

# Evaluation of Major Factors related with Satisfaction Level for Walking and Cycling based on User's Perception in Jakarta

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## 1. Existing Condition of Jakarta

As a mega-city, Jakarta's nucleus area has spatially and economically expanded beyond its original fringes and has been integrated with four other proximate cities, namely Tangerang (in the west), Bekasi (in the east), Bogor, and Depok (in the south) and has been called "Jabodetabek" since 1999. Everyday, around 4 million people are on the road from Bodetabek to Jakarta<sup>1)</sup>.

As consequences, traffic volume on the road far exceed the capacity of existing roadways, with high rate of growth (Table1). At household level, the average number of cars owned per 100 households is 20.7 and the average number of cars owned per car-owning household is 1.2 (JICA and BAPPENAS 2001), which are relatively the same with or even higher than developed countries<sup>1)</sup>.

Table1. Traffic Volume in Jabodetabek 1989-2000

Section	Traffic Volume(1)			Growth Rate	
	1989(2)	1995(3)	2000(4)	1988-1993(%)	1993-2000(%)
Cordon Line					
West Segment	67	142	245	16.3	8.1
South Segment	129	185	233	7.4	3.4
East Segment	94	196	304	16	6.4
<b>Cordon Line Total</b>	<b>290</b>	<b>523</b>	<b>782</b>	<b>12.6</b>	<b>5.9</b>

(1) 16-hour traffic volume, excluding motorcycle. Unit: per 1,000 vehicles  
 (2) Source: Jakarta Outer Ring Road Study, DPU (1998)  
 (3) Source: Arterial Road System Development Study, JICA and DPU (1993)  
 (4) Source: SITRAMP Transportation Survey, JICA and Bappenas (2000a).

Unlike the developed countries, most developing countries including Jakarta city has no proper mass transportation system against the increase of traffic volume. On the other hand, the service of public transports is poor in quality. Although there are public railways throughout Jakarta, they are not popular and inadequate in providing transport service for residents.

Such condition brought the heavy congestion in many section and intersection at peak time. Furthermore, not only the economic loss, but also the environmental impact and road unsafe have become more serious. The URBAIR report (1997) indicated that ambient concentrations of several pollutants routinely exceed statutory limits<sup>2)</sup>. Data by Jakarta Police Department showed, 48 thousands casualties including more than 800 fatalities caused by road accidents in 2005.

Transport Demand Management (TDM) has been in effect

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since the early 1990's through implementing restriction area named 'Three in One' system and 'Car free days' system where motor vehicles are not permitted to use main roads on Saturday and Sunday that started in 2007. Although many initiatives and policies have been tried by Jakarta government, it is unclear in terms of implementation time frame and the scale of each plan. There is no appropriate transport planning for Jakarta, even though many studies and plans have been undertaken and implemented with very limited results. As a consequence, emergency action is frequently implemented to resolve a problem<sup>1)</sup>.

However, in the last four years, there has been strong political support from Jakarta's city government to create a proper and a cheap public transport system. In the end, they succeeded in implementing a Bus Rapid Transit (BRT) system in the core area of Jakarta city in 2004. Simultaneously with the development of the BRT, Jakarta Mass Rapid Transit will be implemented in 2009.

## 2. Purpose based on Importance of Walking and Cycling

High annual traffic volume growth as shown above indicates that the transportation policy has limited attention to support NMT modes. The study of 'Integrated transport master plan in Jabodetabek (SITRAMP) phase I' (JICA, 2001), indicated that private motorized vehicle trip increased significantly from 22.8% (1985) to 30.8%, while NMT decreased from 60% (1970s) to 28,8 % (Table2). NMT in this figure includes walking, cycling and other types such as three-wheeler pedicabs (becaks). Until 2001, becaks played an important role in Jakarta, but this was changed in September 2001 when they were banned even from residential areas<sup>3)</sup>.

Table 2. Mode of trips in Jabodetabek

Description	All Modes	Motorized Modes(%)	Private & Public (%)
Non Motorized Transport	28.8	—	—
Motorized Transport	71.2	—	—
Motorcycle		14.2	45.0
Car		30.8	
Bus		52.7	54.7
Train		2.0	

One important thing must be to note that grouping the modal choices based on income level (JICA, 2001) shows very clear evidence that in Indonesia, private cars are mostly used by higher income groups. Interestingly, for the lowest income group the share of NMT is as high as 60 percent. Therefore,

provision of transport means for the poor is one of the important issues. Although improvement of public transport or infrastructure for motorized transport is important, existing walking and cycling facilities in Jakarta also have extremely priorities to be developed.

Therefore, this study intends not only to identify the importance of Non Motorized Transport (NMT) improvement, in case of walking and cycling in Jakarta city, but also to reveal the major factors related with the satisfaction level of users.

We first define resident's perception on existing condition through a questionnaire survey and observation on the field, then clarify the correlation between satisfaction level and the amount money which will be spent through the Pearson Correlation. And we analyze and identify the factors that affect resident's perception, by using Quantification Method. We also use the Importance-Satisfaction Analysis as a method to know which problems should receive high priority for improvements to achieve the better results.

### 3. Identifying of Walking and Cycling Issues

#### 3.1 Questionnaire Survey

In general, cycling lane is not available in Jakarta city. Many roads have no sidewalk for pedestrians, unless the sidewalk width less than 1.5 meters. Condition is bad and inaccessible for all people. This situation has been creating harmed condition especially for the small children, pregnant women, the elderly and the handicapped.

To identify the issues, the survey on users' perception was conducted through implementing questionnaire survey and observation on the field. The number of samples is 395 (255 of pedestrians and 140 of cyclist) in three main areas: Sudirman, Thamrin and Kota area (Table 3).

Respondents were asked to evaluate the conditions through more than thirty issues concerned with safety-security, convenience, design and physical environment (except climate, seasons and high temperature) as follows; 1=not a problem, 2=minor problem and 3=major problem. Parameter of willingness to spend money is also needed to be identified: "in Rp 1,000, how much residents willing to spend money for improving obstructions?"

The analysis of questionnaire was designed to test the following hypothesis:

- i) There is a significant correlation between satisfaction level

Table 3. Survey areas and sample numbers

Areas	Location	Road width(m)	Pedestrians(n=255)	Cyclist(n=140)
Sudirman	Sudirman	40	45	30
	Benhil	14	26	12
Thamrin	Thamrin	35	53	39
	W.Hasyim	14	23	30
Kota	G.Mada	24	48	30
	Glodok	24	22	
	Mangga Dua	31	18	
	Kota station	20	20	29

and the amount of money will be spent for improvement.

- ii) There is a significant correlation between age, frequency usage, purpose, condition of location and the level satisfaction of users.

The aim of analysis is also to answer the following questions:

- i) Which problem has the highest priority for improvement to achieve better conditions for users?
- ii) Which approach should be developed to realize the improvement, based on clarifying of hypothesis above?

#### 3.2 Result of Questionnaire

63 % of respondents are males. 13% of respondents are over 50 years old and 54% are from 20 to 39 years old, with average age is 26.6 years. The result revealed that frequency of cycling on weekend is higher than weekday, and the average distance of walking is 1-2 kilometer.

The results of walking survey show that in general, "unsafe conditions with heavy traffic" and "overlap vehicles in walking space" as being the biggest problems followed by concern with crime and security (Figure 1). Discontinuity of sidewalk is clearly identified as a major problem for physical factor, followed by problem of narrow sidewalk.

For cyclist's respondents, the rating of personal security and crime problem is not too high, because 85 % of cyclist respondents are male and riding their bicycle not on the night. Top three of cycling problems were "no area for cycling", "bicycle parking", and "extreme level of air pollution" as shown in Figure 2.

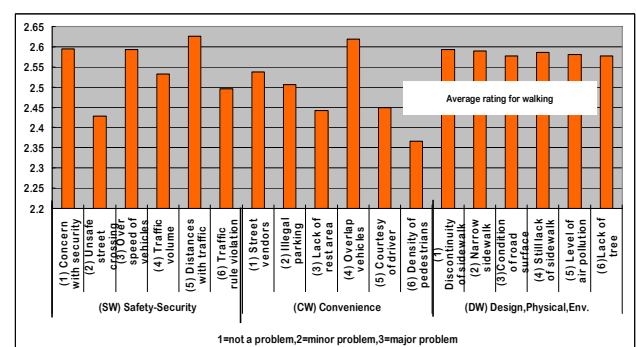


Figure 1. Result of walking survey

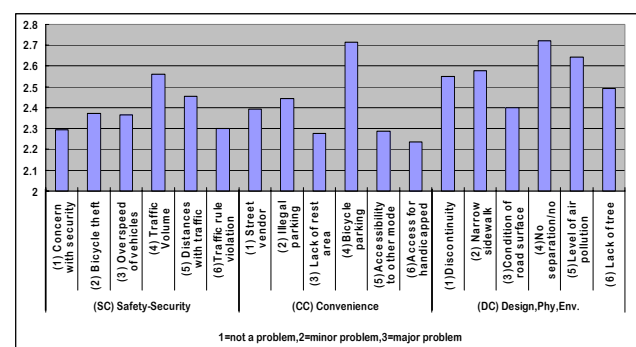


Figure 2. Result of cycling survey

#### 4. In-depth Analysis to Improve Walking and Cycling Conditions

##### 4.1 Relation between satisfaction level and WTP

The facility improvement should be related with the financial aspect through “WTP (Willingness to Pay Money). This term expresses resident’s perception and their willingness regarding the facility improvement. To test the hypothesis i), the quantitative correlation between the satisfaction level and Willingness to Spend Money is shown by Pearson Correlation usage, as shown in equation (1).

$$r = \frac{\sum_{i=1}^n (X_i - \bar{X})(Y_i - \bar{Y})}{(n-1)S_x S_y} \dots\dots\dots(1)$$

Table 5 shows that there is a strong negative correlation between satisfaction level and amount of money which will be spent for improvement. The result means resident’s impression greatly related with Willingness to Spend money ( $r_{\text{walking}} = -0.71$  and  $r_{\text{cycling}} = -0.93$ ). Here, “x” represents a parameter for the user’s satisfaction. A small value for this parameter means that residents are generally willing to spend high rates. “y” is a parameter that represents the value of money. If the value of “y” is large, the user’s satisfaction on existing facility is lower.

Table5. Correlation analysis of walking cycling issues

		Average	Standar Deviation
		$\frac{1}{N} \sum_{i=1}^n x_i$	$\sqrt{\frac{1}{N} \sum_{i=1}^n (x_i - \bar{x})^2}$
Walking	Satisfaction	0.416	0.05
	WTSM	0.117	0.02
Cycling	Satisfaction	0.461	0.11
	WTSM	0.118	0.034

Walking survey				Cycling survey			
Issues	x	y	$(x-y)(x+y)$	Issues	x	y	$(x-y)(x+y)$
SW1	0.365	0.143	-0.00113	SC1	0.6	0.115	-0.00036
SW2	0.468	0.095	-0.0013	SC2	0.52	0.128	0.000609
SW3	0.341	0.121	-0.00029	SC3	0.54	0.113	-0.00036
SW4	0.443	0.106	-0.00039	SC4	0.37	0.13	-0.00111
SW5	0.318	0.124	-0.00063	SC5	0.45	0.104	0.000111
SW6	0.42	0.103	-0.00016	SC6	0.56	0.082	-0.00354
CW1	0.431	0.119	4.3E-05	CC1	0.5	0.105	-0.00045
CW2	0.451	0.101	-0.00067	CC2	0.5	0.09	-0.00098
CW3	0.475	0.104	-0.00087	CC3	0.62	0.088	-0.00462
CW4	0.424	0.114	-4.2E-05	CC4	0.27	0.184	-0.01276
CW5	0.451	0.089	-0.00121	CC5	0.54	0.076	-0.00323
CW6	0.545	0.075	-0.0058	CC6	0.57	0.069	-0.00513
DW1	0.4	0.145	-0.00023	DC1	0.38	0.158	-0.00315
DW2	0.373	0.169	-0.00184	DC2	0.38	0.157	-0.00337
DW3	0.404	0.121	-1.5E-05	DC3	0.52	0.095	-0.00142
DW4	0.388	0.146	-0.00057	DC4	0.21	0.178	-0.01483
DW5	0.384	0.128	-0.00027	DC5	0.32	0.151	-0.00478
DW6	0.408	0.106	1.7E-06	DC6	0.46	0.104	1.42E-05
Average	0.416	0.117	-0.01537	Average	0.46	0.118	-0.05934
S	0.05	0.02		S	0.11	0.034	

##### 4.2 Determine the priority of improvement

With using same parameter of “x” and “y”, the Importance-Satisfaction Analysis is introduced on this study. This analysis is based on the concept that city government will maximize overall satisfaction by emphasizing improvements in areas where the level of satisfaction is relatively low and the perceived importance of the service is relatively high<sup>4)</sup>, as shown in equation (2)

$$IS \text{ Rating} = i(1-s) \dots\dots\dots (2)$$

We categorized rating “s” as representative of satisfaction level and “i” as the importance of improvement identified by willingness to spend money. The results show that in general,

for pedestrian respondents, the lack of sidewalks including discontinuity, as well as narrowness of them, and personal security are ranked with higher priorities (Table 6). Here, cyclists especially perceived that no separation and the lack of cycling lane and parking facilities are important issues. Then, the two axes on the IS Matrix represent Satisfaction (vertical) and Importance (horizontal) can be seen in Figure3. This should make the rank of priorities for improvements clear.

Table6. IS Analysis of walking and cycling issues

Walking survey						Cycling survey					
Issues	s	i	i(1-s)	Rank	Total	Issues	s	i	i(1-s)	Rank	Total
SW						SC					
SW1	0.36	0.1	0.091	1	3	SC1	0.6	0.12	0.046	5	12
SW2	0.46	0.1	0.051	6	16	SC2	0.52	0.13	0.061	2	7
SW3	0.34	0.1	0.08	3	7	SC3	0.54	0.11	0.052	4	11
SW4	0.44	0.1	0.059	5	14	SC4	0.37	0.13	0.082	1	6
SW5	0.32	0.1	0.085	2	5	SC5	0.45	0.1	0.057	3	8
SW6	0.42	0.1	0.06	4	12	SC6	0.56	0.08	0.036	6	15
CW						CC					
CW1	0.43	0.1	0.069	1	9	CC1	0.5	0.11	0.053	2	10
CW2	0.45	0.1	0.057	3	13	CC2	0.5	0.09	0.045	3	14
CW3	0.47	0.1	0.056	4	15	CC3	0.62	0.09	0.034	5	17
CW4	0.42	0.1	0.067	2	10	CC4	0.27	0.18	0.135	1	2
CW5	0.45	0.1	0.05	5	17	CC5	0.54	0.08	0.035	4	16
CW6	0.55	0.1	0.035	6	18	CC6	0.57	0.07	0.03	6	18
DW						DC					
DW1	0.4	0.2	0.09	3	4	DC1	0.38	0.16	0.097	4	5
DW2	0.37	0.2	0.11	1	1	DC2	0.38	0.16	0.088	3	4
DW3	0.4	0.1	0.075	5	8	DC3	0.52	0.1	0.045	6	13
DW4	0.39	0.2	0.092	2	2	DC4	0.21	0.18	0.14	1	1
DW5	0.38	0.1	0.082	4	6	DC5	0.32	0.15	0.103	2	3
DW6	0.41	0.1	0.065	6	11	DC6	0.46	0.1	0.056	5	9

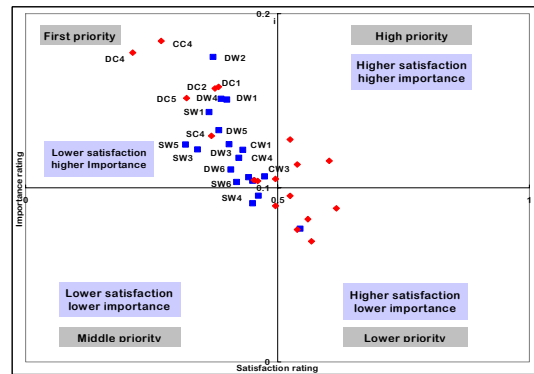


Figure3. IS Matrix for walking cycling issues

##### 4.3 Estimating Factor Analysis for user’s satisfaction

As aiming to clarify hypothesis ii), Quantification Method I was used to investigate major factor which influence on the satisfaction level. Here, we tried to introduce the located conditions by using the categorized score, which mean 1 as representatives of ‘good’, 2 as ‘not too bad’, 3 as ‘too bad’, based on road data and observation on the field as explanatory variables, as shown in Table7.

Figure 4 and 5 show the result of factor analysis for walking and cycling issues. The discriminatively hitting ratio is 70.5% for walking and 62.1% for cycling. Although the correlation ratio is not so high, as 0.405 and 0.303 respectively, the result may be available to evaluate the trend of influence on the satisfaction level by each variable.

Table 7. Score for located conditions

Criteria	SUD	BEN	THA	WHA	GMA	GLO	MG2	KOT
Road width	1	3	1	3	2	2	2	3
Sidewalk width	1	3	1	2	2	2	3	2
Obstruction*	3	3	1	2	3	3	2	3
Road surface**	2	2	1	2	3	3	2	3
Average Score***	1.75	2.75	1	2.25	2.5	2.5	2.25	2.75
Score***	2	3	1	2	3	3	2	3

\* Observation on the field, 1=few, 2=moderate, 3=many \*\*\*Average score: 1:(under 1.6), 2(under 2.3), 3(under 3) \*\*1=good, 2=moderate, 3=bad

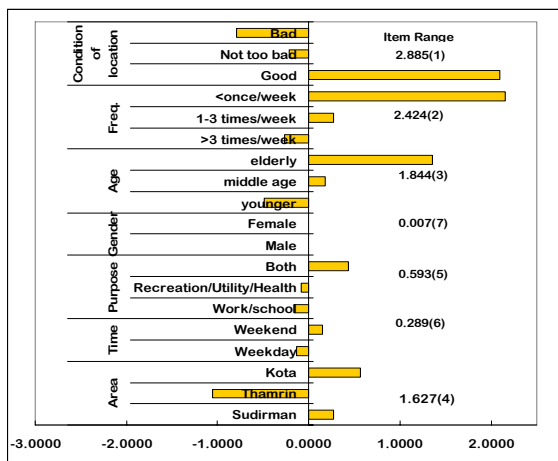


Figure 4. Results of factor analysis for walking

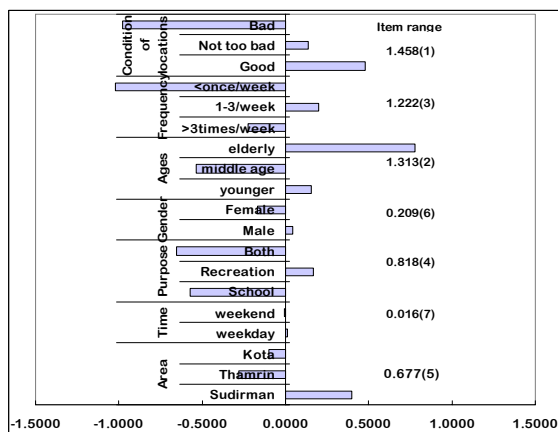


Figure 5. Results of factor analysis for cycling

Especially it becomes clear that three major factors, such as “condition of location”, “walking frequency” and “age” should affect the potential satisfaction both of walking and cycling, with wider range. As for these factors, some interesting findings came out as follows.

- 1) The condition of location was consistent with the tendency of satisfaction level.
- 2) The positive score range is obtained for the category of elderly with age over than 50 years old.
- 3) The influence of frequency showed the contrary tendency for walking and cycling.

And also, the category of weekday usage showed the negative score. This may show that pedestrians and cyclists must be sensitive to the character and quality of traffic volume and air pollution. Furthermore, the negative score for cyclists with usage less than once/week seems to due to the lack both of information and road spaces themselves.

As a result, the improvement of the condition of location may encourage residents not only to make more trips by walking and cycling, but also to improve the satisfaction level.

## 5. Conclusion and Next Approach

The number of motor vehicles on the road far exceeds the capacity of existing roadways. However,

people have to fulfill their daily mobility needs where the existing public transport facilities are not adequate in quality and quantity, to fulfill the demand. This condition has created problems of congestion, air pollution and traffic accidents. On the other hand, the current lack of facilities for walking and cycling has contributed to transport issues in Jakarta.

As summary, the conclusions derived from this investigation of **hypothesis**:

- 1) There is the significant correlation between the satisfaction level and WTP. A small value of satisfaction tends to be associated with the large value of amount of money.
- 2) The satisfaction level for pedestrians is influenced by condition of location, frequency and age. Although purpose of trips is potential item for cyclist naturally, condition of location, age factor, and frequency usage are more being affecting their satisfaction.
- 3) In order to answer the **question i)**, the result of survey revealed that “narrow sidewalk”, “discontinuity of sidewalk” and “personal security-safety” are higher priority for pedestrians. On the term of cycling, special separation for cycling, bicycle parking and air pollution problem are more important issues.

In order to find answer the **question ii)**, several aspects need urgent action in Jakarta city as summarized in conclusion above. It is necessary to maximize level satisfaction by emphasizing improvements in location where the level of satisfaction is relatively low.

On the other hand, regulation and policy improvement like *Car Free Days* also may be needed to increase satisfaction level for middle age, resident with higher walking and cycling trip and so on. So, application of this study may be different according to the financial, needs and characteristics of area.

Finally, this study is still an evaluation of walking cycling issues based on user’s perception. Then, more deeply data according to various conditions such as trip analysis, modal choice and pedestrian flow will be needed for the next steps.

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