

Proceeding GEOCON 2013

The 9th International Conference on

GEOTECHNICAL AND TRANSPORTATION ENGINEERING GEOTROPIKA 2013

and

The 1st International Conference on

CONSTRUCTION AND BUILDING ENGINEERING ICONBUILD 2013

"Sustainability in Construction & Transportation for Better Future"

28th-30th OCTOBER 2013

Persada Johor International Convention Centre, Johor Bahru, Malaysia

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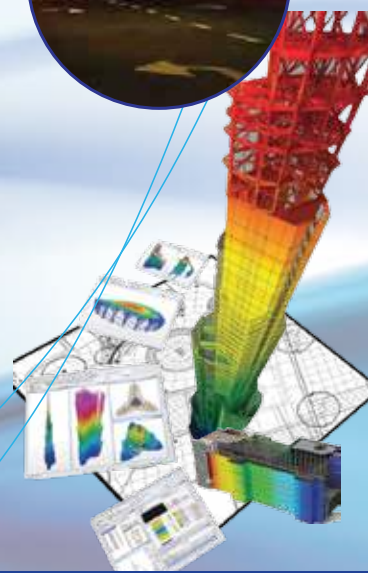
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**ANALYSIS OF IMPACT OF RESIDENTIAL DEVELOPMENT TO THE TRAFFIC
AROUND PURWOKERTO CITY**

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Development of some residential areas around a city generally will develop as satellite city, has become generated traffic for a city. These situations also occur in Purwokerto, the developing city located in South-West Central Java, where the impact to the traffic cause by development of residential areas will be studied in this research. Research was conducted by collecting and analyzing traffic data around Purwokerto. Data collecting include road inventory around area, survey on traffic's trip generation and attraction, traffic volume survey, inventory of infrastructure and traffic supporting facility in the area of study. Data analysis was conducted by using 4 steps transportation model. Those 4 steps were generated traffic, analysis of traffic distribution, analysis of modal choice and route of traffic, and analysis of traffic impact cause by residential development as well. The survey resulting two residential areascategorized as a big scale area and have second class of traffic impact,while the remaining one residential area categorized as a small scale area and

have first class of traffic impact. The rate of trip generation every 100 sq. meters at the peak hour was 7 vehicles for residential area A, 5 vehicle for residential area B and C, 2 vehicles for residential area D, and 1 vehicle for residential area E. Developments of residential area have caused improving of traffic volume in the roads around it. The number of the improvement was three roads have VCR (Volume Capacity ratio) value over 0.75 as well and three junctions also have VCR over 0.75 and were used for traffic management input. Can be concluded that development of residential area around Purwokerto have significantly impact to the traffic.

Key words: development; residential; impact; traffic; improvement; VCR

Introduction

Demand on proper housing has pushed investor to invest in residential development. Many new residential areas have developed around Purwokerto, the developed city located in South-West Central Java. Those new residential areas have inflicted incredible number of traffic generation. Variation in traffic generation will influence the road capacity, moreover the fluctuations of traffic on peak hour is varies from day to another day. Accumulation of the traffic generation will brought about change in the performance traffic. Large number of private car will compound the worst performance of the traffic; lack of discipline, as well as low quality of road condition has made the road or traffic performance become worse. Research on using of private vehicle in Purwokerto shows, that the number of motor cycle is 87.75%, light vehicle 11.99%, and middleweight vehicle 0.25% (Juanita, 2011).

Inconsistency of land using which deviate from the stipulated city planning as well as it does not follow with balance traffic planning have caused the traffic problems like traffic jam, delay traffic, vehicles line. Therefore, area developments have to follow with proper management traffic. Based on the present situation, the analysis impact of residential development to the traffic is very important to solve the conflict between the change in land using and traffic.

Analysis of Traffic Impact

Analysis of traffic impact is a number of activities of analysis that intended to measure the impact of development of business center, residential area, and other public facilities as well as infrastructure to the traffic. Ministry of Public Works of Republic of Indonesia has criteria of development area that have impact to the traffic as follows:

- 1) Development area that have direct access to the arterial road,
- 2) Development area that have not direct access to the arterial road, but:
 - a) have scope of activities and/or business that larger or similar to the minimum stipulated area,
 - b) predicted will brought about the amount of trip higher or similar to the 100 trips men per hour,
 - c) have access to the roads where accumulatively will fulfill the criteria a) and b) above,
 - d) have direct access to the road with degree of saturation ≥ 0.75 , and/or adjacent to the cross road with degree of saturation ≥ 0.75 .

Transportation Planning

Transportation planning uses in this traffic impact analysis have four steps namely, movement generation, spreading movement, selecting mode, and selecting route. Generation and attraction movement is the step that predicts some movement resulted from zone of land using and some traffic attraction that directed to other attraction traffic zone. Traffic generation is depending on two aspects of land using namely, the type of land using and the number of activities as well as intensity of an area of land. The higher the using of land, the higher of traffic volume will be resulted.

Based on the research to the 'Paspati fly over construction', found there is influence of the construction to the performance of roads surrounding. Therefore, analysis use four steps

transportation model, and develop to two scenario, namely with and without 'Paspati' flyover (Tamin, 1998).

Based on the research to the six locations of shopping center in Purwokerto, are known that average attraction movement for motor cycle was six motor cycle per 100 sq. meter at the peak hour. Statistically, attraction model for motor cycle in the shopping center have coefficient of determination R-square is 0.981. The most influence factor to the motor cycle attraction in the shopping center first is the outlet, X3, and the second is the capacity of parking area, X2 . Meanwhile, model of the vehicle (car) attractive movement in the shopping center is and have coefficient of determination R-square of 0.942, the influence factor of car attractive movement is unit outlet, X3, and capacity of shopping center (Hidayat, W. 2010).

Research Methodology

Methodology of the research for analysis impact of residential development

to the traffic includes:

- a. Review to the relevant literatures to get approach and representative design study, as well as regulations on analysis of traffic impact.
- b. Identifications to the primary data
- c. Look into the exact method to conduct survey and analysis,
- d. Collecting of secondary data which include:
 - i) Map of land using in the study area
 - ii) Residential data, include land area, number of housing
 - iii) General City Planning
 - iv) Road conditions and traffic data
 - v) Resident data in study area
- e. Collecting primary data through direct survey, which include:

- i) Road geometry data,
 - ii) Data of traffic volume including traffic in the crossroad
 - iii) Traffic data in and out form residential area
- f. Tabulated survey data into the excel format
- g. To conduct analysis of traffic generation and attraction, traffic distribution, selection of mode, and analysis of selection of the route
- h. To conduct analysis of traffic impact

Discussion

Characteristic of Study Area

District of Banyumas Regional Planning issued by the Banyumas Local Government in 2005 use as guidance in utilizing of space order. District of Banyumas (Note: District or Kabupaten is the level of government under provincial government) located in Southeast of Central Java Province. Area belong to the research is in Banyumas District include Residential “Griya Tegalsari Indah” located in Kembaran sub-district. In the Banyumas Regional Planning, this sub-district is categories as strategic area for economy development. Purwokerto, the city and object of this study, is also located in the District of Banyumas. In the Central Java Province’s Planning, Purwokerto was plan to be areas that have function to serve activities in Southern and Western of Central Java. Meanwhile, based on Banyumas Regional Planning, Purwokerto will develop as strategic area for economic development. Take the rapidly of population growth into consideration, development of Purwokerto was addressed to South area with intention to reduce the rapid development in the North area, since the North area is water catchment area, and also the mountain Slamet conservation buffer zones. In addition, development to the Southern area also intended to reach balance development surrounding Purwokerto.

Classification of Area of Development and Analysis of Traffic Impact

Determination of area of development and class of analysis of traffic impact is given in Table 1.

Table 1: Determination the class of traffic impact analysis

Residential	Movement of Traffic Generation	Classification of Area of Development and Analysis of Traffic Impact	Limitation of Area of Study
A (Griya Tegal Sari Indah)	<p>a) 1.323. man per hour</p> <p>b) Level of traffic generation at the peak hour is 5 vehicles per hour every 100 sq. meter of area of development.</p>	<p>a) Large scale of development area.</p> <p>b) Class III</p>	<p>a) Intersection minimum between collector roads both signalized and unsignalized intersection.</p> <p>b) For road, access by development area as well as area in radius 2 km from outer border of the location of area of development</p>
B (Griya Satria Sumampir)	<p>a) 687 man per hour</p> <p>b) Level of traffic generation at the peak hour is 2 vehicles per hour every 100 sq. meter of area of development.</p>	<p>a) Medium scale of area of development</p> <p>b) Class II</p>	<p>a) Intersection minimum between collector roads both signalized and unsignalized intersection.</p> <p>b) For road, access by development area as well as area in radius 1 km from outer border of the location of area of development</p>
C (Purwokencana I dan II)	<p>a) 594 man per hour</p> <p>b) Level of traffic generation at the peak hour is 5 vehicles per hour every 100 sq. meter of area of development.</p>	<p>a) Medium scale of area of development</p> <p>b) Class II</p>	<p>a) Intersection minimum between collector roads both signalized and unsignalized intersection.</p> <p>b) For road, access by development area as well as area in radius 1 km from outer border of the location of area</p>

			of development
D (Bumi Arca Indah)	<p>a) 442 man per hour</p> <p>b) Level of traffic generation at the peak hour is 1 vehicles per hour every 100 sq. meter of area of development.</p>	<p>a) Small scale of area of development</p> <p>b) Class I.</p>	<p>Close intersection, signalized or</p> <p>Unsignalized, Road accessed to the area of development</p>
E (Teluk)	<p>a) 1.710 man per hour</p> <p>b) Level of traffic generation at the peak hour is 7 vehicles per hour every 100 sq. meter of area of development.</p>	<p>a) Large scale of development area.</p> <p>b) Class III.</p>	<p>a) Intersection minimum between collector roads both signalized and unsignalized intersection.</p> <p>b) For road, access by development area as well as area in radius 2 km from outer border of the location of area of development</p>

Analysis of Traffic Impact

Impact to The Road Performance

Analysis to road performance was conducted by comparing the road condition before and after development of the residential area is given in Table 2.

Table 2: Road performance before and after the development of residential area

Access Road	Road Performance Before	Road Performance After the
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	the present of Residential Area		present of Residential Area	
	Before Build	Year 2012	Without Traffic Generation in 2012	With Traffic Generation in 2012
Residential A:				
Raden Patah road			0.84	0.90
Raya Dkwaluh road			0.43	0.78
Senopati road			0.53	0.68
Sunan Bonang road	0.14	0.22	0.32	0.37
Residential B:				
Jatisari road	0.39	0.64	0.39	0.65
Ringintirto road	0.31	0.51	0.64	0.71
Karang kobar road	0.31	0.50	0.84	0.91
Riyanto road		0.50	0.50	0.56
Residential C:				
Brigjend D. Encung road	0.59	0.82	0.24	0.35
Residential D				
Dr. Suparno road	0.39	0.63	0.36	0.45
Residential E				
Lesanpura road	0.20	0.32	0.41	0.49

Sultan Agung road	0.13	0.21	0.43	0.53
Suwatio road	0.41	0.67	0.40	0.44
Perumnas road	0.25	0.40	0.44	0.64

Impact to The Intersection Performance

Performance of intersection that affected by traffic generation impact come from the traffic movement generated from the residential area are given in Table 3.

Table 3: Performance of the intersection

Type of Intersection	Name of Intersection	Number of road	Volume (pcu/hr)	Capacity (pcu/hr)	VCR	Delay in Intersection (sec/pcu)	Line Opportunity (%)	Length of line (%)
Unsignalized	Jatisari	3	1563.25	2891.25	0.54	9.38	10-24%	
	Ringintirto	3	2726.8	3085.75	0.88	15.08	30-82%	
Signalized	GOR	3						
		N	311.1	1648.68	0.19	25.33		52.63
		S	499.9	2649.24	0.19	38.36		50.53
		W	716.4	3796.58	0.19	50.44		65.45
	Dukuhwaluh	4						
		N		680.9	4.61	3.99098E+17		434.29
		S		803.8	2.95	321019442.1		467.69
	E		404.8	4.04	184764703.6		506.67	

		W		577.3	6.94	29875865 8.4		380.0 0
	Teluk	4						
		N		206.1	0.74	53.26		40.00
		S		241.7	0.74	53.33		57.14
		E		403.7	0.74	55.11		43.64
		W		630.4	0.74	56.53		58.46

Evaluation on Traffic Impact

As shown in Table 2, the value of VCR after residential development higher than the VCR value before development, even though the value still less than critical VCR 0.75 required by MKJI (Note: MKJI in English is Indonesia Road Safety Assembly). Brigjen Encung road that have function as collector secondary road, was a main access to the Residential B, categorized as level of service (LOS) A for the local area. The other five roads which have LOS B are Sunan Bonang road, a primary local road categorized based on limitation study 2 km from Griya Tegal Sari Indah residential, Dr. Suparno road, also primary local road function as main access of Bumi Arca Indah residential and three other roads. to Teluk residential namely primary local road Lesanpuro, Sultan Aging and Sarwatio road both as primary collector road.

Five roads have LOS C are:

1. Senopati road, the road direction to Griya Tegal Indah Sari residential from Purwokerto and function as secondary collector,
2. Jatisari road, a main access to Griya Satria Indah Sumampir, function as primary local road,
3. Ringintirto road, the road function as secondary collector road, as an access road to General Sudirman University and road to Griya Satria Sumampir and to Purwokencana I and II,

4. Riyano road, function as an access to Griya Satria Indah Sumampir residential and surrounding Teluk residential,
5. Perumnas road, function as primary local road.

Those five roads are needed to control traffic in order the VCR value can be maintained.

Some segments road have VCR over the critical value, those roads are:

1. Raden Patah and Raya Dukuhwaluh road. Both are main access from Griya Tegal Sari Indah residential and have level of service D.
2. Karangobar road, an access to Griya Sumampir, Purwakencana I and II residential, and also have LOS D.

Having $VCR > 0.75$, those two segments road need to be widen both 2 meters in the carriage way and 1 meter in the shoulder. Based on traffic safety consideration, MKJI has stated that widening of carriage way and shoulder will decrease the level of traffic accident to 2 – 15%. Besides of widening of carriage way, in that two segment roads also needed Stop and No Parking sign, and in Raya Dukuhwaluh and Raden Patah road also need pedestrian, since the location are close to the campus of University of Muhammadiyah Purwokerto.

MKJI give a limitation that un-signalized intersection has $VCR > 0.75$ is categorized as 'good'. From Table 3 can be seen that Jatisari un-signalized intersection have VCR 0.54, mean have not need improvement, while Ringintirto have $VCR > 0.75$ (0.88), mean need to be changed into signalized intersection, considering turn ratio in that intersection is 50%.

Signalized intersection GOR (mean Sport Centre) has VCR 0.15, mean have no seriously handled, but the drivers have to be care if turn left. Intersection Teluk has VCR 0.74 (close to 0.75) time delay close to 1 minute need resetting of time of traffic light in order the traffic flow form the south and east direction smooth. Dukuhwaluh intersection with $VCR > 0.75$, and highest delay of intersection need road widening both from south and east direction.

Conclusions

From the analysis of traffic impact can be drawn the conclusions as follows: Development of some residential area surrounding Purwokerto has significantly impact to the traffic in the surrounding roads. The capacity of number of roads and intersections improve, where three roads have VCR (Volume Capacity Ratio) value over 0.75 and three intersections also have VCR over 0.75 and were used for traffic management input. In detail, the level of traffic generation resulted from every 100 square meter at the peak hours is 5 vehicles for Residential A and C, 2 vehicles for Residential B, 1 vehicles for residential D, and 7 vehicles for residential E.

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