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# URBAN TRAVEL BEHAVIOR CHARACTERISTICS OF 13 CITIES BASED ON HOUSEHOLD INTERVIEW SURVEY DATA

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**Abstract**: Since the 1960s, JICA (Japan International Cooperation Agency) has been providing assistance in the performance of comprehensive transport planning studies in different parts of the world. A major input to such transport planning studies is the conduct of an HIS (Household Interview Survey) that gathers information on the travel and socio-economic characteristics of the population. These information-rich HIS databases have recently been opened by JICA to researchers. The current study analyzes trip characteristics in relation to socio-economic characteristics of travelers. The analyses are done per city and international comparisons among the 13 cities are made. Possible reasons for similarities and differences among the cities are presented including level of infrastructure development, degree of motorization, demographics, and local culture.

Key Words: Person Trip Survey, Household Interview Survey, International Comparison

## 1. INTRODUCTION

Transportation demand is influenced by various factors like availability of facilities, level of motorization, city structure, pace of economic growth, local culture, and so on. It is very important to analyze the relationships among these factors to be able to grasp current and future travel demand. One of the powerful methods is international comparison using actual economic and travel demand data.

The Japan International Cooperation Agency (JICA) has been conducting development studies mostly in Asian metropolitan cities since the 1960's. These studies have played an important role in addressing urban and transportation problems of these cities and have been a valuable source of information for transport planning. In most cases, a large scale Household Interview Survey (HIS, or Person Trip Survey) is conducted to grasp passenger movement or to build the 4-step travel demand forecasting models. After the study is completed, however, the data is discharged and is usually never utilized again except in some special cases. Needless to mention, the data is statistically authentic and

therefore a valuable resource that can be utilized for plans and academic research.

Recently, JICA has opened these person trip data to academic researchers and other interested parties. The following countries have available data: Tripoli, Lebanon (2001); Phnom Penh, Cambodia (2000); Damascus, Syria (1998); Manila, Philippines(1997); Chengdu, China (2000); Managua, Nicaragua (1998); Belem, Brazil (2000); Bucharest, Romania (1999); Cairo, Egypt (2001); Jabotabek, Indonesia (2000); and Kuala Lumpur, Malaysia (2000).

This paper presents a comparative study utilizing the HIS data plus that of Tokyo (1998) and Hiroshima (1987). The main objectives are:

1) To compile the basic features of the surveys, i.e. sample size, question items etc. This will help in conducting similar HIS in the future.
2) To clarify the relationship of country's economic performance, transportation situations, cultural background and modal share by means of travel behavior analyses or statistical models.

## 2. OUTLINE OF THE 13-CITY HIS DATA

We summarize the past urban transportation development investigations with Japanese assistance in Table-1. From the 1960's over fifty projects have been conducted, and half of them were conducted in the recent decade. There are cities that have twice or three times investigations such as Cairo, Bangkok and Manila. If we could prepare the original HIS data for these cities, the interesting temporal comparison by quasi-aggregate panel analysis might be available. However almost surveys conducted before the 1980's were stocked as paper sheets and we never find them.

Last year JICA started to look for the past available HIS original digital data, and the eleven cities' HIS data were collected. Figure-1 shows the location of the eleven cities. They are distributed not only in the Asian region but also Middle East or Central America.

Usually, the HIS data consists of household data, individual data and trip data. The collected 11 HIS data sets also have same data structure, but the detail formats were quite different among them because of the differences in survey companies. Therefore, JICA merged the household, individual information into trip data for ease in comparison analyses, and integrated with similar format HIS data were opened to researchers. The total data file size is about 1 Giga bytes.

Table-1 The Past Urban Transport Development Investigation by Japanese Assistance

| | | | | | |
|---|---|---|---|---|---|
| 1.Egypt（Cairo） | 1966 | 19.Malaysia（Klang Valley） | 1987 | 37. Paraguay（Asuncion） | 1999 |
| 2.Lebanon | 1966 | 20.Singapore | 1988 | 38.Syria（Damascus） | 1999 |
| 3.Chile | 1967 | 21. Paraguay（Asuncion） | 1988 | 39.Romania（Bucharest） | 1999 |
| 4.Mexico（Guadalajara） | 1969 | 22.Yemen | 1988 | 40. Philippines（Manila） | 1999 |
| 5.South Korea（Seoul） | 1972 | 23.Malaysia（Klang Valley） | 1989 | 41.Azerbaijan（Baku） | 2001 |
| 6.Iran（Tehran） | 1977 | 24.Egypt（Cairo） | 1989 | 42.Lebanon（Tripoli） | 2001 |
| 7.Thailand（Bangkok） | 1979 | 25.Pakistan（Lahore） | 1991 | 43.Cambodia（Phnom Penh） | 2001 |
| 8.Malaysia | 1980 | 26.Guatemala | 1991 | 44.China（Chengdu） | 2001 |
| 9.Indonesia（Medan） | 1980 | 27.Brazil（Belem） | 1991 | 45.Philippines（Manila） | 2001 |
| 10.Philippines（Davao） | 1981 | 28.India（Kolkata Calcutta） | 1992 | 46.Brazil（Belem） | 2001 |
| 11.Panama | 1984 | 29.Nepal（Kathmandu） | 1992 | 47.Thailand（Chiang Mai） | 2001 |
| 12.Colombia | 1984 | 30.Colombia（Cartagena） | 1992 | 48.Egypt（Cairo） | 2002 |
| 13.Philippines（Manila） | 1985 | 31.China（Dalian） | 1995 | 49.Indonesia（Jakarta） | 2003 |
| 14Thailand（Bangkok） | 1986 | 32.Vietnam（Hanoi） | 1996 | 50.Vietnam（Ho Chi Minh） | 2003 |
| 15.Ecuador（Guayaquil） | 1986 | 33.Guatemala | 1996 | 51.Peru (Lima) | 2003 |
| 16.Paraguay（Asuncion） | 1986 | 34.Honduras（Tegucigalpa） | 1996 | 52.Kenya (Nairobi) | 2004 |
| 17.Malaysia（Penang） | 1987 | 35.Colombia（Bogota） | 1996 | | |
| 18.Iraq（Baghdad） | 1987 | 36.Nicaragua | 1998 | | |

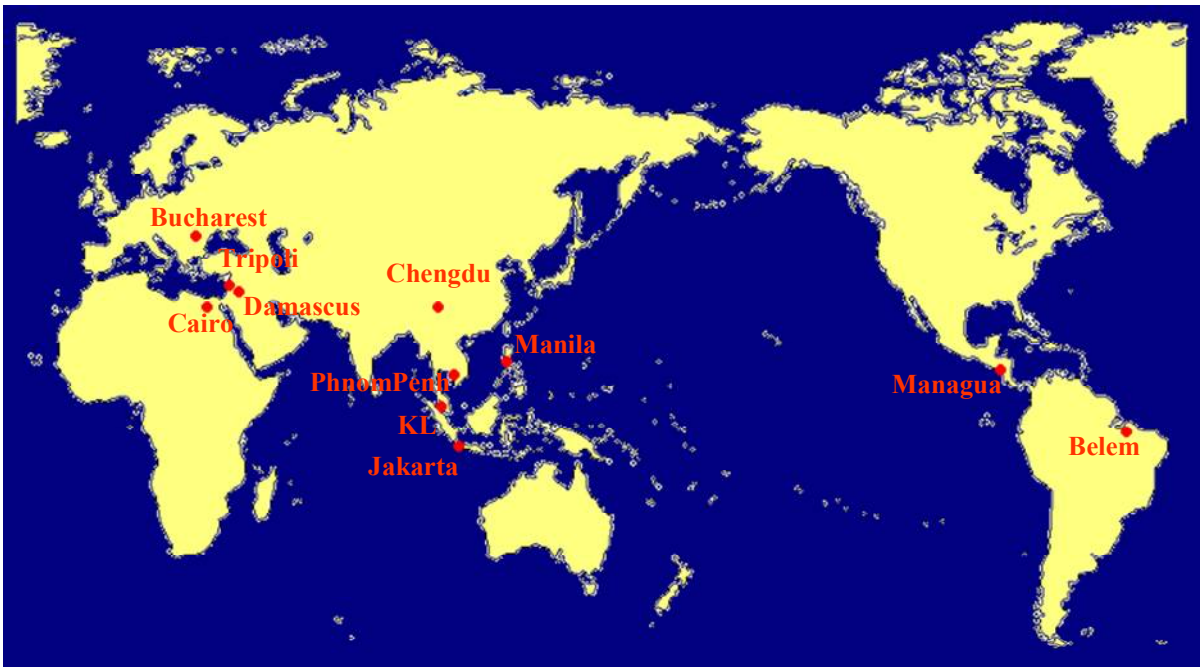



Figure-1 Location of JICA "HIS database" City

The basic profile of the HIS database is summarized in Table-2. The population size ranges from 0.33 million to over 30 million. The item numbers 5 to 7 in Table-2 mean the recorded number in each HIS database. "6.Number of individuals" divided by "3.Population" is the sampling rate and the average rate is about 2-3%. "8.(Trip) Generation Unit" is "7.Number of trips" divided by "6.Number of individuals", is "net" trip generation unit. Of course the actual sampling processes and some definitions of trip were different among these data, however, it is shown that the values are not so different among cities around two trips per day. Developed country cities have relatively high unit, and it is suggested that well developed transportation system would realize frequent trip generation. However, the conditions of conducted surveys were very different among these cities, so we could not derive statistically proper insights from the result.

Table-2 Profile of Analyzed HIS data

| 1.Country | 2.City | 3.Population | 4.Year | 5.# of households | 6.# of individuals | 7.# of trips | 8.Generation Unit (7/6) |
|---|---|---|---|---|---|---|---|
| Lebanon | Tripoli | 330,900 | 2000 | 1,321 | 3,608 | 7,615 | 2.11 |
| Cambodia | Phnom Penh | 1,152,000 | 2000 | 6,446 | 18,664 | 40,369 | 2.16 |
| Syria | Damascus | 3,078,190 | 1998 | 17,202 | 38,490 | 81,698 | 2.12 |
| Philippines | Manila | 9,454,000 | 1996 | 60,752 | 231,889 | 471,035 | 2.03 |
| China | Chengdu | 3,090,000 | 2000 | 14,537 | 31,188 | 70,199 | 2.25 |
| Nicaragua | Managua | 1,200,000 | 1998 | 8,089 | 24,854 | 54,138 | 2.18 |
| Brazil | Belem | 1,782,394 | 2000 | 6,889 | 24,043 | 59,529 | 2.48 |
| Romania | Bucharest | 2,150,000 | 1998 | 32,888 | 67,509 | 143,311 | 2.12 |
| Egypt | Cairo | 14,400,000 | 2001 | 41,962 | 136,070 | 268,360 | 1.97 |
| Indonesia | Jakarta | 20,964,000 | 2000 | 100,864 | 423,237 | 1,083,280 | 2.56 |
| Malaysia | KL | 1,390,800 | 1998 | 27,331 | 80,560 | 218,460 | 2.71 |
| Japan | Tokyo | 33,000,000 | 1998 | 316,398 | 747,671 | 2,101,442 | 2.81 |
| Japan | Hiroshima | 1,500,000 | 1987 | 40,885 | 105,119 | 285,194 | 2.71 |

## 3. COMPARISON ON HOUSEHOLD AND INDIVIDUAL CHARACTERISTICS

Figure-2 to 4 summarizes the basic characteristics of 13-city data. These outputs are calculated by

generated trip data excluding non-trip individuals, therefore, they are "net" proportions, not "gross".

Number of household members is greater in developing countries, but Asian cities are less except Phnom Penh. It is interesting that the proportion of developed countries are almost same.

Apparently, the rate of car ownership relates to economical level, Figure-3 also shows the general tendency. Comparing Hiroshima and Tokyo in Japan, the high rates in Kuala Lumpur, Cairo and Tripoli are distinct. The rate in Hiroshima is less than Tokyo, that is why the Hiroshima data was surveyed in 1987. Usually, local cities rate are higher than central areas.

Although the difference of surveys, the age structure is similar among 13 cities. But the younger generation's trips are greater in Cairo, Managua and Tripoli, on the other hand, the older ones are greater in Japanese cities, Bucharest and Chengdu. The high rate of aged trips in Chengdu might be the effect of the single child policy in China.

Figure-5 represents the net trip generation by gender. The unit in Tokyo, Hiroshima and Kuala Lumpur are almost over three per day, and that of Cairo is less than two. The most interesting result is the

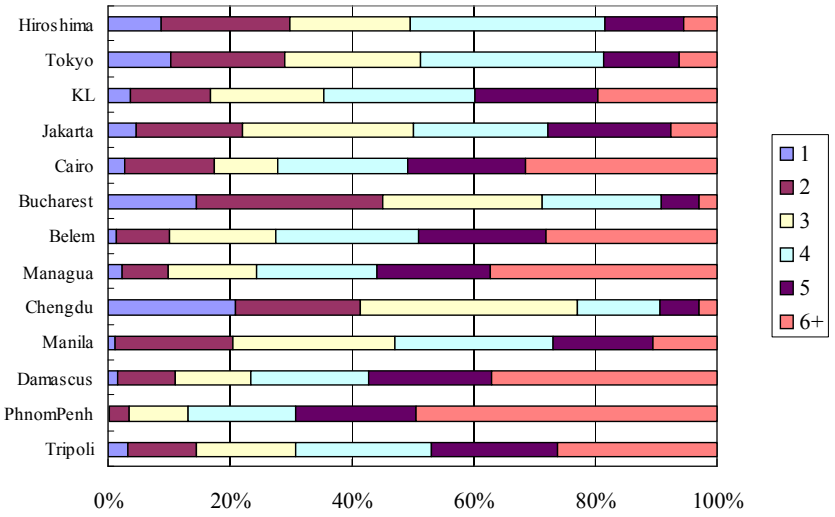



Figure-2 Number of Household Members

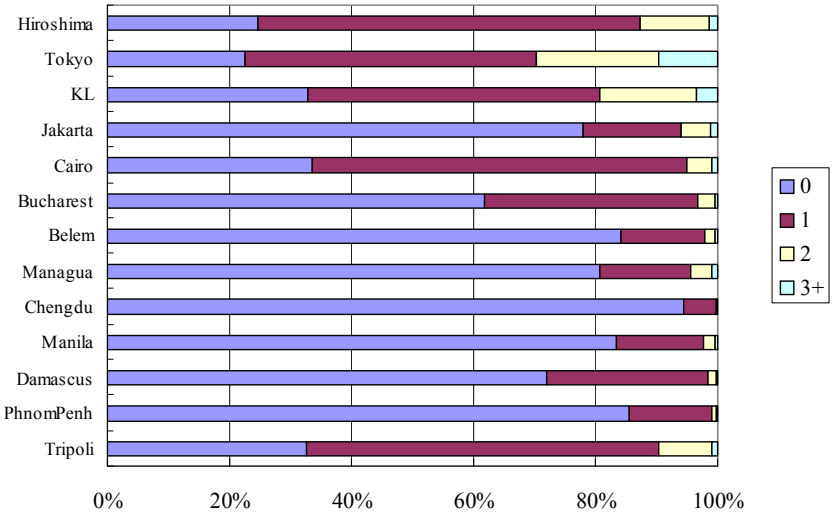



Figure-3 Number of Car Ownership

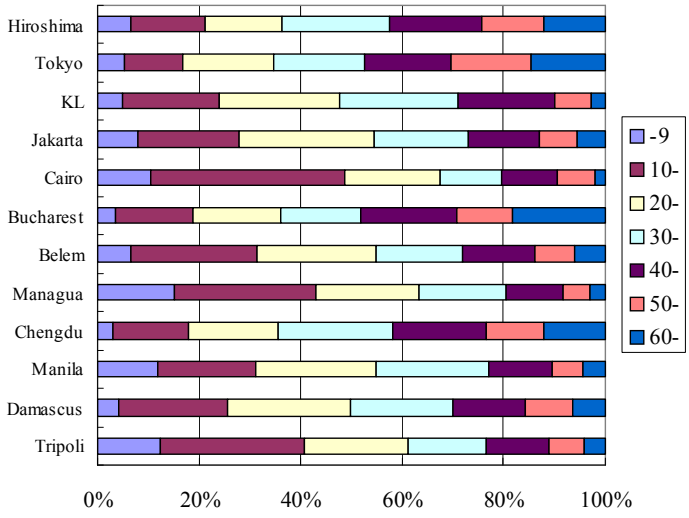
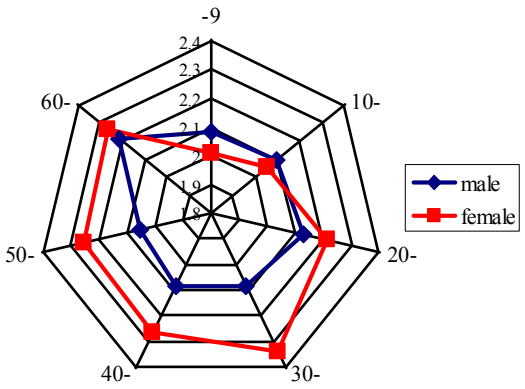
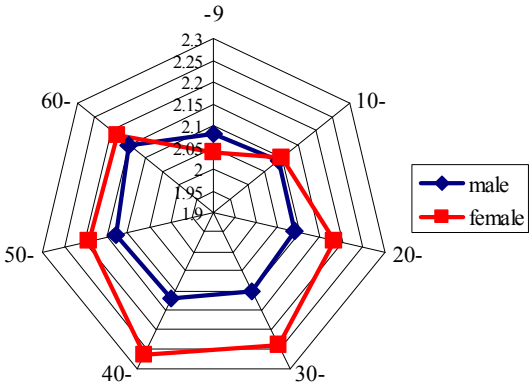


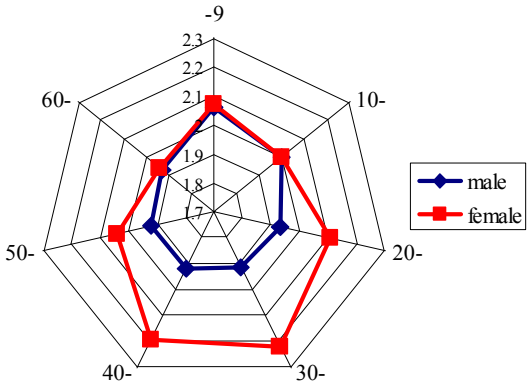

Figure-4 Age Structure by Trips



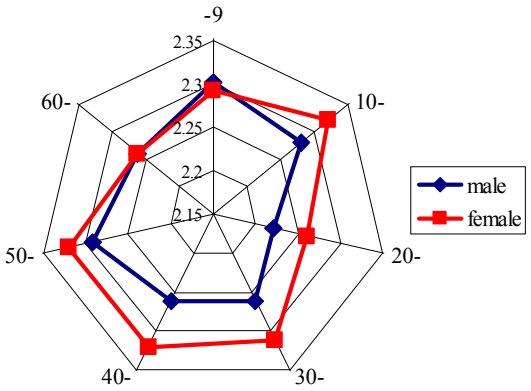

Tripoli



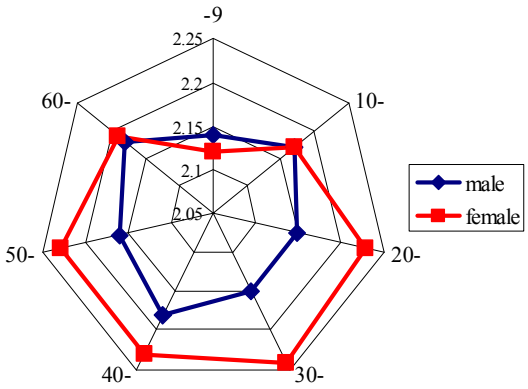

Damascus



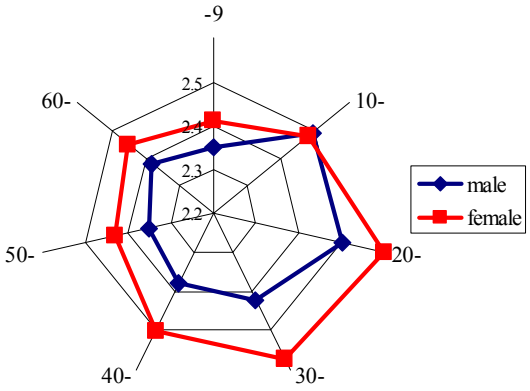

Manila




Chengdu




Managua




Belem

Figure-5(1) Number of Generated Trips Per Person by Age & Gender

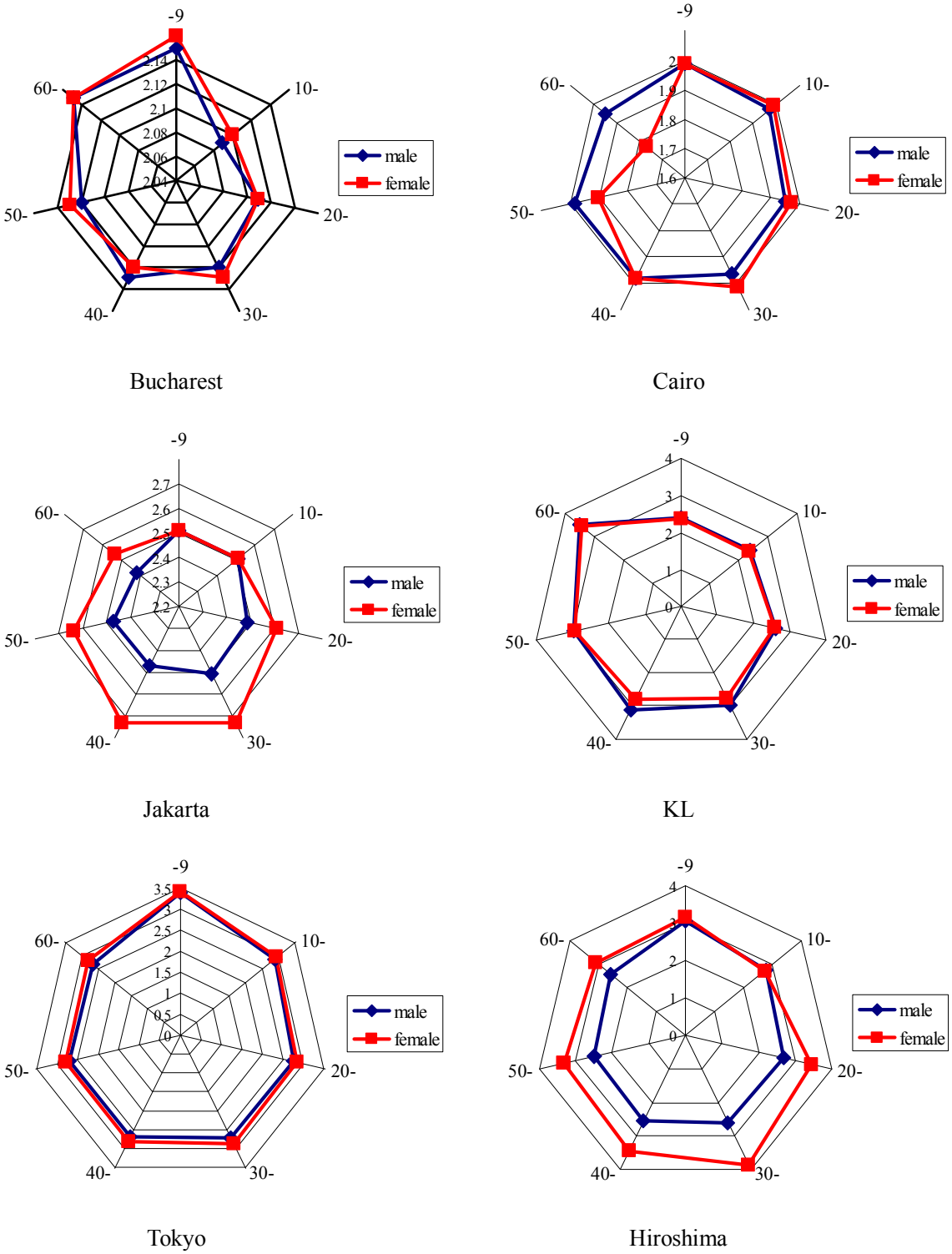



Figure-5(2) Number of Generated Trips Per Person by Age & Gender

rate of female is greater than male in most cities, but some Islamic countries, Cairo and Kuala Lumpur, have less female generation unit. It is suggested that the religious and cultural background influence travel behavior.

The distribution of trip purposes in Figure-6 shows quite important result. Almost cities have similar distribution except Hiroshima. The survey in Hiroshima was tour-based considering trip chaining conditions, not trip-based data, therefore the proportion is quite different. The features of the

distribution are listed as 1)high rate of "go to school" in Cairo, 2)high rate of "Shopping" in Phnom Penh. However, the definition of trip purposes were not consistent among the survey sheets, and we can not identify the reasons of the differences exactly.
This chapter summarized the characteristics on household, individual and trip purposes of 13 cities. It is clarified that the age or household structure by generated trips are quite different among the 13 cities, but the proportions of trip purposes are relatively similar. This suggests that the fundamental activities in large cities would have similar patterns in the world.

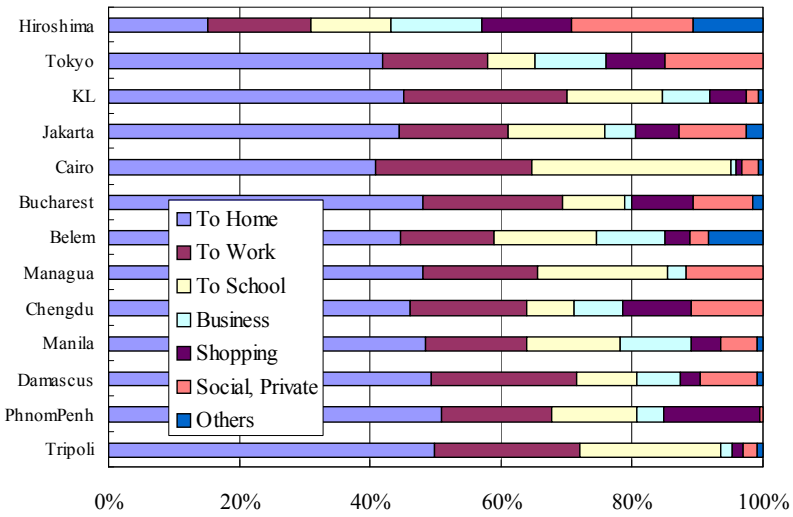



Figure-6 Distribution of Trip Purposes

## 4. COMPARISON ANALYSIS ON TIME OF GENERATED TRIPS

Departure times of trips in the 13 cities were culled from the HIS databases and compared. Figure 7 shows the proportion of trips and their departure times. Dominant peaks can be seen in the figure, referring to morning, midday, and afternoon peaks of travel. Tripoli and Cairo have the most pronounced AM peak, with about 30% of all trips departing around 7 AM. Around 10-15% of all trips are during the peak hour for most of the other cities, a value that is typical of urban areas. There is earlier morning peak (6 am) for Jakarta, Managua, and Manila, owing perhaps to sprawl or congested or unpredictable traffic. There is relatively unmarked hourly variation for Tokyo and Hiroshima, due perhaps to a mature transport infrastructure in these cities that provide ease in traveling any time of the day.

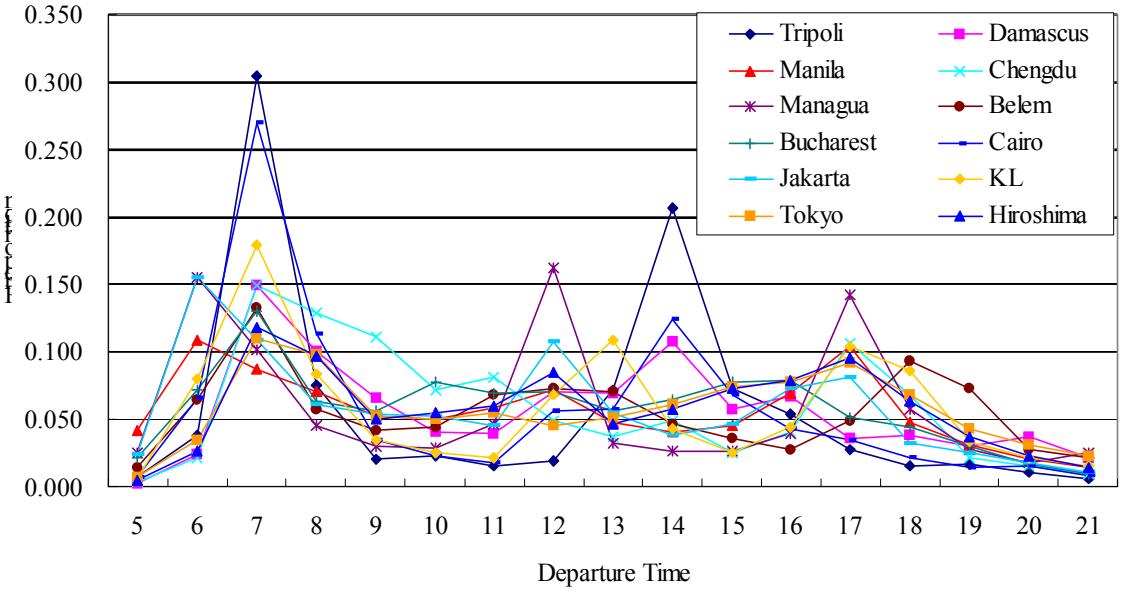



Figure-7 Distribution of Departure Time

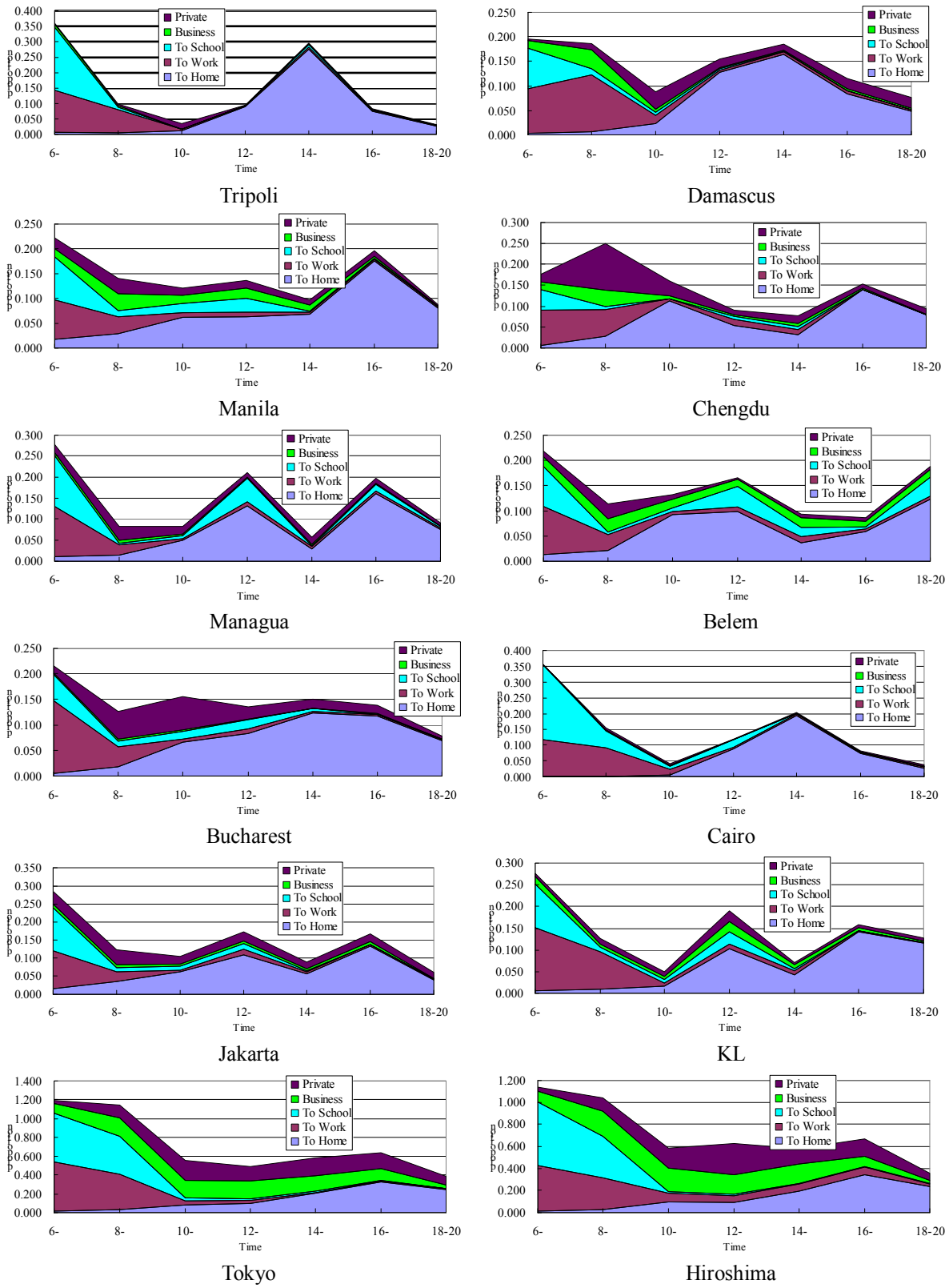



Figure-8 Distribution of Departure Time by Trip Purpose

"To Home" departure times are greatest in the afternoon for all the cities, as expected. Noon "To Home" departure times are also prominent for Chengdu, Belem, Managua, Jakarta, and KL. "To Work" departure times are concentrated in the morning as expected. "Private" and "Business" trips

are well distributed the whole day for Tokyo and Hiroshima perhaps due to the mature transport infrastructure in these cities. "To School" departure times are concentrated only in the morning for some cities (Tokyo, Hiroshima, Damascus, and Chengdu). Many students in these cities do not go home during lunch break; many of them have packed lunches like 'o-bento' for Japanese students. The other cities also have pronounced morning and afternoon departures for "To School" trips. This may be due to the school being either in the morning session or afternoon session such as public schools in Metro Manila (some public high schools even have 3 sessions in 1 day due to the sheer number of students and the schools' limited facilities). Or lunch may be taken at home or some restaurant and the students go back to school after lunch break.

## 5. CHARACTERISTICS OF MODAL SHARE

There is a rich diversity of modes in the cities of the study area; the number of modes ranges from 8 (Damascus) to 22 (Cairo, including animal-drawn mode). To be comparable, the diverse modes have been reclassified into 12 standard categories. The diverse modes are shown in Table 3.

Table-3 Various Transportation Modes Listed In Survey Sheet

**Tripoli:**
1 Passenger Car (C)
2 Taxi / Service (T)
3 Light Bus / Pass. Van (B)
4 Pick-up / Cargo Van (B)
5 Truck 2-Axle (C)
6 Truck 3-Axle (C)
7 Truck 4-Axle or more (C)
8 Large Bus (B)
9 Bicycle / Motorcycle (W)
0 Walking

**Damascus:**
1 Walking
2 Bicycle and Motorcycle (W)
3 Passenger Car (C)
4 Taxi (T)
5 Microbus (B)
6 Bus (B)
7 Truck (C)
8 Others

**KL:**
1 Walking
2 Bicycle (W)
3 Motorcycle (W)
4 Car (C)
5 Small Van(For Passenger) (C)
6 Taxi (T)
7 Mini Bus (B)
8 Feeder Bus to/from station (B)
9 Intrakota (B)
10 Park Mmay/City Liner (B)
11 Other Stage Buse(with AC) (B)
12 Other Stage Buse(not AC) (B)
13 Factory Bus (B)
14 School Bus (B)
15 Other Buses (B)
16 Small Lorry(light 2-Axles) (C)
17 Other Lorries (C)
18 STAR(LRT) (R)
19 KTM Train (R)

**Manila:**
1 Walking
2 Pedicab (T)
3 Bicycle (W)
4 Motorcycle (W)
5 Tricycle (T)
6 Jeepney (B)
7 Mini-bus (B)
8 Standard Bus (B)
9 Taxi (T)
10 HOV Taxi (T)
11 Car/Jeep (C)
12 Sch./Co./Tourist Bus (B)
13 Utility Vehicle (C)
14 Truck (C)
15 Trailer (C)
16 LRT (R)
17 PNR (R)
18 Water Transport

**Chengdu:**
1 Walking
2 Bicycle (W)
3 Tricycle by man (W)
4 Motorcycle (T)
5 Tri-motorcycle (T)
6 Taxi (T)
7 Passenger Car (C)
8 Middle Car (C)
9 Large Car (C)
10 Light Truck (C)
11 Large Truck (C)
12 Large Bus (B)
13 Middle Bus (B)
14 Rail (R)

**Phnom Penh:**
1 Passenger Car
2 Taxi (T)
3 Light Bus/Pass.Van (B)
4 Pick-up/Cargo Van (B)
5 Truck/Trailer (C)
6 Large Bus (B)
7 Motorcycle (W)
8 Mortodop (T)
9 Motorumo (T)
10 Cyclo (T)
11 Bicycle (W)

**Managua:**
1 Walk
2 Car (C)
3 Truck(small) (C)
4 Truck (C)
6 Taxi (T)
8 Micro bus (B)
9 Bus (B)
10 Motor cycle (W)
11 Bicycle (W)

**Belem:**
1 Bus (B)
2 Micro Bus (B)
3 Alternative
4 Car Driver (C)
5 Car Ride (C)
6 Taxi (T)
7 Rented Bus (B)
8 School Bus (B)
9 Motor Bike (W)
10 Cicro Motor (T)
11 Bike (W)
12 By Foot
13 Boat
14 Truck (C)

**Bucharest:**
1 Walk
2 Bicycle (W)
3 Motorcycle (W)
4 Automobile (C)
5 Pickup, Freight Vehicle (C)
6 Medium truck (C)
7 Heavy Truck (C)
8 Taxi (T)
9 Maxi Taxi (T)
10 RATB Bus (B)
11 Express Bus (B)
12 Private, Company Bus (B)
13 Trolley Bus (B)
14 Tram (R)
15 Metro (Subway) (R)
16 Train (Railway) (R)

**Cairo:**
1 On-Foot
2 Bicycle (W)
3 Motorcycle (W)
4 Private Car Driver (C)
5 Private Car Passengers (C)
6 Pickup for Passengers (C)
7 Taxi (T)
8 Shared Taxi (T)
9 Public Minibus (B)
10 Public Bus (B)
11 Public A/C Bus (B)
12 Cooperative Minibus (B)
13 Company (Work) Car (C)
14 Factory/Company Bus (B)
15 School Bus (B)
16 Truck for Passengers (C)
17 Nile Bus (B)
18 Tram (R)
19 Heliopolis Metro (R)
20 Underground Metro (R)
21 ENR Train (R)
22 Animal Drawn

**Jakarta:**
1 Walking to final destination
2 Walking for transfer
3 Bicycle (W)
4 motorcycle (W)
5 Sedan, jeep, kijang (C)
6 Colt, mini cab (C)
7 Pick up (C)
8 Truck (C)
9 Rail(express) (R)
10 Rail(economy) (R)
11 Patas AC (B)
12 Large bus (patas) (B)
13 Medium bus (B)
14 Mini bus(Angkot) (B)
15 Taxi (T)
16 Bajaj (T)
17 Ojek (T)
18 Becak (T)
19 Omprengan (T)
20 Comp. bus, school bus (B)

Character in parenthesis equals to Figure-11 classification: (W):2 wheel, (C): Car, (T): Taxi, (B): Bus, (R):Rail

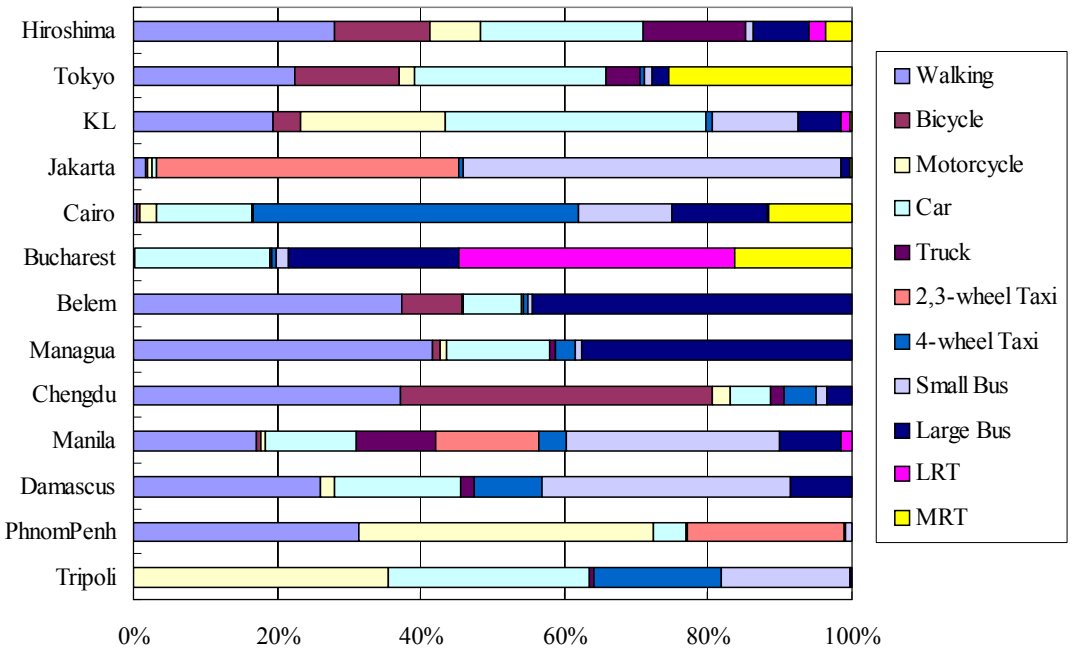



Figure-9 Modal Share

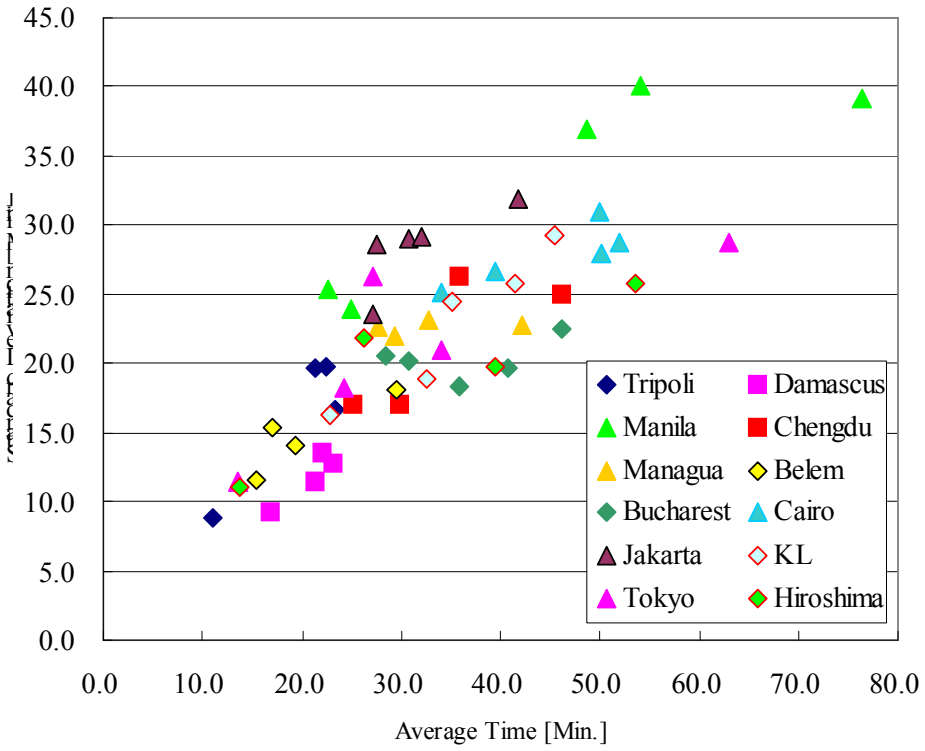



Figure-10 Average Trip Duration vs. Its Standard Deviation

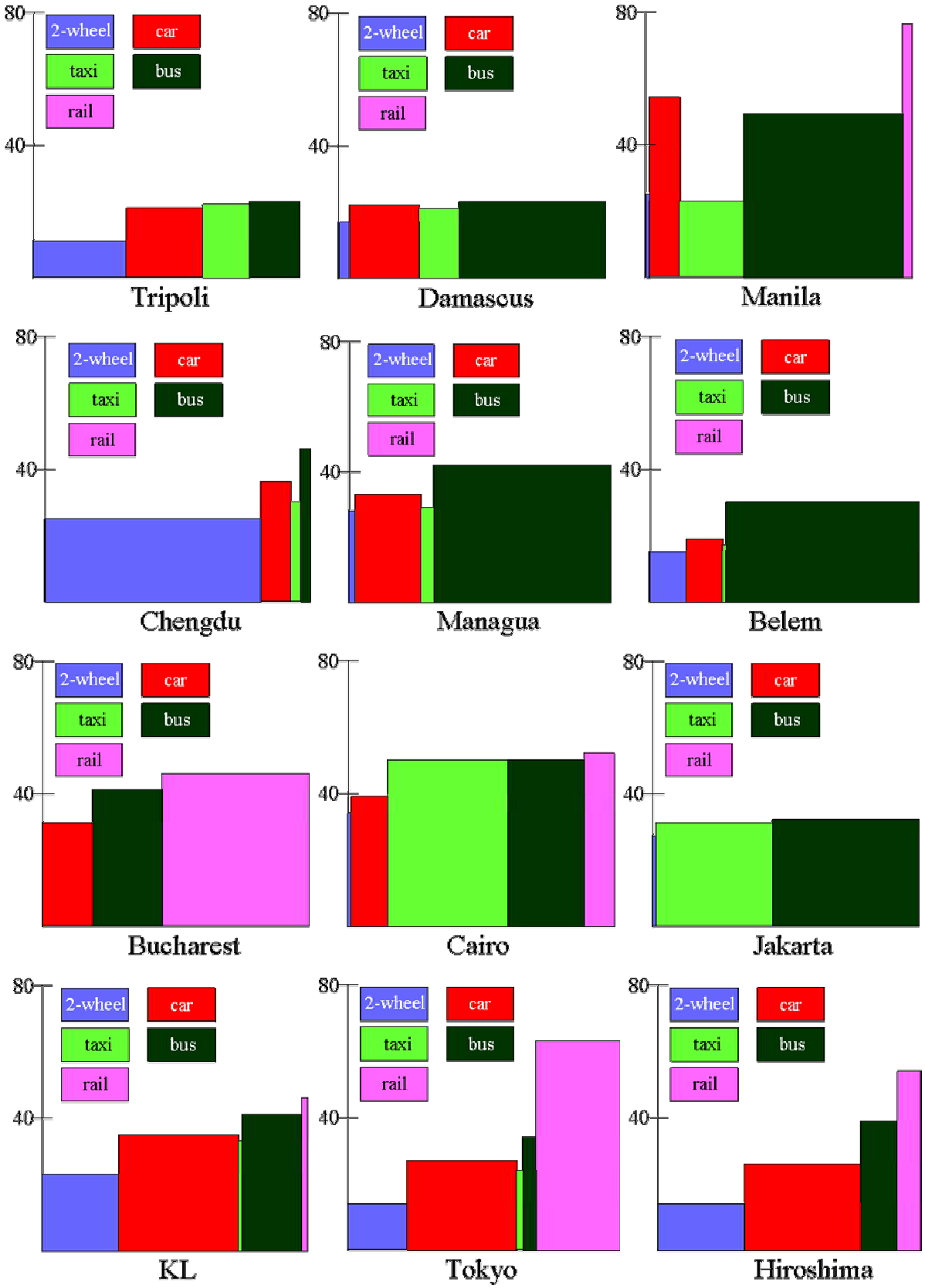



Figure-11 Modal Share (Horizontal Axis: Total 100%) vs.
Average Trip Duration (Vertical Axis: [Min.])
(Classification of modes is shown in Table-3)

Bicycle trips are biggest in Chengdu, the bicycle being a major mode in China. In Tokyo and Hiroshima, the bicycle is an important access mode to train stations and for short trips. The bicycle is not as important in the other cities due perhaps to the hot weather, culture, and others. About 30% - 40% of all trips is done by "walking" for Belem, Managua, Chengdu, Damascus, and Phnom Penh. The motorcycle is an important mode in KL, Phnom Penh, and Tripoli. The private car has a large share in affluent cities like Hiroshima, Tokyo, and KL, as was earlier depicted in the relatively high car ownership characteristics in these cities. The 2-3 wheel taxi has a big share of trips in Jakarta, Manila, and Phnom Penh. The small bus is an important mode in Jakarta, Manila, and Damascus. The jeepney (which is reclassified as "small bus" in the analysis) takes around 40% of all person-trips in Metro Manila (MMUTIS, 1999). The large bus is dominant in the Central American cities of Belem and Managua. The rail modes have a big share of trips in Tokyo and Bucharest, where rail infrastructure is most mature.

Figure 10 shows the level of heterogeneity of the average trip durations of the 13 cities. Manila and Jakarta have high standard deviations for trips longer than 30 minutes. Hiroshima and Tokyo display greater homogeneity in trip durations probably owing to the fact that public transport modes (i.e. rail-based) have regular, stable, and predictable travel times.

Figure 11 shows the modal share versus average trip duration in minutes. The 2-wheel vehicle (bicycle and motorcycle) is most significant in Chengdu as mentioned earlier, with average travel duration of about 25 minutes. The average bicycle trip duration in Tokyo and Hiroshima is shorter than Chengdu's, around 15 minutes. Car trips are longest for Manila with approximately 55 minutes travel duration. Bus mode plays an important role in most cities, as shown by its high share and long travel time, as in the case of developing country cities of Damascus, Manila, Managua, Belem, Cairo, and Jakarta. Rail has the biggest share for Tokyo (approx. 30%) and Bucharest (approx. 55%), with average travel durations of 70 and 45 minutes, respectively. Hiroshima and Cairo have comparable share of rail trips and travel durations.

## 6. ANALYSIS ON TRIP CHAINING

Trip chaining analysis identifies the number of trips made per day that travelers make as well as the diversity in trip purposes of the chained trips. Table 4 presents the top 10 trip chains of the cities of the study area. The two predominant trips chains for most of the cities consist of 2 home-based trips. Seventy percent (70%, for Manila) to 90% (for Cairo) of all trips chains consist of 2 trips. The most common trip chains are "S-H" and "W-H" (i.e. "To School" combined with "To Home" and "To Work" chained with "To Home"). The exception is Chengdu where the predominant trip chains are "W-H" ("To Work" combined with "To Home") and "D-H" ("To Department store (or shopping)" combined with "To Home"). The "S-H" chain ("To School" combined with "To Home") is a mere 5$^{th}$ in ranking for Chengdu, preceded by "P-H" ("To Private" chained with "To Home") and "B-H" ("To Business" chained with "To Home"). This may be explained by China's one-child policy; the population of school-age people is controlled.

Figure 12 shows the % share of trip makers per number of trips category. As established earlier, the majority of trip makers make 2 trips per day for all the cities of the study area. Tokyo and Hiroshima have the highest percent shares of travelers making 3 trips or more. This may be due to a well developed transport infrastructure already in place which may enable people to make more trips in a day.

Figure 13 shows the gender characteristics of travelers analyzed against the number of trips category. More than 50% of trip makers are female (in terms of number of people) in Belem, Bucharest, Hiroshima, and Manila. However, males still dominate the travelers making 3 or more trips per day for these 4 cities except for Hiroshima. Bucharest, Tokyo, and Hiroshima have more females than

males doing 3 trips per day.

Figure 14 shows the age profile of each number of trips category. Bucharest, Chengdu, Hiroshima, and Tokyo have the greatest percent share of elderly people (>60 years old) who make 2 trips per day, a finding that is consistent with an earlier observation in Chapter 3.

Table 4 – Top 10 Trip Chains

| Tripoli | Cum(%) | Damascus | Cum(%) | Manila | Cum(%) | Chengdu | Cum(%) | Managua | Cum(%) |
|---|---|---|---|---|---|---|---|---|---|
| S-H | 41.2 | W-H | 40.3 | S-H | 27.4 | W-H | 25.8 | S-H | 37.1 |
| W-H | 80.9 | S-H | 59.2 | W-H | 48.7 | D-H | 44.2 | W-H | 66.8 |
| D-H | 83.9 | P-H | 73.5 | D-H | 58.1 | P-H | 58.6 | P-H | 83.2 |
| P-H | 86.7 | B-H | 84.1 | P-H | 63.9 | B-H | 70.7 | B-H | 86.0 |
| B-H | 88.8 | D-H | 89.2 | B-H | 69.7 | S-H | 77.1 | P-H-P-H | 87.4 |
| W-H-W-H | 90.3 | W-H-W-H | 90.8 | S-H-S-H | 70.8 | W-H-W-H | 81.2 | W-H-W-H | 88.5 |
| S-H-S-H | 90.7 | W-H-P-H | 91.9 | W-H-W-H | 71.5 | S-H-S-H | 83.2 | P-P-H | 89.2 |
| W-H-P-H | 91.0 | B-H-B-H | 92.9 | W-P-W-H | 71.9 | P-H-P-H | 83.8 | W-S-H | 89.9 |
| W-H-B-H | 91.2 | P-H-P-H | 93.2 | B-H-B-H | 72.3 | B-H-B-H | 84.4 | S-H-P-H | 90.5 |
| W-W-H | 91.3 | W-H-D-H | 93.5 | B-B-H | 72.6 | D-H-P-H | 84.9 | W-H-S-H | 91.0 |

| Belem | Cum(%) | Bucharest | Cum(%) | Cairo | Cum(%) | Jakarta | Cum(%) | KL | Cum(%) |
|---|---|---|---|---|---|---|---|---|---|
| S-H | 33.3 | W-H | 40.1 | S-H | 53.0 | S-H | 29.7 | W-H | 43.5 |
| W-H | 54.6 | S-H | 58.4 | W-H | 90.2 | W-H | 56.1 | S-H | 72.2 |
| B-H | 66.4 | D-H | 74.2 | W-H-W-H | 90.8 | D-H | 65.8 | D-H | 76.8 |
| D-H | 73.3 | P-H | 86.6 | P-H | 91.1 | P-H | 72.1 | W-D-B-H | 80.3 |
| P-H | 77.5 | B-H | 87.3 | S-H-S-H | 91.3 | S-H-P-H | 75.6 | W-H-W-H | 82.6 |
| W-H-B-H | 79.9 | W-D-H | 87.8 | B-H | 91.5 | W-H-W-H | 77.4 | S-H-S-H | 84.1 |
| W-H-W-H | 81.5 | W-H-D-H | 88.3 | D-H | 91.6 | D-H-P-H | 78.9 | P-H | 85.3 |
| B-H-B-H | 82.6 | P-P-H | 88.7 | S-H-W-H | 91.7 | W-H-P-H | 80.2 | B-H | 86.4 |
| S-H-S-H | 83.5 | W-H-P-H | 89.2 | W-H-S-H | 91.7 | W-P-W-H | 81.3 | W-H-D-H | 87.3 |
| W-H-S-H | 84.5 | P-H-P-H | 89.6 | W-B-H | 91.8 | S-P-H | 82.4 | W-D-H | 88.2 |

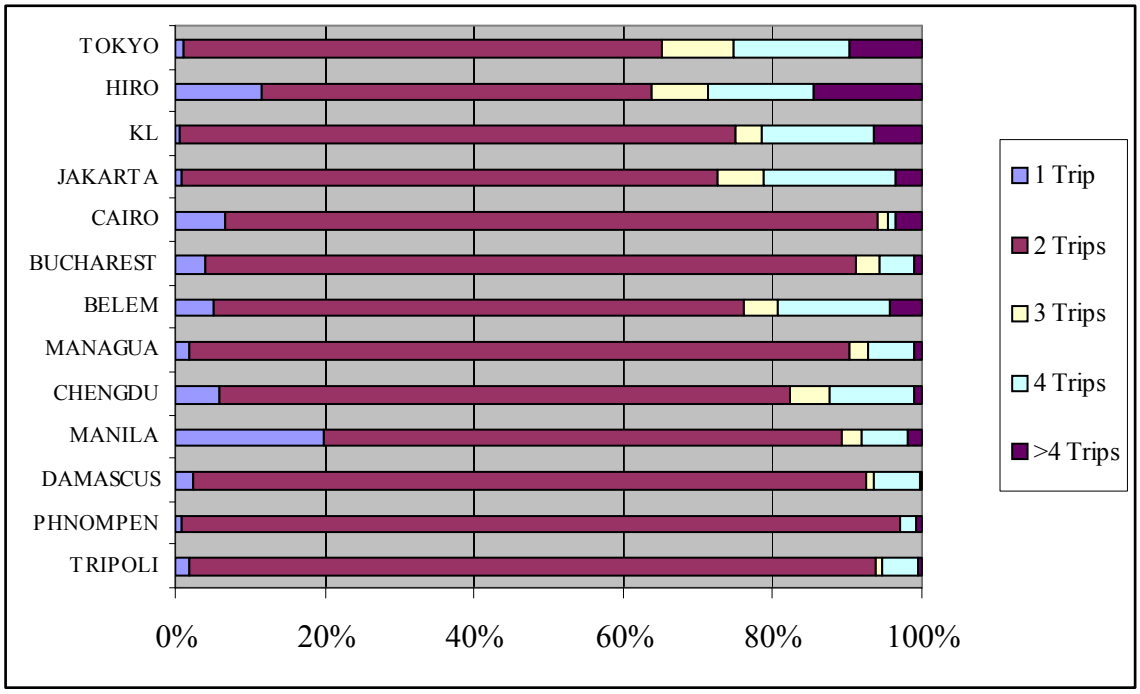



Figure 12 – Proportion (%) of Travelers According to Number of Trips

## 7. CONCLUSION

This paper analyzes the travel and socio-economic characteristics of trip makers in 13 Asian, Central American, and Middle Eastern Cities using the HIS (Household Interview Survey) databases which were mostly developed through assistance from JICA (Japan International Cooperation Agency). Although the format of the databases is not totally standardized owing to the different consulting groups that carried them out, a fairly reasonable level of standardization and reclassification have been done to allow international comparison among the cities.

The study compared trip characteristics with possible determinants of travel demand. Age, gender, and car ownership were analyzed vis-à-vis trip characteristics such as trip purpose, modal share, number of trips per day, departure times, and average trip durations. Analysis was made for each city and comparisons were made across the different cities. Similarities and variations among the cities were identified. Possible explanations for such patterns were also presented. This include the level of development of transport infrastructure, level of motorization, demographics, and local culture, among others.

It is considered that these results illustrate a part of city developing process in the world. Therefore the similarities or the differences may give insights based on the past conducted transportation policies. However, the analyzed data do not include precise Level Of Service (LOS) data, the close relationship between travel behavior and LOS should be examined by the further analyses.

## REFERENCE

JICA (Japan International Cooperation Agency, 1999) Metro Manila Urban Transportation Integration Study. Final Report. II-3-13.

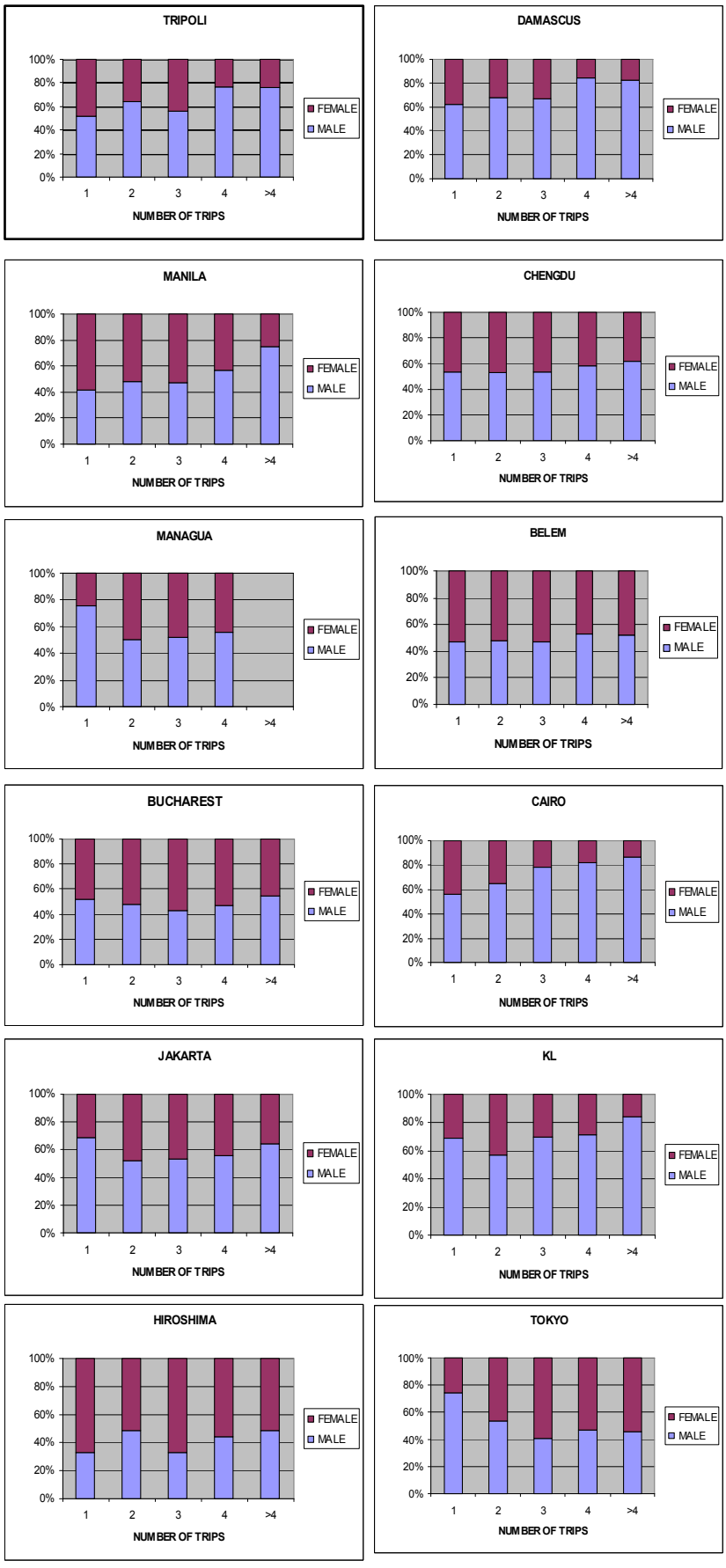



Figure 13 – Number of Trips by Gender

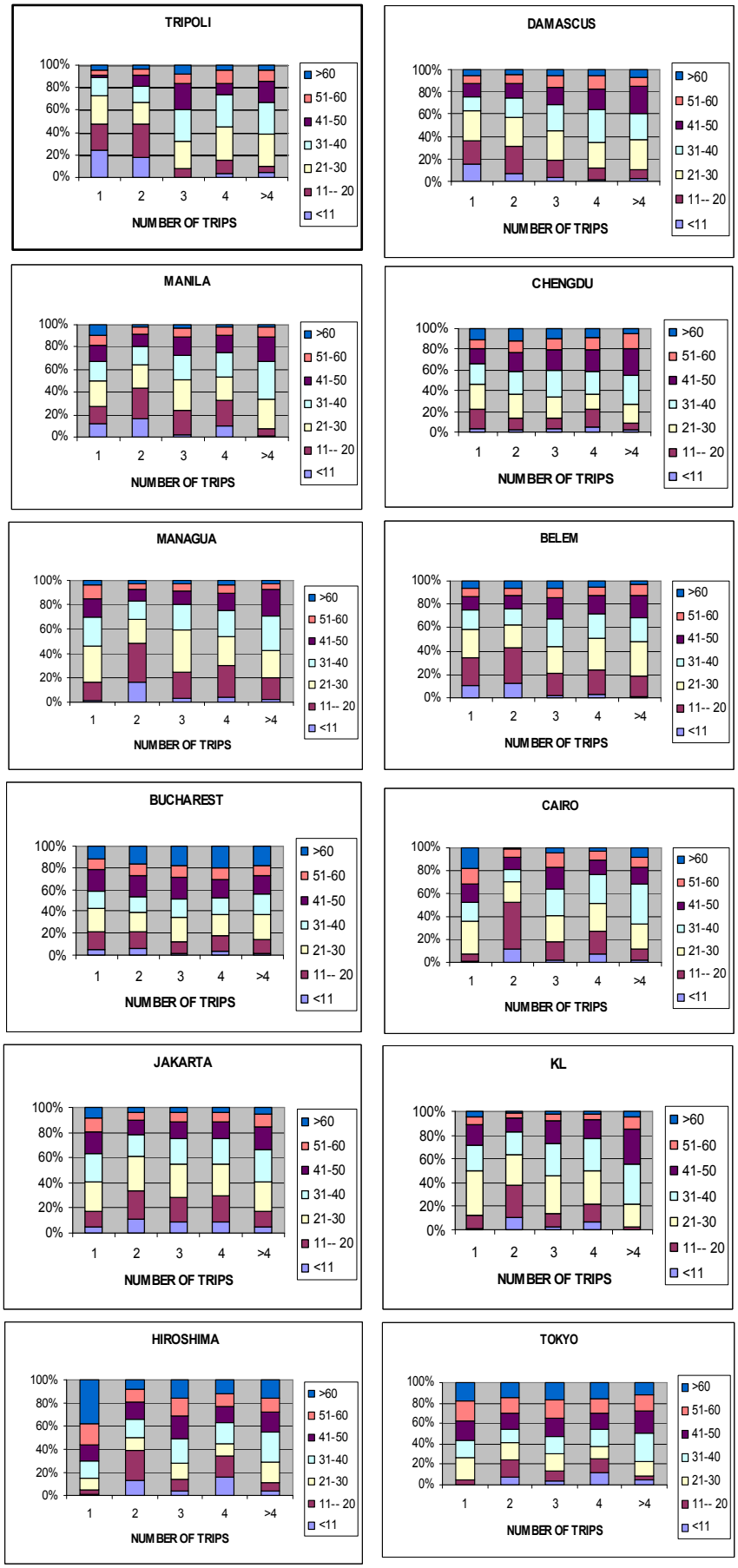



Figure 14 – Number of Trips by Age