

# The Influence of Land Use and Traffic Flow to the Performance of the Road Corridors of Manado - Bitung Using Structural Equation Modeling

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## ABSTRACT

The daily human activities need and means of transportation to be able to perform the activities, so there is a center of growth and specialization the activities in one location will trigger the growth of movement, so that the development of the road network as this relationship is needed for the development of a region. Associated with this problem, need to further study the performance of the roads based on the current land use and traffic so that it can be planned for a policy in the management of the transportation in the region of study right. Model approach to know the influence of traffic flow and land use on the performance of the Manado - Bitung is Structural Equation Modeling (SEM). The results of the study showed that the performance of the corridor of the road Bitung-Manado Model with the approach of Shem is the model fit based on the criteria of Goodness of Fit (GoF). Land Use with the indicator industry, trade and services provide the greatest impact on the performance of the roads of 0.466 Manado-Bitung, next traffic flow with road capacity indicator and the density of 0.447 in affect the performance of the roads Manado - Bitung. The flow of local movement and the flow of continuous movement is the dominant factor in shaping the performance of the corridor.

**KEYWORDS:** Land Use, traffic flow, performance, SEM, GoF

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## INTRODUCTION

The movement of people and goods can reflect the inter-connectedness one region with other regions. This inter-connectedness is very important for the development of a region [1]. The existence of a center of growth and specialization the activities in one location will trigger the growth of revival movement, so that the development of the road network as this relationship is needed for the development of a region [2]. The level of accessibility can be measured from the big and the small flow of the movement of the population between the area where the accessibility is a measure of ease dash power of a region with other areas that are assessed from several indicators.

The purpose of the transportation plan is seeking to resolve transportation problems with the most appropriate way by using the existing resources. The rail transport plan is basically the estimate transportation needs in the future that must be associated with a technical problem transportation generally the exact opposite of efforts to ensure that the means that has no enabled optimum him and intended to design and build various new facilities [3].

Some of the research related land use and traffic flows, [4], shows that the development of spatial or land use, determine the needs of spatial interaction, or transportation. But it is difficult to isolate empirically the impact of land use transportation and vice versa because of the large number of concurrent flows changes other factors. This presents a problem if the likely impact of the integrated land use and transportation policy to reduce travel request must be predicted. [5], develop transportation model and the use of integrated land (MetroScope). This model is used to explore some options regional growth management and also to produce expected and new regional transport plan. Compare the results of MetroScope with previous forecast shows that the transportation model and integrated land use can produce a different result in this case the length of the journey, vehicle mileage, the level of traffic delays, elect mode and route, and the location of the workplace and household. [6], traffic flow in the city is affected by many factors including land use (especially commercial land use because of the nature of the creation of trips). This phenomenon can be more effective when combined with the factor of accessibility and connectivity of the road. [7], with the approach of Structural Equation Modeling shows that the selection of modal carrier transportation at excitement influenced by the status of economic activity patterns and customer satisfaction, service activity pattern provides the greatest influence on the modal carriers transportation.

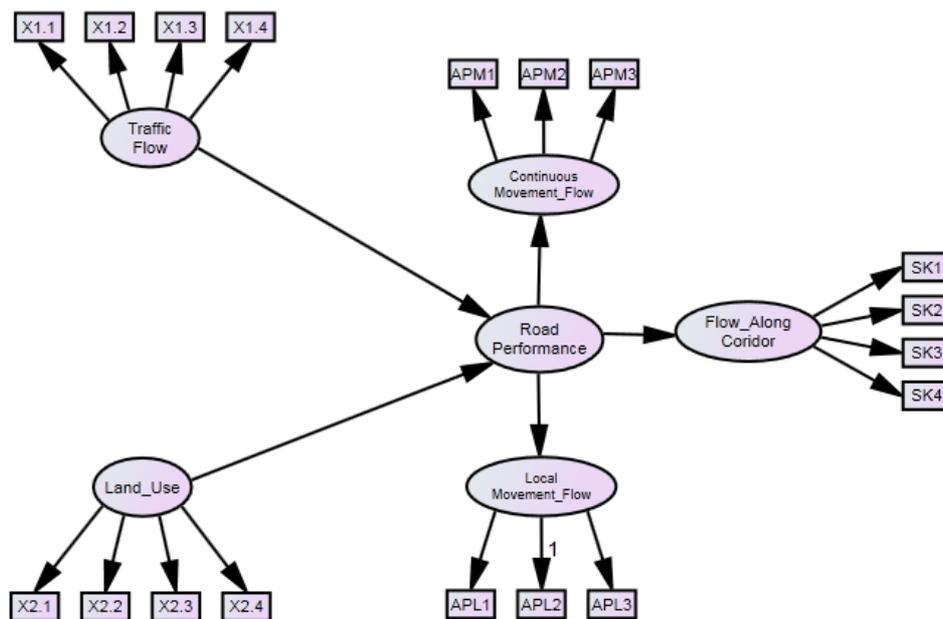
Visible in the field a use phenomenon of land along the roads changed so it will affect the traffic flow. This research analyzes the model of the relationship between traffic flow that occurs in the roads with land use parameters. For that we need to study on the model of the performance based on the land use and traffic flows in Manado using SEM.

## METHODOLOGY

The data of this research is the primary data taken directly by giving questionnaires through in Manado. Sampling method used simple random sampling [8]. Structural Equation Modeling (SEM) is a collection of methods of statistics that allows testing of a series of relatively complex relationship simultaneously [9][10]. The complex relationships that can be built from one or several dependent variables with one or several independent variables. Each of the independent and dependent variables can be in the form of the factor (change built from several indicators). These variables in the form of a single variable is observed or measured directly in a research. [11][12].

Research variables divided into 3 aspects of the aspects of traffic flow with the indicator: traffic flow (X1.1), speed (X1.2), density (X1.3), the capacity of the way (X1.4). Aspects of land use with the indicator: settlements (X2.1), industry (X2.2), trade and services (X2.3), office (X2.4). Aspects of the performance of the corridor with the indicator: Current Continuous Movement (APM): the condition of the free traffic flow (APM1), high speed (APM2), traffic volume (APM3). The flow of Local Movement (APL): the condition of the free traffic flow (APL1), high speed (APL2), traffic volume (APL3). The flow of the movement along the corridors: Volume vehicle (SK1), the speed of the vehicle (SK2), side barriers (land use) (SK3), the capacity of the way (SK4) [13][14][15].

Research using SEM allows a researcher can answer the question that is regressive and dimensional (measuring the dimensions of a concept). The identification of the dimensions of a concept or change (done with confirmatory factor analysis) [16], and to measure the influence or the degree of the relationship between the factors that have been identified the dimension (done with the path analysis). The Model of SEM are organized based on the conceptual framework that served as follows:



Picture 1. The Conceptual Framework the performance of the corridor of Manado – Bitung [13][17]

## RESULTS AND DISCUSSION

Validity test is intended to determine whether the questions in the questionnaire is quite representative and reliability is the size of the internal consistency of the indicators a variable proxies which shows the degree to which each indicator that indicates a common adjectives variable. Validity test and reliability is done by using confirmatory factor analysis, and the results are presented in table 1 below.

**Table 1. Validity test and Reliability**

The variables	The indicator	The validity of Convergence			Reliability		Composite Reliability (CR)
		Loading Factor	P-value	Conclusion	P-value	Conclusion	
<b>Traffic Flow (X1)</b>	Current (X1.1)	0.788	0.000	Valid	0.000	Reliable	<b>0.901</b>
	Speed (X1.2)	0.826	0.000	Valid	0.000	Reliable	
	The density (X1.3)	0.848	0.000	Valid	0.000	Reliable	
	The capacity of the way (X1.4)	0.869	0.000	Valid	0.000	Reliable	
<b>Land Use (X2)</b>	Settlement (X2.1)	0.721	0.000	Valid	0.000	Reliable	<b>0.900</b>
	The Industry (X2.2)	0.844	0.000	Valid	0.000	Reliable	
	Trade and services (X2.3)	0.962	0.000	Valid	0.000	Reliable	
	Office (X2.4)	0.786	0.000	Valid	0.000	Reliable	
<b>The current movement continuously (APM)</b>	The condition of the free traffic flow (APM1)	0.902	0.000	Valid	0.000	Reliable	<b>0.929</b>
	High speed (APM2)	0.908	0.000	Valid	0.000	Reliable	
	Low traffic volume (APM3)	0.897	0.000	Valid	0.000	Reliable	
<b>The flow of local movement (APL)</b>	The condition of the free traffic flow (APL1)	0.893	0.000	Valid	0.000	Reliable	<b>0.828</b>
	High speed (APL2)	0.547	0.000	Valid	0.000	Reliable	
	Low traffic volume (APL3)	0.883	0.000	Valid	0.000	Reliable	
<b>The flow of the movement along the Corridors (SK)</b>	The volume of the vehicle (SK1)	0.808	0.000	Valid	0.000	Reliable	<b>0.895</b>
	The speed of the vehicle (SK2)	0.817	0.000	Valid	0.000	Reliable	
	Side barriers (land use) (SK3)	0.823	0.000	Valid	0.000	Reliable	
	<b>The capacity of the way (SK4)</b>	<b>0.853</b>	<b>0.000</b>	<b>Valid</b>	<b>0.000</b>	<b>Reliable</b>	

Table 1 shows that all the value of loading greater than 0.5, value p-value on varians value error 0 smaller than  $\alpha=0.05$  and the value of CR greater than 0.7, it can be said that all latent variables with the indicator has been valid and reliable. Traffic Flow (X1) with the biggest indicator is the capacity of the way (X1.4) of 0.869. Land Use (X2) with the biggest indicator is the trade and services (X2.3) of 0.962, current movement continuously (APM) with the biggest indicator high speed (APM2) of 9.908, Current local movement (APL) with the biggest indicator is the condition of the free traffic flow (APL1) of 0.893 and the flow of the movement along the Corridors (SK) with the biggest indicator is the capacity of the way (SK4) of 0.853.

After the validity test and reliability on each of the latent variable, some prerequisites that must be met in the structural modeling based on covariance. The assumption that must be met is normal multivariate, non singular and outlier.

**Normalitas Test**

Normalitas from data is one of the conditions in the modeling of Structural Equation Modeling (SEM). Testing normalitas stressed on multivariate data with see the value of kurtosis skewness, and statistically can be seen from the value of the Pearson correlation between dj and q. If used the level of the significance of 5 percent, then the value of the Pearson correlation between dj and q more than 0.5 or p smaller  $\alpha = 0.05$  said normal distribution by multivariate data. The value of the Pearson correlation between dj and q of 0.969 or  $p = 0.000 < \alpha = 0.05$ , so that it can be said that the normal multivariate distribution data.

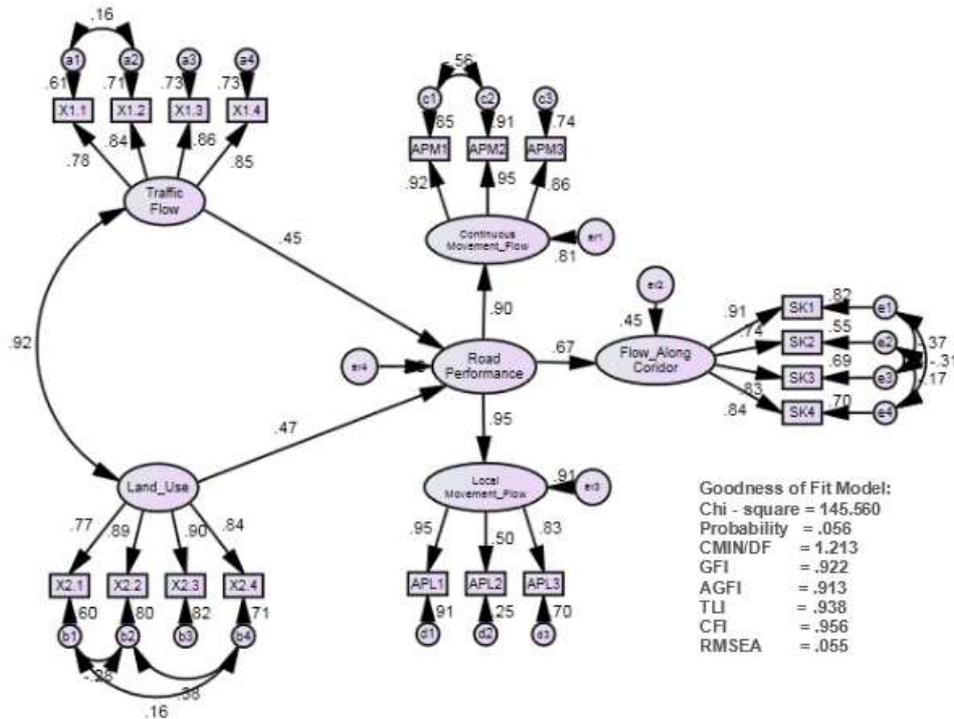
**Non Singularity**

Non singularity can be seen through determinant covarians matrix. The value of a very small determinant or near zero indicates an indication there had been the problem that cannot be used for research. The research results provide the value of the determinant of sample covariance matrix of .029. This value is almost pushed from zeros so that it can be said that there had been no problems singularity on the data analyzed.

**Outlier**

Outlier is the observation that far from the observation of the other observation or appears in a good extreme univariate or multivariate. Test results outlier in this research is presented on the Mahalanobis distance or the Mahalanobis d-squared. Mahalanobis value greater than the Chi-square table or the value of  $p1 < 0.001$  said the observation that outlier. In this research there are four data outlier, because it is still under 5 percent of the observation ( $250 \times 5$  percent = 13), it can be said is not an outlier.

Next, the influence between the latent variables used Structural Equation Modeling with the form of the path diagram as follows:



**Figure 2: Relationship Traffic Flow, Land Use to the performance of the Road**

Now the structural equation in Figure 2 as follows:

$$\text{Corridor Performance} = 0.274 \text{ Traffic Flow} + 0.634 \text{ Land Use}$$

The results of the complete model testing Figure 2 with AMOS program in detail can be seen in the following table:

**Table 2. The results of the Model testing the corridor performance**

The criteria	Cut – Off Value	Results Calculation	Description
Chi - Square	It is expected that small	145.560	$\chi^2$ with df= 120 Is 146.567 Good
Probability	$\geq 0.05$	0.056	Good
RMSEA	$\leq 0.08$	0.055	Good
GFI	$\geq 0.90$	0.922	Good
AGFI	$\geq 0.90$	0.913	Good
CMIN/df	$\leq 2.00$	1.213	Good
TLI	$\geq 0.90$	0.938	Good
CFI	$\geq 0.90$	0.956	Good

Source: processed data

Table 2 shows that the 8 (eight) criteria used to assess worthy / a model whether or not it states good and good enough. It can be said that the model can be accepted, which means there is a similarity between the model with data.

The path coefficient testing on Figure 2 and equality above in detail is presented in the following table:

**Table 3. The results of the Model Line Coefficient testing the performance of the corridor of Manado - Bitung**

The variables	Coefficient	Critical Rasio (C.R.)	Prob.	Description
Traffic Flow → Corridor Performance	0.447	3.035	0.002	Significant
Land Use → Corridor Performance	0.466	3.178	0.001	Significant
Corridor Performance → the flow of the Movement Constantly	0.908	8.059	0.000	Significant
Corridor Performance →- the flow of Local Movement	0.959	9.056	0.000	Significant
Corridor Performance → the flow of the Movement throughout the Corridors of	0.666	7.000	0.00	Significant

Source: processed data

From the appropriate model and table 3, so it can be in interprets each path coefficient as follows:

- Traffic flows have positive and significant impact on the performance of the corridor. This can be seen from the path marked by the positive coefficient of 0.447 with the value C.R.of 3.035 and obtained the significance probability (p) of 0.002 smaller than equal significance ( $\alpha$ ) determined by 0.05. Thus the traffic flow directly impact on the performance of the corridor of 0.447. which means that every there is increasing traffic flow and will improve the performance of the corridor of 0.447.
- Land use have positive and significant impact on the performance of the corridor. This can be seen from the path marked by the positive coefficient of 0.466 with the value C.R. of 3.178 and obtained the significance probability (p) of 0.001 smaller than equal significance ( $\alpha$ ) determined by 0.05. Thus the land use directly impact on the performance of the corridor of 0.466. which means that every increase in the land and will increase the performance of the corridor of 0.466.

This is in line with the [18], that the process of the development of land use will affect the process of the journey/transportation existing before, and [19], stated that the development of a land area will cause the traffic will affect the land use patterns. In general the development of commercial activities occur in the center of the business center and heavy traffic while industrial activities, settlement and service shops, gasoline, restaurants and others happened along the main road leading to the city while the housing or the field that is located on the streets of the city center changed to become the center of trade, shops, offices and others in the wider scale.

### CONCLUSION

The conclusion from the analysis of the data and the discussion is:

- The results of the study showed that characteristics user respondents corridors of Bitung - Manado is a productive age in travel and the journey with still interested in all the workers. Walkers in Manado city have intensity level in doing its journey is every day, the average aged 28, have gender male of 58 percent, and workers as students, private employees and others.
- The capacity of the road and the density is the dominant factor in shaping traffic flow (X1), Industry (X2.2), trade and services (X2.3) is the dominant factor in shaping Land Use (X2), high speed (APM2) and the condition of the free traffic flow (APM1) is the dominant factor in shaping the flow of continuous movement (APM), free traffic flow (APL1) and low traffic volume (APL3) is the dominant factor in shaping the flow of local movement (APL), the current condition and the capacity of the way (SK4) and side barriers (land use) (SK3) is the dominant factor in shaping the flow of the movement along the Corridors (SK).
- The performance of the corridor of the road Bitung-Manado Model with the approach of SEM is the model fit based on the criteria of GoF. Land Use with the indicator industry, trade and services is the dominant factor in affect the performance of the roads, next is traffic flow with road capacity indicator and density. While the flow of the movement of the local) and the flow of continuous movement is the dominant factor in shaping the performance of the corridor.

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