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Research Article

Impact of Land Use Change on Road Safety (Case study: Land Use Change in Bonorejo, Salatiga City)

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ABSTRACT

The development of urban areas is seen as quite rapid in line with the development of community demands for public facilities and social facilities for activities and businesses related to offices, shopping centers, education, and so on. The development of the area needs to be measured, namely how much land use changes to traffic violations around locations that experience land use changes, how much influence land use changes have on traffic accidents around locations that experience land use changes and recommendations for improving road safety around locations that have changed land use. land use change on road safety, namely increasing V/C ratio and decreasing LOS (level of service) on road sections around the land use change location and high levels of speed (above the maximum speed limit) on road sections around the land use change location. land. Therefore, it is necessary to evaluate the implementation of the recommendations at each stage.

Keywords: Land use, increased safety, level of service, accidents, traffic

INTRODUCTION

Urban area development viewed Enough rapid in line with development demands public to facility public and facilities social for activities and/ or business related with office, center shopping, education, and so on.

If the existing infrastructure no can support Then cross so must done study Handling infrastructure the or arrangement management to Then its cross. In general, has accepted a draft analysis "internalize externalities" with the consequences of "polluter pays" with understanding that party developer must give real contribution in Handling impact Then cross as consequence development an Area or location certain. impact change use land to safety road on Jl. Soekarno Hatta Kelurahan Noborejo, Argomulyo District, Salatiga City, Central Java is estimated can interesting Then influential cross to performance Road network around location. Therefore that, for count magnitude impact plan impact change use land to safety road to existing road need done analysis impact Then cross, so that if estimated arise impact Then cross so impact the expected can minimized with give the right solution.

Regarding with matter mentioned above, then writer consider important for analyze and research plan impact change use land to safety road on Jl. Soekarno Hatta Kelurahan Noborejo, Argomulyo District, Salatiga City, Central Java with title Impact Land Use Change to Road Safety (Study case: change use land in Bonorejo, Salatiga City).

Which means for know impact Then the resulting cross consequence change use land to safety road if woke up to network the roads around it, so that impact the will can anticipated with do management and engineering Then required cross, in order to ensure safety, smoothness and order Then cross around location the.

As for the purpose research This is Do identification impact Then cross to change use land to safety road, good to section road internal and also external, Doing analysis performance existing section at the time development and operation Because change use land said, Doing analysis modeling performance section the road at the moment has happen change of use land for development and operations, Carrying out analysis modeling performance section road at 5 years after happen change use land at peak hours, Implementing evaluation performance Then cross before and after the occurrence change use Salatiga City land, Carrying out model simulation with and without Handling

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impact Then cross, Set recommendation Handling impact in support operationalization Land Use Change and increasing performance Then cross around development Land Use Change The.

With target composition Report Study change use land and recommend proposal Handling best to development change use land so that safety Then cross in Salatiga City still Good.

With scope activity Explanation plan development new or development, Scope of study area based on plan development or development, Estimates transportation used like awakening pull Then cross, distribution journey election mode, loading, access and or need parking, Determination year the basis used as base analysis, Period analysis of at least 5 (five) years, Needs past data collection cross, Characteristics and intensity of use land existing and also conditions that will arrival, Use and selection of transportation models

METHODS

Indication problem with existence change use land predicted will cause problem namely: Increasing potential violation Then cross around location that experienced change use land; Increasing potential accident Then cross / descend level safety the way around location that experienced change use land; Delay effort prevention accident Then cross around location that experienced change use land.
Can formulated problem problem study This that is How much big influence change use land to violation Then cross; How much big influence change use land to accident Then cross; and How method for increase safety around location that experienced change use land.
The location of this research was carried out by taking the location in Bonorejo Village, Salatiga City. This location was chosen because it was in the process of changing land use, the high level of traffic accidents and the high level of mobility around the location.
Scope of discussion in research This that is level change use land on site research; Level violations around current location in the process of change use land; Accident rate Then cross around location in the process of change use land; Improvement safety around current location in the process of change use land.
As for the purpose study This that is Measure level change use land on site study; Measure how much big change use land to violation Then cross around location that experienced change use land; Measuring how much big influence change use land to accident Then cross around location that experienced change use land; Formulate recommendation improvement safety the way around location that experienced change use land.
With hope study This beneficial Use: Improvement understanding about impact change use land to safety road; Add enrichment in study theory about change use land; Add enrichment in study theory about safety road; and Improvement understanding about effort improvement safety road.
The relationship between land use and transportation according to the Structure Model (Hasler and Button, 2008) can be described as follows:

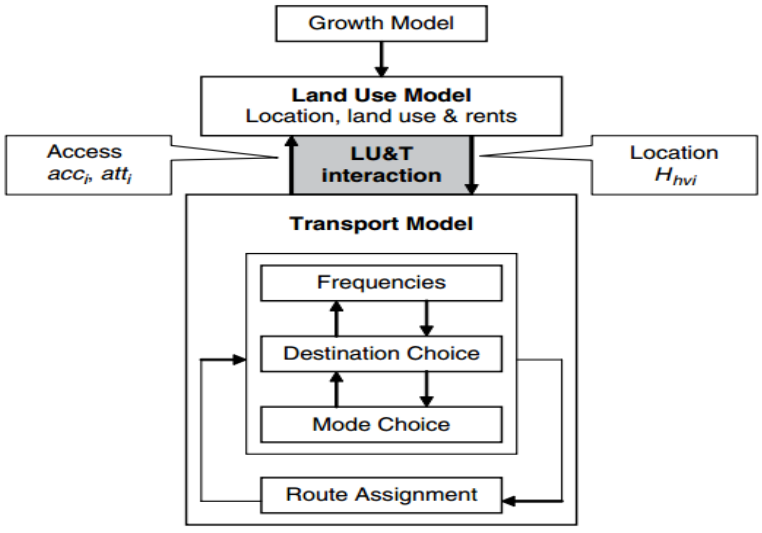

Figure 1. Model of the relationship between transportation and land use. (Hasler and Button, 2008)

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According to Hasler and Button (2008) This model requires several levels of aggregation for its main variables: socio-economic clusters for groups (households and firms), building types, spatial zones, destinations for activities and time periods. The model is described by assuming that development in an area in terms of location, land use, land prices and accessibility greatly influences the development of the transportation system, namely increasing the frequency of travel, flexibility in choosing travel destinations, flexibility in choosing the type of transportation that serves travel needs and flexibility in choosing routes.

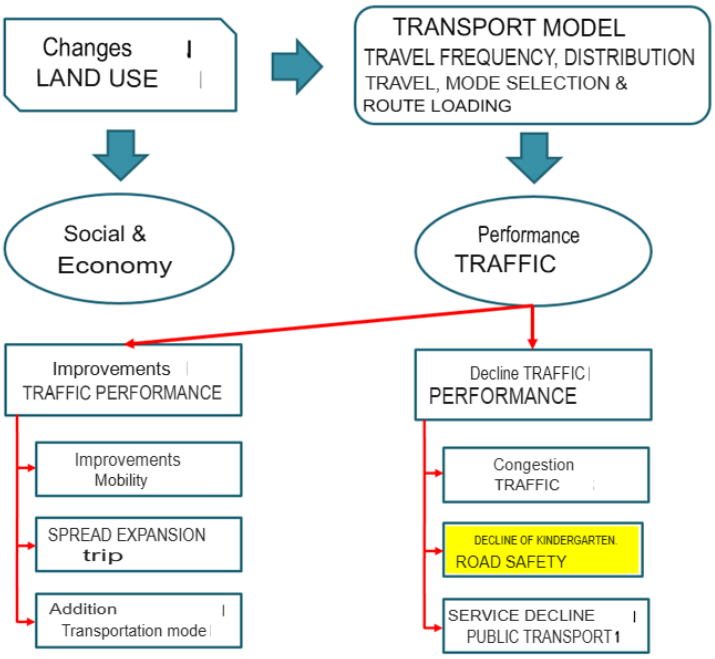

Figure 2. Relationship flow change use land

The developed area is an area that provides new traffic generation and attraction that will burden existing traffic. The recommendations given can be in the form of efforts that must be made to the existing traffic system and infrastructure in order to deal with the additional burden from the area to be developed. The Andalalin study stage is directed at the improvement program for the next 5 or 10 years from when the area is opened and fully functional (in accordance with the operational stages of the area). Based on Clark's research (1994), there are 3 impacts that will be caused by an activity center on traffic, namely smooth traffic flow, pedestrian comfort and traffic safety. Those who will receive the impact are:

1. Road users;
2. Local residents;
3. Local community facilities;
4. Local economic activities (local business);
5. Public transport management (public transport operators);
6. Local government (local authority).

The extent of the impact of activity centers on traffic flow is influenced by the following factors:

1. Travel awakening.
2. Whether an activity center is attractive or not.
3. The level of traffic flow on the existing road network.
4. Road infrastructure around the activity center.
5. Type of travel attraction by activity center.
6. Competition between several nearby activity centers.

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Method Data collection

1. Secondary Data Collection
2. Primary Data Collection

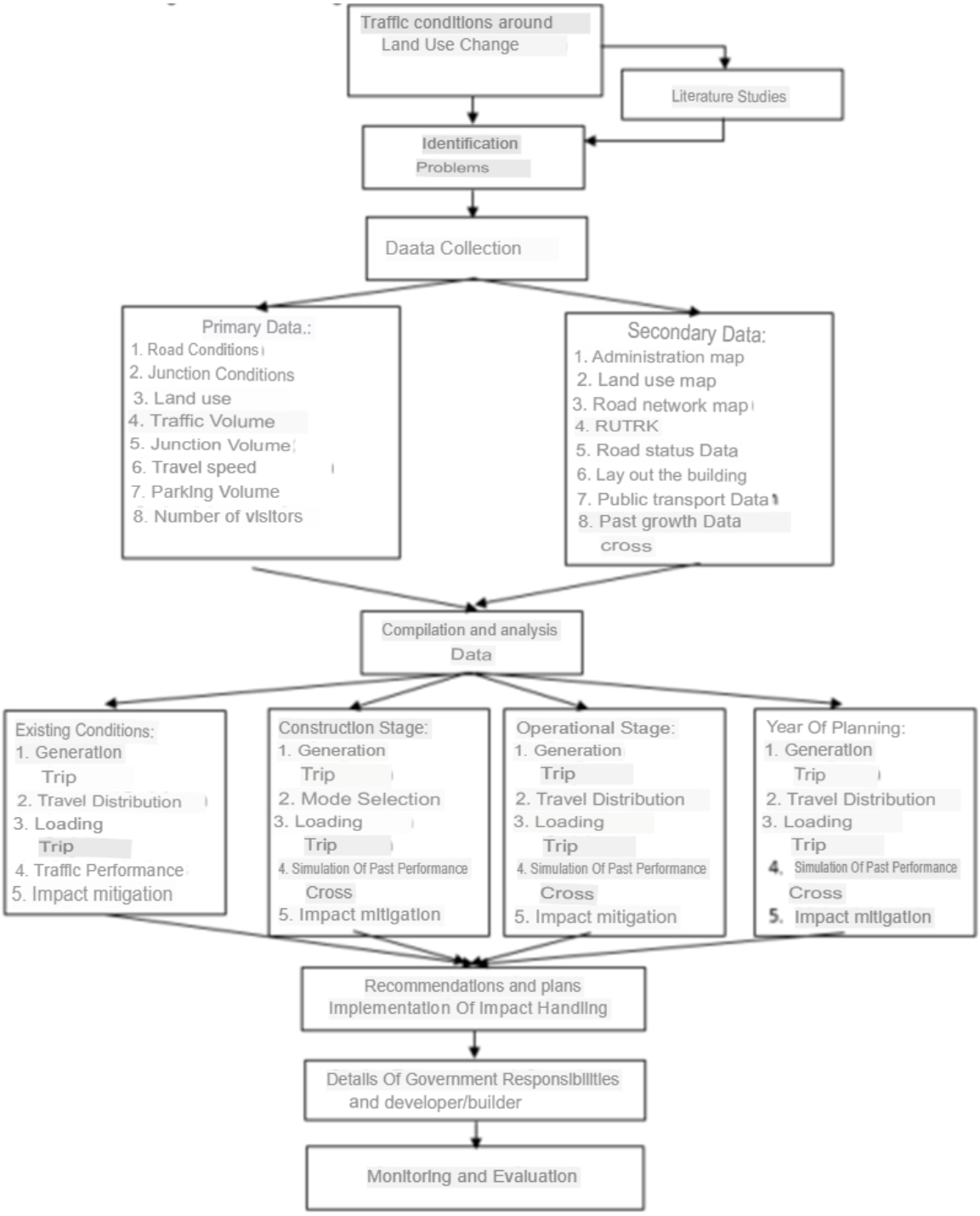

Figure 3. Methodology Flowchart

Analysis Method

This study will examine traffic performance around the Operational location for several conditions, including existing conditions without Operations, existing conditions with Operations, conditions with Operations in the planned year

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and conditions in the planned year after handling. Four stages *(Four Step Model)* modeling Then the cross used is as following that is; Estimation Resurrection Trip Generation, Distribution Trip Distribution, Modal Split and Charging Trip /Traffic Assignment.
Analysis Sections and intersections namely Road Network Performance, Speed Vehicles, Speed Current Free *(Free Flow Speed),* Speed Travel, Relationship between Traffic Flow with Travel Time. Road Capacity.

RESULTS AND DISCUSSIONS

change use land located on Jl. Soekarno Hatta, District Argomulyo City of Salatiga planned as activity industry by PT. Erella with Usage land around change use land consists of from center activity trade and office. Changes use land consequence PT Erella Salatiga City activities use wide land of 32,935 m2 and an area of floor building amounting to 64,042 m2. The utilization of space in the change area use land as following:

Table 1. Usage floor

No	Use Floor	No	Use Floor
1	Facility production cosmetics	8	office administration, warehouse
2	Processing facilities waste	9	security post
3	Water reservoirs	10	syrup facilities, administration production, corridor
4	Facility cephalosporin production	11	solid, semi-solid, administrative facilities production, corridor
5	Drug warehouse So, administration	12	locker, canteen
6	Material warehouse raw, warehouse material pack, administration	13	utility area
7	syrup facilities, administration production, corridor	14	solid facilities, utility area, production administration, lab qc, r&d

Figure 4. Study location

Location Limits Study is:
Adjacent north: Settlements and Plantations
Adjacent south: Jalan Arjuna

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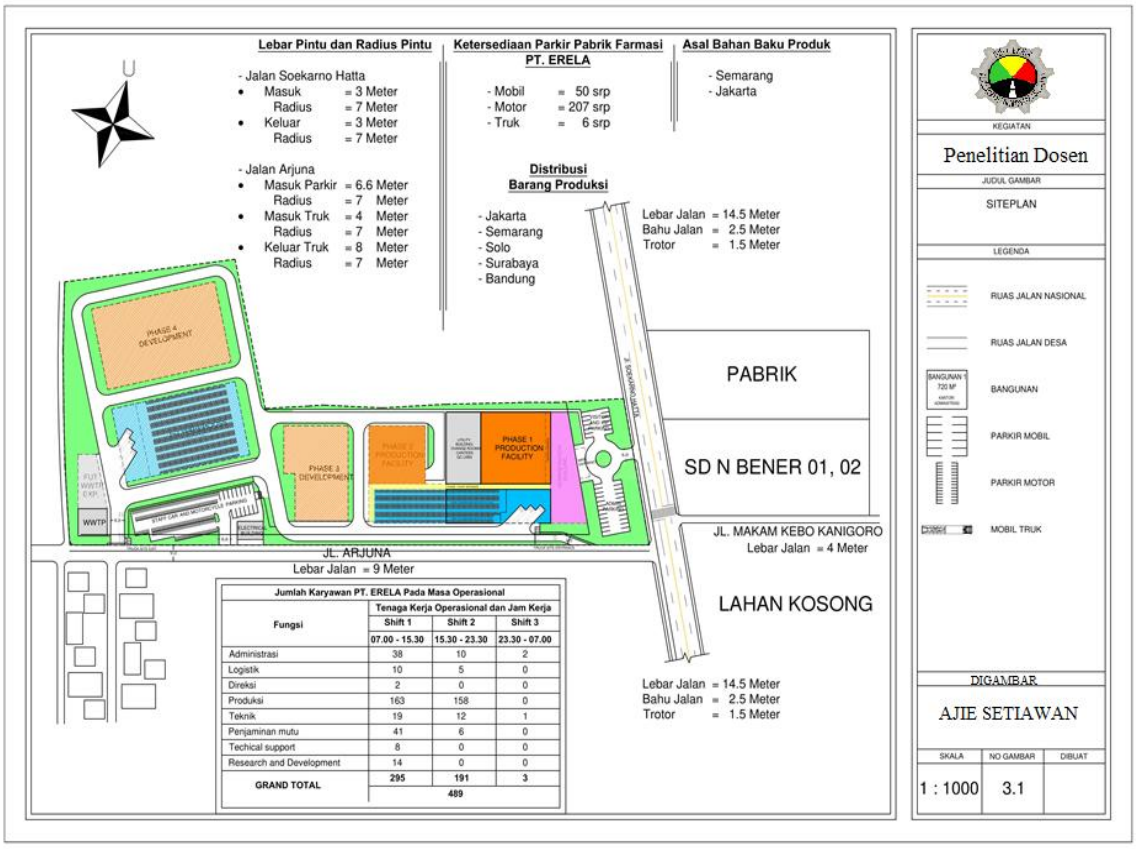
Adjacent west: Settlements and Land Empty
Adjacent East: Soekarno – Hatta Street

There are other activities in the area location is as following:
Warehouse area;
Residential area;
Trade and services

Comparative Study (Semarang Location)
Comparators analyzed is PT. ERELLA Semarang which is located on Jalan Murbei, Banyumanik District, Semarang City. Considerations Selection of Comparison Locations is Because similar characteristics, good from aspect products and operations.
After us know details of the Comparative Locations, then done Survey conducted with take notes vehicles leaving / entering the Comparison Location The results of the survey are vehicles leaving / entering the Comparison Location can seen in the following table:



Jumlah Karyawan PT. ERELA Pada Masa Operasional			
Fungsi	Tenaga Kerja Operasional dan Jam Kerja		
	Shift 1	Shift 2	Shift 3
	07.00 - 15.30	15.30 - 23.30	23.30 - 07.00
Administrasi	38	10	2
Logistik	10	5	0
Direksi	2	0	0
Produksi	163	158	0
Teknik	19	12	1
Penjaminan mutu	41	6	0
Techical support	8	0	0
Research and Development	14	0	0
GRAND TOTAL	295	191	3
	489		

Figure 5. Site plan

Table 2. Manpower Requirements Operational

Function	Number of Workers		
	Shift 1	Shift 2	Shift 3
Administration	38	10	2
Logistics	10	5	0
Board of Directors	2	0	0

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Production	163	158	0
Teknik	19	12	1
Penjaminan mutu	41	6	0
Technical support	8	0	0
Research and Development	14	0	0
GRAND TOTAL	**295**	**191**	**3**
	489		

Condition of Traffic and Road Transportation Infrastructure and Facilities Network Road around Development consists of from:

a) Section Affected roads
   1) Jl. Soekarno Hatta
   2) South Ring Road, Salatiga
   3) Jl.
   4) Jl.
   5) Arjuna St.
   6) Jl. Kebo Kanigoro Tomb
   7) Jl. Merbabu

b) Crossroads Affected
   1) Tingkir Terminal 4-way intersection
   2) South Ring Road 3-way intersection
   3) Arjuna 4-way intersection
   4) Noborejo Market 3-way intersection

Table 3. Awakening by type vehicle

No	Type Vehicle	Generation / Attraction (smp / hour)
1	MC	85.3
2	LV	34
3	Public transportation	10
4	HV	15.4
Total		**144.7**

Survey Results Rise / Pull, 2021

From the results Survey on so produced pull / lift highest occurs during rush hour Morning namely at 07.00 – 08.00 it is 144.7 smp / hour for rise / pull journey.

Table 3. Pull per (smp /hour)

Zone	Area	Pull/Generation(s mp /hr)
2	Noborijo	15.4
3	Tadpole	13.7
	Two Towns	
4	Randu Acir (North)	20.4

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	Gathering	
5	Ledok	9.5
	Worms	
6	Middle Tingkir	28.9
	North Tingkir	
	Salatiga Toll Exit	
7	Right	7.5
	The True Cebongan	
8	One Krajan	16.4
	Cebongan Hamlet	
9	Need	21.6
	Durian	
10	Randu Acir (South)	11.3
Total		144.7

Table 4. OD Matrix (smp /hour) Operational

O.D.	1	2	3	4	5	6	7	8	9	10	Total
1		***15.4***	***13.7***	***20.4***	***9.5***	***28.9***	***7.5***	***16.4***	***21.6***	***11.3***	***144.7***
2	***15.4***	0.0	9.7	60.9	85.2	19.5	19.5	12.2	29.2	7.3	258.9
3	***13.7***	16.4	0.0	36.9	55.4	30,8	6,2	18,5	30,8	10,3	218,7
4	***20,4***	53,1	44,2	0,0	238,8	115,0	26,5	44,2	336,1	26,5	904,8
5	***9,5***	32,1	85,7	310,7	0,0	267,8	32,1	75,0	214,3	53,6	1080,8
6	***28,9***	18,2	27,3	127,5	95,7	0,0	13,7	36,4	113,9	22,8	484,4
7	***7,5***	8,5	4,7	17,9	23,6	12,3	0,0	7,6	16,1	3,8	102,0
8	***16,4***	8,2	10,3	30,8	49,2	36,9	6,2	0,0	51,3	12,3	221,4
9	***21,6***	78,2	156,5	964,9	417,3	443,3	52,2	208,6	0,0	286,9	2629,5
10	***11,3***	4,7	11,6	53,5	58,2	23,3	4,7	18,6	58,2	0,0	244,1
Total	***144,7***	234,8	363,8	1623,6	1032,8	977,7	168,4	437.5	871.3	434.7	

Table 5. OD Matrix (smp /hour) Operational (Vehicle Distribution)

O.D.	1	2	3	4	5	6	7	8	9	10	Total
1		0.0	0.0	10.3	0.0	17.1	0.0	0,0	7,7	0,0	35,1
2	0,0	0,0	9,7	60,9	85,2	19,5	19,5	12,2	29,2	7,3	243,5
3	0,0	16,4	0,0	36,9	55,4	30,8	6,2	18,5	30,8	10,3	205,0
4	10,3	53,1	44,2	0,0	238,8	115,0	26,5	44,2	336,1	26,5	894,7
5	0,0	32,1	85,7	310,7	0,0	267,8	32,1	75,0	214,3	53,6	1071,3
6	17,1	18,2	27,3	127,5	95,7	0,0	13,7	36,4	113,9	22,8	472,6
7	0,0	8,5	4,7	17,9	23,6	12,3	0,0	7,6	16,1	3,8	94,5
8	0,0	8,2	10,3	30,8	49,2	36,9	6,2	0,0	51,3	12,3	205,0
9	7,7	78,2	156,5	964,9	417,3	443,3	52,2	208,6	0,0	286,9	2615.6

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10	0.0	4.7	11.6	53.5	58.2	23.3	4.7	18.6	58.2	0.0	232.8
Total	35.1	219.4	350.1	1613.5	1023.3	965.9	160.9	421.1	857.4	423.4	

Table 6. Operational Volume

Section	Volume		Resurrection	Influence of Generation (%) on Volume	Total Volume	VC Ratio	Level of Service
	smp/hour	%					
Jl. Gen. Soedirman (U)	1062	99.1%	9.50	0.9%	1071	0.25	B
Jl. Gen. Soedirman (S)	1181	96.8%	38.40	3.2%	1219	0.24	B
Jl.	426	93.6%	28.90	6.4%	455	0.11	A
JL.	82	100.0%	0.00	0.0%	82	0.06	A
Salatiga Ring Road (TB)	777	97.4%	20.40	2.6%	798	0.29	B
Salatiga Ring Road (BT)	438	95.5%	20.40	4.5%	458	0.16	A
Jl. Soekarno Hatta Segment II	1813	97.4%	49.30	2.6%	1863	0.33	B
Jl. Soekarno Hatta Segment I	2373	97.6%	58.80	2.4%	2431	0.43	B
BTS. Salatiga City - Sruwen	2494	99.1%	21.60	0.9%	2515	0.90	E
Jl. Kebo Kanigoro Tomb	74	90.7%	7.50	9.3%	81	0.06	A
Arjuna St.	228	93.7%	15.40	6.3%	244	0.08	A
Jl. Merbabu	191	94.4%	11.30	5.6%	202	0.17	A

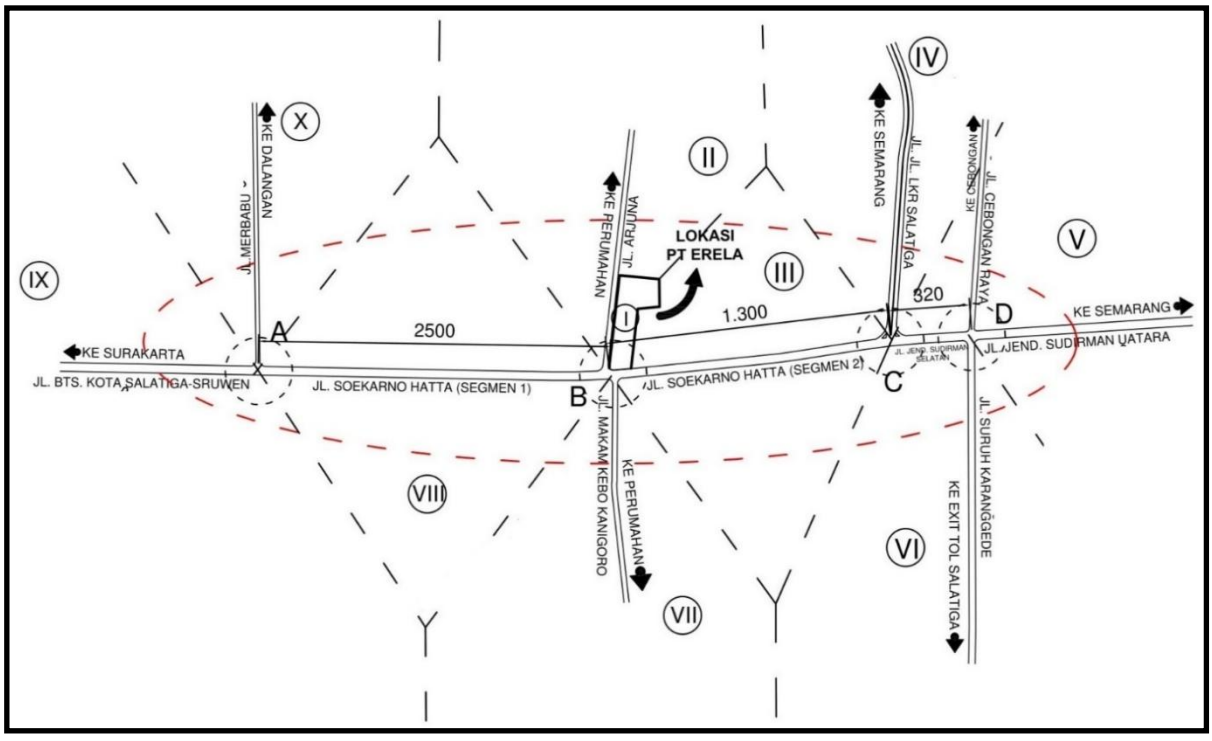

Figure 5. OD Matrix Image

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Table 6. Traffic Speed

Road Section	Indicator		Speed	
	Length (m)	Average time(s)	m/s	km/h
Jl. Soekarno Hatta (U-Terminal)	50	4.04	12.39	44.59
Jl. Soekarno Hatta (S-Terminal)	50	3.57	14.01	50.43
Jl. Suruh Karanggede (T-Terminal)	50	3.99	12.54	45.13
Jl. Cebongan Raya (B-Terminal)	50	5.65	8.85	31.85
Jl. Soekarno Hatta (U-JLS)	50	3.67	13.62	49.03
Jl. Soekarno Hatta (S-JLS)	50	3.68	13.60	48.95
South Ring Road (B-JLS)	50	3.27	15.27	54.97
Jl. Soekarno Hatta (U-Psr. Noborejo)	50	3.69	13.56	48.83
Jl. Soekarno Hatta (S-Psr. Noborejo)	50	3.65	13.70	49.31
Jl. Merbabu (B-Psr. Noborejo)	50	5.74	8.71	31.34
Jl. Soekarno Hatta (U-Location)	50	3.37	14.84	53.42
Jl. Soekarno Hatta (S-Location)	50	3.33	15.00	54.01
Jl. Kanigono Buffalo Tomb (T-Location)	50	5.88	8.50	30.59
Jl. Arjuna (B-Location)	50	4.17	11.98	43.14

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Table 6. Speed Then cross impact change use land to safety in bonorejo city Salatiga

NO	IMPACT	LOCATION
1.	Increasing the V/C ratio and decreasing *the LOS (level of service)* on the section's road around location change use land	- Jl. Jend. Sudirman from 0.24 to 0.25 (B) - Jl. Soekarno Hatta from 0.34 to 0.39 (B) - Jl. BTS. Salatiga – Sruwen from 0.85 to 0.90 (E)
2.	The height level speed (above eyes speed maximum) on the sections the way around location change use land	- Jl. Soekarno Hatta (50.43 – 54 km/h) - Ring Road (54.97)

Table 7. Recommendation Handling impact

NO.	IMPACT OF DEVELOPMENT	HANDLING RECOMMENDATIONS
1.	Increasing the V/C ratio and decreasing *the LOS (level of service)* on the section's road around location change use land	Do management Then cross on the section roads and intersections around construction location, namely minimize obstacle side, installation equipment roads on sections and intersections affected change use land as well as existence counseling safety passed cross to public perpetrator transportation.
2	The height level speed (above limit speed maximum) on the sections the way around location change use land	

CONCLUSION

1. Change use land impact on various field / sector life public including sector transportation. Changes use land in the sector transportation that is existence change of generation model travel, dissemination / distribution travel, election modes and loading the journey that ultimately impact on the level safety road /

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2. Impact change use land to safety road that is increasing V/C ratio and decreasing LOS (level of service) on sections road around location change use land and height level speed (above limit speed maximum) on the sections the way around location change use land.
3. Effort For overcome the impact that arises consequence existence change use land is do management Then cross on the section roads and intersections around location development, namely minimize obstacle side, installation equipment roads on sections and intersections affected change use land as well as existence counseling safety passed cross to public perpetrator transportation.

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