

**YEMEN ARAB REPUBLIC**  
**URBAN TRANSPORT STUDY**  
**IN**  
**YEMEN ARAB REPUBLIC**  
**FINAL REPORT**  
**VOLUME 2, APPENDIX**

**NOVEMBER 1988**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

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国際協力事業団

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Appendix Table 2.1.1 Government Expenditures and Receipts

(Y.R. Million of current prices)

Year	1980	1981	1982	1983	1984	1985	1986
Current Expenditure	2,953	3,325	5,181	6,200	5,770	6,046	NA
Capital Expenditure	3,919	3,683	4,017	2,944	3,100	3,422	
Extra Budgetary Expenditure	137	789	1,764	922	1,147	1,528	
Total Expenditure	7,010	7,797	10,962	10,067	10,024	10,996	NA
Revenues	3,050	3,335	3,698	4,405	4,650	5,376	
Grants	666	1,519	2,004	852	761	660	
Budget Deficit	3,294	2,943	5,262	4,807	4,613	6,036	NA
Deficit Financing							
Domestic	1,263	2,024	4,425	3,913	3,807	4,176	
External	2,030	920	847	900	806	972	

Source: Transport Sector Study (COP/RPT Econ. Study Group, October 1986) and CPO January, 1988.

Appendix Table 2.1.2 Gross Fixed Capital Formation (Total of Private & Public Sectors): 1981-86

	(In Y.R. Millions)													
	At constant prices of 1981					At current prices								
	1981	1982	1983	1984	1985	1986	1981-86 (% p.a.)	1981	1982	1983	1984	1985	1986	1981-86 (% p.a.)
1. Agri. Forest, Fishing	436	408	547	540	461	329	-5.8%	436	424	592	596	619	529	3.9%
Mining & Quarry	59	69	57	141	26	32	-13.0%	59	72	62	157	35	52	-2.6%
Manufacturing	376	227	193	171	430	282	-5.9%	376	237	209	191	578	451	3.7%
Electri. Gas, Water	1,111	1,000	497	499	625	500	-17.3%	1,111	1,041	538	556	839	801	-6.7%
Construction	80	50	50	71	77	72	-2.1%	80	52	54	79	104	116	7.7%
Whole & Retail Trade	526	231	214	201	200	161	-26.7%	526	241	232	224	269	257	-15.4%
Transport & Comm. 1)	857	1,069	764	486	240	357	-19.1%	857	1,013	827	541	322	571	-8.5%
Financial Inst.	44	33	58	41	32	49	2.2%	44	34	63	47	44	79	12.4%
Real Est. & Busin. S.	790	651	713	814	612	577	6.5%	790	778	772	905	820	923	3.2%
Community, Social	1,627	1,735	964	1,180	683	726	-17.5%	1,627	1,806	1,044	1,315	917	1,163	6.9%
Total	5,906	5,443	4,057	4,138	3,386	3,085	-13.9%	5,906	5,698	4,393	4,610	4,547	4,938	-3.6%
2. (Transport. & Comm.) 1)	(857)	1,069	764	486	240	357	-19.1%	(857)	1,013	827	541	322	571	-8.5%
(Private Sector)	(345)	321	347	114	46	43	-51.6%	(345)	234	376	127	60	69	-38.0%
(Public Sector)	(512)	748	417	372	194	314	-10.3%	(512)	779	451	414	260	502	-0.4%

Statistical Year Book (C.P.O. 1986 & 1987)

Notes: 1) Transport & Communication sector is divided into private and public, which are shown in 2. ( ).  
2) 1986 figures are provisional.



Appendix Table 2.1.3 Per Capita GNP &amp; GDP

	1981	1982	1983	1984	1985	1986	1981-86 p.a.
A. Population	8,540	8,682	8,826	8,973	9,122	9,274	1.7%
B. GNP							
1) Cur. P in Mill.	18,627	23,169	23,727	25,416	37,210	44,726	19.1%
. Per capita GNP in Ryals	2,181	2,669	2,688	2,832	4,074	4,773	17.0%
2) Const. prices in 1981, Mill.	18,627	20,057	19,315	19,453	23,055	24,072	5.3%
. Per capita GNP	2,181	2,310	2,188	2,168	2,664	2,701	4.4%
C. GDP							
1) Cur. P in Mill	13,111	16,395	17,729	19,297	30,939	37,472	23.4%
. Per capita GDP in Ryals	1,535	1,888	2,008	2,150	3,575	4,205	22.3%
2) Const. prices in 1981, Mill.	13,111	14,193	14,432	14,770	19,139	20,254	9.1%
. Per capita GDP in Ryals	1,535	1,635	1,635	1,646	2,098	2,184	7.3%

Statistical Year Books (CPO 1986, 1987)

- Notes:
1. Estimated by using the population in 1981 and 1986.
  2. B 2) Estimated by using the ration of GDP in constant prices and current prices.
  3. Per capita figures in 1981-86 are calculated in this study.



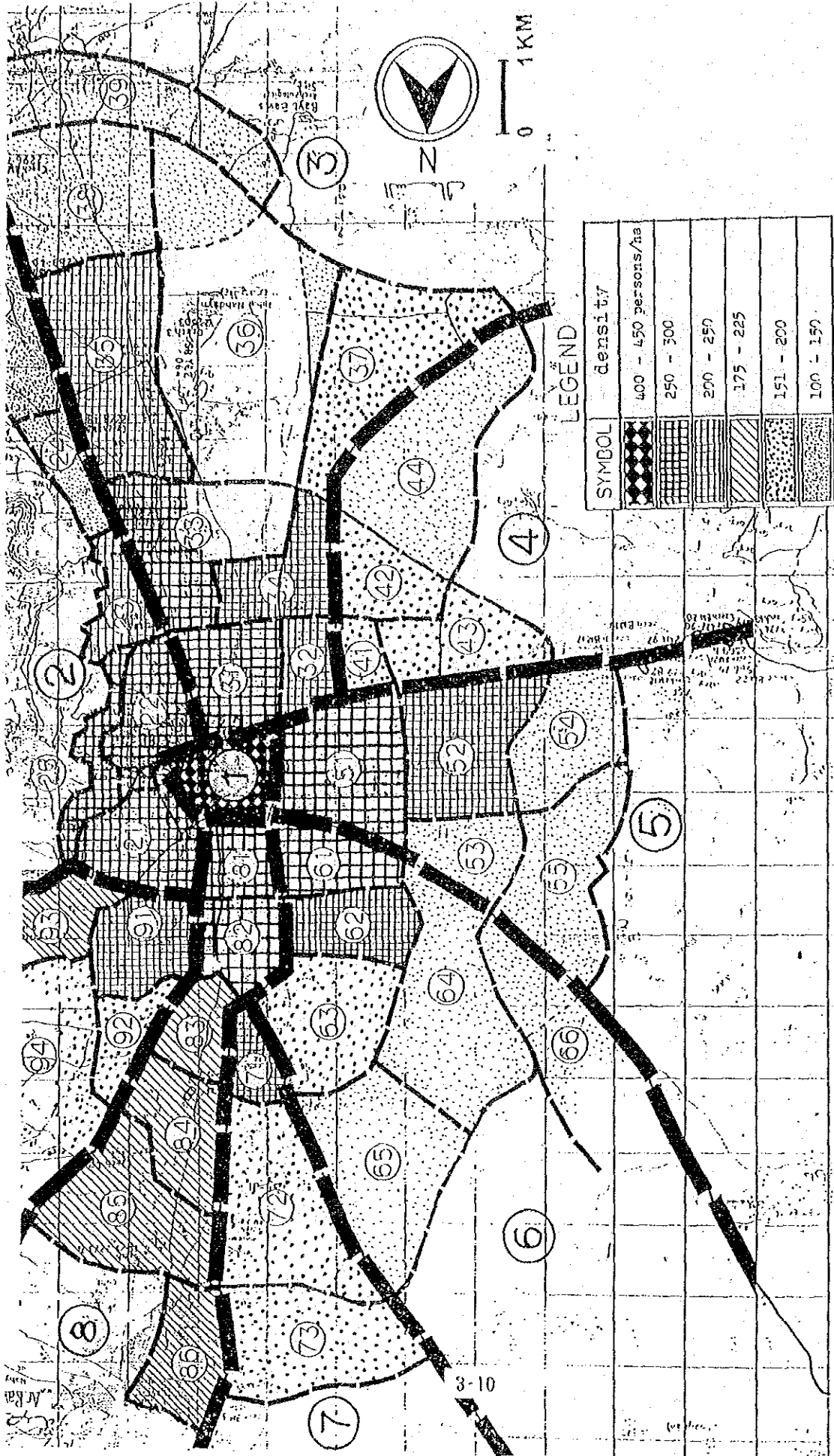
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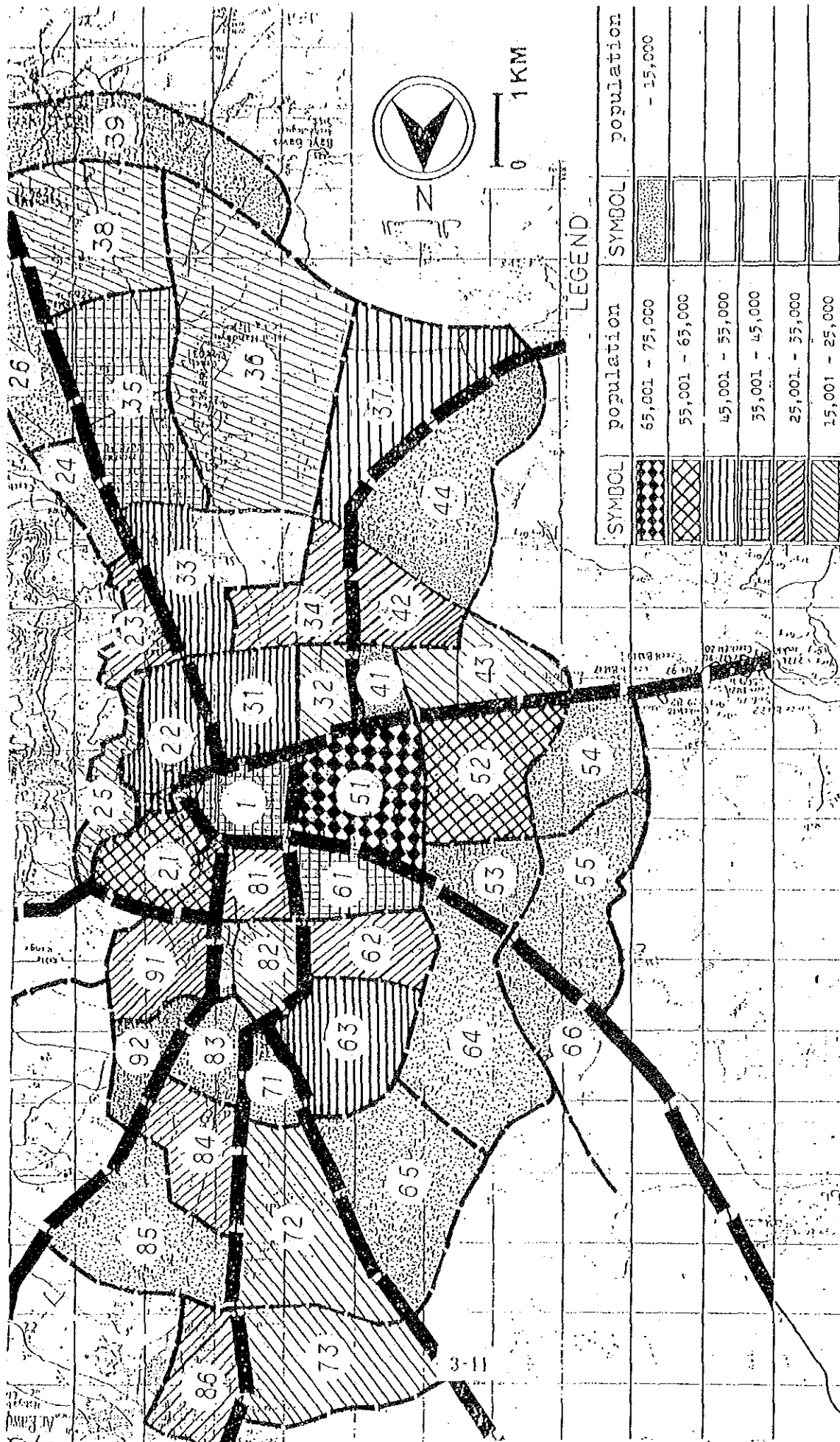
Appendix Table 3.1.1.1 Area and Population for Each Zone in Sana'a  
(1986, 1991 and 2000)

Sector	Area In habited	Area No Peoples	Total Area	Population			Projected Gross Density	Prospected		Revised Urban Area	
				Actual (1986)	Projected (1991) (2000)			Urbanized Area (2000)	(1991)		
Zone	(ha)	(ha)	(ha)	(1986)	(1991)	(2000)		(2000)	(1991)	(1986)	
1	11	108.0	52.0	160.0	40,000	42,000	42,000	400	100%	100%	95%
2	21	220.0	4.0	224.0	22,000	33,000	55,000	250-300	100%	60%	40%
	22	180.6	22.2	202.8	25,000	31,000	45,000	250-300	100%	70%	55%
23		120.0	-	120.0	10,500	16,000	24,000	200-250	100%	70%	40%
24		59.5	60.5	120.0	2,000	3,000	6,000	100-150	100%	50%	30%
25		77.0	13.5	90.5	6,000	10,000	20,000	250-300	100%	50%	30%
26		453.0	50.2	503.2	3,000	5,000	17,000	-100	100%	40%	20%
Total		1110.1	150.4	1260.5	68,500	98,000	167,000				
3	31	166.1	47.6	213.7	26,500	36,000	45,000	250-300	100%	80%	60%
	32	102.2	4.6	106.8	16,500	21,000	23,000	200-250	100%	90%	70%
	33	171.0	38.6	209.6	24,000	33,000	47,000	250-300	100%	70%	50%
	34	144.2	51.3	195.5	16,000	21,000	32,000	200-250	100%	65%	50%
	35	347.0	140.0	487.0	7,000	20,000	48,000	200-250	70%	30%	10%
	36	242.5	720.0	962.5	1,000	6,000	18,000	100-150	60%	20%	3%
	37	299.3	.8	300.1	5,000	22,000	52,000	150-200	100%	50%	10%
	38	404.0	21.0	425.0	2,000	4,000	16,000	100-150	40%	40%	5%
	39	393.0	44.0	437.0	1,000	4,000	12,000	100-150	30%	10%	3%
	Total		2269.3	1067.9	3337.2	99,000	167,000	293,000			
4	41	64.1	11.3	75.4	8,000	9,000	11,000	150-200	100%	80%	70%
	42	174.0	-	174.0	9,000	17,000	30,000	150-200	100%	55%	30%
	43	139.5	81.7	221.2	5,000	9,000	24,000	150-200	100%	40%	20%
	44	468.0	52.0	520.0	1,000	2,000	16,000	100-150	35%	5%	3%
Total		845.6	145.0	990.6	23,000	37,000	81,000				
5	51	269.4	60.4	329.8	56,500	60,000	67,000	250-300	100%	90%	85%
	52	287.4	43.8	331.2	23,000	34,000	57,000	200-250	100%	60%	40%
	53	52.0	112.0	164.0	2,500	3,000	5,000	100-150	100%	70%	50%
	54	119.0	118.0	237.0	1,500	3,000	7,000	100-150	60%	25%	10%
	55	178.0	177.0	355.0	2,000	7,000	13,000	100-150	75%	40%	10%
Total		905.8	511.2	1417.0	85,500	107,000	149,000				
6	61	159.9	13.8	173.7	24,000	32,000	40,000	250-300	100%	80%	60%
	62	130.1	34.4	164.5	8,000	16,000	29,000	200-250	100%	60%	30%
	63	269.6	65.1	334.7	9,500	23,000	47,000	150-200	100%	50%	20%
	64	95.0	283.0	378.0	500	2,000	12,000	100-150	100%	20%	3%
	65	73.0	217.0	290.0	1,500	3,000	9,000	100-150	100%	30%	15%
Total		727.6	613.3	1340.9	43,500	76,000	137,000				
7	71	24.5	65.3	89.8	2,500	4,000	5,000	200-250	100%	80%	50%
	72	323.5	17.0	340.5	4,500	12,000	25,000	150-200	50%	25%	10%
	73	344.5	18.0	362.5	1,500	5,000	16,000	150-200	30%	10%	3%
Total		692.5	100.3	792.8	8,500	21,000	41,000				
8	81	102.7	12.1	114.8	18,000	23,000	25,000	250-300	100%	90%	70%
	82	86.3	71.6	157.9	11,000	15,000	21,000	250-300	100%	70%	50%
	83	84.8	57.9	142.7	4,500	9,000	14,000	175-225	100%	60%	30%
	84	152.0	64.3	216.3	5,500	13,000	26,000	175-225	100%	50%	20%
	85	250.0	28.4	278.4	2,000	9,000	13,000	175-225	30%	20%	5%
	86	217.2	24.0	241.2	7,500	16,000	33,000	175-225	85%	40%	20%
Total		893.0	258.3	1151.3	48,500	85,000	132,000				
9	91	165.4	30.0	195.4	9,500	14,000	26,000	200-250	80%	45%	30%
	92	50.8	5.0	55.8	1,000	3,000	7,000	150-200	90%	40%	40%
	93	-	-	46.7	-	-	-	100-150	-	-	-
Total		216.2	35.0	297.9	10,500	17,000	33,000				
Grand											
Total		7768.1	2933.4	10748.2	427,000	650,000	1,077,500				

Appendix Fig. 3.1.1.1 Distribution of Projected Population Density, Sana'a 2000



Appendix Fig. 3.1.1.1.2 Population Distribution of Sana'a, 2000



Appendix Table 3.2.1.1 Number of Housing Units in the Census of 1975  
1986 in the Governorates and the Country

Governorates	Number of Housing Units			Average rate of annual growth
	1975	1986	%	
Sana'a	131,853	273,002	207.1	6.84 %
Taiz	176,178	265,560	150.7	3.80
Al-Hodeidah	145,574	209,603	144.0	3.37
Ibb	154,291	216,002	140.0	3.11
Dhamar	85,500	123,846	144.8	3.42
Hajja	64,969	118,056	181.7	5.58
Sa'ada	27,992	47,924	171.2	5.01
Al-Mahwit	31,072	45,542	146.6	3.54
Al-Beida	30,914	46,752	151.2	3.83
Marib	7,706	15,284	**	-
Al-Jawf		8,007	**	-
Total	856,059	1,369,578	160.0	10.44

Source: Statistical year Book 1986 (C.P.O 1987)



Appendix Table 3.2.1.2 Number of Licences Issued for Houses Construction and Area in the 5 Main Cities

	Sana'a		Taiz		Hodeidah		Ibb		Dhamar		Total
	Licences	Area (m2)	Licences	Area (m2)	Licences	Area (m2)	Licences	Area (m2)	Licences	Area (m2)	
1976	1,598	551,512	944	241,855	661	324,970	541	51,811			3,744 1,179,148
1977	2,423	784,994	1,118	97,764	400	125,046	216	39,704			4,157 1,047,508
1978	2,862	993,970	1,660	359,294	401	164,597	262	80,619			5,185 1,598,480
1979	2,172	829,404	1,541	318,329	387	248,604	350	91,668			4,450 1,488,005
1980	1,674	570,230	1,578	269,594	340	312,570	370	154,391	373	109,943	4,335 1,416,728
1981	2,362	752,808	1,156	188,858	307	108,341	360	75,050	233	73,071	4,418 1,198,128
1982	3,478	911,411	951	114,262	150	42,659	312	30,977	256	68,088	5,147 1,167,397
1983	3,124	862,428	1,032	149,435	202	42,148	124	34,949	419	112,298	4,901 1,201,258
1984	3,993	1,217,091	1,300	409,944	270	91,740	183	48,621	351	125,018	6,097 1,892,414
1985	3,642	1,107,430	2,070	582,134	405	131,791	359	76,008	435	90,186	6,911 1,987,549
1986	2,709	763,892	1,432	544,537	402	133,845	567	114,159	290	146,250	5,400 1,702,683

Source: Office of Municipalities in Main Cities in Statistical Year Book (1987)



APPENDIX TO CHAPTER 4



## Appendix Note 4.1 General Description of Roads

### 4.1.1 Sana'a

#### 1) Airport road

Connecting the airport at a distance of 13 km north side of the city, it extends further to the north town of Al Hayfah. The road extends to the south and the name becomes Al Qiyada street from the intersection with Ring road and goes to the center of the city with the name of Ali Abudul Mughni road. The road becomes 4 lanes from the intersection with Sadah road to the city center.

#### 2) Sadah road

This is an arterial road to Sadah, a northern city of Yemen. The road is 4 lanes up to the crossing with Airport road and becomes 2 lanes in the further suburban sections.

#### 3) Marib road

The road extending to the eastern city of Yemen, Marib, has 2 lanes except for the inside of the Ring road. The area from Ring road to Old city has become commercial area, and light industries have developed recently at the area outside the junction of the north-eastern boulevard.

#### 4) Taiz road

It connects Sana'a with southern cities of Yemen, Taiz, Ibb, Dhamar, etc. It has paved 4 lanes from Old city to Ring road and paved 2 lanes from Ring road to the south. The district between Old city and 45 m road is commercial area and areas of light industries. They are extending to the south along the road. Housing development is going on extensively in the area outside Sana'a bypass.

The paved 2 lane section from the Ring road to the police check point of 3.5 km is under work of widening to paved 4 lanes. The work is scheduled to be completed by the end of 1988.

5) Haddah road

The road to the southern suburban area, Haddah district, has paved 6 lanes from the intersection of Az Zubayri up to Sana'a bypass and pavement becomes 2 lanes at outside of Sana'a bypass. Commercial area continues from Az Zubayri to Ring road and housing development is going on along the road out of Ring road.

6) Az Zubayri street

Crossing Sana'a from east to west, the road name becomes Hodeidah road which goes to the important port city, Hodeidah. The section of 5.2 km from Old city to Sana'a bypass has 6 lanes and beyond it in the suburban area the road becomes paved 2 lanes. But Az Zubayri street from Bab Al Yemen to the intersection at Haddah road, the capacity is reduced because of so many parking on the shoulders.

7) Wadi Dahr road

This is a radial road extending to north-west and reaching to Shibam and Thula. Sana'a University campus located on 1.5 km length along the Wadi Dahr road from Ring road to Sana'a bypass has a schedule of construction of buildings on the southern side. At the same time the road section along the campus is closed and a new bypass will be constructed. Most sections from Old city to Ring road have 4 lanes (partially 2 lanes) with shoulders. It becomes paved 2 lanes outside the Ring road.

8) Roads surrounding Old Sana'a

It is composed of the following 6 roads;

\* Ali Abdul Mughni street; West side road of the old city with 4-6 lanes, its roadside area is the commercial and business center of the Sana'a.

\* Shuub street; North side road of 2 lanes with partial shoulders. There are many stores along both sides of the road.

\* Al Mashad street; Connection road on the north east between Shuub street and Wadi Al Qasr street. It is a 2 lane paved

road and a cemetery is located along the road.

- \* Wadi Al Qasr street; East side road of 4 lanes with median. Along the road a cemetery is located. Citadel link of Nugum qat market branches off at mid-point of this road and is connected to Ring road.
- \* As Salam street and Street No. 23; These roads are one way each other, connecting Az Zubayri street and Wadi Al Qasr street. Road width is 7 meters, and many stores are along the street.
- \* As Zubayri street; It is a 6 lanes road along the South Castle Wall of Old city.

9) Ring road

Rounding road at radius lengths of 1.5 km to 2.5 km, the whole sections are completed in 1983. The section from Wadi Dhar road to Airport road have 6 lanes with 2 meter width median and there are many stores and houses along the road. The section between Airport road and Marib road is composed of 4 lanes and comparatively narrow in width.

The section from Marib road to Taiz road was completed a few years ago. It has 6 lanes with 3 meters median. Traffic volume is relatively small and roadside areas are not intensively developed. The section passes the hilly terrain and there is a segment with a 5% gradient. One public park is under construction and another is in planning. The section between Taiz road and Az Zubayri street has 4 lanes and the center opened drainage of 5m width.

The section from Az Zubayri street to Wadi Dahr road has a 2 meter width center opened drainage. Each direction of the road has a width of 7.1 meters while only 1 lane is available to the traffic because of many parkings. There are Sana'a University and shopping stores along the road.

10) North-eastern boulevard and 45 meter road

North-eastern boulevard and the 45 meter road were constructed

to support the development toward north and south respectively due to the steep sloped mountains of the east and west areas. North-eastern boulevard has been completed half at the east side of Airport road. From Airport road to Sadah road the boulevard has 6 lanes ensuring enough width of shoulders and parking lanes. The eastern section from Sadah road has 4 lanes paved and a 30 meter width ROW. The boulevard joins at the Eastern boulevard which has a 6 lane section to the Ring road and then southward to Old city through Street No. 24.

The 45 meter road, running the east-west direction in the southern part of the city is located between Ring road and Sana'a bypass. It has been paved with 2 lanes.

- 11) Sana'a bypass (60 m road) is constructed outside of 45 meters road from Taiz road in the south to Wadi Dhar road in the north-west and paved with 2 lanes.

#### 4.1.2 Taiz

- 1) Jamal street

As a main road in the northern part of the old city, it has 4 lanes and runs in parallel to Jaynai street & 26th September street. It connects with Sana'a road in the eastern side and with Hodeidah road in the western side.

- 2) Jaynai street & 26th September street

It extends from east to west in parallel to Jamal street. Road width is narrow and the eastern one third has 2 lanes under one way control. Many shops and stores are along the road.

- 3) Center boulevard

Radial road of paved 2 lanes extending toward north from the eastern part of Jamal street. housing construction and a new Qat market are on the roadside.



4) First Ring road

A half circle road with paved 4 lanes connecting to Jaynai street. The half circle is located from east to the center of the city. There is no bridge at the western Sailah which enforces traffic to detour.

5) 2nd Ring road

As a half circle road located outside the First Ring road, it connects to Sana'a road at the eastern side and planned to intersect the Hodeidah road at the western side of the city. It is designed to have 4 lanes and the eastern half of the road is paved while at the western side ROW has been just ensured.

6) Park way

As a planned road outside the 2nd Ring road, its ROW has been ensured.

7) As Samil street

It is a 2 lane road connecting Jamal street and 26th September street. The alignment is poor because of developed houses and stores. GLTC bus terminal is located.

8) 13th June street and Qasr Al Shaab street

It is located in the eastern part of the city and has a function as a bypass of Jamal street. There are houses, government offices along the road.

9) Sabir street

It is a 2 lane gravel surfaced road to southern Sabir Al Mawadin village constructed on the steep terrains of Mt. Sabir.

10) Salah street

It is located in the southeast side of the city with 2 lanes. This road continues to the old palace.

11) South Ring road

A half circle road constructed on the southern steep terrains of Mt. Sabir. The bridge has not been completed yet at Al Jahmaliyah in the eastern part of the road.

4.1.3 Hodeidah

1) Sana'a street

This is the main street in Hodeidah with 4 lanes. Many stores along the route extend toward east from the central triangle park of the city. The street name becomes Sana'a road from the crossing with Zaid street and goes to Sana'a and Taiz.

2) Port road

It is a 4 lane paved road with houses and public facilities such as school, police station and park along the route. It goes to the Hodeidah port from Al Corniche street passing by the central triangle park.

3) Zaid street and Gamal street

It is a half circle road of 4 lanes surrounding the city. It has the function as a bypass from Hodeidah port to Sana'a road.

4) Corniche street

It is a 4 lane road from south to north along the Red Sea. There is a fish port-market along the route.

5) Jizan road

It is a 2 lane road from Zaid street extending to Jizan in Saudi Arabia by crossing over the boundary. The roadside in the city area is not urbanized yet.

6) Shamsan street

It is a 4 lane road toward northeast from Sana'a street. The road name becomes Jizan road after crossing Zaid street.

7) 50 meters road

This is a planned bypass to the port, but now only 2 lanes have been paved at the section from Port road to Jizan road. There are houses and market along the route and the northern side is still wasteland.

## Appendix Note 4.2 Road Capacity and Level of Service

The followings are quoted from "Highway Capacity manual, special Report 209, (Transportation Research Board, USA, 1985).

### LEVELS OF SERVICE

#### Measures of Effectiveness

Freeway operating characteristics include a wide range of rates of flow over which speed is relatively constant. This means that speed alone is not adequate as a performance measure by which to define levels of service.

Although speed is a major concern of drivers with respect to service quality, freedom to maneuver and proximity to other vehicles are equally important parameters. These other qualities are directly related to the *density* of the freeway traffic stream. Further, rate of flow increases with increasing density throughout the full range of stable flows (see Figure 3-3).

For these reasons, density is the parameter used to define levels of service for basic freeway segments. The densities used to define the various levels of service (LOS) are as follows:

Level of Service	Density (pc/mi/ln)
A	12
B	20
C	30
D	42
E	67

These values are boundary conditions representing the maximum allowable densities for the associated level of service. The LOS-E boundary of 67 pc/mi/ln has been generally found to be the *critical density* at which capacity most often occurs. This corresponds to an average travel speed of 30 mph and a capacity of 2,000 pcphpl for 60-mph and 70-mph design speeds. The exact speed and density, however, at which capacity occurs may vary somewhat from location to location.

#### Level-of-Service Criteria

Level-of-service criteria for basic freeway segments are given in Table 3-1 for 70-mph, 60-mph, and 50-mph design speed elements. To be within a given level of service, the *density* criterion must be met. The average travel speeds and maximum service flow rates indicated in the table are expected to exist under *ideal* conditions for the given densities. Actual average travel speeds for traffic streams under non-ideal conditions may be somewhat lower than the values shown.

Design speed depends on the combination of horizontal and vertical alignment. Other influences on driver behavior, such as the development environment, local driving habits, and other factors, may cause the relationship among density, speed, and flow to differ from the typical values of Table 3-1. Where local speed-flow-density data are available, they may be used as a guide in determining which design speed best represents local conditions.

#### DESCRIPTION OF LEVELS OF SERVICE

The levels of service have been defined to represent reasonable ranges in the three critical variables: average travel speed, density, and flow rate. The basic shape of the typical speed-density-flow curves requires that as level of service moves from A to F, the range of densities and speeds covered by each level becomes larger, while the corresponding range of service flow rates becomes smaller.

The values in Table 3-1 reflect the influence of the 55-mph speed limit. Even with this speed limit clearly signed and reasonably enforced, average travel speeds for the better levels of service are still expected to be slightly higher than the 55-mph limit. Where enforcement is particularly stringent, or where lower speed limits are posted, speeds may be somewhat lower than those given in Table 3-1.

TABLE 3-1. LEVELS OF SERVICE FOR BASIC FREEWAY SECTIONS

LOS	DENSITY (PC/MI/LN)	70 MPH DESIGN SPEED			60 MPH DESIGN SPEED			50 MPH DESIGN SPEED		
		SPEED <sup>b</sup> (MPH)	v/c	MSF <sup>a</sup> (PCPHPL)	SPEED <sup>b</sup> (MPH)	v/c	MSF <sup>a</sup> (PCPHPL)	SPEED <sup>b</sup> (MPH)	v/c	MSF <sup>a</sup> (PCPHPL)
A	≤ 12	≥ 60	0.35	700	—	—	—	—	—	—
B	≤ 20	≥ 57	0.54	1,100	≥ 50	0.49	1,000	—	—	—
C	≤ 30	≥ 54	0.77	1,550	≥ 47	0.69	1,400	≥ 43	0.67	1,300
D	≤ 42	≥ 46	0.93	1,850	≥ 42	0.84	1,700	≥ 40	0.83	1,600
E	≤ 67	≥ 30	1.00	2,000	≥ 30	1.00	2,000	≥ 28	1.00	1,900
F	> 67	< 30	<sup>c</sup>	<sup>c</sup>	< 30	<sup>c</sup>	<sup>c</sup>	< 28	<sup>c</sup>	<sup>c</sup>

<sup>a</sup> Maximum service flow rate per lane under ideal conditions.

<sup>b</sup> Average travel speed.

<sup>c</sup> Highly variable, unstable.

NOTE: All values of MSF Rounded to the nearest 50 pcph.

General descriptions of operating conditions for each of the levels of service are as follows:

1. *Level-of-service A*—Level A describes primarily free flow operations. Average travel speeds near 60 mph generally prevail on 70-mph freeway elements. Vehicles are almost completely unimpeded in their ability to maneuver within the traffic stream. The average spacing between vehicles is about 440 ft, or 22 car-lengths, with a maximum density of 12 pc/mi/ln. This affords the motorist a high level of physical and psychological comfort. The effects of minor incidents or breakdowns are easily absorbed at this level. Although they may cause a deterioration in LOS in the vicinity of the incident, standing queues will not form, and traffic quickly returns to LOS A on passing the disruption.

2. *Level-of-service B*—Level B also represents reasonably free-flow conditions, and speeds of over 57 mph are maintained on 70-mph freeway elements. The average spacing between vehicles is about 260 ft, or 13 car-lengths, with a maximum density of 20 pc/mi/ln. The ability to maneuver within the traffic stream is only slightly restricted, and the general level of physical and psychological comfort provided to drivers is still high. The effects of minor incidents and breakdowns are still easily absorbed, though local deterioration in service would be more severe than for LOS A.

3. *Level-of-service C*—Level C provides for stable operations, but flows approach the range in which small increases in flow will cause substantial deterioration in service. Average travel speeds are still over 54 mph. Freedom to maneuver within the traffic stream is noticeably restricted at LOS C, and lane changes require additional care and vigilance by the driver. Average spacings are in the range of 175 ft, or 9 car-lengths, with a maximum density of 30 pc/mi/ln. Minor incidents may still be absorbed, but the local deterioration in service will be substantial. Queues may be expected to form behind any significant blockage. The driver now experiences a noticeable increase in tension due to the additional vigilance required for safe operation.

4. *Level-of-service D*—Level D borders on unstable flow. In this range, small increases in flow cause substantial deterioration in service. Average travel speeds of 46 mph or more can still be maintained on 70-mph freeway elements. Freedom to maneuver within the traffic stream is severely limited, and the driver experiences drastically reduced physical and psychological comfort levels. Even minor incidents can be expected to create substantial queuing, because the traffic stream has little space to absorb disruptions. Average spacings are about 125 ft, or 6 car-lengths, with a maximum density of 42 pc/mi/ln.

5. *Level-of-service E*—The boundary between LOS D and LOS E describes operation at capacity. Operations in this level are extremely unstable, because there are virtually no usable gaps in the traffic stream. Vehicles are spaced at approximately 80 ft, or 4 car-lengths, at relatively uniform headways. This, however, represents the minimum spacing at which stable flow can be accommodated. Any disruption to the traffic stream, such as a vehicle entering from a ramp, or a vehicle changing lanes, causes following vehicles to give way to admit the vehicle. This condition establishes a disruption wave which propagates through the upstream traffic flow. At capacity, the traffic stream has no ability to dissipate even the most minor disruptions. Any incident can be expected to produce a serious breakdown with extensive queuing. The range of flows encompassed by LOS E is relatively small compared to other levels, but reflects a sub-

stantial deterioration in service. Maneuverability within the traffic stream is extremely limited, and the level of physical and psychological comfort afforded to the driver is extremely poor. Average travel speeds at capacity are approximately 30 mph.

6. *Level-of-service F*—Level F describes forced or breakdown flow. Such conditions generally exist within queues forming behind breakdown points. Such breakdowns occur for a number of reasons:

a. Traffic incidents cause a temporary reduction in the capacity of a short segment, such that the number of vehicles arriving at the point is greater than the number of vehicles that can traverse it.

b. Recurring points of congestion exist, such as merge or weaving areas and lane drops, where the number of vehicles arriving is greater than the number of vehicles traversing the point.

c. In forecasting situations, any location presents a problem when the projected peak hour (or other) flow rate exceeds the estimated capacity of the location.

It is noted that in all cases, breakdown occurs when the ratio of actual arrival flow rate to actual capacity or the forecasted flow rate to estimated capacity exceeds 1.00. Operations at such a point will generally be at or near capacity, and downstream operations may be better as vehicles pass the bottleneck (assuming that there are no additional downstream problems). The LOS F operations observed within a queue are the result of a breakdown or bottleneck at a downstream point. The designation "LOS F" is used, therefore, to identify the point of the breakdown or bottleneck, as well as the operations within the queue which forms behind it.

The extent of queuing, and the delays caused by queuing, are of great interest in the analysis of congested freeway segments. Chapter 6 contains a methodology for estimating the queue length and delays behind a bottleneck with known arrival and discharge rates. The procedure allows a rough quantification of the extent of congestion created by a LOS F situation.

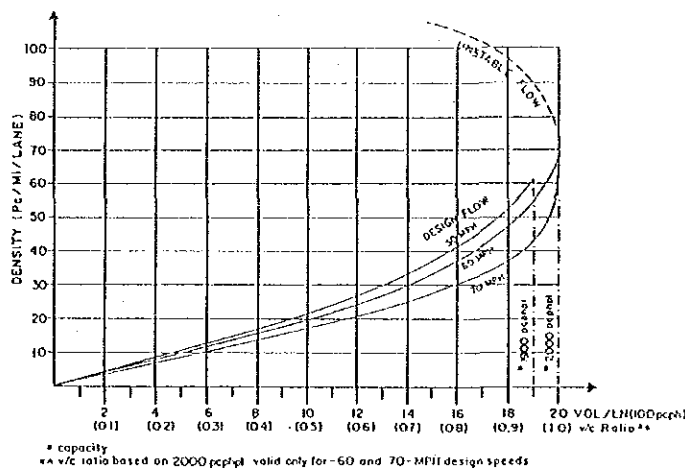


Figure 3-3. Density-flow relationships under ideal conditions.

Appendix Table 4.5.1 Link Volume and Capacity in 1987, Sana'a

Link	-- Node --		Dir.	Leng. (10m)	Sect. Lane	Int. Lane	Wid.	Adj. Factor	Cap. /hr.	Link Volume		Volume/Cap.		Velocity	
	From	To								Peak-H	Day	LV/C	TOT	Peak	Off-P
11	23	24	1	11	1	1	10.0	0.97	1399	397	4177	0.283	0.230		
11	24	23	2	11	1	1	10.0	0.97	1399	249	3235	0.177	-		
12	12	23	1	103	1	1	16.1	0.96	1381	397	4177	0.287	0.233		
12	23	12	2	103	1	1	16.1	0.96	1381	249	3235	0.180	-		
13	9	12	1	118	1	1	16.0	0.96	1381	703	9394	0.509	0.622		
13	12	9	2	118	1	1	16.0	0.96	1381	1016	10984	0.735	-		
14	4	9	1	200	1	1	16.0	0.96	1381	640	7360	0.463	0.524		
14	9	4	2	200	1	1	16.0	0.96	1381	810	9315	0.586	-		
21	21	24	1	41	2	1	17.6	0.95	1376	916	10531	0.665	0.576	16	24
21	24	21	2	41	2	1	17.6	0.95	1376	670	8250	0.486	-	17	37
22	13	21	1	71	2	2	16.5	0.96	2759	1077	12385	0.390	0.345	37	56
22	21	13	2	71	2	2	16.5	0.96	2759	827	9511	0.299	-	38	53
23	8	13	1	103	2	2	19.0	0.95	2744	1118	12510	0.407	0.361	37	49
23	13	8	2	103	2	2	19.0	0.95	2744	865	10236	0.315	-	37	52
24	5	8	1	55	3	2	24.8	0.94	2709	1118	12510	0.412	0.366	44	37
24	8	5	2	55	3	2	24.8	0.94	2709	865	10236	0.319	-	23	27
25	2	5	1	46	1	1	6.0	0.94	1357	910	10465	0.670	0.636		
25	5	2	2	46	1	1	6.0	0.94	1357	818	9407	0.602	-		
26	1	2	1	200	1	1	6.0	0.94	1357	850	9775	0.626	0.637		
26	2	1	2	200	1	1	6.0	0.94	1357	880	10120	0.648	-		
31	7	14	1	78	3	2	21.0	0.95	2732	1384	17028	0.506	0.569	26	28
31	14	7	2	78	3	2	21.0	0.95	2732	1726	17925	0.631	-	40	51
32	6	7	1	28	3	2	25.7	0.94	2704	1366	15709	0.505	0.509	41	43
32	7	6	2	28	3	2	25.7	0.94	2704	1392	16008	0.514	-	32	55
33	5	6	1	75	3	1.5	21.4	0.95	2047	1350	15525	0.659	0.715	24	19
33	6	5	2	75	3	1.5	21.4	0.95	2047	1579	18159	0.771	-	22	19
34	3	5	1	200	1	1	18.1	0.99	1430	1365	15698	0.954	0.905		
34	5	3	2	200	1	1	18.1	0.99	1430	1226	14099	0.857	-		
41	26	27	1	40	1	1	9.0	0.97	1402	213	2323	0.151	0.151		
41	27	26	2	40	1	1	9.0	0.97	1402	0	0	0	-		
42	27	28	1	21	2	1	14.7	0.96	1385	213	2323	0.153	0.359	34	50
42	28	27	2	21	2	1	14.7	0.96	1385	783	8347	0.565	-	25	27
43	28	29	1	44	2	1	14.7	0.96	1385	213	2323	0.153	0.359	24	39
43	29	28	2	44	2	1	14.7	0.96	1385	783	8347	0.565	-	11	22
44	29	30	1	45	2	1	14.7	0.96	1385	213	2323	0.153	0.359	24	39
44	30	29	2	45	2	1	14.7	0.96	1385	783	8347	0.565	-	11	22
45	30	31	1	27	2	1	14.7	0.96	1385	697	8016	0.503	0.405	33	48
45	31	30	2	27	2	1	14.7	0.96	1385	425	4888	0.306	-	19	27
46	31	32	1	34	2	1	24.1	0.94	1356	992	11408	0.731	0.623	19	26
46	32	31	2	34	2	1	24.1	0.94	1356	700	8050	0.516	-	24	45
47	32	33	1	147	1	1	7.0	0.98	1408	974	8937	0.691	0.658	39	44
47	33	32	2	147	1	1	7.0	0.98	1408	881	9248	0.625	-	36	52
48	33	34	1	200	1	1	7.0	0.98	1408	804	6982	0.571	0.502		
48	34	33	2	200	1	1	7.0	0.98	1408	611	6142	0.433	-		
51	61	62	1	82	3	2	25.6	0.94	2704	2057	26602	0.760	0.781	28	40
51	62	61	2	82	3	2	25.6	0.94	2704	2172	25796	0.803	-	43	36
52	62	63	1	14	3	2	25.5	0.94	2705	2057	26602	0.760	0.781	13	12
52	63	62	2	14	3	2	25.5	0.94	2705	2172	25796	0.802	-	29	25
53	63	64	1	13	3	2	25.5	0.94	2705	1644	18906	0.607	0.619	13	12
53	64	63	2	13	3	2	25.5	0.94	2705	1707	19631	0.631	-	29	25
54	64	65	1	25	3	2	25.0	0.94	2708	1505	19620	0.555	0.679	24	26
54	65	64	2	25	3	2	25.0	0.94	2708	2177	26034	0.803	-	3	13
55	65	99	1	49	3	2	23.5	0.94	2717	1807	20780	0.665	0.664	28	32

Appendix Table 4.5.1 Link Volume and Capacity in 1987, Sana'a

Link	-- Node --		Dir.	Leng. (10m)	Sect. Lane	Int. Lane	Wid.	Adj. Factor	Cap. /hr.	Link Volume		Volume/Cap.		Velocity	
	From	To								Peak-H	Day	LV/C	TOT	Peak	Off-P
55	99	65	2	49	3	2	23.5	0.94	2717	1805	20758	0.664	-	14	43
56	99	66	1	25	3	2	23.5	0.94	2717	1807	20780	0.665	0.664	28	32
56	66	99	2	25	3	2	23.5	0.94	2717	1805	20758	0.664	-	14	43
57	66	67	1	14	3	2	23.9	0.94	2714	1633	18780	0.601	0.600	17	32
57	67	66	2	14	3	2	23.9	0.94	2714	1626	18699	0.599	-	6	13
58	67	68	1	21	3	2	23.8	0.94	2715	1492	17158	0.549	0.551	32	40
58	68	67	2	21	3	2	23.8	0.94	2715	1501	17262	0.552	-	28	50
59	68	69	1	45	3	2	23.2	0.94	2718	1351	15537	0.497	0.501	13	17
59	69	68	2	45	3	2	23.2	0.94	2718	1376	15824	0.506	-	33	40
60	69	70	1	53	3	2	24.0	0.94	2714	1170	13455	0.431	0.477	37	43
60	70	69	2	53	3	2	24.0	0.94	2714	1423	16365	0.524	-	14	40
61	70	71	1	13	3	3	24.0	0.99	4332	1053	12110	0.243	0.269	26	36
61	71	70	2	13	3	3	24.0	0.99	4332	1281	14732	0.295	-	30	50
62	71	72	1	165	3	3	24.0	0.99	4332	702	8073	0.162	0.179	64	61
62	72	71	2	165	3	3	24.0	0.99	4332	854	9821	0.197	-	52	61
63	72	73	1	0	3	3	24.0	0.99	4332	560	6458	0.129	0.143	-	-
63	73	72	2	0	3	3	24.0	0.99	4332	683	7857	0.157	-	-	-
71	66	76	1	40	3	2	20.6	0.95	2734	638	7337	0.233	0.334	31	46
71	76	66	2	40	3	2	20.6	0.95	2734	1190	13685	0.435	-	17	33
72	76	77	1	30	3	1.5	23.2	0.94	2039	801	9211	0.392	0.465	43	60
72	77	76	2	30	3	1.5	23.2	0.94	2039	1097	12615	0.538	-	34	31
73	77	79	1	7	3	2	23.9	0.94	2714	963	10216	0.354	0.362	10	10
73	79	77	2	7	3	2	23.9	0.94	2714	1004	11464	0.369	-	19	23
74	79	80	1	37	3	3	20.0	0.99	2858	963	10216	0.336	0.344	24	20
74	80	79	2	37	3	3	20.0	0.99	2858	1004	11464	0.351	-	20	44
75	80	92	1	78	3	2	20.0	0.95	2738	1111	12847	0.405	0.414	24	59
75	92	80	2	78	3	2	20.0	0.95	2738	1157	13212	0.422	-	34	58
76	92	94	1	85	3	2	20.0	0.95	2738	889	10224	0.324	0.366	36	30
76	94	92	2	85	3	2	20.0	0.95	2738	1116	12834	0.407	-	35	59
77	94	95	1	200	1	1	13.5	0.99	1230	666	7659	0.541	0.707	-	-
77	95	94	2	200	1	1	13.5	0.99	1230	1075	12363	0.873	-	-	-
80	101	88	1	24	2	1	15.7	0.96	1382	1207	13881	0.873	0.948	23	23
80	88	101	2	24	2	1	15.7	0.96	1382	1415	16273	1.023	-	25	28
81	61	101	1	144	2	1	15.7	0.96	1382	1207	13881	0.873	0.948	23	23
81	101	61	2	144	2	1	15.7	0.96	1382	1415	16273	1.023	-	25	28
82	88	90	1	84	1	1	6.2	0.98	1411	1100	12775	0.779	0.756	21	32
82	90	88	2	84	1	1	6.2	0.98	1411	1036	13526	0.734	-	24	35
83	90	97	1	148	1	1	7.0	0.98	1408	1363	15675	0.968	0.911	24	37
83	97	90	2	148	1	1	7.0	0.98	1408	1203	13835	0.854	-	27	33
84	97	98	1	200	1	1	7.0	0.99	1429	2138	24587	1.496	1.191	35	30
84	98	97	2	200	1	1	7.0	0.99	1429	1268	14582	0.887	-	33	48
111	12	13	1	32	3	2	20.0	0.95	2738	612	8942	0.223	0.260	15	21
111	13	12	2	32	3	2	20.0	0.95	2738	812	9326	0.296	-	23	37
112	13	14	1	89	3	2	16.0	0.96	2762	761	9406	0.275	0.275	23	42
112	14	13	2	89	3	2	16.0	0.96	2762	759	8959	0.274	-	27	37
113	14	15	1	51	3	2	26.0	0.94	2702	1027	11811	0.380	0.405	34	45
113	15	14	2	51	3	2	26.0	0.94	2702	1162	13363	0.430	-	16	57
114	15	16	1	56	3	2	25.9	0.99	2858	989	11374	0.346	0.359	58	59
114	16	15	2	56	3	2	25.9	0.99	2858	1067	12271	0.373	-	63	53
115	16	17	1	105	3	2	25.9	0.94	2702	952	10948	0.352	0.356	47	56
115	17	16	2	105	3	2	25.9	0.94	2702	973	11190	0.360	-	55	57
116	17	32	1	11	3	2	23.1	0.94	2719	915	10523	0.336	0.329	13	21
116	32	17	2	11	3	2	23.1	0.94	2719	879	10109	0.323	-	26	66

Appendix Table 4.5.1 Link Volume and Capacity in 1987, Sana'a

Link	-- Node --		Dir.	Leng. (10m)	Sect. Lane	Int. Lane	Wid.	Adj. Factor	Cap. /hr.	Link Volume		Volume/Cap.		Velocity	
	From	To								Peak-H	Day	LV/C	TOT	Peak	Off-P
121	32	36	1	51	2	1	16.2	0.96	1380	1318	15157	0.955	1.006	36	42
121	36	32	2	51	2	1	16.2	0.96	1380	1461	16802	1.058	-	17	46
122	36	39	1	25	2	1	16.2	0.99	1429	1459	16779	1.020	1.042	16	29
122	39	36	2	25	2	1	16.2	0.99	1429	1521	17492	1.064	-	41	36
123	39	48	1	70	2	1	16.4	0.96	1380	1058	12167	0.766	0.789	25	31
123	48	39	2	70	2	1	16.4	0.96	1380	1120	12880	0.811	-	25	34
124	48	50	1	25	2	1	16.3	0.96	1380	1156	13294	0.837	0.867	24	27
124	50	48	2	25	2	1	16.3	0.96	1380	1237	14226	0.896	-	13	23
125	50	51	1	25	2	1	16.3	0.99	1429	1341	15422	0.938	0.867	25	26
125	51	50	2	25	2	1	26.3	0.99	1429	1137	13076	0.795	-	30	57
126	51	52	1	10	2	1	16.9	0.95	1378	1612	18538	1.169	1.038	25	26
126	52	51	2	10	2	1	16.9	0.95	1378	1249	14364	0.906	-	30	57
127	52	69	1	25	2	1	16.5	0.96	1379	1612	18538	1.168	1.037	7	20
127	69	52	2	25	2	1	16.5	0.96	1379	1249	14364	0.905	-	26	21
131	69	75	1	71	2	1	16.0	0.96	1381	797	9166	0.577	0.597	41	41
131	75	69	2	71	2	1	16.0	0.96	1381	852	9798	0.616	-	13	44
132	75	78	1	58	2	1	16.0	0.96	1381	797	9166	0.577	0.597	52	54
132	78	75	2	58	2	1	16.0	0.96	1381	852	9798	0.616	-	42	54
133	78	80	1	34	2	1	19.0	0.96	1372	797	9166	0.580	0.600	44	26
133	80	78	2	34	2	1	19.0	0.96	1372	852	9798	0.620	-	14	19
141	84	80	1	80	3	2	23.4	0.94	2717	713	8753	0.262	0.280	36	33
141	80	84	2	80	3	2	23.4	0.94	2717	812	9614	0.298	-	28	44
142	100	84	1	95	3	2	25.6	0.94	2704	1235	14180	0.456	0.400	30	31
142	84	100	2	95	3	2	25.6	0.94	2704	932	10718	0.344	-	35	48
143	100	88	1	71	3	2	25.6	0.94	2704	1235	14180	0.456	0.400	30	31
143	88	100	2	71	3	2	25.6	0.94	2704	932	10718	0.344	-	35	48
151	87	88	1	40	3	2	24.0	0.94	2714	883	10028	0.325	0.297	29	12
151	88	87	2	40	3	2	24.0	0.94	2714	732	8945	0.269	-	15	30
152	11	87	1	455	3	2	23.0	0.94	2720	380	4370	0.139	0.178	52	53
152	87	11	2	455	3	2	23.0	0.94	2720	590	6785	0.216	-	49	49
153	11	12	1	101	3	2	23.0	0.94	2720	601	7864	0.220	0.220	40	40
153	12	11	2	101	3	2	23.0	0.94	2720	596	6848	0.219	-	61	69
161	25	26	1	10	3	2	22.8	0.94	2721	1942	22333	0.713	0.595	35	36
161	26	25	2	10	3	2	22.8	0.94	2721	1297	14916	0.476	-	14	38
162	20	25	1	38	3	2	19.9	0.95	2738	1286	14789	0.469	0.530	35	36
162	25	20	2	38	3	2	19.9	0.95	2738	1618	18607	0.590	-	14	38
163	14	20	1	70	3	2	21.0	0.95	2732	1158	14855	0.423	0.454	9	34
163	20	14	2	70	3	2	21.0	0.95	2732	1326	13635	0.485	-	12	20
171	64	81	1	65	2	2	15.4	0.96	2765	1252	14276	0.452	0.401	32	33
171	81	64	2	65	2	2	15.4	0.96	2765	967	13260	0.349	-	22	27
172	81	82	1	25	2	2	15.4	0.96	2765	750	8625	0.271	0.240	29	30
172	82	81	2	25	2	2	15.4	0.96	2765	580	6670	0.209	-	43	36
173	82	83	1	32	2	2	13.4	0.96	2765	750	8625	0.271	0.240	30	46
173	83	82	2	32	2	2	13.4	0.96	2765	580	6670	0.209	-	37	50
174	83	84	1	27	2	2	24.8	0.94	2709	725	8338	0.267	0.238	15	21
174	84	83	2	27	2	2	24.8	0.94	2709	565	6498	0.208	-	40	41
175	84	91	1	80	2	2	13.4	0.94	2778	640	7360	0.230	0.205	50	48
175	91	84	2	80	2	2	13.4	0.94	2778	500	5750	0.179	-	29	19
176	91	96	1	90	2	2	15.4	0.96	2765	320	3680	0.115	0.103	-	-
176	96	91	2	90	2	2	15.4	0.96	2765	250	2875	0.090	-	-	-
181	90	91	1	211	1	1	6.9	0.98	1408	427	4911	0.303	0.269	-	-
181	91	90	2	211	1	1	6.9	0.98	1408	333	3830	0.236	-	-	-
182	91	92	1	71	1	1	7.0	0.98	1408	300	3450	0.213	0.188	-	-



Appendix Table 4.5.1 Link Volume and Capacity in 1987, Sana'a

Link	-- Node --		Dir.	Leng. (10m)	Sect. Lane	Int. Lane	Wid.	Adj. Factor	Cap. /hr.	Link Volume Peak-H	Volume/Day	Volume/Cap. LV/C	TOT	Velocity	
	From	To												Peak	Off-P
182	92	91	2	71	1	1	7.0	0.98	1408	230	2645	0.163	-	-	-
191	97	96	1	294	1	1	8.9	0.97	1402	407	4681	0.290	0.373	-	-
191	96	97	2	294	1	1	8.9	0.97	1402	639	7349	0.455	-	-	-
192	96	94	1	58	1	1	8.9	0.97	1402	280	3220	0.199	0.260	-	-
192	94	96	2	58	1	1	8.9	0.97	1402	450	5175	0.320	-	-	-
193	93	94	1	200	1	1	9.0	0.97	1402	170	1955	0.121	0.156	-	-
193	94	93	2	200	1	1	9.0	0.97	1402	270	3105	0.192	-	-	-
194	72	93	1	211	1	1	8.9	0.97	1402	270	3105	0.192	0.156	-	-
194	93	72	2	211	1	1	8.9	0.97	1402	170	1955	0.121	-	-	-
195	35	72	1	218	1	1	8.9	0.99	1429	270	3105	0.188	0.153	-	-
195	72	35	2	218	1	1	8.9	0.99	1429	170	1955	0.118	-	-	-
196	33	35	1	218	1	1	8.9	0.99	1429	270	3105	0.188	0.153	-	-
196	35	33	2	218	1	1	8.9	0.99	1429	170	1955	0.118	-	-	-
201	8	7	1	102	3	3	38.5	0.91	3940	157	1806	0.039	0.031	-	-
201	7	8	2	102	3	3	38.5	0.91	3940	89	1024	0.022	-	-	-
202	9	8	1	45	1	1	16.9	0.95	1378	157	1806	0.113	0.089	-	-
202	8	9	2	45	1	1	16.9	0.95	1378	89	1024	0.064	-	-	-
203	10	9	1	143	1	1	16.9	0.95	1378	160	1840	0.116	0.090	-	-
203	9	10	2	143	1	1	16.9	0.95	1378	90	1035	0.065	-	-	-
204	10	11	1	170	3	2	24.1	0.94	2713	90	1035	0.033	0.046	-	-
204	11	10	2	170	3	2	24.1	0.94	2713	160	1840	0.058	-	-	-
211	87	89	1	40	1	1	7.3	0.97	1407	508	5842	0.361	0.350	-	-
211	89	87	2	40	1	1	7.3	0.97	1407	478	5497	0.339	-	-	-
212	89	90	1	41	1	1	7.2	0.97	1407	508	5842	0.361	0.350	-	-
212	90	89	2	41	1	1	7.2	0.97	1407	478	5497	0.339	-	-	-
311	26	43	1	35	3	2	22.8	0.94	2721	2155	24783	0.791	0.634	26	34
311	43	26	2	35	3	2	22.8	0.94	2721	1297	14916	0.476	-	41	52
312	43	44	1	21	3	2	20.5	0.95	2735	2155	24783	0.787	0.774	12	33
312	44	43	2	21	3	2	20.5	0.95	2735	2080	23920	0.760	-	15	36
313	44	45	1	18	3	2	27.5	0.93	2693	2478	26527	0.920	0.815	28	43
313	45	44	2	18	3	2	27.5	0.93	2693	1914	23565	0.710	-	25	43
314	45	58	1	17	3	2	25.7	0.94	2703	2478	26527	0.916	0.812	8	31
314	58	45	2	17	3	2	25.7	0.94	2703	1914	23565	0.708	-	33	35
315	58	64	1	38	3	2	23.1	0.94	2719	2478	26527	0.911	0.807	12	24
315	64	58	2	38	3	2	23.1	0.94	2719	1914	23565	0.703	-	14	40
321	78	92	1	122	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-
321	92	78	2	122	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
331	79	78	1	50	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-
331	78	79	2	50	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
332	83	79	1	79	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-
332	79	83	2	79	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
341	74	93	1	55	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-
341	93	74	2	55	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
342	71	74	1	88	1	1	0.0	0.94	1357	270	3000	0.198	0.198	-	-
342	74	71	2	88	1	1	0.0	0.94	1357	270	3000	0.198	-	-	-
351	24	25	1	73	2	1	13.2	0.96	1389	527	6061	0.379	0.394	-	-
351	25	24	2	73	2	1	13.2	0.96	1389	570	6555	0.410	-	-	-
361	22	23	1	40	1	0.5	5.1	0.98	707	615	6143	0.869	0.753	-	-
361	23	22	2	40	0.5	0.5	5.1	0.98	707	450	5601	0.636	-	-	-
362	22	60	1	155	2	2	16.0	0.96	2762	691	7947	0.250	0.280	-	-
362	60	22	2	155	2	2	16.0	0.96	2762	860	9890	0.311	-	-	-
371	22	24	1	60	1	1	9.1	0.97	1402	615	7073	0.438	0.379	-	-
371	24	22	2	60	1	1	9.1	0.97	1402	450	5175	0.320	-	-	-

Appendix Table 4.5.1 Link Volume and Capacity in 1987, Sana'a

Link	-- Node --		Dir.	Leng. (10m)	Sect. Lane	Int. Lane	Wid.	Adj. Factor	Cap. /hr.	Link Volume		Volume/Cap.		Velocity	
	From	To								Peak-H	Day	LV/C	TOT	Peak	Off-P
381	60	61	1	36	2	1	6.8	0.98	1408	1039	11348	0.737	0.694	-	-
391	61	60	2	35	2	1	7.1	0.97	1408	917	11549	0.651	-	-	-
401	85	82	1	67	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-
401	82	85	2	67	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
402	86	85	1	36	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-
402	85	86	2	36	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
403	61	86	1	70	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-
403	86	61	2	70	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
411	62	86	1	64	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-
411	86	62	2	64	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
421	63	85	1	85	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-
421	85	63	2	85	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
431	81	76	1	80	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-
431	76	81	2	80	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
441	77	75	1	66	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-
441	75	77	2	66	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
451	78	74	1	100	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-
451	74	78	2	100	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
461	55	68	1	31	1	1	7.6	0.97	1406	648	7452	0.460	0.391	-	-
461	68	55	2	31	1	1	7.6	0.97	1406	454	5221	0.322	-	-	-
462	54	55	1	2	1	1	11.9	0.96	1393	648	7452	0.465	0.395	31	35
462	55	54	2	2	1	1	11.9	0.96	1393	454	4981	0.325	-	9	43
463	53	54	1	23	1	1	11.9	0.96	1393	648	7452	0.465	0.395	31	35
463	54	53	2	23	1	1	11.9	0.96	1393	454	5221	0.325	-	9	43
464	47	53	1	37	1	1	11.9	0.96	1393	648	7452	0.465	0.395	7	27
464	53	47	2	37	1	1	11.9	0.96	1393	454	5221	0.325	-	22	33
465	40	47	1	66	1	1	12.9	0.96	1390	710	8165	0.510	0.525	24	33
465	47	40	2	66	1	1	12.9	0.96	1390	750	8625	0.539	-	16	24
466	37	40	1	15	1	1	11.2	0.97	1395	710	8165	0.508	0.523	36	42
466	40	37	2	15	2	1	11.2	0.97	1395	750	8625	0.537	-	20	36
467	31	37	1	30	2	2	16.1	0.96	2761	775	8913	0.280	0.330	23	49
467	37	31	2	30	2	2	16.1	0.96	2761	1051	12087	0.380	-	33	37
471	54	51	1	28	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-
471	51	54	2	28	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
481	53	50	1	36	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-
481	50	53	2	36	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
491	48	49	1	55	2	1	16.0	0.96	1381	455	5233	0.329	0.288	-	-
491	49	48	2	55	2	1	16.0	0.96	1381	343	3945	0.248	-	-	-
492	47	48	1	40	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-
492	48	47	2	40	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
501	37	36	1	29	1	1	10.7	0.97	1397	276	3174	0.197	0.212	-	-
501	36	37	2	29	1	1	10.7	0.97	1397	317	1500	0.226	-	-	-
511	36	35	1	164	1	1	8.4	0.97	1404	279	3209	0.198	0.153	-	-
511	35	36	2	164	1	1	8.4	0.97	1404	151	1737	0.107	-	-	-
521	49	70	1	75	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-
521	70	49	2	75	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
522	38	49	1	66	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-
522	49	38	2	66	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
541	39	38	1	70	1	1	0.0	0.94	1357	270	3000	0.198	0.198	-	-
541	38	39	2	70	1	1	0.0	0.94	1357	270	3000	0.198	-	-	-
551	55	52	1	25	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-
551	52	55	2	25	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
552	56	55	1	53	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-

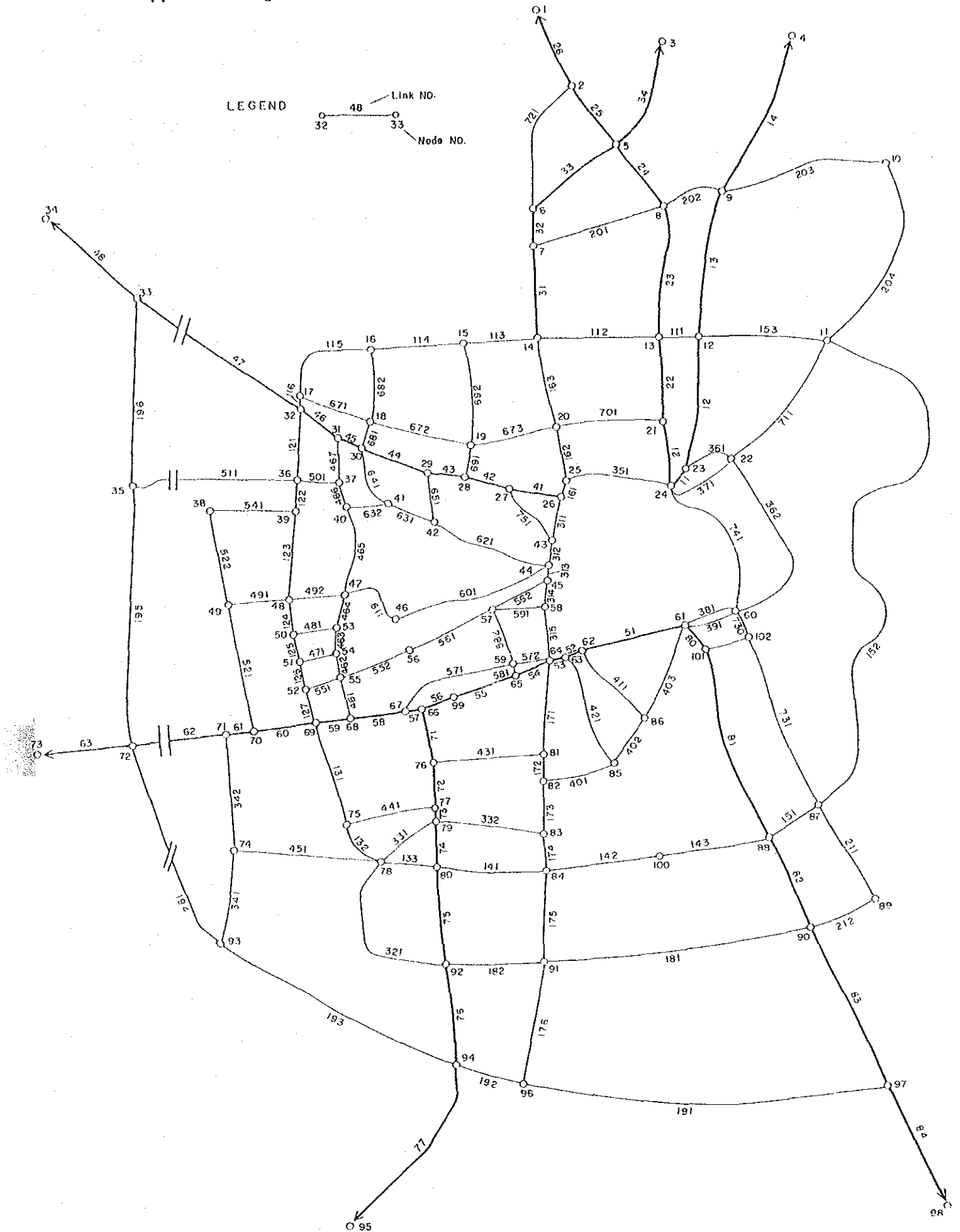
Appendix Table 4.5.1 Link Volume and Capacity in 1987, Sana'a

Link	Node		Dir.	Leng. (10m)	Sect. Lane	Int. Lane	Wid.	Adj. Factor	Cap. /hr.	Link Volume		Volume/Cap.		Velocity	
	From	To								Peak-H	Day	LV/C	TOT	Peak	Off-P
552	55	56	2	53	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
561	57	56	1	118	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-
561	56	57	2	118	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
562	45	57	1	50	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-
562	57	45	2	50	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
571	59	67	1	53	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-
571	67	59	2	53	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
572	64	59	1	24	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-
572	59	64	2	24	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
581	59	65	1	5	1	1	0.0	0.94	1357	270	3000	0.198	0.198	-	-
581	65	59	2	5	1	1	0.0	0.94	1357	270	3000	0.198	-	-	-
582	57	59	1	58	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-
582	59	57	2	58	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
591	58	57	1	50	1	1	0.0	0.94	1357	135	1500	0.099	0.099	-	-
591	57	58	2	50	1	1	0.0	0.94	1357	135	1500	0.099	-	-	-
601	44	46	1	112	1	1	5.1	0.98	1414	507	4567	0.358	0.358	25	25
601	46	44	2	112	1	1	5.1	0.98	1414	0	0	0	-	-	-
611	46	47	1	50	1	1	8.1	0.97	1405	507	5831	0.360	0.360	18	24
611	47	46	2	50	1	1	8.1	0.97	1405	0	0	0	-	-	-
621	44	42	1	87	1	1	9.2	0.97	1401	619	6528	0.441	0.441	14	25
621	42	44	2	87	1	1	9.2	0.97	1401	0	0	0	-	-	-
631	42	41	1	40	1	1	9.0	0.97	1402	320	3680	0.228	0.228	38	32
631	41	42	2	40	1	1	9.0	0.97	1402	0	0	0	-	-	-
632	41	40	1	0	2	2	12.0	0.96	2786	135	1500	0.048	0.048	23	35
632	40	41	2	0	2	2	12.0	0.96	2786	135	1500	0.048	-	-	-
641	41	30	1	44	2	2	15.2	0.96	2766	135	1500	0.048	0.048	-	-
641	30	41	2	44	2	2	15.2	0.96	2766	135	1500	0.048	-	-	-
651	42	29	1	40	1	1	9.0	0.97	1402	300	3450	0.213	0.155	-	-
651	29	42	2	40	1	1	9.0	0.97	1402	135	1500	0.096	-	-	-
671	18	17	1	60	2	2	0.0	0.94	2715	1036	11914	0.381	0.297	-	-
671	17	18	2	60	2	2	0.0	0.94	2715	582	6693	0.214	-	-	-
672	19	18	1	78	2	2	0.0	0.94	2715	1036	11914	0.381	0.297	-	-
672	18	19	2	78	2	2	0.0	0.94	2715	582	6693	0.214	-	-	-
673	20	19	1	56	1	1	13.5	0.96	1388	1036	11914	0.746	0.582	-	-
673	19	20	2	56	2	1	13.5	0.96	1388	582	6693	0.419	-	-	-
681	18	30	1	27	1	1	0.0	0.94	1357	37	426	0.027	0.048	-	-
681	30	18	2	27	1	1	0.0	0.94	1357	94	1081	0.069	-	-	-
682	16	18	1	51	1	1	0.0	0.94	1357	37	426	0.027	0.048	-	-
682	18	16	2	51	1	1	0.0	0.94	1357	94	1081	0.069	-	-	-
691	19	29	1	28	1	1	0.0	0.94	1357	38	437	0.028	0.049	-	-
691	29	19	2	28	1	1	0.0	0.94	1357	95	1093	0.070	-	-	-
692	15	19	1	80	1	1	0.0	0.94	1357	38	437	0.028	0.049	-	-
692	19	15	2	80	1	1	0.0	0.94	1357	95	1093	0.070	-	-	-
701	21	20	1	78	1	1	13.5	0.96	1388	660	7590	0.475	0.414	-	-
701	20	21	2	78	1	1	13.5	0.96	1388	492	5658	0.354	-	-	-
711	11	22	1	107	1	1	7.1	0.97	1408	135	1500	0.095	0.095	-	-
711	22	11	2	107	1	1	7.1	0.97	1408	135	1500	0.095	-	-	-
721	2	6	1	98	2	1	16.0	0.96	1381	561	6452	0.406	0.462	-	-
721	6	2	2	98	2	1	16.0	0.96	1381	716	8234	0.518	-	-	-
730	102	87	1	24	1	1	8.2	0.97	1404	966	11109	0.688	0.696	-	-
730	87	102	2	24	1	1	8.2	0.97	1404	990	11385	0.705	-	-	-
731	60	87	1	166	1	1	8.2	0.97	1404	966	11109	0.688	0.696	-	-
731	87	60	2	166	1	1	8.2	0.97	1404	990	11385	0.705	-	-	-

Appendix Table 4.5.1 Link Volume and Capacity in 1987, Sana'a

Link	-- Node --		Dir.	Leng. (10m)	Sect. Lane	Int. Lane	Wid.	Adj. Factor	Cap. /hr.	Link Volume		Volume/Cap.		Velocity	
	From	To								Peak-H	Day	LV/C	TOT	Peak	Off-P
741	24	60	1	145	1	1	0.0	0.94	1357	847	9741	0.624	0.532	25	28
741	60	24	2	145	1	1	0.0	0.94	1357	597	6866	0.439	-	24	21
751	27	43	1	45	1	1	0.0	0.94	1357	783	9005	0.577	0.677	-	-
751	43	27	2	45	1	1	0.0	0.94	1357	0	0	0	-	-	-

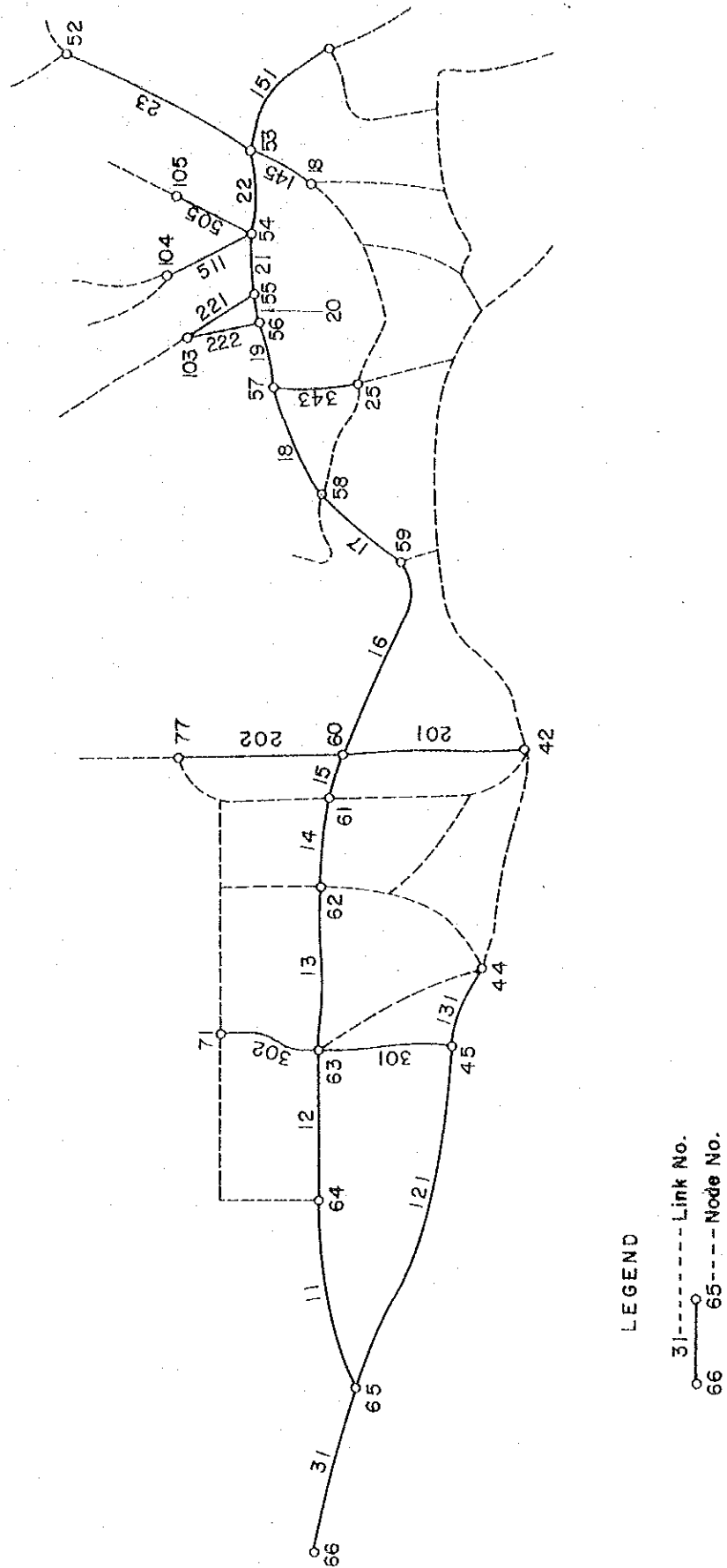
Appendix Fig. 4.5.1 Link and Node Number on Road Network, Sana'a



Appendix Table 4.5.2 Link Volume and Capacity in 1987, Taiz

Link	-- Node --		Dir.	Leng. (10m)	Sect. Lane	Int. Lane	Wid.	Adj. Factor	Cap. /hr.	L-V Peak-H	Volume/Cap.	
	From	To									LV/C	TOT
11	64	65	1	26	2	2	16.1	0.96	2762	884	0.320	0.327
11	65	64	2	26	2	2	16.1	0.96	2762	926	0.335	-
12	63	64	1	47	2	2	20.0	0.95	2738	1157	0.422	0.473
12	64	63	2	47	2	2	20.0	0.95	2738	1435	0.524	-
13	62	63	1	34	2	2	20.0	0.95	2738	1780	0.650	0.587
13	63	62	2	34	2	2	20.0	0.95	2738	1439	0.525	-
14	61	62	1	19	2	2	20.0	0.95	2738	2425	0.885	0.723
14	62	61	2	19	2	2	20.0	0.95	2738	1537	0.561	-
15	60	61	1	10	2	2	23.4	0.94	2712	2425	0.894	0.730
15	61	60	2	10	2	2	23.4	0.94	2712	1537	0.566	-
16	59	60	1	46	2	2	17.4	0.95	2753	1892	0.687	0.589
16	60	59	2	46	2	2	17.4	0.95	2753	1356	0.492	-
17	58	59	1	24	2	2	17.4	0.95	2753	1520	0.552	0.539
17	59	58	2	24	2	2	17.4	0.95	2753	1448	0.525	-
18	57	58	1	25	2	2	18.0	0.95	2750	2169	0.788	0.575
18	58	57	2	25	2	2	18.0	0.95	2750	995	0.361	-
19	56	57	1	10	2	2	18.0	0.95	2750	1585	0.576	0.561
19	57	56	2	10	2	2	18.0	0.95	2750	1502	0.546	-
20	55	56	1	10	2	2	18.0	0.95	2750	1585	0.576	0.561
20	56	55	2	10	2	2	18.0	0.95	2750	1502	0.546	-
21	54	55	1	13	2	2	18.0	0.95	2750	1075	0.390	0.348
21	55	54	2	13	2	2	18.0	0.95	2750	840	0.305	-
22	53	54	1	20	2	2	18.2	0.95	2750	1075	0.390	0.348
22	54	53	2	20	2	2	18.2	0.95	2750	840	0.305	-
23	52	53	1	48	2	2	17.5	0.95	2753	1114	0.404	0.383
23	53	52	2	48	2	2	17.5	0.95	2753	998	0.362	-
31	65	66	1	26	2	2	16.1	0.98	2816	1387	0.492	0.553
31	66	65	2	26	2	2	16.1	0.98	2816	1729	0.613	-
121	45	65	1	76	1	2	11.4	0.97	1395	681	0.488	0.606
121	65	45	2	76	1	1	11.4	0.97	1395	1011	0.724	-
131	44	45	1	17	1	1	13.0	0.96	1390	704	0.506	0.151
131	45	44	2	17	1	1	13.0	0.96	1390	1086	0.781	-
145	53	18	1	17	1	1	9.7	0.97	1400	476	0.34	0.322
145	18	53	2	17	1	1	9.7	0.97	1400	427	0.305	-
151	10	53	1	30	1	1	12.9	0.96	1390	790	0.568	0.491
151	53	10	2	30	1	1	12.9	0.96	1390	576	0.414	-
201	60	42	1	39	2	2	16.9	0.95	2756	580	0.210	0.189
201	42	60	2	39	2	2	16.9	0.95	2756	467	0.169	-
202	77	60	1	28	2	2	14.9	0.95	2768	800	0.289	0.178
202	60	77	2	28	2	2	14.9	0.95	2768	188	0.067	-
221	103	55	1	24	0	0	0.0	0	0	0	0	0.11
221	55	103	2	24	2	2	0.0	0.94	2714	300	0.110	-
222	103	56	1	24	2	2	0.0	0.94	2714	300	0.110	0.11
222	56	103	2	24	0	0	0.0	0	0	0	0	-
301	63	45	1	27	1	2	0.0	0.94	1357	300	0.221	0.221
301	45	63	2	27	1	2	0.0	0.94	1357	300	0.221	-
302	71	63	1	20	1	2	0.0	0.94	1357	300	0.221	0.221
302	63	71	2	20	1	1	0.0	0.94	1357	300	0.221	-
343	57	25	1	16	1	1	10.3	0.97	1398	398	0.284	0.421
343	25	57	2	16	1	2	10.3	0.97	1398	780	0.557	-
505	105	54	1	22	1	1	0.0	0.94	1357	150	0.110	0.110
505	54	105	2	22	1	1	0.0	0.94	1357	150	0.110	-
511	104	54	1	22	1	1	0.0	0.94	1357	150	0.110	0.110
511	54	104	2	22	1	1	0.0	0.94	1357	150	0.110	-

Appendix Fig. 4.5.2 Link and Node Number on Road Network, Taiz



Appendix Table 4.5.3 Link Volume and Capacity in 1987, Hodeidah

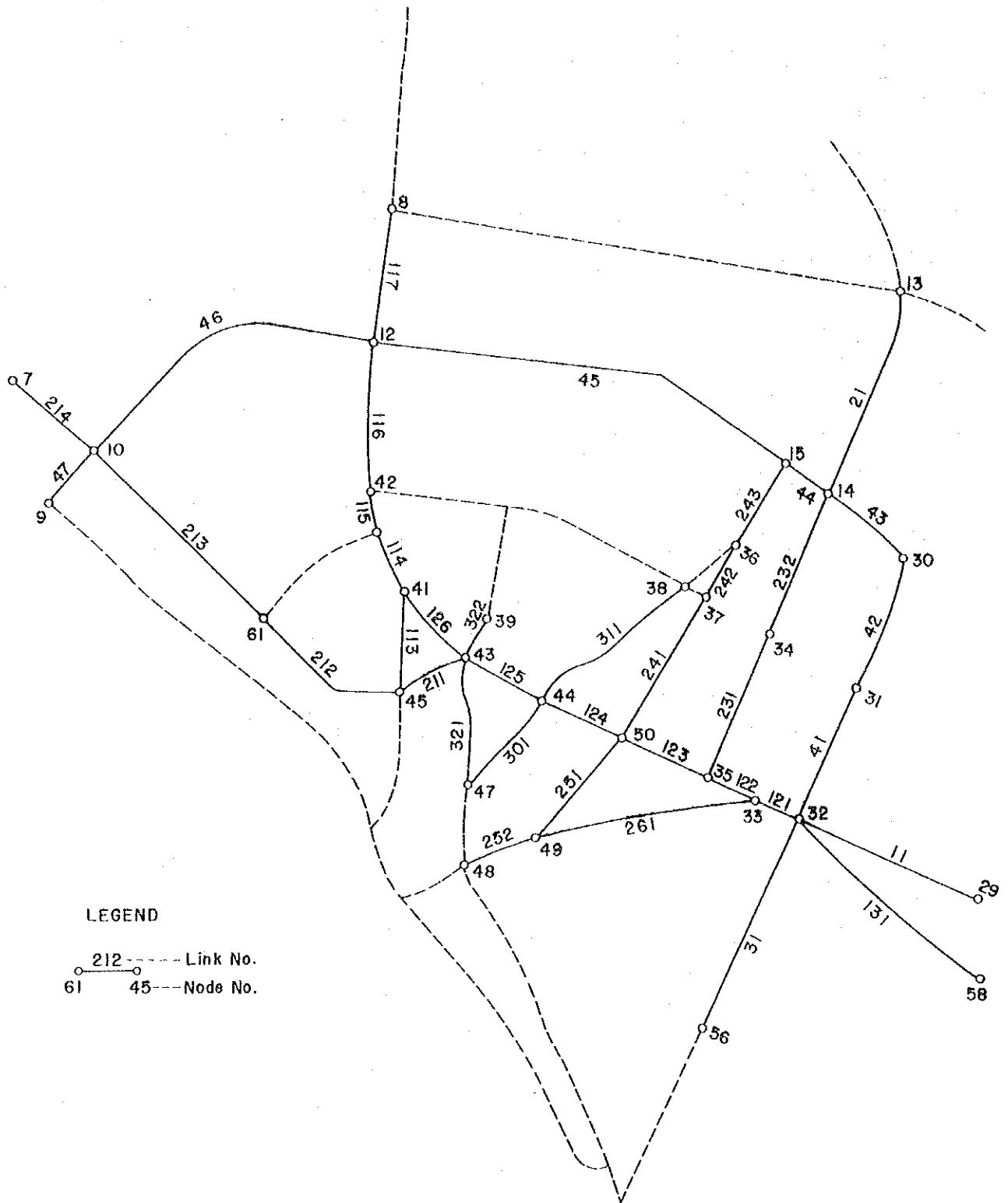
Link	-- Node -- From	To	Dir.	Leng. (10m)	Sect. Lane	Int. Lane	Wid.	Adj. Factor	Cap. /hr.	L-V Peak-H	Volume/LV/C	Cap. TOT
11	29	32	1	50	2	2	22.0	0.94	2726	864	0.316	0.296
11	32	29	2	50	2	2	22.0	0.94	2726	750	0.275	-
21	13	14	1	80	1	2	11.4	0.97	1395	371	0.265	0.259
21	14	13	2	80	1	2	11.4	0.97	1395	353	0.253	-
31	32	56	1	90	2	2	17.2	0.95	2754	779	0.282	0.274
31	56	32	2	90	2	2	17.2	0.95	2754	732	0.265	-
41	31	32	1	60	3	3	25.3	0.94	4059	569	0.140	0.149
41	32	31	2	60	3	3	25.3	0.94	4059	644	0.158	-
42	30	31	1	60	3	3	25.3	0.94	4059	569	0.140	0.149
42	31	30	2	60	3	3	25.3	0.94	4059	644	0.158	-
43	30	14	1	50	3	3	25.3	0.94	4059	569	0.140	0.149
43	14	30	2	50	3	3	25.3	0.94	4059	644	0.158	-
44	14	15	1	22	2	2	17.7	0.95	2751	386	0.140	0.132
44	15	14	2	22	2	2	17.7	0.95	2751	341	0.123	-
45	15	12	1	270	2	2	17.7	0.95	2751	386	0.140	0.132
45	12	15	2	270	2	2	17.7	0.95	2751	341	0.123	-
46	12	10	1	140	2	2	17.7	0.95	2751	309	0.112	0.105
46	10	12	2	140	2	2	17.7	0.95	2751	273	0.099	-
47	10	9	1	17	2	2	0.0	0.94	2714	70	0.025	0.025
47	9	10	2	17	2	2	0.0	0.94	2714	70	0.025	-
113	41	45	1	42	2	2	14.2	0.96	2772	823	0.296	0.296
113	45	41	2	0	0	0	0.0	0	0	0	0	-
114	40	41	1	20	2	2	18.5	0.95	2747	1196	0.435	0.436
114	41	40	2	20	2	2	18.5	0.95	2747	1201	0.437	-
115	42	40	1	15	2	2	18.5	0.95	2747	1196	0.435	0.436
115	40	42	2	15	2	2	18.5	0.95	2747	1201	0.437	-
116	12	42	1	70	2	2	18.5	0.95	2747	718	0.261	0.261
116	42	12	2	70	2	2	18.5	0.95	2747	721	0.262	-
117	8	12	1	50	2	2	18.5	0.95	2747	502	0.182	0.183
117	12	8	2	50	2	2	18.5	0.95	2747	505	0.183	-
121	32	33	1	21	2	2	22.0	0.94	2726	1698	0.622	0.151
121	33	32	2	21	2	2	22.0	0.94	2726	1559	0.571	-
122	33	35	1	27	2	2	22.0	0.94	2726	1698	0.62	0.597
122	35	33	2	27	2	2	22.0	0.94	2726	1559	0.571	-
123	35	50	1	38	2	2	22.0	0.94	2726	1738	0.637	0.655
123	50	35	2	38	2	2	22.0	0.94	2726	1837	0.673	-
124	50	44	1	40	2	2	22.0	0.94	2726	1891	0.693	0.630
124	44	50	2	40	2	2	22.0	0.94	2726	1547	0.567	-
125	44	43	1	40	2	2	22.0	0.94	2726	1528	0.560	0.547
125	43	44	2	40	2	2	22.0	0.94	2726	1458	0.534	-
126	43	41	1	39	3	3	12.4	0.96	4175	1580	0.378	0.378
126	41	43	2	39	0	0	0.0	0	0	0	0	-
131	58	32	1	50	2	2	11.0	0.97	2792	376	0.134	0.108
131	32	58	2	50	2	2	11.0	0.97	2792	228	0.081	-
211	43	45	1	0	0	0	0.0	0	0	0	0	0.430
211	45	43	2	30	2	2	8.8	0.97	2804	1206	0.430	-
212	45	61	1	75	2	2	0.0	0.94	2714	220	0.081	0.081
212	61	45	2	75	2	2	0.0	0.94	2714	220	0.081	-
213	61	10	1	100	2	2	0.0	0.94	2714	220	0.081	0.081
213	10	61	2	100	2	2	0.0	0.94	2714	220	0.081	-
214	10	7	1	50	2	2	0.0	0.94	2714	150	0.055	0.055
214	7	10	2	50	2	2	0.0	0.94	2714	150	0.055	-
231	34	35	1	60	2	2	18.0	0.95	2750	742	0.269	0.216
231	35	34	2	60	2	2	18.0	0.95	2750	446	0.162	-
232	14	34	1	70	2	2	18.0	0.95	2750	742	0.269	0.263



Appendix Table 4.5.3 Link Volume and Capacity in 1987, Hodeidah

Link	-- Node --		Dir.	Leng. (10m)	Sect. Lane	Int. Lane	Wid.	Adj. Factor	Cap. /hr.	L-V Peak-H	Volume/Cap.	
	From	To									LV/C	TOI
232	34	14	2	70	2	2	18.0	0.95	2750	706	0.256	-
241	37	50	1	68	2	2	18.0	0.95	2750	550	0.2	0.181
241	50	37	2	68	2	2	18.0	0.95	2750	446	0.162	-
242	36	37	1	30	2	2	18.0	0.95	2750	550	0.2	0.181
242	37	36	2	30	2	2	18.0	0.95	2750	446	0.162	-
243	15	36	1	38	2	2	18.0	0.95	2750	550	0.2	0.228
243	36	15	2	38	2	2	18.0	0.95	2750	706	0.256	-
251	50	49	1	68	2	2	18.5	0.95	2747	374	0.136	0.132
251	49	50	2	68	2	2	18.5	0.95	2747	355	0.129	-
252	49	48	1	25	2	2	18.5	0.95	2747	374	0.136	0.192
352	48	49	2	25	2	2	18.5	0.95	2747	681	0.247	-
261	33	49	1	115	0	0	0.0	0	0	0	0	0.232
261	49	33	2	115	1	1	8.0	0.97	1405	326	0.232	-
301	44	47	1	50	0	0	0.0	0	0	0	0	0.185
301	47	44	2	50	1	2	8.0	0.97	1404	260	0.185	-
311	38	44	1	82	2	2	18.9	0.95	2744	350	0.127	0.136
311	44	38	2	82	2	2	18.9	0.95	2744	400	0.145	-
321	43	47	1	56	1	1	0.0	0.94	1357	300	0.221	0.224
321	47	43	2	56	1	1	0.0	0.94	1357	308	0.226	-
322	39	43	1	20	1	1	0.0	0.94	1357	248	0.182	0.172
322	43	39	2	20	1	1	0.0	0.94	1357	220	0.162	-

Appendix Fig. 4.5.3 Link and Node Number on Road Network, Hodeidah



Appendix Table 4.5.4 Volume and Capacity of Intersections in 1987 and 1992, Sana'a

Link	Node		Dir.	Leng. (10m)	Sect. Lane	(LN)	Int. Lane	Adj. Factor	Capacity Sect	Capacity (F)		Link Volume		LV87/Cap.		LV92/Cap.		Velocity Peak Off-P
	From	To								1987	1992	P/C	TOI	P/C	TOI	P/C	TOI	
26	2	1	2	200	1	1	1	6	0.94	1357	1357	880	1305	0.648	0.648	0.961	0.961	-
25	1	2	1	200	1	1	1	6	0.94	1357	1357	850	1290	0.636	-	0.928	-	-
23	5	2	1	46	1	1	1	6	0.94	1357	1357	818	1213	0.602	-	0.893	-	-
731	6	2	2	98	2	1	1	16	0.95	1381	2762	716	1061	0.259	1.488	0.384	2.206	-
34	3	2	2	200	1	1	1	16.1	0.96	1430	1430	1226	1818	0.857	0.857	1.271	1.271	-
14	9	4	2	200	1	1	1	16	0.96	1381	1381	810	1201	0.586	0.586	0.869	0.869	-
25	2	5	1	46	1	1	1	6	0.94	1357	4071	910	1349	0.223	-	0.331	-	-
34	5	1	2	200	1	1	3	18.1	0.99	1430	4290	1365	2024	0.318	-	0.471	-	22
33	6	5	1	75	3	1.5	3	21.35	0.95	2047	4094	1579	2341	0.385	-	0.571	-	27
24	8	5	2	55	3	3	3	24.75	0.94	2709	4064	865	1282	0.212	1.140	0.315	1.690	-
731	6	2	1	98	2	1	2	16	0.96	1381	2762	561	832	0.203	-	0.301	-	-
33	5	6	1	75	3	1.5	3	21.35	0.95	2047	4094	1350	2001	0.329	-	0.488	-	24
32	7	6	1	28	3	3	3	25.65	0.94	2704	4056	1392	2064	0.343	0.876	0.508	1.298	32
32	6	7	1	28	3	3	3	25.65	0.94	2704	4056	1366	2025	0.386	-	0.499	-	41
21	8	7	1	102	3	3	3	38.45	0.91	3940	3940	157	233	0.039	-	0.059	-	43
31	14	7	2	78	3	2	3	21	0.95	2732	4098	1726	2559	0.421	0.797	0.624	1.182	40
24	5	8	1	55	3	3	3	24.75	0.94	2709	4064	1118	1657	0.275	-	0.407	-	44
204	7	8	2	102	3	3	3	38.45	0.91	3940	3940	89	132	0.022	-	0.033	-	-
202	9	8	1	45	1	1	2	16.9	0.95	1378	2756	157	233	0.055	-	0.084	-	-
23	13	8	2	103	2	2	2	19	0.95	2744	2744	865	1282	0.315	0.669	0.467	0.993	-
14	4	9	1	200	1	1	1	16	0.96	1381	1378	640	949	0.231	-	0.343	-	-
202	8	9	2	45	1	1	1	16.9	0.95	1378	1378	89	132	0.064	-	0.095	-	-
10	9	9	1	143	1	1	1	16.9	0.95	1378	1378	160	237	0.116	-	0.172	-	-
13	12	9	2	118	1	1	2	16	0.96	1381	2762	1016	1506	0.367	0.780	0.545	1.156	-
203	9	10	2	143	1	1	1	16.9	0.95	1378	1378	90	133	0.065	-	0.096	-	-
204	11	10	2	170	3	2	3	24.1	0.94	2713	4070	160	237	0.039	0.104	0.058	0.155	-
204	10	11	1	170	3	2	2	24.1	0.94	2713	4070	90	133	0.022	-	0.032	-	-
153	12	11	2	101	3	2	3	23	0.94	2730	4080	596	884	0.146	-	0.216	-	61
711	22	11	2	107	1	1	1	7.1	0.97	1408	4324	135	200	0.021	-	0.047	-	-
152	87	11	2	455	3	2	3	23	0.94	2730	4080	590	875	0.144	0.344	0.214	0.511	49
13	9	12	1	118	1	1	1	16.1	0.96	1381	2762	703	1042	0.254	-	0.377	-	-
133	11	12	1	101	3	2	2	23	0.94	2730	4080	601	891	0.147	-	0.218	-	40
111	13	12	2	32	3	2	3	20	0.95	2738	4107	812	1204	0.197	-	0.293	-	37
12	23	12	2	103	1	1	1	16.1	0.96	1381	4143	249	369	0.060	0.659	0.089	0.977	-
23	8	13	1	103	2	2	2	19	0.95	2744	4116	1118	1657	0.271	-	0.402	-	37
111	12	13	1	32	3	2	3	20	0.95	2738	4107	612	907	0.149	-	0.220	-	15
112	14	13	2	89	3	2	2	15.95	0.96	2752	4133	759	1125	0.274	-	0.407	-	21
22	21	13	2	71	2	2	3	16.5	0.96	2759	4139	827	1226	0.199	0.895	0.296	1.327	27
31	7	14	1	78	3	2	4	21	0.95	2732	5464	1384	2052	0.253	-	0.375	-	38
112	13	14	1	89	3	2	2	15.95	0.96	2752	4143	761	1128	0.183	-	0.272	-	26
113	15	14	2	51	3	2	4	25.95	0.94	2702	5404	1162	1723	0.215	-	0.318	-	23
163	20	14	1	70	3	2	4	20.95	0.95	2732	5484	1326	1966	0.242	0.894	0.359	1.326	42
113	14	15	1	51	3	2	2	25.95	0.94	2702	5404	1027	1523	0.380	-	0.563	-	16
114	16	15	2	56	3	2	2	25.9	0.99	2888	2888	1067	1582	0.373	-	0.553	-	20
892	19	15	2	80	1	1	1	0	0.94	1357	1357	95	141	0.070	0.823	0.103	1.220	34
114	15	16	2	56	3	2	3	25.9	0.99	2858	4387	989	1466	0.230	-	0.342	-	15
115	17	16	2	105	3	2	3	25.9	0.94	2702	4053	973	1442	0.240	-	0.355	-	21
682	18	16	2	51	3	1	1	0	0.94	1357	1357	94	139	0.069	0.540	0.102	0.800	37
115	16	17	1	105	3	2	3	25.9	0.94	2702	4053	952	1411	0.234	-	0.348	-	49
671	18	17	1	60	3	2	2	0	0.94	2715	2715	1036	1536	0.381	-	0.565	-	56
32	32	17	2	11	3	3	3	23.05	0.94	2719	4079	879	1303	0.215	0.861	0.319	1.233	-
682	16	18	1	51	3	1	1	0	0.94	1357	1357	37	55	0.027	-	0.040	-	26
671	17	18	1	60	2	2	2	0	0.94	2715	2715	582	863	0.214	-	0.317	-	-
672	19	18	1	78	2	2	2	0	0.94	2715	2715	1036	1536	0.381	-	0.565	-	-

Appendix Table 4.5.4 Volume and Capacity of Intersections in 1987 and 1992, Sana'a

Link	Node From	Node To	Dir.	Leng. (10m)	Sect. Lane	Int. Lane (LN)	Adj. Factor	Capacity (F)	Link Volume 1987	Link Volume 1992	LV87/Cap. P/C	LV92/Cap. TOT	LV92/Cap. P/C	TOI	Velocity Peak Off-P
681	30	18	1	27	1	1	0.94	1357	94	139	0.069	0.692	0.102	1.026	-
692	15	19	1	80	1	1	0.94	1357	38	56	0.028	-	0.041	-	-
672	18	19	2	78	2	2	0.94	2715	583	863	0.214	-	0.317	-	-
673	20	19	1	56	1	1	0.96	1388	1036	1536	0.746	-	1.106	-	-
691	29	19	2	28	1	1	0.94	1357	93	141	0.070	1.058	0.103	1.569	9
163	14	20	1	70	2	3	0.95	2732	4098	1158	0.282	-	0.418	-	34
673	19	20	2	56	1	2	0.96	1388	2776	582	0.209	-	0.310	-	-
701	21	20	1	78	1	1	0.96	1388	2776	582	0.209	-	0.310	-	-
162	25	20	2	38	1	2	0.95	2738	4107	1618	0.399	1.123	0.584	1.666	14
22	13	21	1	71	2	2	0.96	2759	1077	1597	0.390	-	0.578	-	37
701	20	21	1	78	1	1	0.96	1388	2776	582	0.209	-	0.310	-	-
21	24	21	2	41	2	2	0.95	1376	2752	670	0.243	0.811	0.350	1.202	17
711	11	22	1	107	1	1	0.97	1408	1408	155	0.095	-	0.142	-	37
361	23	22	2	60	1	1	0.98	1408	1408	155	0.095	-	0.142	-	-
371	24	22	2	60	1	1	0.97	1402	1402	450	0.320	-	0.473	-	-
362	60	22	2	155	2	2	0.96	2762	2762	850	0.311	1.046	0.461	1.551	-
12	12	23	1	103	1	1	0.96	1381	1381	397	0.287	-	0.426	-	-
361	22	23	1	40	1	1	0.98	1408	1408	155	0.095	-	0.142	-	-
11	22	23	1	40	1	1	0.97	1399	1399	249	0.177	0.900	0.263	1.334	16
21	21	24	1	41	2	1	0.95	1376	2752	916	0.332	-	0.493	-	24
371	22	24	1	60	1	1	0.97	1402	2804	615	0.219	-	0.325	-	-
11	23	24	1	11	1	1	0.97	1399	1399	397	0.283	-	0.420	-	-
351	25	24	2	73	2	1	0.96	1389	2778	570	0.205	-	0.304	-	24
741	60	24	2	145	1	1	0.94	1357	1357	885	0.439	1.481	0.652	2.195	35
162	20	25	1	38	3	2	0.95	2738	2738	1286	0.469	-	0.696	-	36
351	24	25	1	73	2	1	0.96	1389	2778	527	0.189	-	0.281	-	21
25	161	25	2	10	3	3	0.94	2721	4082	1297	0.317	0.977	0.471	1.448	14
161	25	26	1	10	3	2	0.94	2721	4082	1297	0.317	0.977	0.471	1.448	35
41	27	26	2	40	1	1	0.97	1402	1402	2879	0.475	-	0.705	-	35
311	43	26	2	35	3	3	0.94	1402	1402	0	0	-	0	-	-
41	26	27	1	40	1	1	0.97	1402	1402	1297	0.317	0.793	0.471	1.175	41
42	28	27	2	21	2	1	0.96	1385	2770	213	0.151	-	0.225	-	41
42	27	28	1	21	2	2	0.96	1385	2770	783	0.282	0.434	0.419	0.644	25
43	29	28	2	44	2	1	0.96	1385	2770	213	0.151	-	0.225	-	27
691	19	29	1	28	1	1	0.94	1357	1357	38	0.028	-	0.041	-	34
45	28	29	1	44	2	1	0.96	1385	2770	213	0.151	-	0.225	-	50
44	30	29	2	45	2	1	0.96	1385	2770	783	0.282	0.434	0.419	0.644	34
651	42	39	1	40	1	1	0.97	1402	1402	300	0.213	0.601	0.317	0.891	11
681	18	30	1	27	1	1	0.94	1357	1357	37	0.027	-	0.040	-	22
44	29	30	1	45	2	1	0.96	1385	2770	213	0.151	-	0.225	-	24
45	31	30	2	27	2	1	0.96	1385	2770	425	0.153	-	0.227	-	39
641	41	30	1	44	2	2	0.96	1385	2766	135	0.048	0.306	0.072	0.454	19
45	30	31	1	27	2	1	0.96	1385	2766	135	0.048	0.306	0.072	0.454	27
46	32	31	1	34	2	1	0.94	1357	1357	1033	0.167	-	0.248	-	33
467	37	31	2	30	2	2	0.96	1385	2761	1051	0.253	0.679	0.376	1.007	48
116	17	32	1	11	3	4	0.94	2719	5358	915	0.168	-	0.249	-	24
45	31	32	1	34	2	1	0.94	1357	1357	1033	0.167	-	0.248	-	45
47	33	32	2	147	1	1	0.98	1408	1408	881	0.208	-	0.309	-	37
121	35	32	2	51	2	1	0.96	1380	5320	1461	0.264	0.885	0.392	1.312	13
48	34	33	1	147	1	1	0.98	1408	1408	974	0.264	-	0.361	-	21
48	34	33	2	147	1	1	0.98	1408	1408	974	0.264	-	0.361	-	19
196	35	33	2	218	1	1	0.99	1429	170	1306	0.208	-	0.309	-	26
48	33	34	1	200	1	1	0.98	1408	1408	804	0.264	-	0.361	-	35
33	34	35	1	218	1	1	0.99	1429	270	1192	0.571	0.571	0.946	0.846	32
33	35	35	1	218	1	1	0.99	1429	270	400	0.188	-	0.280	-	44

Appendix Table 4.5.4 Volume and Capacity of Intersections in 1987 and 1992, Sana'a

Link	-- Node --		Leng. (10m)	Dir.	Sect. Lane	(LN)	Int. Lane	Adj. Factor	Capacity Sect	Cap. (P)	Link Volume		LV87/Cap.		LV92/Cap.		Velocity Peak Off-P
	From	To									1987	1992	P/C	TOT	P/C	TOT	
511	36	35	1	164	1	1	1	1	8.4	0.97	1404	1404	414	0.198	0.294	-	-
195	72	35	2	218	1	1	1	1	8.9	0.99	1429	1429	170	0.118	0.506	0.176	0.751
121	32	36	1	51	2	1	2	1	16.15	0.96	1380	1380	1954	0.477	-	0.707	42
511	36	36	2	164	1	1	1	1	8.4	0.97	1404	1404	224	0.107	-	0.159	-
501	37	36	1	29	1	1	1	1	10.65	0.97	1397	1397	276	0.197	-	0.292	-
122	39	36	2	25	2	1	2	1	16.15	0.99	1439	1439	1521	0.592	1.314	0.788	1.949
467	31	37	2	30	2	2	2	1	16.1	0.96	2761	2761	775	0.280	-	0.416	23
501	36	37	1	29	1	1	1	1	10.65	0.97	1397	1397	317	0.226	-	0.336	49
466	40	37	2	15	2	1	2	1	11.2	0.97	1395	1395	470	0.268	0.776	0.398	1.151
541	39	38	1	70	1	1	1	1	0	0.94	1357	1357	270	0.198	-	0.294	20
522	49	38	1	66	1	1	1	1	0	0.94	1357	1357	135	0.099	0.298	0.147	0.442
122	36	39	2	25	2	1	2	1	16.15	0.99	1439	1439	2163	1.020	-	1.513	16
541	38	39	2	70	1	1	1	1	0	0.94	1357	1357	370	0.198	-	0.294	29
123	48	39	2	70	2	1	2	1	16.4	0.96	1380	1380	1120	0.811	2.001	1.203	3.011
466	37	40	1	15	1	1	1	1	11.2	0.97	1395	1395	710	0.508	-	0.754	25
632	41	40	1	0	2	2	2	1	12.9	0.96	2786	2786	135	0.048	-	0.071	36
465	47	40	2	44	2	2	2	1	15.2	0.96	2786	2786	135	0.048	-	0.072	42
641	30	41	2	44	2	2	2	1	15.2	0.96	2786	2786	135	0.048	-	0.072	35
632	40	41	2	0	2	2	2	1	12.9	0.96	2786	2786	135	0.048	-	0.071	23
631	42	41	1	40	1	1	1	1	9	0.97	1402	1402	320	0.228	0.325	0.338	0.482
651	29	42	1	40	1	1	1	1	9	0.97	1402	1402	135	0.096	-	0.142	38
631	41	42	2	40	1	1	1	1	9	0.97	1402	1402	0	0	-	0	32
621	44	42	1	87	1	1	1	1	9.2	0.97	1401	1401	619	0.441	0.538	0.655	0.797
311	26	43	3	35	3	2	3	2	23.75	0.94	2721	4062	3195	0.527	-	0.782	14
751	27	43	1	45	1	1	1	1	0	0.94	1357	1357	783	0.577	-	0.855	26
312	44	43	2	21	3	2	3	2	26.45	0.95	2735	4103	2090	0.507	1.612	0.751	2.389
621	42	44	2	87	1	1	1	1	9.2	0.97	1401	4203	0	0	-	0	15
312	43	44	1	21	3	2	3	2	26.45	0.95	2735	4103	2155	0.525	-	0.778	12
318	45	44	2	18	3	2	3	2	27.45	0.93	2633	4040	1914	0.473	-	0.702	25
601	46	44	2	112	1	1	1	1	5.05	0.98	1414	1414	0	0.999	-	0	25
313	44	45	1	18	3	2	3	2	27.45	0.93	2633	4040	2478	0.613	-	0.909	28
562	57	45	2	50	1	1	1	1	0	0.94	1357	1357	135	0.099	-	0.147	43
314	58	45	2	17	3	2	3	2	35.7	0.94	2703	4056	1914	0.472	1.184	0.699	1.756
601	44	46	1	112	1	1	1	1	5.05	0.98	1414	1414	507	0.358	-	0.531	25
611	47	46	2	50	1	1	1	1	8.05	0.97	1405	1405	0	0.358	-	0.531	25
465	40	47	1	66	1	1	1	1	32.9	0.96	1390	1390	710	0.510	-	0.757	24
511	46	47	1	50	1	1	1	1	8.05	0.97	1405	1405	507	0.360	-	0.534	18
492	48	47	2	40	1	1	1	1	0	0.94	1357	1357	135	0.099	-	0.147	24
464	53	47	2	37	1	1	1	1	11.9	0.96	1393	1393	454	0.325	1.237	0.483	1.922
123	39	48	1	70	2	1	2	1	16.4	0.96	1380	1380	1058	0.383	-	0.568	33
492	47	48	1	40	1	1	1	1	0	0.94	1357	1357	135	0.099	-	0.147	25
491	49	48	2	55	2	1	2	1	16	0.96	1381	1381	343	0.124	-	0.184	23
124	50	48	2	25	2	1	2	1	16.25	0.96	1380	1380	1237	0.448	1.035	0.664	1.564
522	38	49	1	66	1	1	1	1	0	0.94	1357	1357	135	0.099	-	0.147	13
491	48	49	2	55	2	1	2	1	16	0.96	1381	1381	455	0.164	-	0.244	24
521	70	49	1	75	1	1	1	1	0	0.94	1357	1357	135	0.099	0.363	0.147	0.539
124	48	50	2	25	2	1	2	1	16.25	0.96	1380	1380	1156	0.418	-	0.620	30
125	51	50	2	25	2	1	2	1	25.25	0.99	1499	2338	1137	0.397	-	0.589	30
481	53	50	1	36	1	1	1	1	0	0.94	1357	1357	135	0.099	0.363	0.147	0.539
125	50	51	2	25	2	1	2	1	16.25	0.96	1380	1380	1341	0.469	-	0.696	24
126	52	51	2	10	2	1	2	1	16.25	0.99	1499	2338	1249	0.453	-	0.671	26
471	54	51	1	28	1	1	1	1	16.85	0.95	1378	2356	1852	0.463	-	0.671	30
126	51	52	1	10	2	1	2	1	16.85	0.95	1378	2356	136	0.099	1.031	0.147	1.514
551	55	52	1	25	1	1	1	1	0	0.94	1357	1357	1612	0.584	-	0.867	25
551	55	52	1	25	1	1	1	1	0	0.94	1357	1357	135	0.099	-	0.147	25

Appendix Table 4.5.4 Volume and Capacity of Intersections in 1987 and 1992, Sana'a

Link	Node From	Node To	Dir.	Leng. (10m)	Sect. Lane	Int. Lane (LN)	Adj. Factor	Capacity (F)	Link Volume		LV87/Cap.		LV92/Cap.		Velocity Peak Off-P				
									1987	1992	P/C	TOT	P/C	TOT					
127	69	52	2	25	2	1	2	16.45	0.96	1379	2758	1249	1852	0.452	1.137	0.671	1.686	26	21
464	47	53	1	37	1	1	1	11.9	0.96	1393	1393	648	961	0.465	-	0.689	-	7	27
481	50	53	2	36	1	1	1	0	0.94	1357	1357	135	200	0.099	-	0.147	-	-	-
463	54	53	2	23	1	1	1	11.9	0.96	1393	1393	454	673	0.325	0.890	0.483	1.320	9	43
471	51	54	2	28	1	1	1	0	0.94	1357	1357	135	200	0.099	-	0.147	-	-	-
463	53	54	1	23	1	1	1	11.9	0.96	1393	1393	648	961	0.465	-	0.689	-	31	35
462	55	54	2	2	1	1	1	11.9	0.96	1393	1393	454	673	0.325	0.890	0.483	1.320	9	43
551	52	55	2	25	1	1	1	0	0.94	1357	1357	135	200	0.099	-	0.147	-	-	-
462	54	55	1	53	1	1	1	11.9	0.96	1393	1393	648	961	0.465	-	0.689	-	31	35
552	55	55	1	53	1	1	1	0	0.94	1357	1357	135	200	0.099	-	0.147	-	-	-
461	56	55	2	31	1	1	1	7.55	0.97	1406	1406	454	673	0.322	0.987	0.478	1.463	-	-
552	56	56	2	53	1	1	1	0	0.94	1357	1357	135	200	0.099	-	0.147	-	-	-
561	57	56	1	118	1	1	1	0	0.94	1357	1357	135	200	0.099	0.198	0.147	0.294	-	-
562	45	57	1	50	1	1	1	0	0.94	1357	1357	135	200	0.099	-	0.147	-	-	-
561	56	57	2	118	1	1	1	0	0.94	1357	1357	135	200	0.099	-	0.147	-	-	-
591	56	57	1	50	1	1	1	0	0.94	1357	1357	135	200	0.099	-	0.147	-	-	-
582	59	57	2	58	1	1	1	0	0.94	1357	1357	135	200	0.099	0.397	0.147	0.589	8	31
314	45	58	1	17	3	2	3	25.7	0.94	2703	4055	2478	3674	0.611	-	0.906	-	-	-
591	57	58	2	50	1	1	1	0	0.94	1357	1357	135	200	0.099	-	0.147	-	-	-
315	64	58	2	38	3	2	3	23.1	0.94	2719	4079	1914	2838	0.469	1.179	0.695	1.749	14	40
582	57	59	1	58	1	1	1	0	0.94	1357	1357	135	200	0.099	-	0.147	-	-	-
581	55	59	2	24	1	1	1	0	0.94	1357	1357	135	200	0.099	-	0.147	-	-	-
571	67	59	2	5	1	1	1	0	0.94	1357	1357	135	200	0.099	0.497	0.147	0.737	-	-
362	22	60	1	155	2	2	2	15.95	0.96	2762	2762	691	1024	0.350	-	0.370	-	25	28
741	24	60	1	145	1	1	1	0	0.94	1357	1357	135	200	0.099	-	0.147	-	-	-
391	61	60	2	35	2	1	2	7.1	0.97	1408	2816	847	1256	0.312	-	0.452	-	-	-
731	102	60	1	24	1	1	3	8.2	0.97	1404	4212	990	1468	0.235	1.122	0.348	1.664	-	-
381	60	61	1	36	2	1	2	6.8	0.98	1408	2816	1039	1540	0.368	-	0.545	-	-	-
51	62	61	2	82	3	2	3	25.6	0.94	2704	4055	2172	3220	0.535	-	0.793	-	43	36
403	86	61	2	70	1	1	1	0	0.94	1357	1357	135	200	0.099	-	0.147	-	-	-
80	101	61	1	24	2	1	2	15.65	0.96	1382	2764	1415	2098	0.511	1.515	0.758	2.247	25	28
51	61	62	1	82	3	2	3	25.6	0.94	2704	4056	2057	3050	0.507	-	0.751	-	28	40
52	63	62	2	14	3	2	3	25.45	0.94	2705	4058	2172	3220	0.535	-	0.793	-	29	25
411	86	62	2	64	1	1	1	0	0.94	1357	1357	135	200	0.099	1.141	0.147	1.692	-	-
52	63	63	1	14	3	2	3	25.45	0.94	2705	4058	2057	3050	0.506	-	0.751	-	13	12
53	64	63	2	13	3	2	3	25.45	0.94	2705	4058	1707	2531	0.420	-	0.623	-	29	25
421	85	63	2	65	1	1	1	0	0.94	1357	1357	135	200	0.099	1.027	0.147	1.522	-	-
572	59	64	1	38	3	2	1	23.1	0.94	2719	5438	2478	3674	0.455	-	0.675	-	12	24
54	65	64	2	24	1	1	1	0	0.94	1357	1357	135	200	0.099	-	0.147	-	-	-
53	63	64	1	13	3	2	4	25.45	0.94	2705	5410	1644	2427	0.303	-	0.450	-	13	12
54	65	64	2	25	3	2	3	25	0.94	2708	5416	2177	3227	0.401	-	0.595	-	13	13
171	81	64	2	65	2	2	3	15.4	0.96	2755	4148	967	1434	0.233	1.038	0.345	1.539	22	27
581	59	65	1	5	1	1	3	0	0.94	1357	1357	135	200	0.099	-	0.147	-	-	-
54	64	65	1	25	3	2	3	25	0.94	2708	4062	1505	2231	0.370	-	0.549	-	24	26
55	59	65	2	49	3	2	3	23.45	0.94	2717	4076	1805	2676	0.442	1.012	0.656	1.500	14	43
56	59	66	1	25	3	2	3	23.45	0.94	2717	4076	1807	2679	0.443	-	0.657	-	28	32
57	67	66	2	14	3	2	3	23.85	0.94	2714	4071	1626	2411	0.399	-	0.592	-	6	13
71	75	66	2	40	3	2	3	20.55	0.95	2734	4101	1190	1764	0.290	1.132	0.430	1.679	17	33
571	59	67	1	53	1	1	1	0	0.94	1357	1357	135	200	0.099	-	0.147	-	-	-
57	66	67	1	14	3	2	3	23.85	0.94	2714	4071	1633	2421	0.401	-	0.594	-	17	32
58	68	67	2	21	3	2	3	23.8	0.94	2715	4073	1501	2225	0.368	0.869	0.546	1.288	28	50
461	55	68	1	31	1	1	1	7.55	0.97	1406	1406	454	673	0.322	-	0.689	-	-	-
58	67	68	1	21	3	2	3	23.8	0.94	2715	4073	1492	2212	0.366	-	0.543	-	32	40

Appendix Table 4.5.4 Volume and Capacity of Intersections in 1987 and 1992, Sana'a

Link	From	To	Dir.	Leng. (10m)	Lane	Int. Lane	Adj. Factor	Capacity		Link Volume		LV87/Cap.		LV92/Cap.		Velocity	
								Sec	(F)	1987	1992	P/C	TOI	P/C	TOI		Peak Off-P
59	69	68	2	45	3	2	0.94	2718	4077	1576	2040	0.337	1.164	0.500	1.735	33	40
127	52	69	1	25	2	1	0.96	1379	2758	1612	2390	0.384	-	0.866	-	7	20
59	68	69	1	45	3	2	0.94	2718	4077	1351	2003	0.331	-	0.491	-	13	17
60	70	69	2	53	3	2	0.94	2714	4071	1423	2110	0.349	-	0.518	-	14	40
131	75	69	2	71	2	1	0.96	1381	2762	852	1263	0.308	1.573	0.457	2.333	13	44
321	49	70	1	75	1	1	0.94	1357	1357	135	200	0.099	-	0.147	-	-	-
60	69	70	1	53	3	2	0.94	2714	4071	1170	1735	0.287	-	0.426	-	37	43
61	71	70	2	13	3	3	0.99	4332	4332	1281	1899	0.295	0.682	0.438	1.011	30	50
61	70	71	1	13	3	3	0.99	4332	4332	1053	1561	0.243	-	0.360	-	26	36
62	72	71	1	163	3	3	0.94	1357	1357	854	1266	0.197	-	0.292	-	52	61
342	74	71	2	88	1	1	0.94	1357	1357	270	400	0.198	0.639	0.294	0.947	-	-
195	35	72	1	218	1	1	0.99	1429	1429	270	400	0.188	-	0.280	-	64	61
63	73	72	1	165	3	3	0.94	1357	1357	702	1041	0.162	-	0.240	-	-	-
63	72	73	1	211	3	3	0.99	4332	4332	683	1013	0.157	-	0.233	-	-	-
342	71	74	1	88	1	1	0.94	1357	1357	560	830	0.129	0.129	0.191	0.191	-	-
451	78	74	2	55	1	1	0.94	1357	1357	270	400	0.198	-	0.294	-	-	-
131	69	75	1	71	2	1	0.96	1381	2762	797	1182	0.288	-	0.427	-	41	41
441	77	75	1	66	1	1	0.94	1357	1357	135	200	0.099	-	0.147	-	-	-
132	78	75	2	58	2	1	0.96	1381	2762	852	1263	0.308	0.696	0.457	1.032	42	54
71	66	76	1	40	3	2	0.95	2734	4101	639	946	0.155	-	0.230	-	31	46
72	77	76	2	30	3	1.5	0.94	2039	4078	1097	1636	0.269	-	0.398	-	34	31
431	81	76	1	80	1	1	0.94	1357	1357	135	200	0.099	0.524	0.147	0.776	-	-
441	75	77	2	66	1	1	0.94	1357	1357	135	200	0.099	-	0.147	-	-	-
72	76	77	1	30	3	1.5	0.94	2039	4078	801	1187	0.196	-	0.291	-	43	60
73	79	77	2	7	3	2	0.94	2714	4071	1004	1488	0.246	0.542	0.365	0.804	19	23
451	74	78	2	100	1	1	0.94	1357	1357	135	200	0.099	-	0.147	-	-	-
132	75	78	1	58	2	1	0.96	1381	2762	797	1182	0.288	-	0.427	-	52	54
331	79	78	1	50	1	1	0.94	1357	1357	135	200	0.099	-	0.147	-	-	-
133	80	78	2	34	2	1	0.96	1372	2744	852	1263	0.310	-	0.460	-	14	19
321	92	78	2	132	1	1	0.94	1357	1357	135	200	0.099	0.897	0.147	1.330	-	-
73	77	79	1	7	3	2	0.94	2714	4071	963	1428	0.236	-	0.350	-	10	10
331	78	79	2	50	1	1	0.94	1357	1357	135	200	0.099	-	0.147	-	-	-
74	80	79	2	37	3	2	0.99	2858	2858	1004	1488	0.351	-	0.520	-	20	44
332	83	79	1	79	1	1	0.94	1357	1357	135	200	0.099	0.786	0.147	1.166	-	-
133	78	80	1	34	2	1	0.96	1372	2744	797	1182	0.193	-	0.287	-	44	26
74	79	80	1	37	3	3	0.99	2858	2858	963	1428	0.252	-	0.374	-	34	20
141	84	80	1	80	1	2	0.94	2717	5434	713	1057	0.131	-	0.194	-	36	33
75	92	80	2	78	3	2	0.95	2738	5476	1157	1715	0.211	0.788	0.313	1.169	34	58
171	64	81	1	65	2	2	0.96	2765	2765	1252	1836	0.452	-	0.671	-	32	33
431	76	81	2	80	1	1	0.94	1357	1357	135	200	0.099	-	0.147	-	-	-
172	82	81	2	25	2	2	0.96	2765	2765	580	860	0.209	0.762	0.310	1.129	43	36
172	81	82	1	25	2	2	0.96	2765	2765	750	1112	0.271	-	0.402	-	29	30
173	83	82	2	32	2	2	0.96	2765	2765	580	860	0.209	-	0.310	-	37	50
401	85	82	1	67	1	1	0.94	1357	1357	135	200	0.099	0.580	0.147	0.860	-	-
332	79	83	2	79	1	1	0.94	1357	1357	135	200	0.099	-	0.147	-	-	-
173	82	83	1	32	2	2	0.96	2765	2765	750	1112	0.271	-	0.402	-	30	46
174	84	83	2	27	2	2	0.94	2709	2709	565	838	0.208	0.579	0.309	0.858	40	41
141	80	84	2	80	3	2	0.94	2717	5434	812	1204	0.149	-	0.221	-	28	44
174	83	84	1	27	2	3	0.94	2709	4064	725	1075	0.178	-	0.264	-	15	21
142	100	84	1	95	2	2	0.94	2704	5408	1235	1831	0.228	-	0.338	-	30	31
175	91	84	2	80	2	2	0.94	2778	4167	500	741	0.119	0.676	0.177	1.002	19	19

Appendix Table 4.5.4 Volume and Capacity of Intersections in 1987 and 1992, Sana'a

Link	Node		Leng. Sect. (10m)	Dir.	Sect. Lane	Int. Lane (LN)	Adj. Factor	Capacity Sect	Link Volume		LV87/Cap.		LV92/Cap.		Velocity Peak Off-P		
	From	To							1987	1992	P/C	TOI	P/C	TOI			
421	85	85	1	85	1	1	0	0.94	1357	1357	135	200	0.099	-	0.147	-	
401	82	85	2	67	1	1	0	0.94	1357	1357	135	200	0.099	-	0.147	-	
402	86	85	1	36	1	1	0	0.94	1357	1357	135	200	0.099	0.298	0.147	0.442	
403	81	86	1	70	1	1	0	0.94	1357	1357	135	200	0.099	-	0.147	-	
61	86	86	1	64	1	1	0	0.94	1357	1357	135	200	0.099	-	0.147	-	
411	62	86	1	64	1	1	0	0.94	1357	1357	135	200	0.099	0.298	0.147	0.442	
402	85	86	2	36	1	1	0	0.94	1357	1357	135	200	0.099	-	0.147	-	
152	11	87	1	455	3	2	3	0.94	2720	5440	380	563	0.069	-	0.103	53	
102	87	102	1	144	1	1	4	8.2	1404	5616	966	1432	0.172	-	0.255	-	
151	88	87	2	40	3	2	4	23.95	0.94	2714	5428	732	1085	0.134	-	0.199	30
211	89	87	2	40	1	1	4	7.3	1407	5628	478	709	0.084	0.451	0.135	0.684	
81	101	88	1	144	2	1	3	15.65	0.96	1382	4146	1207	1789	0.291	-	0.431	23
143	100	88	2	95	3	2	5	25.6	0.94	2704	4056	932	1382	0.229	-	0.340	35
151	87	88	1	40	1	1	3	23.95	0.94	2714	4071	883	1309	0.216	-	0.321	48
82	90	88	2	84	1	1	3	6.2	0.98	1411	4233	1036	1536	0.244	0.982	0.352	1.456
211	89	89	1	40	1	1	1	7.3	0.97	1407	1407	508	753	0.361	-	0.535	24
212	90	89	2	41	1	1	1	7.2	0.97	1407	1407	478	709	0.329	0.700	0.503	1.038
82	88	90	1	84	1	1	1	6.2	0.98	1411	1411	1100	1621	0.779	-	1.155	21
212	89	90	1	41	1	1	1	7.2	0.97	1407	1407	508	753	0.361	-	0.535	-
181	91	90	1	211	1	1	1	6.9	0.98	1408	1408	338	494	0.236	-	0.350	-
97	90	90	2	148	1	1	1	7	0.98	1408	1408	1203	1785	0.854	2.231	1.266	3.308
175	84	91	1	80	2	2	3	13.35	0.94	2778	4167	640	949	0.153	-	0.227	-
181	91	91	1	211	1	1	1	6.9	0.98	1408	1408	427	633	0.303	-	0.449	-
182	92	91	2	71	1	1	1	6.9	0.98	1408	1408	230	341	0.163	-	0.242	-
176	96	91	2	90	2	1	3	15.4	0.96	2765	4148	250	371	0.060	0.680	0.089	1.008
321	78	92	1	122	1	1	1	0	0.94	1357	2714	135	200	0.049	-	0.073	-
75	80	92	1	78	3	2	3	20	0.95	2738	4107	1111	1647	0.270	-	0.401	24
182	91	92	1	71	1	1	1	7	0.98	1408	1408	500	445	0.213	-	0.315	59
176	94	92	2	85	3	2	3	20	0.95	2738	4107	1116	1654	0.271	0.805	0.402	1.192
194	72	93	1	211	1	1	1	8.9	0.97	1402	1402	270	400	0.192	-	0.285	35
341	74	93	1	55	1	1	1	0	0.94	1357	1357	135	200	0.099	-	0.147	-
193	94	93	2	200	1	1	1	8.95	0.97	1402	1402	270	400	0.192	0.484	0.285	0.718
76	92	94	1	85	3	2	3	20	0.95	2738	4107	889	1318	0.216	-	0.320	36
193	93	94	1	200	1	1	1	8.95	0.97	1402	1402	170	252	0.121	-	0.179	-
77	95	94	2	200	1	1	2	13.5	0.99	1230	2460	1075	1594	0.436	-	0.647	-
192	96	94	1	58	1	1	1	8.9	0.97	1402	1402	280	415	0.199	0.974	0.296	1.444
177	94	95	1	200	1	1	1	13.5	0.99	1230	1230	665	987	0.541	0.541	0.802	0.802
176	91	95	1	90	2	2	2	15.4	0.96	2765	2765	320	474	0.115	-	0.171	-
192	94	96	2	58	1	1	1	8.9	0.97	1402	1402	450	667	0.320	-	0.475	-
191	97	95	1	294	1	1	1	8.9	0.97	1402	1402	407	603	0.290	0.727	0.430	1.077
83	90	97	1	148	1	1	1	7	0.98	1408	1408	1363	2021	0.968	-	1.435	24
191	96	97	2	294	1	1	1	8.9	0.97	1402	1402	839	947	0.455	-	0.675	-
64	98	97	2	200	1	1	1	7	0.99	1429	1429	1368	1880	0.887	2.311	1.315	3.426
84	97	98	1	200	1	1	1	7	0.99	1429	1429	2138	3170	1.496	1.496	2.218	2.218
55	65	99	3	49	3	2	3	23.45	0.94	2717	4076	1807	2679	0.443	-	0.637	28
56	65	99	2	25	3	2	3	23.45	0.94	2717	4076	1807	2676	0.442	0.886	0.656	1.313
143	88	100	1	71	3	2	3	25.6	0.94	2704	4056	1335	1831	0.304	-	0.451	30
142	84	100	2	95	3	2	3	25.6	0.94	2704	4056	932	1382	0.229	0.534	0.310	0.792
80	61	101	1	24	2	1	2	15.65	0.96	1382	2764	1207	1789	0.136	-	0.647	35
81	88	101	2	144	2	1	2	15.65	0.96	1382	2764	1415	2098	0.511	0.948	0.758	1.406
731	87	102	2	142	1	1	1	8.2	0.97	1404	1404	990	1468	0.705	-	1.043	-
730	60	102	1	24	1	1	1	8.2	0.97	1404	1404	996	1432	0.688	1.395	1.020	2.065