IMPACTS OF THE INDUSTRIAL DISTRIBUTION TO THE DISTRIBUTION OF POPULATION AND TRAFFIC PERFORMANCE IN SURABAYA - INDONESIA

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Abstract: Surabaya which lies in eastern part of Java island as a second biggest city in Indonesia has a current population of 3 million and it is predicted to have reached approximately 6 million inhabitants in the next 20 years. The urban traffic becoming worst time by time and the opening or widening urban highway even frequently resulted a rapid traffic growth and has led to unwanted urban traffic congestion. To bring about sustainable reduction in urban traffic volumes, significant changes will be necessary in the way of households and businesses engage in daily travel. Such changes are likely to involve changes in traffic generating and attracting land within urban areas. In this study the changes in the location of industries will be exercised, and it is expected to have the changes also in the location of residential and services and finally the positive impacts on traffic performances will be realised. In the first part of the study, some scenarios on industrial allocation will be adopted. A Lowry model will give interesting results from the view point of determination of the districts having potential for development. To prevent haphazard development of the city, new centres should be planned in advance. In the second part, the traffic flow results of the scenarios situation will be analysed. And finally it can be compared which land use policies are suited to have a better traffic performance.

Key words : land use-transport interaction, Lowry model, traffic performance, population distribution, trip generation

1. INTRODUCTION

The urban transportation system is intimately related to land use. Concentration of employment and activities stresses the transport system. By observing a city's land use pattern, it should be possible to understand what traffic performance in the city it would have. Rapid economic growth of urbanization will cause a shift in activities. These activities can establish the character of the city in form and its movement. Transportation system, as one of the accessibility, can shape the city's social-economic activities, which in turn, influence transport demand. The spatial distributions of residents and workers are assumed to create the major demands for travel, which drive development of the transportation system. The transportation system represents both the physical infrastructure and services provided by the different travel modes, for either passenger or freight movement.

In this research, the location of industries will be exercised. With a given transport accessibility and using a Lowry model , the allocation of residential/population and services will be found. This such location of activities will generate trips. The trip generation (and trip attraction) then analyzed by a model of regression based. TRANPLAN then used to see the trip distribution and assignment, where traffic performance will be described.

This paper will be organized into three parts. The First part covers the determination of the population and service employment distribution in districts, by means of the Lowry model, depending on the existing industrial development trend .The second part covers the scenarios related of relocation of the industrial development, by adapting the same model. Part three the impact of the population and employment distribution through such scenarios to the traffic performance will be studied.

2. MODEL APPLICATION

2.1. Model Subsystems

There are two subsystems, which will work in the model; there are the land use and the transportation subsystems. Following is a chart, which describe the relationship between these two subsystems:

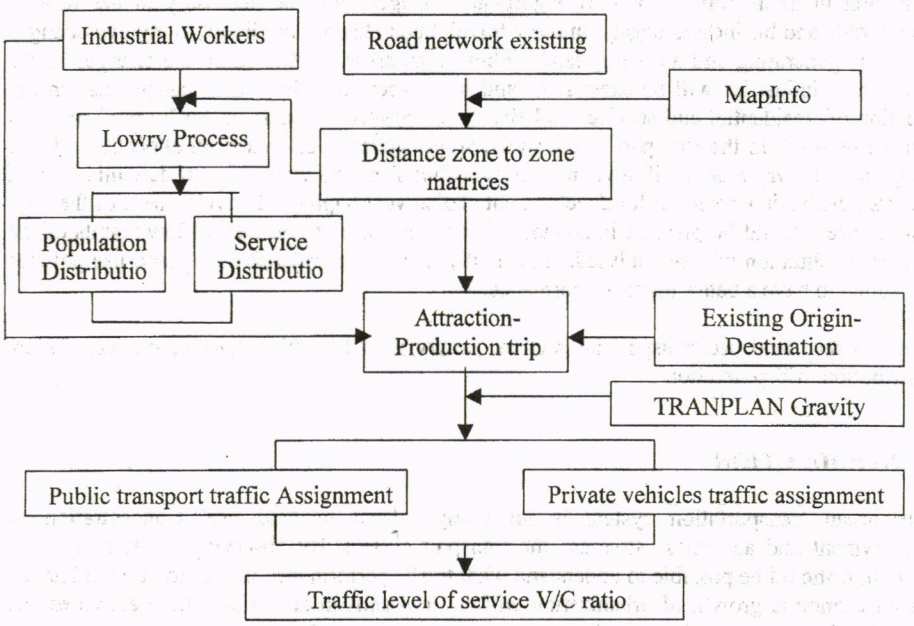


Figure 1. Relationship between land use and the transportation subsystems

2.2. The Lowry Model

One of the famous models concerning land use or activity allocation is a Lowry model, which has been using since 1964. The original Lowry model incorporates the spatial distribution of population, and workers. In this model workers are defined into basic/industry and non-basic (service) workers. In essence, the approach consists of linking together two spatial interaction models. One of these models allocates workers to a predefined set of land use zones on the basis of exogenously supplied basic employment levels (i.e., employment in manufacturing

and primary industries). The dependent families of these workers are then defined using a suitable activity ratio (the ratio of total regional population to total regional employment). These workers and their families demand services, and these demands are met by means of a second spatial interaction model which allocates this service supply, in the form of "nonbasic" employment, across the same spatial zoning system. Iteration is required to then bring the resulting residential and nonbasic (service) employment activity allocation models into line with each other.

Followings the structure of the Lowry model will be described:

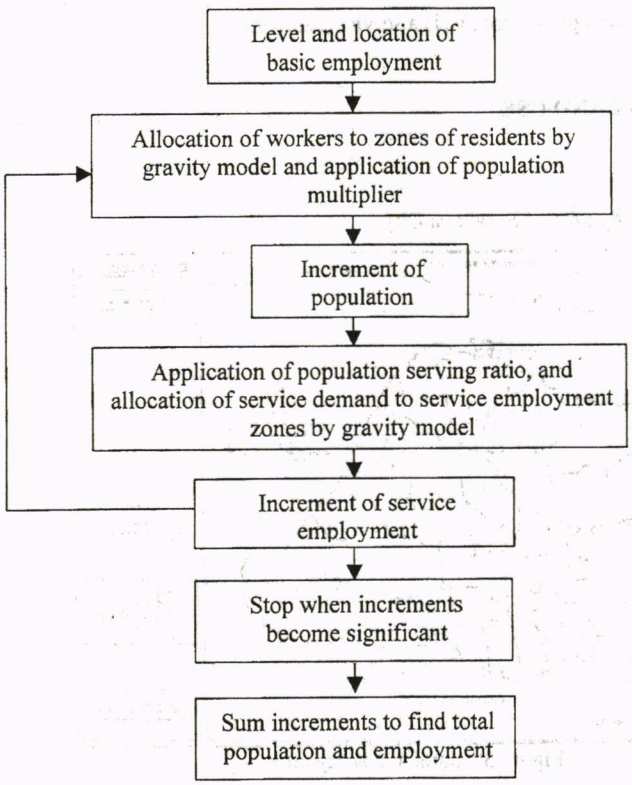


Figure 2. Structure of the Lowry model

The residential locations are calculated from the following production constrained gravity model:

$$T_{do} = E_d \cdot \frac{H_o / t_{do}}{\sum_0 H_o / t_{do}} \qquad (1)$$

Where E_d means the number of employment, H_o is a housing opportunity and t_{do} is traffic impedance, where in this case of study was chosen as a distance between origin and destination.

Residential work trip ends are summed and multiplied by μ, the number of persons per worker to give population Ro

$$Ro = \mu T_{do} \tag{2}$$

The location of service employment are calculated from the following Gravity model as follows:

$$T_{od} = R_o . v \frac{F_d / t^2_{od}}{\sum_d F_d / t^2_{od}} \tag{3}$$

Where v is a service workers per person, F_d is a service attraction.

3. STUDY AREA AND LAND USE

3.1. Study Area

Following is a map of study area of Surabaya City:

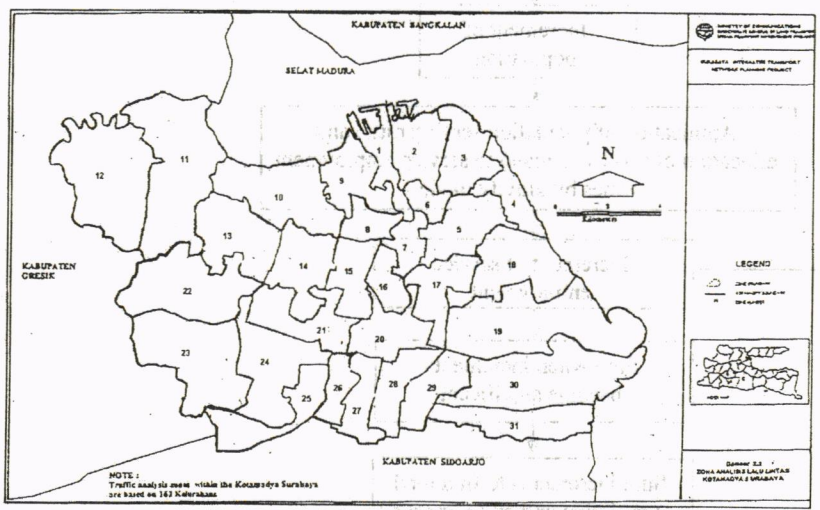


Figure 3 : Surabaya study area

District was taken as the traffic zones, which so called as Kecamatan, totally 31 zones and as it can be seen, numbers identifies it. These 31 numbers of districts stated in 1998, and there was only 28 previously.

3.2. Transportation Systems And Land Use Patterns Of Surabaya

Surabaya City, is a second biggest city in Indonesia. In 1970's, the population in Central Business District (CBD) had grown. In this period, the urbanization toward east and west had been relatively slow, but high toward the south.

Since 1980's the population in CBD starting to decrease, it has been decreasing in its population at an approximate rate of minus 0,35 % in the last decade. It indicates that a gradual change of land use, that is, from housing to non-housing purposes such as commercial and office uses has been taking place in the CBD. On the other hand, the population in the suburban area of Surabaya is rapidly increasing at a growth rate ranging from 6 to 12% per year. Now CBD has been specialized in to business and commercial uses, while suburban areas have been change into residential use. As can be seen in Kecamatan Lakar Santri, Karang Pilang, Wonocolo, Rungkut , Sukolilo , Kenjeran, Tandes and Benowo has been rapidly growing.

But again if we compare to the period 1990-1996, almost all of the overall Kecamatans population was decreasing, only some were still increase in a very small percentage. In this period, the growth of Kecamatan Gunung Anyar and Karang Pilang had a significant decrease, i.e. around 17%. All of these figures of population development can be seen in table 1 below.

Table 1 - Past Trends in Population, Share of Population and Growth Rates

District	Year/Time Period				Year/Time Period				Annual Growth Rate (%)	
	1971	1980	1990	1996	1971	1980	1990	1996	1971-1980	1980-1990
	P opulation				**Share of Population (%)**					
Pabean Cantikan	39.309	101.711	88.416	89.751	2,5	5,0	4,2	3,8	11,11	-1,39
Semampir	97.01	162.131	166.496	156.26	6,2	8,0	8,0	6,7	5,88	0,27
Kenjeran	19.336	41.709	84.364	85.685	1,2	2,1	4,0	3,7	7,56	7,3
Tambaksari	126.707	163.598	188.225	203.75	8,2	8,1	9,0	8,7	2,89	1,41
Simokerto	101.207	112.47	98.107	107.63	6,5	5,6	4,7	4,6	1,21	-1,36
Genteng	72.848	89.704	73.878	64.929	4,7	4,4	3,5	2,8	2,4	-1,92
Bubutan	155.223	122.802	109.214	106.35	10,0	6,1	5,2	4,5	2,53	-1,36
Krembangan	143.718	125.511	119.225	119.4	9,3	6,2	5,7	5,1	-1,49	-0,51
Asemrowo	-	-	-	20.834	0	0	0	0,9	-	-
Benowo	8.715	23.157	35.986	39.466	0,6	1,1	1,7	1,7	4,51	4,51
Tandes	34.547	91.799	196.119	83.416	2,2	4,6	9,4	3,6	14,22	7,89
Sukoma-nunggal	-	-	-	78.864	0	0	0	3,4	-	-
Sawahan	157.797	205.665	208 699	201.34	10,2	10,2	10,0	8,6	2,98	0,15
Tegalsari	91.474	129.57	117.837	116.93	5,9	6,4	5,6	5,0	3,96	-0,94
Gubeng	127.974	161.097	156.428	142.61	8,2	8,0	7,5	6,1	2,6	-0,29
Mulyorejo	-	-	-	50.921	0	0	0	2,2	9,96	9,67
Sukolilo	27.27	58.821	148.11	68.265	1,8	2,9	7,1	2,9	9,96	9,67
Wonokromo	214.94	171.845	171 421	172.36	13,8	8,5	8,2	7,4	2,4	-0,02
Dukuh Pakis	-	-	-	44.558	0	0	0	1,9	-	-
Lakarsantri	20.17	31.54	57.094	61.077	1,3	1,6	2,7	2,6	3,02	6,11
Wiyung	-	-	-	35.464	0	0	0	1,5	-	-
Karang Pilang	52.232	81.577	140.046	46.063	3,4	4,0	6,7	2,0	5,99	5,54
Jambangan	-	-	-	29.936	0	0	0	1,3	-	-
Gayungan	-	-	-	35.895	0	0	0	1,5	-	-
Wonocolo	40.587	86.234	140.614	58.932	2,6	4,3	6,7	2,5	8,72	5,01
Tenggilis Mejoyo	-	-	-	39.558	0	0	0	1,7	-	-
Rungkut	21.148	56.486	172.993	56.408	1,4	2,8	8,3	2,4	11,52	11,84
Gunung Anyar	-	-	-	27.874	0	0	0	1,2	-	-

Source : Surabaya in figures 1996

In general, densely populated Kecamatan represents lower rates, while Kecamatan of low population density show high growth rates. It can be seen also that there may exist a certain maximum level of population density that may fall approximately 800 person/ha in Surabaya City.

3.3. Surabaya restructuring program (scenarios)

Decentralization of jobs and residences typically reduces transit performance. Distributing traffic flows more widely across the transport network and reducing radial corridor volume may reduce congestion. In addition, the decentralization of employment and residence has the potential for reducing the travel distances of commuters. Employment decentralization, in particular can be visualized as moving job locations closer to residential locations and improving the jobs/housing balance.

City can also be influenced by development control. Planning controls have proved effective in preventing certain developments. Their effectiveness in achieving positive objectives is less certain, but in cities with strong government, like Singapore or Hongkong, they have undoubtedly proved successful in creating major industrial estates and shopping centers.

Dynamic processes play important part in the formulation of the city structure. The first building to go up influences the position of the second building. The early concentration of commerce in one place attracts new commerce to the same place.

In this research, some scenarios of land use policy will be analyzed by using the famous model of Lowry.

The first scenario, from the 1996 data of industries, the location of services and population or residential will be found by applying the model. 1996 was chosen as a base year data, because since 1997, the development was not stable due to the monetary crisis.

The second scenario will be, where it is assumed there is no land use policy intervention. The industries assumed have a normal growth, in this case 7%. By using 1996 as a base year, the new location of services and population will be found by the model.

The city of Surabaya has a master plan up to 2005. So that, the third scenario, as the last scenario, it will be analyzed if the Surabaya Master Plan 2005 is implemented. The industries will be developed to more concentrated into west area of Surabaya.

The land use policy planned in Surabaya was not as a unicenter city, but as a multicore or multicenter, as can be seen from the figure 2 below.

It is expected by this planning control, the distribution of population will be spread all over the study area or avoiding a concentration of population in one place in order to have a balance land use development and also to have a good traffic performance.

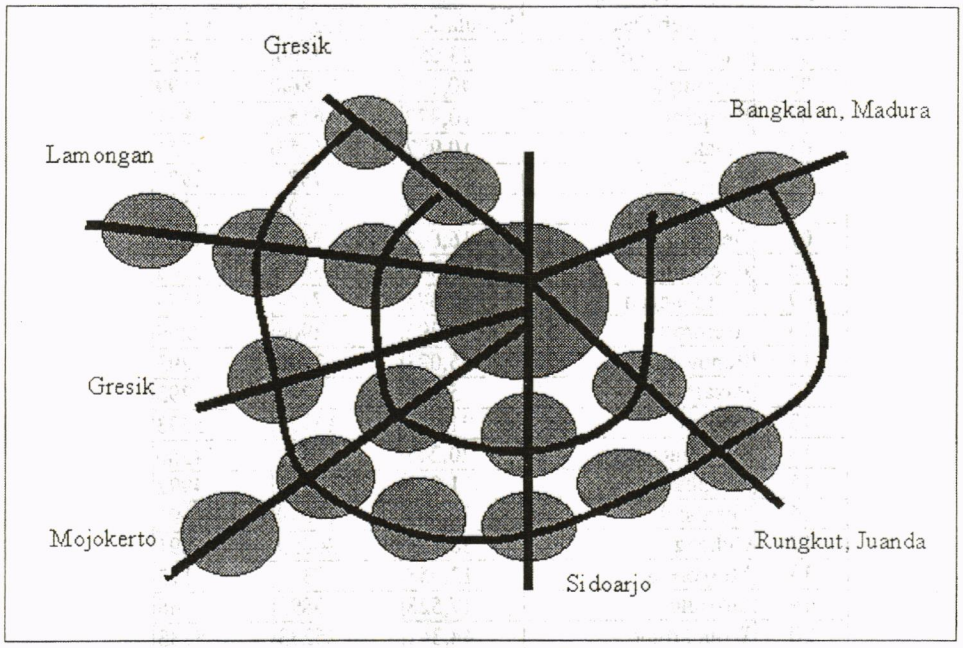


Figure 4: Multicore development land use plan of Surabaya.
Design by MPS-2000, master plan team of 2005

4. LAND USE MODEL PROCESS

The purpose of using the well known and widely used Dynamic Lowry model in the study is to determine the distribution of population and service sector employment depending on the current scenarios industrial distribution

As was mentioned before, the statistic data 1996 of population and basic workers or number of person engaged in industries, in this case large and medium industry, was taken from Surabaya Municipality Statistical Office, as a base year.

By means of the Lowry, it can be seen in the following table the distribution of services.

In table 3 also shows the industrial development in 2000 and 2005 if it is assumed that the current situation remains unchanged, depending on the normal trend of industries. On the same table also shows the situation of industries if the Master Plan of Surabaya 2005 is adopted. This figures of industries has been obtained assuming the average density of the current industrial area.

Table 2: Population, industrial and service values 1996 of Surabaya (First scenario)

No	Kecamatan / Sub District	1996		
		Population	Service(*)	Basic
01	Pabean Cantikan	23,057	13060	3487
02	Semampir	40,178	22868	5199
03	Kenjeran	10,977	6154	851
04	Bulak	10,977	6153	851
05	Tambaksari	52,419	29874	2981
06	Simokerto	27,678	15692	1214
07	Genteng	16,667	9405	1002
08	Bubutan	27,341	15502	1168
09	Krembangan	30,686	17444	1373
10	Asemrowo	5,292	2906	9259
11	Benowo	5,023	2740	293
12	Pakal	5,019	2740	293
13	Tandes	21,422	12121	5393
14	Sukomanunggal	20,245	11470	14360
15	Sawahan	51,822	29511	4992
16	Tegalsari	30,058	17079	1991
17	Gubeng	36,674	20859	891
18	Mulyorejo	13,058	7341	112
19	Sukolilo	17,528	9893	66
20	Wonokromo	44,341	25233	5233
21	Dukuh Pakis	11,418	6401	49
22	Sambi Kereb	7,806	4334	49
23	Lakarsantri	7,797	4333	481
24	Wiyung	9,069	5054	359
25	Karangpilang	11,790	6626	13247
26	Jambangan	7,641	4248	2765
27	Gayungan	9,186	5121	2784
28	Wonocolo	15,126	8522	327
29	Tenggilis Mejoyo	10,125	5666	18309
30	Rungkut	14,473	8140	13636
31	Gunung Anyar	7,118	3943	26587

Source : Surabaya in figures 1996

(*) : Data processed

Table 3: Values of district based industrial employment 1996, prediction of 2000 and 2005 (current trend and prediction of master plan)

No	Kecamatan /District	Industrial Employment			
		1996	2000	2005 (TREND)	2005 (MASTER PLAN)
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
01	Pabean Cantikan	3487	4571	6411	3,487
02	Semampir	5199	6815	9558	5,199
03	Kenjeran	851	1115	1565	851
04	Bulak	851	1115	1565	851
05	Tambaksari	2981	3907	5480	2,981
06	Simokerto	1214	1591	2232	1,214
07	Genteng	1002	1313	1842	1,002
08	Bubutan	1168	1531	2147	1,168
09	Krembangan	1373	1800	2524	1,373
10	Asemrowo	9259	12137	17022	137,266
11	Benowo	293	384	539	130,261
12	Pakal	293	384	539	95,918
13	Tandes	5393	7069	9915	86,588
14	Sukomanunggal	14360	18823	26400	42,916
15	Sawahan	4992	6543	9178	4,992
16	Tegalsari	1991	2610	3660	1,991
17	Gubeng	891	1168	1638	891
18	Mulyorejo	112	147	206	112
19	Sukolilo	66	87	121	66
20	Wonokromo	5233	6859	9621	5,233
21	Dukuh Pakis	49	64	90	49
22	Sambi Kereb	49	64	90	49
23	Lakarsantri	481	630	884	481
24	Wiyung	359	471	660	359
25	Karangpilang	13247	17364	24354	13,247
26	Jambangan	2765	3624	5083	2,765
27	Gayungan	2784	3649	5118	2,784
28	Wonocolo	327	429	601	327
29	Tenggilis Mejoyo	18309	23999	33660	18,309
30	Rungkut	13636	17874	25069	94,785
31	Gunung Anyar	26587	34850	48879	52,659

By applying the Lowry model to those data above mentioned, now we could compare the districts development for each scenario, with the current normal trend (table 4) and when the Master Plan industrial area is adopted (table 5).

Table 4: Distribution of Population and Service employment using second scenario obtained by Lowry model

No	District	BASIC Employment 1996	BASIC Employment 2005 (current trend)	Population 2005	Service 2005
01	Pabean Cantikan	3487	6411	29253	12750
02	Semampir	5199	9558	60229	26412
03	Kenjeran	851	1565	23996	10445
04	Bulak	851	1565	23992	10445
05	Tambaksari	2981	5480	74347	32631
06	Simokerto	1214	2232	32659	14265
07	Genteng	1002	1842	23719	10318
08	Bubutan	1168	2147	36791	16079
09	Krembangan	1373	2524	41239	18042
10	Asemrowo	9259	17022	11890	5108
11	Benowo	293	539	8563	3645
12	Pakal	293	539	8563	3645
13	Tandes	5393	9915	50636	22176
14	Sukomanunggal	14360	26400	53384	23382
15	Sawahan	4992	9178	75057	32937
16	Tegalsari	1991	3660	40274	17612
17	Gubeng	891	1638	54444	23850
18	Mulyorejo	112	206	37842	16532
19	Sukolilo	66	121	59987	26306
20	Wonokromo	5233	9621	59861	26250
21	Dukuh Pakis	49	90	26848	11691
22	Sambi Kereb	49	90	15079	6501
23	Lakarsantri	481	884	15083	6499
24	Wiyung	359	660	15083	6499
25	Karangpilang	13247	24354	29548	12886
26	Jambangan	2765	5083	18778	8138
27	Gayungan	2784	5118	19016	8233
28	Wonocolo	327	601	31655	13800
29	Tenggilis Mejoyo	18309	33660	41338	18087
30	Rungkut	13636	25069	48391	21194
31	Gunung Anyar	26587	48879	40888	17875

Table 5: Distribution of Population and Service employment using third scenario obtained by Lowry model

No	District	BASIC Employment 1996	BASIC Employment 2005 (Master Plan)	Population 2005	Service 2005
01	Pabean Cantikan	3487	3,487	104258	17602
02	Semampir	5199	5,199	167135	28270
03	Kenjeran	851	851	94294	15904
04	Bulak	851	851	42147	7061
05	Tambaksari	2981	2,981	110160	18605
06	Simokerto	1214	1,214	61786	10384
07	Genteng	1002	1,002	73045	12297
08	Bubutan	1168	1,168	154336	26095
09	Krembangan	1373	1,373	123469	20854
10	Asemrowo	9259	137,266	48235	8081
11	Benowo	293	130,261	42545	7114
12	Pakal	293	95,918	32148	5359
13	Tandes	5393	86,588	110558	18656
14	Sukomanunggal	14360	42,916	130613	22066
15	Sawahan	4992	4,992	68506	11532
16	Tegalsari	1991	1,991	97041	16374
17	Gubeng	891	891	144995	24511
18	Mulyorejo	112	112	136198	23011
19	Sukolilo	66	66	152952	25867
20	Wonokromo	5233	5,233	149655	25309
21	Dukuh Pakis	49	49	113647	19185
22	Sambi Kereb	49	49	73408	12361
23	Lakarsantri	481	481	63850	10733
24	Wiyung	359	359	128579	21722
25	Karangpilang	13247	13,247	58550	9841
26	Jambangan	2765	2,765	43882	7351
27	Gayungan	2784	2,784	67281	11319
28	Wonocolo	327	327	109381	18467
29	Tenggilis Mejoyo	18309	18,309	94795	15991
30	Rungkut	13636	94,785	182132	30809
31	Gunung Anyar	26587	52,659	91122	15364

From those three scenarios, we will analiyze the density of each district, referring to the distribution of service and population by having area wide data from Surabaya in Figures. In the following graph it can be seen the comparison of land density distribution in general among the scenarios.

For the master plan scenario, it looks that there is a significant increase of density in some districts where the density of first or second scenario is still low. Although the estimation on population for scenario 3 seems always higher than scenario 2.

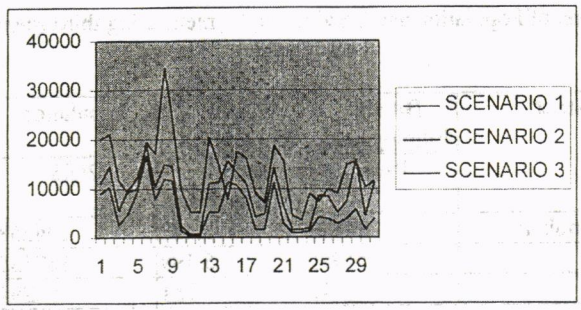
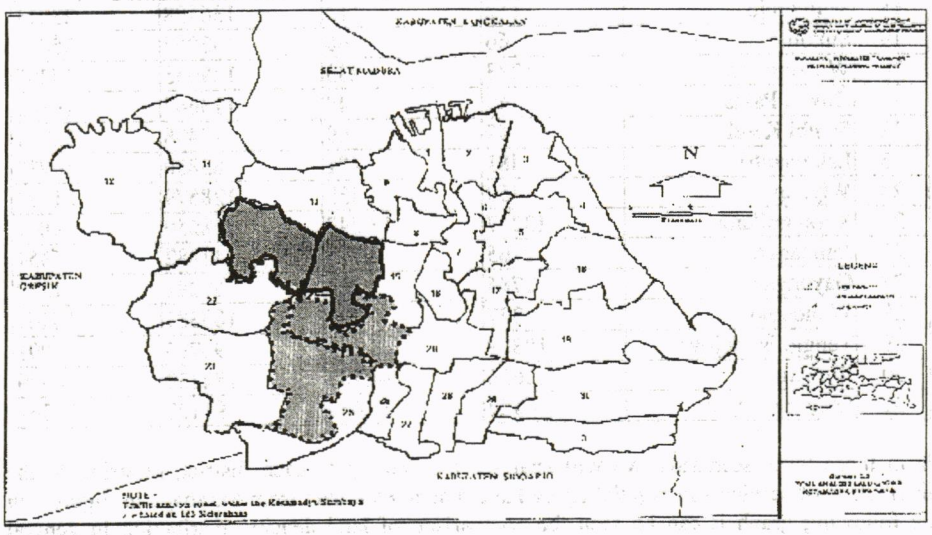


Figure 5: The distribution of land density for scenario one, two and three.

It can be seen also from below chart the comparison of trend development of population spreading between scenario two and three.

By scenario two, where using a current trend of industrial employment, the land used more developed to west areas, that is to Kecamatan Sukomanuggal and Tandes, while by the development control the development tend to the south area, i.e. to Kecamatan Dukuh Pakis and Wiyung. Scenario 2 land use development more to the high density district compares to scenario 3.
Because of the industries in Rungkut, Gunung Anyar and Tenggilis Menjoyo still remain unchanged up to 2005, that is why the development of land used both for scenario two and three will be moved to the west area, i.e. Kecamatan Sukolilo and Rungkut



scenario 2 ..... scenario 3

Figure 6 : Population development of scenario 2 and 3

To sum up, the implementation of dynamic Lowry model in Surabaya has given interesting results from the view point of the determination of the districts having potential for development. By viewing the results, if there are some new centers having potential to develop, then it can be planned in advance to prevent haphazard development of the city. Later, as also will be analyzed in this study, the impact of the distribution of land used to the traffic performance can be evaluated.

5. ADAPTATION OF TRANSPORT MODEL TO THE LAND USE SCENARIOS

The scenario data on population distribution, which has been resulted, will be used to analyze the traffic performance. Surabaya road network has been installed in MapInfo and it has already updated. As was mentioned before, the study area consists of 31 traffic zones. It contains of 219 number of nodes and 303 links.

From Surabaya Integrated Transport Network Project (SITNP) and updated by the survey done in August 2000, the Origin- Destination trip was found. The new trip generation and attraction with a scenario resulted on population and service distribution than found by using regression analysis.

To find trip distribution, which influenced by distribution of workers, a relationship between existing trip production/ attraction and the number of workers is built. Modal split data was found from the survey done in August 2000 as follows; Public vehicles: Buses 19.2 % and Public passenger car 16.75%
Private cars: Car 16.23% ,Motorcycle 30.34%,Taxi 3.04%,Buses 0.82%, Bicycles 3.87% and Tricycles 2.46 %. Walking is excluded from the process. The working trip (person/hour) than convert to passenger car unit/hour by using Indonesian Highway Capacity Manual, which using the pcu factors for Car; 1,Buses : 1.2 ,motorcycle; 0.25 and unmotorised ; 0.80

Private and public trip distribution than assigned by Equilibrium Tranplan process.
Road capacity data (from Public work Department) needed as input.

Finally, after the traffic assignment process, than traffic performance, where in this case expressed by level of service (V/C) are found for all the three scenarios as follows (Table shows only for up to 20th worst links):

Tabel 6. Surabaya Traffic Level Of Service (Scenario 1)
Processed By Tranplan

Number	Link Number		Volume/ Capacity
	A Node (*)	B Node (*)	
1	2014	2015	0.48
2	2015	2014	0.48
3	1605	2007	0.44
4	2007	1605	0.44
5	2006	2012	0.4
6	2012	2006	0.4
7	1409	1410	0.39
8	1410	1409	0.39
9	1401	1409	0.38
10	1409	1401	0.38
11	1410	1501	0.37
12	1501	1410	0.37
13	1607	2011	0.37
14	2004	2014	0.37
15	2011	1607	0.37
16	2014	2004	0.37
17	202	206	0.36
18	206	202	0.36
19	1501	1505	0.34
20	1505	1501	0.34
(*) The first two digit number indicates zone numbers			

Tabel 7. Surabaya Traffic Level Of Service (Scenario 2)
Processed By Tranplan

Number	Link Number		Volume/ Capacity
	A Node (*)	B Node (*)	
1	2014	2015	0.8
2	2015	2014	0.8
3	2001	2002	0.73
4	2002	2001	0.73
5	1409	1410	0.71
6	1410	1409	0.71
7	1401	1409	0.69
8	1409	1401	0.69
9	1410	1501	0.68
10	1501	1410	0.68
11	1605	2007	0.67
12	2007	1605	0.67
13	2006	2012	0.66
14	2012	2006	0.66
15	2004	2014	0.65
16	2014	2004	0.65
17	1607	2011	0.62
18	2011	1607	0.62
19	3001	3101	0.59
20	3101	3001	0.59
(*) The first two digit number indicates zone numbers			

Tabel 8. Surabaya Traffic Level Of Service (Scenario 3) Processed By Tranplan

Number	Link Number		Volume/ Capacity
	A Node (*)	B Node (*)	
1	1501	1505	0.65
2	1505	1501	0.65
3	2101	2103	0.57
4	2103	2101	0.57
5	202	206	0.56
6	206	202	0.56
7	1801	1803	0.54
8	1803	1801	0.54
9	2009	2102	0.54
10	2102	2009	0.54
11	1410	1501	0.5
12	1501	1410	0.5
13	2014	2015	0.49
14	2015	2014	0.49
15	2301	2401	0.45
16	2401	2301	0.45
17	206	602	0.44
18	602	206	0.44
19	1605	2007	0.44
20	1707	1709	0.44
(*) The first two digit number indicates zone numbers			

From those figures it can be seen that for the year 1996 there is still no problem on traffic flow. While if we compare between scenario 2 which represents by V/C is significant higher than scenario 3 This is clearly due to the distribution of population resulted from Lowry Model which has been found previously. By those figures it can be concluded that the industrial distribution of scenario 3 will give better impacts to the traffic performance.

6. CONCLUSIONS

The urban land-use and transportation systems are interdependent. Land use can generate traffics both origin and destination of the region. Especially in SURABAYA City, rapid population growth and economic activity generate intensive traffic.

The spatial distribution, density and employment structure of such expected changes in SURABAYA will need careful understanding in order to establish the desired traffic level of service where sustainability of economic, social, and environment The location of the future residential areas to match and link with such economic activities should be considered together with the infrastructure including services of the urban and region. Land Use policy is another tools to overcome transportation problems. If there is no control on land use

development than traffic problem cannot be avoided. Lowry Model can be used as a tool to analyse the population distribution.

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