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Range of Topics

The journal features original research articles as well as review articles in all areas of traffic and transportation engineering. Subject areas include (but are not limited to) the following fields:

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Mass Transportation Models of Needs Guided Bus-Way Using Structural Equation Modelling

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Abstract Transportation problem is a complex issue, because of the rate of growth of road infrastructure that is not proportional to the increase in the number of movements is increasing. This is indicated by the high level of private vehicle ownership, mobility assistance, an indication of public transport services are inadequate and limited highway. Resulting cause congestion, delay time, and decreased levels of comfort. This research is aimed to determine the pattern of mass transport based on Indonesian government legislation No. 22/2009 about traffic and road transport. Therefore, the factors that influence the pattern of mass transport must be modeled. the methods used in this research is the Confirmatory Factor Analysis (CFA) for confirmed indicators to latent variables (outer loading), and Structural Equation Modeling with PLS approach to determine the effect between the latent variables (inner weight). The results shows that variables defined has a significant positive effect on demand Guided Busway (CE) with a contribution of 77.0 per cent.

Keywords Transportation, Mass Transport, Confirmatory Factor Analysis (CFA), Structural Equation Modeling, PLS Approach

1. Introduction

Mass transport based on UU No.9/2009, has a definition that road transport is organized with a view to realizing the traffic and transport roads with safe, secure, fast, smooth, orderly and organized, comfortable and efficient, and able to integrate other modes of transport, to reach all parts of the mainland to support equity, growth and stability as a driver, driving and supporting national development with an affordable cost.

The concept of urban movement has always dominated the movement of commuters, especially with the availability of land in the city of Surabaya increasingly difficult, so many choose expansion to the south (Sidoarjo) and the West (Gresik). Increasing population density indicates the traffic flow and the higher trip generation from the corridors of the transition to Surabaya and vice versa. This is also indicated by the severity of the jam that occurs on the highway and the length of travel time.

Segment transport conditions Surabaya - Sidoarjo is still relying on road transport, the majority use for bike transport modes 55.19 percent. For that we need the development or management of a mass public transport system that has the characteristics of large transport capacity, travel time better, safe and affordable for the whole society. In particular, this

study aims to get a model of mass transportation needs of the corridor Sidoarjo - Surabaya, the research needs of Guided Busway. The Guided Busway is a bus service that is reliable, fast in the city where the bus was moving as usual bus and at a certain place where the bus is equipped with two wheels in front wheels guide normal bus, which serves to guide the bus along the track that had been prepared according to plan and the position can be carried out in accordance with the bus a safe speed.

Surabaya - Sidoarjo Corridors is the highest corridors of development, thus urging for the handling and mass transit systems development actions that have the characteristics of large transport capacity, travel time better, safe and affordable for the whole society. Sidoarjo path to Surabaya is Kertosusila Gate Development Area (KGDA). Therefore, the selection of study sites was very appropriate to support Surabaya Metropolitan Area.

2. Methods

The data used in this study is primary data obtained through questionnaires. The sampling method used was proporsif probability sampling approach. The stages of this study are as follows[1]:

1. Prepare questionnaire as a research tool or instrument;
2. The number of samples taken, which are relatively smaller than the total population, but were able to present the entire population for the three study locations as much as 168 samples;
3. How to get the sample, in a way that is spread in the

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form of questionnaires at that time and the number of observations, which is given directly to the technical implementation of public transport users;

4. Descriptive analysis;

5. Testing the validity and reliability of the questionnaire using CFA (Confirmatory Factor Analysis), in order to measure the research variables are valid and reliable;

6. SEM analysis using PLS.

Data analysis using the program Partial Least Square (PLS) with the following steps[2] :

1. Outer Test Model, including:

a) Test the validity done by:

1. Convergent validity

Value convergent validity can be seen from the results of loading factors. The indicator is called valid if it has a value of > 0.5 .

2. Discriminant validity

Value discriminant validity can be seen from the results of cross loadings. The indicator is called valid if the value of each indicator in measuring variables konstruknya predominantly higher compared to assess construct another variable.

b) Reliability tests carried out by:

1. Composite reliability

Construct a variable called reliable if it has a value of > 0.6 .

2. A VE

Construct a variable called reliable if it has a value of A VE > 0.5 .

2. Inner Test Model

This test can be seen the results of that test the value of inner weight formulation of research hypotheses and goodness of fit model[3]. The model can be declared to have the goodness of fit if it has a value of R-Square > 0 .

Originally Destinations

Variable origin destination (ATP) consists of three indicators, namely travel time (X1.1), length of trip (X1.2) and travel expenses (X1.3). Respondents' assessment of the indicator variable origin destination (ATP) completely presented in Table 1 below.

Table 1. Description of Indicator Variables Origin Destinations (ATP)

Questions	Mean	Deviation of standard
MAGERSARI		
Time of travel (X1.1)	87.64	44.77
Length of travel (X1.2)	37.74	21.70
Cost of travel (X1.3)	37,702.38	212,455.87
GEDANGAN		
Time of travel (X1.1)	87.30	40.83
Length of travel (X1.2)	37.50	19.90
Cost of travel (X1.3)	35,100.00	41,252.62
KRIAN		
Time of travel (X1.1)	96.36	48.73
Length of travel (X1.2)	40.91	21.47
Cost of travel (X1.3)	53,500	44,443.31

Source: Results of questionnaire data collection, processing

Average travel time, length of trip and travel expenses of the biggest Krian district, amounting to 96.36 minutes, 40.91 km and Rp 53,500, -. This shows that there is a trend among travel time, length of trip and travel expenses. That is, the longer the trip, the more long-distance and the greater the travel expenses incurred, and vice versa. So the description of the indicator variable origin destination (ATP) is a travel, length of travel and travel expenses.

Pattern of Travel (PP)

Variable travel pattern consists of 7 categories, namely home, work, school / college, social / recreation, shopping, business, and more. Distribution of respondents to complete travel patterns presented in Table 2 below.

3. Results and Discussions

Table 2. Description of Variable Travel Pattern (PP)

TRAVEL PATTERN	MAGERSARI		GEDANGAN		KRIAN	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Return	-	-	-	-	-	-
Work	22	78.6	17	85.0	15	68.2
School/College	-	-	-	-	-	-
Social/Recreation	-	-	-	-	-	-
Shopping	8	19.0	3	15.0	7	31.8
Bussiness	1	2.4	-	-	-	-
Others	-	-	-	-	-	-

Source: Results of questionnaire data collection, processing

Based on the table above, it turns out most of the respondents have travel patterns to work that is equal to 78.6 percent for the district Magersari, 85 percent for sub Gedangan, and further to 68.2 percent Krian district. Next to shopping, respectively by 19.0 percent to Magersari, 15.0 percent and 31.8 percent for Gedangan to Krian.

The willingness and ability to pay (KKM)

Variable Willingness and ability to pay (KKM) consists of three indicators, namely income (X3.1), transportation expenses (X3.2) and utilities (X3.3). Indicators of the respondents assessment of the willingness and ability of variable pay (KKM) fully presented in Table 3 below.

Table 3. Description of Indicator Variables willingness and ability to pay (KKM)

Questions	Mean	Deviation of standard
MAGERSARI		
Income (X3.1)	3807156.05	2387279.48
Transportation expenses (X3.2)	2604761.90	1714529.36
Utility (X3.3)	2.21	0.81
GEDANGAN		
Income (X3.1)	3750916.85	2734259.17
Transportation expenses (X3.2)	2510000.00	1712956.74
Utility (X3.3)	2.25	0.94
KRIAN		
Income (X3.1)	4466055.59	2734259.17
Transportation expenses (X3.2)	2822727.27	1712956.74
Utility (X3.3)	2.27	0.94

Source: Results of questionnaire data collection, processing

Table 4. Convergent Validity In the ATP, KKM and Sample Bootstrap (B = 300)

VARIABLE	INDICATOR	LOADING ORIGINAL	Bootstrap B=300	
			Loading	T estimated
Origin Destination (ATP)	Time of travel (X1.1)	0.952	0.952	298.79
	Length of travel (X1.2)	0.944	0.945	243.36
	Cost of travel (X1.3)	0.963	0.962	384.09
Willingness and ability to pay (KKM)	Income (X3.1)	0.957	0.958	203.68
	Transportation expenses (X3.2)	0.944	0.976	884.22
	Utility (X3.3)	0.963	0.927	189.97

Average revenue (X3.1), transportation expenses (X3.2) and utilities (X3.3), the largest of the Krian district, amounting to Rp 4,466,055, Rp 2,822,727 and 2.27. This shows that there is a trend between income (X3.1), transportation expenses (X3.2) and utilities (X3.3). So the description of the indicator variable willingness and ability to pay (KKM) is income (X3.1), transportation expenses (X3.2) and utilities (X3.3).

Validity and Reliability

Validity test is intended to determine whether the questions in the questionnaire sufficiently representative[4]. Test validity is done by using confirmatory factor analysis on each of the latent variables namely the origin destination (ATP) and the willingness and ability to pay (KKM) through SmartPLS program.

Convergent Validity

Testing the measurement model through loading factors conducted to determine the validity of the indicator by seeing the value of convergent validity indicators in the model. Each indicator in the model must meet the convergent validity namely have a value > 0.5.

Discriminant Validity

Discriminant validity test aimed at testing the validity of the block indicator[4]. Test of discriminant validity of the indicators can be seen in the cross loadings between indicators konstrunkya. ST aims to establish that the variable has a value of discriminant construct validity was good. AVE value declared satisfactory if > 0.5. AVE test results appear in the table below.

Table 5. Discriminant Validity In the ATP, KKM

Variable	Value
	Average Variance Extracted
Origin Destination (ATP)	0.908
Willingness and ability to pay (KKM)	0.909

Reliability test aims to test the reliability of the variable constructs using composite reliability[5]. Composite reliability demonstrated satisfactory value if > 0.6. Results composite reliability values in Table 6. It shows that all the blocks of indicators that measure the construct of origin destination (ATP) and the willingness and ability to pay (KKM) has a value of composite reliability > 0.6. Composite reliability in this study is seen in the following table 6.

Table 6. Composite Reliability in the ATP, KKM

Variable	Value
	Composite Reliability
Origin Destination (ATP)	0.967
Willingness and ability to pay (KKM)	0.968

Structural Equation Model

Structural Test Model (inner weight) indicated by the results of the structural path coefficients[6]. Where the results of path coefficient formulas answer the hypothesis in this study include:

- H₁: ATP significantly influence the KGB
- H₂: PP significantly influence the KGB
- H₃: KKB significant effect on KGB

The results of the structural path coefficients (inner weight) and their significance more value shown in the table below.

Table 7. Test weight on the need for inner Guided Busway (KGB) with a bootstrap sample

Influence	Coeff of Originality	Bootstrap B=100		Bootstrap B=200		Bootstrap B=300		Bootstrap B=500	
		Coeff.	TTest	Coeff.	TTest	Coeff.	TTest	Coeff.	TTest
ATP → KGB	1.463	1.480	6.263	1.540	5.154	1.509	8.250	1.477	10.629
PP → KGB	0.198	0.207	2.623	0.205	2.641	0.193	3.411	0.192	4.173
PP → KGB	0.446	0.449	1.901	0.515	1.660	0.496	2.955	0.465	3.560

After tested the validity and reliability of all latent variables that yield valid and reliable, and the testing of B = 500 bootstrap samples yielded significant results, then proceed with the analysis is presented the following diagram:

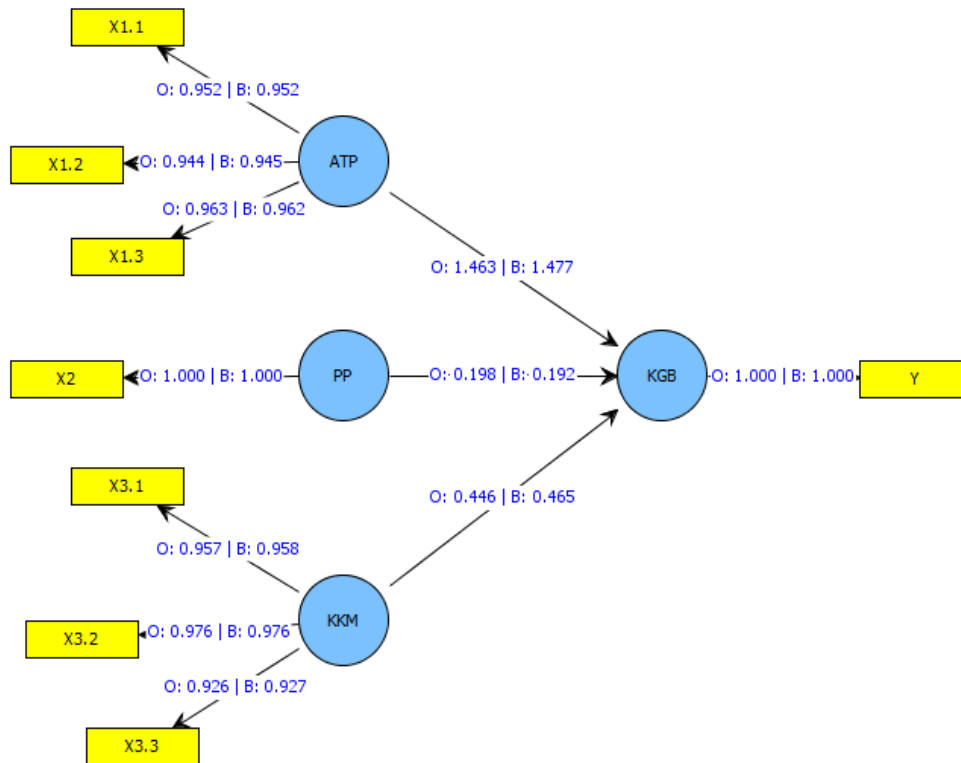


Figure 1. Effect of ATP, PP and KKM to KGB

Test results on the complete model with SmartPLS program can be seen from the R-square value that describes the goodness-of-fit of a model. R-square value recommended is greater than zero. The results of this study with the data processing using Smart PLS give R-square values as shown in Table 8 below:

Table 8. Goodness of Fit of R-Square

Variable	R-Square
Origin Destination (ATP), Travel Pattern (PP), Willingness and ability to pay (KKM) → Needs Guided Busway (KGB)	0,770

Table 8 explains that the contribution or the proportion of variable origin Destinations (ATP), Pattern Travel (PP), willingness and ability to pay (KKM) in explaining the

variation around the variable needs Guided Busway (KGB) of 0.770 or 77.0 percent

The results of all the R-square values indicate that all the R-square value is greater than zero. This means that this research model meets the required Goodness of Fit.

the model of fit, it can be interpreted in each path coefficient. The coefficients of these pathways is hypothesized in this study, which can be presented in the following structural equation:

$$KGB = 1,477ATP + 0,192PP + 0,465KKM$$

which,

KGB = Needs Guided Busway

ATP = Origin Destinations

PP = Travel Patterns

KKM = Willingness and ability to pay

Testing path coefficients in Figure 1 and the above equation in detail presented in the following table:

Table 9. Results of testing path coefficient model needs guided busway

Variable	Coefficient	T statistic	T table	Keterangan
Origin Destinations (ATP) → Needs Guided Busway (KGB)	1.477	10.629	1,96	Significant
Travel Pattern (PP) → Needs Guided Busway (KGB)	0.192	4.173	1,96	Significant
Willingness and ability To pay (KKM) → Needs Guided Busway (KGB)	0.465	3.560	1,96	Significant

Table 9 shows that the inner weight between:

1. Originally Destinations (ATP) have positive and significant impact on Needs Guided Busway (KGB). This can be seen from the path coefficient is positive amounted to 1.477 with a value of 10.629 T statistics greater than T-table = 1.96. Thus Originally Destinations (ATP) directly affect the need for Guided Busway (KGB) of 1.458, which means that whenever there is an increase of Origin Destinations (ATP) it will raise the need for Guided Busway (KGB) of 1.477.

2. Pattern of Travel (PP) have positive and significant impact on Needs Guided Busway (KGB). This can be seen from the path coefficient is positive amounted to 0.192 with a value of 4.173 T statistics greater than T-table = 1.96. Thus Travel Pattern (PP) affects directly the needs Guided Busway (KGB) of 0.192, which means that whenever there is an increase Pattern Travel (PP) it will raise the need for Guided Busway (KGB) of 0.192.

3. The willingness and ability to pay (KKM) have positive and significant impact on Needs Guided Busway (KGB). This can be seen from the path coefficient is positive amounted to 0.465 with a value of 3.560 T statistics greater than T-table = 1.96. Thus the willingness and ability to pay (KKM) directly affect the need for Guided Busway (KGB) of 0.465, which means that every increase in willingness and ability to pay (KKM) it will increase the need for Guided Busway (KGB) of 0.465.

4. Conclusions

Based on the analysis and discussion of some of the conclusions obtained are as follows:

1. Originally Destinations (ATP), Pattern Travel (PP), willingness and ability to pay (KKM) have positive and

significant impact on Needs Guided Busway (KGB) of 0.770 or 77.0 percent, and 27 percent described other variables that are not included in the model.

2. Originally Destinations (ATP) is the dominant variable in affecting Needs Guided Busway (KGB), and the next is the willingness and ability to pay (KKM).

3. Model Needs Guided Busway (KGB) is **$KGB = 1,477ATP + 0,192PP + 0,465KKM$**

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