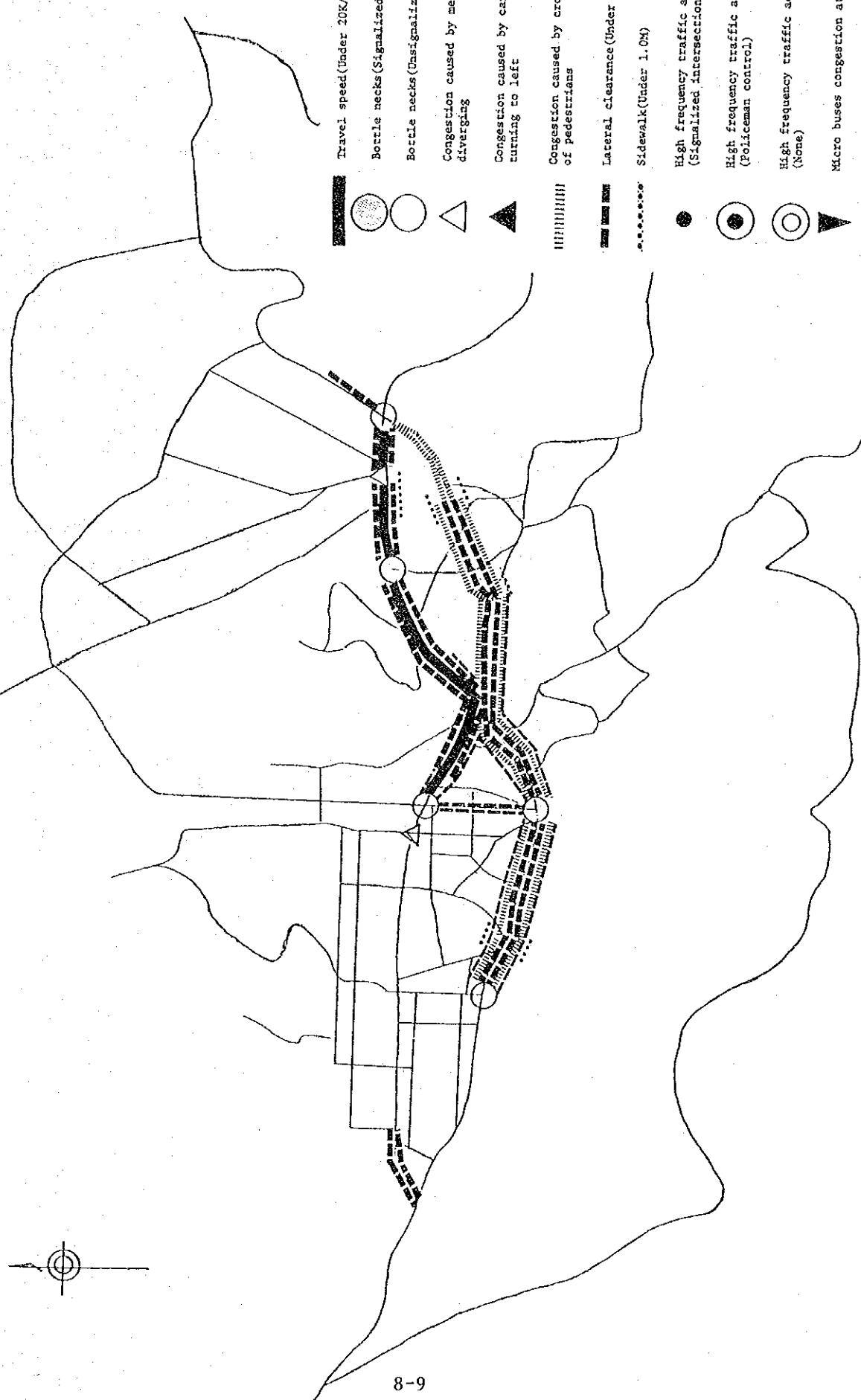
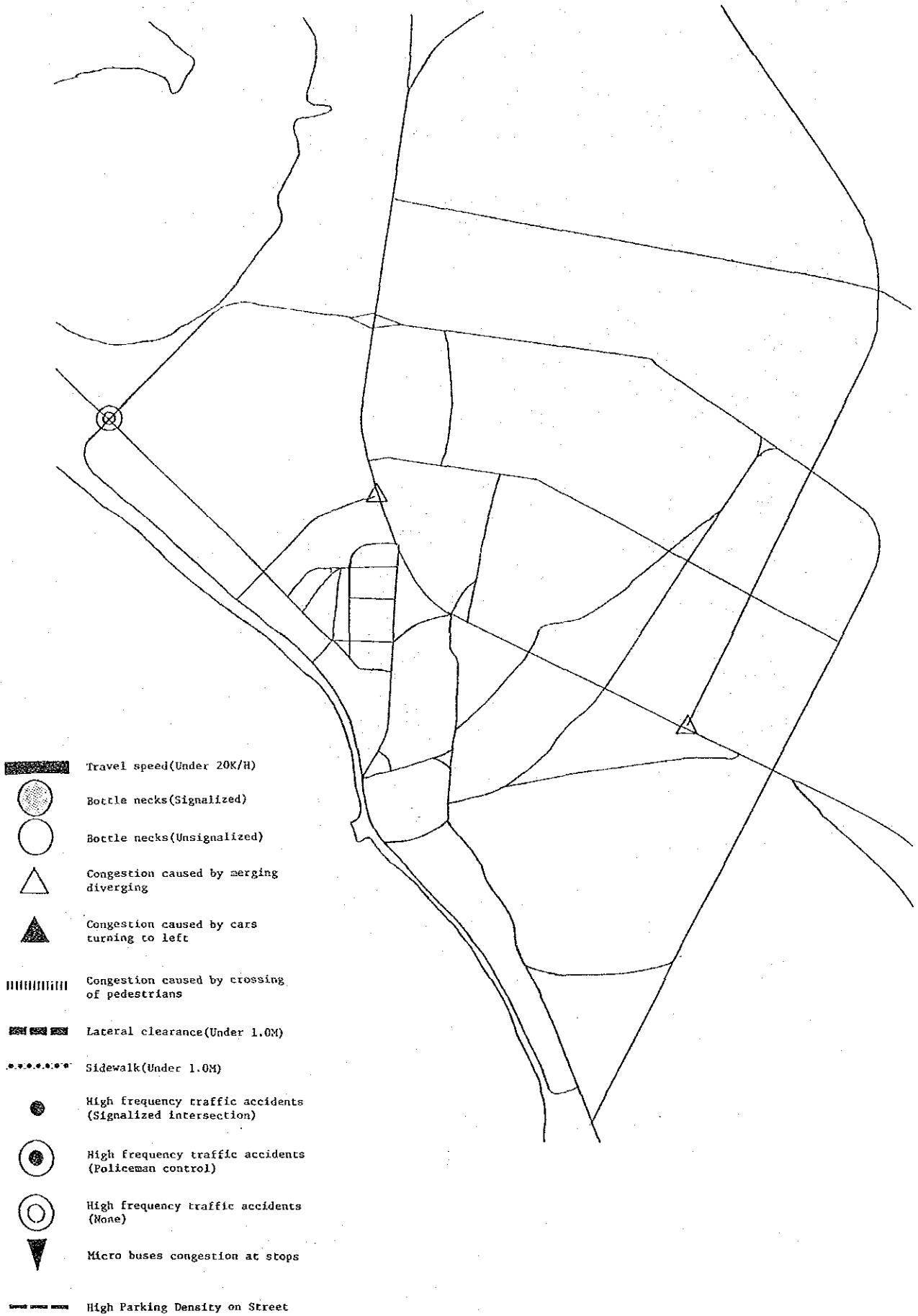


Fig. 8.4.2 Locations of Current Traffic Problems in Taiz



- Travel speed(Under 20K/H)
- Bottle necks(Signalized)
- Bottle necks(Unsignalized)
- Congestion caused by merging/diverging
- Congestion caused by cars turning to left
- Congestion caused by crossing of pedestrians
- Lateral clearance(Under 1.0M)
- Sidewalk(Under 1.0M)
- High frequency traffic accidents (Signalized intersection)
- High frequency traffic accidents (Policeman control)
- High frequency traffic accidents (None)
- Micro buses congestion at stops
- High Parking Density on Street

Fig. 8.4.3 Locations of Current Traffic Problems in Hodeidah



**CHAPTER 9 TRAFFIC GROWTH PROSPECT**





## CHAPTER 9 TRAFFIC GROWTH PROSPECT

### 9.1 Traffic Growth

Y.A.R. is in the process of economic development which has accompanied increased use of vehicles. It is likely that vehicle use will increase further in the future, even with the constraints imposed on the economy of the country. However, the rate of increase of traffic may differ from those in the past and among the regions or cities because of changing economic circumstances.

A macroscopic study of the growth rate of road traffic was conducted in the three cities and the estimate is calculated for 1992 when the recommendable short term action plans would be scheduled to be completed. The forecast in 2000 is also discussed. The forecast in 2000 can be used as an indication of the increased traffic volumes, which in turn necessitates a long range plan of road network construction and of transport policies.

### 9.2 Traffic Growth Forecast

Traffic growth trend was studied by using population data, the trip rate per person and registered vehicles.

#### 9.2.1 Population

Population forecast was discussed in Chapter 3 from which the figures for 1991 and 2000 are summarized as follows:

	1987	1991	2000
Sana'a	465,000	650,000	1,080,000
Taiz	189,000	239,000	403,000
Hodeidah	164,000	208,000	351,000

From Tables 3.1.1.1, 3.1.2.1 and 3.1.3.1.