## 2) Employment by Economic Sector

Figure 3.2.4 and Figure 3.2.5 illustrate the number of workers by workplace and economic sector. This is a result of aggregating the answers on workplaces based on the Commuter Survey. Each color shows the number of workers per economic sector, as follows:

1) Red: Primary sector such as agriculture, forestry, fishery, and mining;

2) Green: Secondary sector such as industry/factory, construction, and electric/gas/water; and

3) Blue: Tertiary sector such as finance, trading, service, government, etc.

In Kabupaten Bangkalan and southern Kabupaten Gresik, the share of the primary sector was high. There were many areas where the number of people working in the secondary sector was high, such as in central Gresik and Kabupaten Sidoarjo.

Inside Kota Surabaya, there is no traffic analysis zone where many people work in the primary sector except for coastal areas, such as Kelurahan Kenjeran, Keptih, and Wonorejo. The areas where the share of the secondary sector was relatively high were concentrated in southern Kota Surabaya, such as Kelurahan Kalirungkut, Rungkut Kidul, and Kutisari. Other areas where secondary sector employment was dominant were in the north, such as Tanjung Perak and Kelurahan Geding. The rest of the areas are characterized by a predominance of tertiary sector workers.
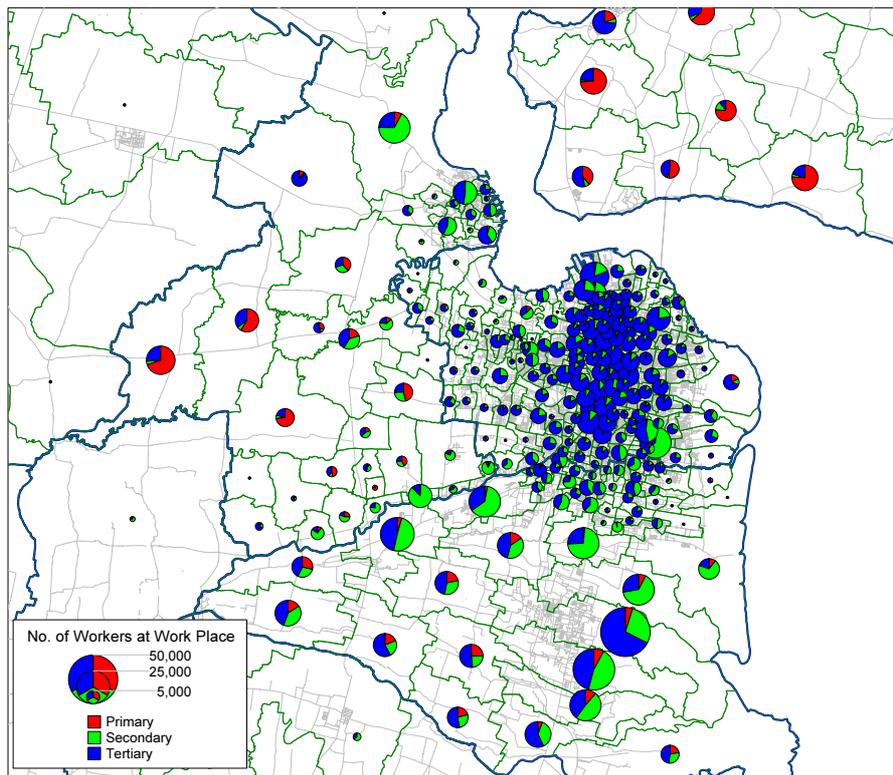
Source: 2009 Commuter Survey, JICA Study Team

Figure 3.2.4   Number of Workers in GKS by Workplace and Economic Sector
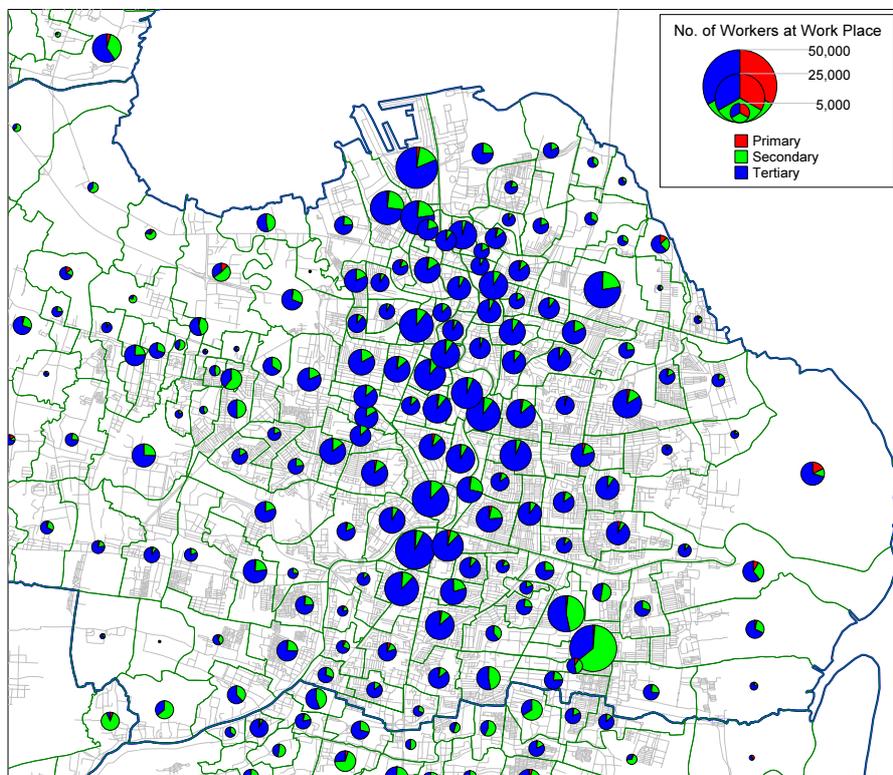
Source: 2009 Commuter Survey, JICA Study Team

Figure 3.2.5   Number of Workers in Kota Surabaya by Workplace and Economic Sector

3.3 Summary of Travel Demand

1) Number of Person Trips

Table 3.3.1 shows the estimated trip rate by trip purpose and age group. In this table, the rate of both "commuting" and "to-school" trips was estimated based on the results of the Commuter Survey, while the rate of "business" and "private" trips was based on the results of the Trip Diary Survey.

The average trip rate was estimated at 1.09, which does not include "to-home" trips. Younger groups registered higher trip rates, while the oldest group indicates the least.

Table 3.3.1 Trip Rate by Purpose and Age Group

Age Group	Trip Rate (trips/person/day)					Trip Maker Ratio (%)	Trip Rate (Net)
	Commute [1]	School [1]	Business [2]	Private [2]	Total		
5-9	0.01	0.94	0.03	0.44	1.41	75.7	1.87
10-14	0.01	0.93	0.03	0.34	1.31	71.7	1.82
15-19	0.07	0.73	0.07	0.38	1.25	72.7	1.72
20-24	0.38	0.19	0.09	0.40	1.06	70.1	1.52
25-29	0.51	0.02	0.10	0.36	0.99	60.0	1.64
30-34	0.53	0.00	0.18	0.27	0.98	59.8	1.63
35-39	0.53	0.00	0.13	0.31	0.97	57.3	1.69
40-44	0.53	0.00	0.25	0.37	1.15	67.0	1.71
45-49	0.54	0.00	0.16	0.37	1.06	63.0	1.69
50-54	0.50	0.00	0.22	0.42	1.14	61.7	1.85
55-59	0.42	0.00	0.21	0.32	0.96	50.0	1.92
60 and over	0.20	0.00	0.10	0.29	0.60	57.4	1.05
Total	0.34	0.26	0.14	0.35	1.09	63.7	1.71

Source: 1) 2009 Commuter Survey, JICA Study Team
2) 2009 Trip Diary Survey, JICA Study Team
Note: Trip rate did not include return trips to home.

The total number of person trips generated in the study area, which can be calculated with the population by age group and the rates described in Table 3.3.1, was estimated at 8.8 million per day (refer to Table 3.3.2). The share of commuting trips was 31% and that of to-school trips was 24.1%. Traffic volume that is observed on the ground must include return trips to home.

Table 3.3.2 Estimated Number of Trips

Trip Purpose	No. of Trips (1,000)	Share (%)
Commute	2,727.8	31.0
School	2,126.7	24.1
Business	1,100.7	12.5
Private	2,857.7	32.4
Total	8,812.9	100.0

Source: 2009 Commuter Survey, JICA Study Team

2) Trip Purpose and Mode Choice

Figure 3.3.1 and Table 3.3.3 describe the modal choice by trip purpose. The figures were estimated based on the results of the Trip Diary Survey. The share of motorcycle for commuting and business trips is about 60%, while that for to-school and private trips is about 30%. Besides, half of the latter trips are walk trips, implying that those trip makers may shift to motor vehicles resulting from improved transportation services.
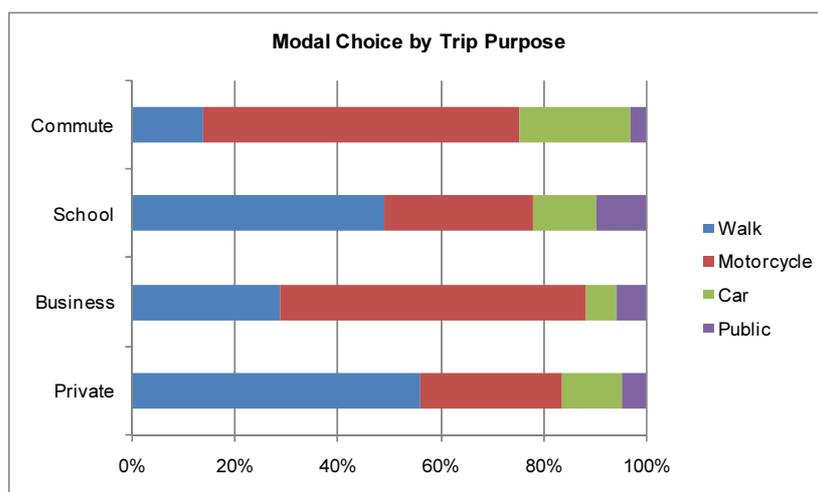
Source: 2009 Commuter Survey, JICA Study Team

Figure 3.3.1   Modal Choice by Trip Purpose

The modal share of motorized trips, which exclude walk trips, is described in Table 3.3.3. The share of motorcycles indicates 69.0% for all purposes, followed by cars at 22.2%. The modal share of public transportation, which consists of buses and trains, was less than 10% and only to-school trips showed a relatively higher need for this mode. The share of cars for business trips seems to be unreasonably low as compared to other trip purposes.

Table 3.3.3   Modal Share by Trip Purpose

(Unit: %)

Trip Purpose	Modal Share (including Walk trips)				Modal Share of Motorized Trips		
	Walk	Motorcycle	Car	Public	Motorcycle	Car	Public
Commute	14.1	61.4	21.5	3.0	71.5	25.0	3.5
School	49.1	29.0	12.3	9.6	57.0	24.2	18.8
Business	28.8	59.6	5.9	5.7	83.7	8.2	8.0
Private	56.2	27.4	11.8	4.6	62.6	26.8	10.6
Total	40.4	41.1	13.2	5.3	69.0	22.2	8.8

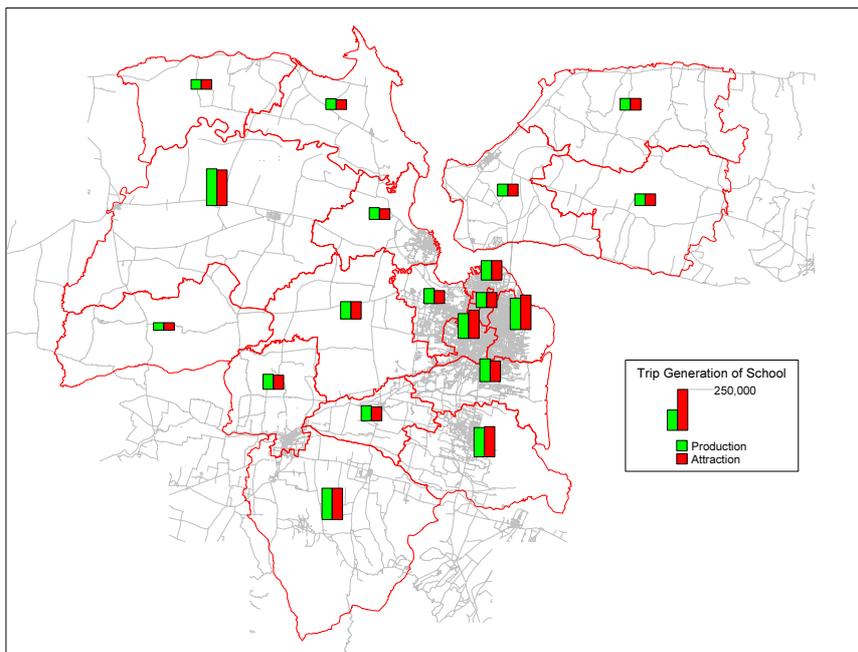Source: 2009 Trip Diary Survey, JICA Study Team

3) Trip Generation by TAZ

The following two figures show the trip generation of commuting and to-school trips by integrated TAZ. Kota Surabaya, zones in Sidoarjo, and outer zones registered a large number of trip generations, based on the survey. However, it was only in Surabaya where trip attraction exceeded trip generation, which means there were many trips going to this area. School trips had the same tendency.
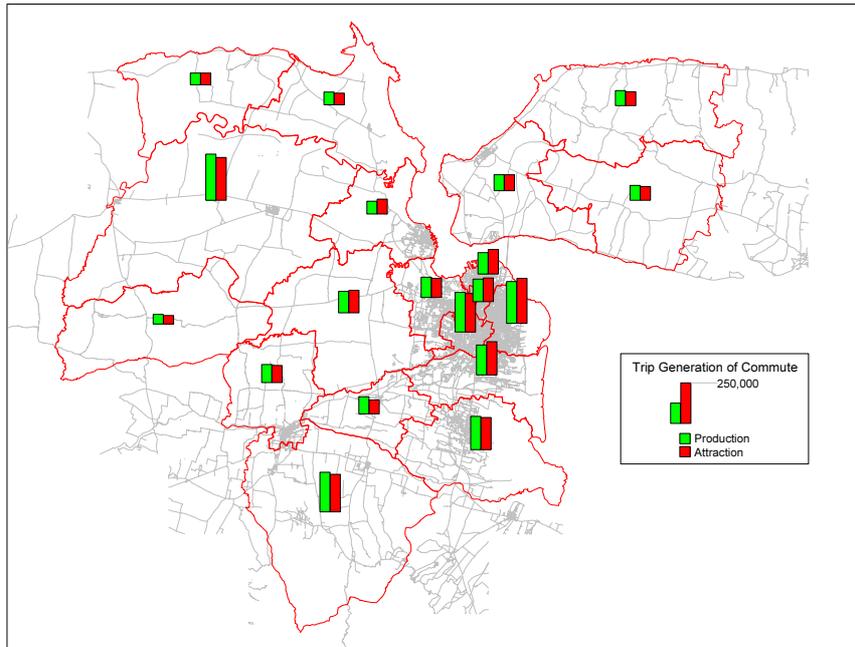
Source: 2009 Commuter Survey, JICA Study Team

Figure 3.3.2   Generation of Commuting Trips by TAZ

Source: 2009 Commuter Survey, JICA Study Team

Figure 3.3.3   Generation of School Trips by TAZ

4)   Hourly Distribution

The following figure depicts the concentration of travel departure.   The highest record of commuting and to-school trips occurred between 7:00 and 8:00 a.m., accounting for almost 40% of the total.   To-school trips started earlier than commuting trips, in general.   The rate of to-school trips departing before 8:00 a.m. indicated a 72% share, while that of commuting trips was 58%. Some to-school trips took place in the afternoon, and this might represent a double-shift school system, but this was not large.
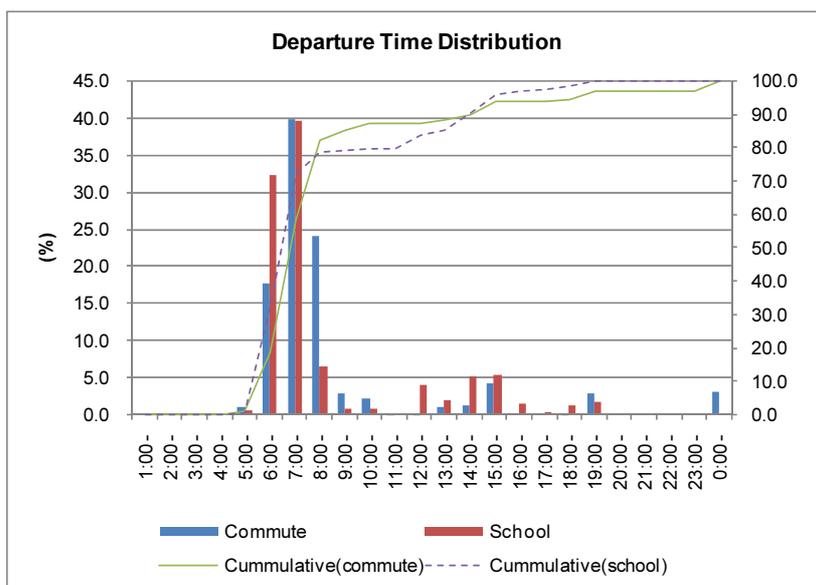
Source: 2009 Trip Diary Survey, JICA Study Team

Figure 3.3.4   Departure Time Distribution

Figure 3.3.5 shows the departure time distribution for "business," "shopping," "visiting friends," and other private purpose trips.   The peak hour for shopping trips was between 5:00 and 6:00 a.m., and the peak hour for business trips was between 7:00 and 8:00 a.m.   The rest of the private trips did not have obvious peak hours.
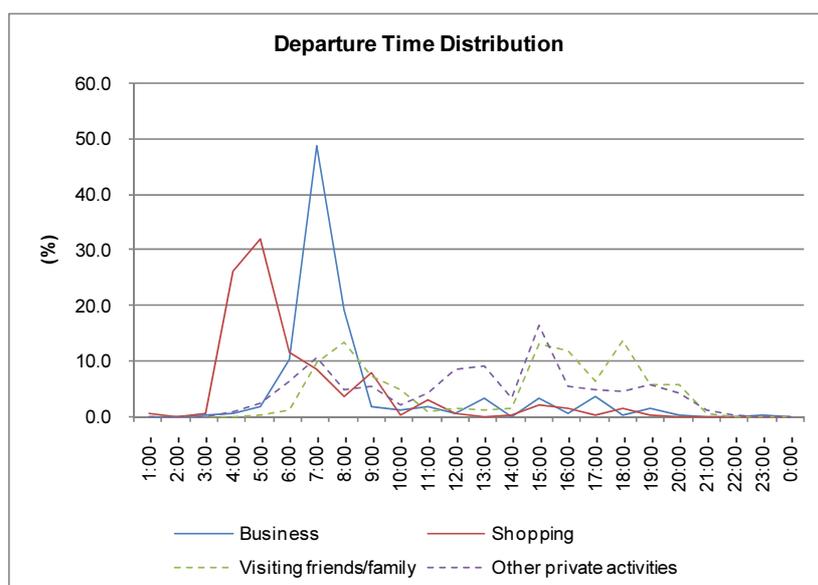
Source: 2009 Trip Diary Survey, JICA Study Team

Figure 3.3.5   Departure Time by Trip Purpose

5)   Travel Time

In the Trip Diary Survey, the departure time and arriving time of each activity were collected. Based on the results, an average travel time by mode was estimated.   Table 3.3.4 and Table 3.3.5 describe the results of the calculation by trip purpose.

The average travel time of each mode for commuting trips was longer than that of to-school trips.   In the case of the former, the average travel time by both motorcycles and passenger cars was almost the same, at about 40 minutes.   The standard deviation of both commuting trips and to-school trips by walking was relatively higher than for other modes.   This means that travel by walking has a wide time range, because there are people who travel long distances but have no mode of transportation except to walk.

Table 3.3.4   Average Travel Time for Commuting and To-school Purposes

(Unit: minutes)

Mode	Commute		School	
	Average	STDEV	Average	STDEV
Walk	29.8	70.2	27.7	105.4
Motorcycle	37.4	52.7	29.6	13.6
Car	38.6	53.0	24.1	10.5
Public Transport	22.5	7.6	20.6	7.3

Source: 2009 Trip Diary Survey, JICA Study Team

Table 3.3.5 shows the average travel time for other purposes. The average travel time for other private trips was longer than the rest for all modes. The average travel time of trips by public transportation either seemed unreasonable or was not available because not enough data for analysis was collected.