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How Much Money Will Losses Cause of Accident and Traffic Jam in Bandar Lampung, Indonesia

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Abstract: - Traffic jam caused financial losses when viewed from the value of time, accidents and pollution. This study try to calculate the financial losses cause of three factors above. The cost of accidents viewed from treatment costs from 5 hospitals as a sample and lost productivity charges. In one year with 65 mortality accident, 105 mayor accident and 523 minor accident, totally accident cost is Rp 50,8 Billion. Financial losses due to value of time as a impact from traffic jam is Rp. 2,1 Billion pe year. Total cost losses caused by pollution within 1 year due to traffic volume on two main road along 9,1 km as a sample in CBD area of Bandar Lampung is Rp. 169 Billion. We can imagine if the calculation of time, fuel consumption and pollution take fom all roads segment in Bandar Lampung. The value of financial losses due to congestion and accidents which is large enough, represent the importance of implementing traffic management in Bandar Lampung.

Key-Words: - Financial Losses; Traffic Jam; Value of Time; Accidents; Fuel Consumption; Pollution

1. Introduction

Bandar Lampung is a major city located on the southern island of Sumatra, which is automatic entrance to Sumatra from Java by land. Lintas Sumatra through town is called Soekamo Hatta Street. In 2012, the city government plans to build three bridges overpass (flyover). The three fly over fly overs in Jalan Gajah Mada to 400 meters along Juanda Street, then fly over linking P. Antasari Street to Tirtayasa Street along the 200 meters and fly over connecting Sultan Agung Street to the canal along Sultan Agung Street 200 meters.

Consequently, the condition of transportation in Bandar Lampung increasingly crowded and need a quick solution. For this reason the study

was conducted to discover and develop concrete steps that can be done by the Government of the city of Bandar Lampung, with the support of the Provincial Government and the Department, to create good conditions for urban transport. Based on data from the Police Unit of Bandar Lampung, the number of traffic accidents that occurred in the past five years since 2007-2011 is at 2826 accident with a death reached 600 people, serious injured 840 people, and slightly injured 3068 people. (Bandar Lampung Police, 2012). The high number of accidents were caused by human factors both motorists and road users. Traffic jam caused financial losses when viewed from the value of time, accidents, fuel consumption and pollution. This study try to calculate the financial losses cause of four factors

above. The cost of accidents viewed from treatment costs from 5 hospitals as a sample and lost productivity charges.

2 Accident Cost

Cost of traffic accidents caused by the occurrence of an accident, such costs include: the cost of care of victims, the cost of property damage, the cost of handling traffic accidents, and the cost of lost productivity of victims.

2.1 The Components of Accident Cost

In calculating the cost of traffic accidents, generally based on a level of losses experienced by victims, the costs for the loss of resources at the time of the accident, as well as the costs for the loss of revenue in the future. Accident cost components that can be taken into account in the analysis of the cost of accidents include: Cost casualty losses (ambulance, hospital care, rehabilitation, insurance, loss of job I income, loss due to death, Losses due to pain, Loss of family and relatives); Cost of material losses (damage to the vehicle, damage I loss of personal items, damage to goods transported, cost of towing, damage to roads and road equipment, costs due to traffic congestion); Also handling charges (Administrative costs, handling and field investigations, court proceedings)

2.2 The Method of Calculating Accident Costs

According to Anh (2005), there are six methods that can be used in the calculation of the amount of the traffic accident cost, as follows:

1. The Gross Output Human Capital

The Gross Output method is a method to analyze the cost of accidents by calculating the reduction in the value of the resources lost from all sides due to accidents. This method is very suitable

for use as a reference for transportation planners to take into account the cost of traffic accidents in developing countries like Indonesia.

2. The Net Output Approach

The net output method, is almost the same as the gross output method, the value of the gross output less the consumption of accident victims for life. Consumption in this case is the costs for food, fuel, etc.. This method is difficult to implement because of the difficulty of predicting how much consumption it costs to be incurred for the victims in the future.

3. Life-insurance Approach

Life-insurance method is the method used to obtain the value of prevention of accidents is directly related to the individual who is willing to insure themselves. For a developing country like Indonesia, it is assumed that only a very few have insurance, so poorly when applied in Indonesia.

4. The Court Award Approach

Method of the court award is approach to determine the amount given to the dependents of the court life of those who died or were injured due to traffic accidents. "Magnitude" granted by a court interpretation can contain multiple values, so it is assumed for the condition of Indonesia is relatively difficult to implement.

5. Implicit Public Sector Valuation Approach

This method is the approach that calculates all the costs incurred by the public sector in order to prevent accidents, but is considered very possible risk of error allocating resources and activities.

6. The Willingness to Pay Approach
Willingness to Pay Method is an engineering approach to get quite complicated and difficult in the assessment, although perceived will align with the principles of social welfare maximization and cost benefit analysis. This method is the approach taken to determine the percentage of people willing to pay more to reduce the risk of accidents.

2.3 Cost of Traffic Accident Victims Using Gross Output Method

Cost of accident victims is the cost of accidents caused by the traffic accident that occurred on a road, intersection, or a region annually. The calculation of the cost of accident victims in this study are based on the Guidelines for Cost Calculation Amount of Traffic Accident Research Agency Works Public Works Indonesia. The guidelines use a method of Gross Output (Human Capital), which takes into account the direct costs incurred because of accidents and the cost of lost productivity of victims.

1. Direct Cost

Is hospital costs incurred for the care of victims to medical care and to get existing facilities at the hospital, treated either as an in-patient or out-patient. Victim care costs can be obtained through the information in the hospital's medical records. To determine the category of the victim should be noted also old victim in hospital care.

2. Indirect Cost

Costs were calculated as the income loss of traffic accidents victims. Value of lost productivity experienced by victims of traffic accidents is calculated based on the length of time that accident victim can't produce income

levels (the value of productivity). For the dead victim, the production is assumed by difference between the average life (Statistic Agency) and the average age of the death victims due to an accident (the Police). While the value of productivity is calculated as GDP per capita (Statistic Agency).

In this analysis will use the Gross Output Method for calculating the cost of accident victims, through the approach data from hospital treatment costs for the handling of victims, and the cost of lost earnings of traffic accidents victims.

The method used in this study is Gross Output (Human Capital), which is calculate direct costs such as the cost of hospital care and indirect costs such as productivity losses of the victims.

$$\text{Cost of productivity losses} = \frac{\text{unproductive days} \times \text{GDP/population/workdays}}{(1)}$$

Observation is doing in accident black spots as the validation data to the secondary data obtained from the Police to reach the factors that cause accidents. Accident factors that observed are physical factors (road layout, surface and road design) as well as its traffic control devices (road markings, street lighting, traffic signs).

2.4 The Number of Traffic Accident

The number of accidents and victims that occurred in Bandar Lampung from police recorded 2007-2011, shown in the figure 1 and table 1 below.

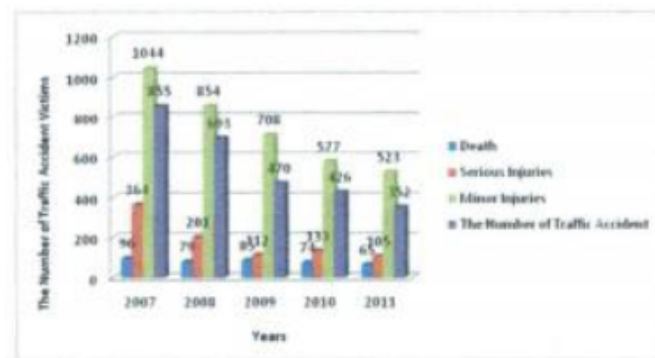


Fig 1. Number of Accident and Victims 2007-2011

From the above graph it can be observed that the decrease in the number of traffic accidents, but still quite a high number of accidents and victims each year. Victims who were suffered light injuries most every year, followed by serious injuries and fatality.

2.5 The Characteristic of Traffic Accident

Characteristics of traffic accidents are analyzed in this study is that factors causing accidents, type of vehicle involved in the accident, and the types of accidents by accident position. From Figure 2 it can be observed that humans error are the main factors causing traffic accidents in 2007-2009 with a percentage of 79.1%. No discipline is a major problem faced in improving highway safety. According to data obtained from Bandar Lampung Police, as many as 79.4% of accidents are caused because drivers are less disciplined I undisciplined in driving. See Figure 3. From the pictures it appears that the motorcycle has a large percentage of traffic accidents involved is equal to 70.9%.

The large number of motorcycles involved in accidents since 2007-2011 in Bandar Lampung, in comparison to other modes of transportation in the amount of 3522 motorcycles. This suggests that the magnitude of choices in using motorcycles because a motorcycle has the

most convenient access than other vehicles.



Fig 2. Factors Causing Traffic Accidents 2007-2009

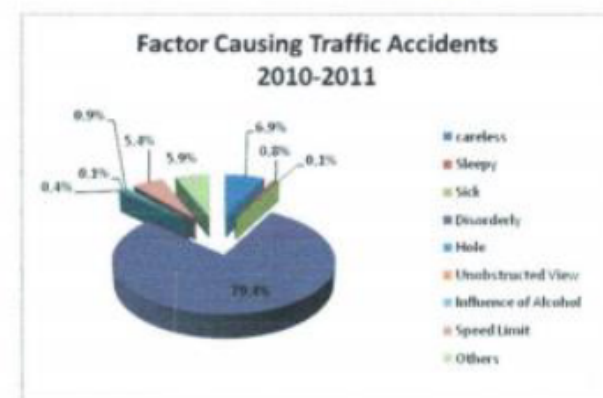
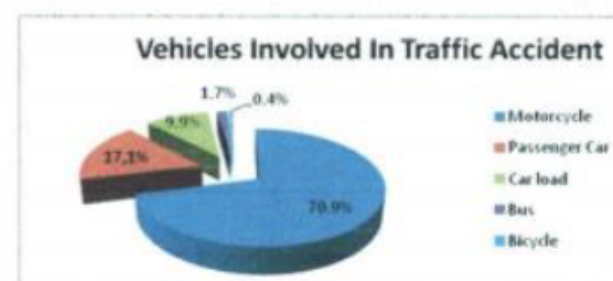


Fig 3. Factors Causing Traffic Accidents 2010-2011

Fig 4. Type of Vehicle Involved Traffic Accident
The number

It is not too big so easy to overtaking another vehicle movement, also flexible to switch lanes. But it has a lower stability than four-wheeled vehicles such as cars, trucks, and other vehicles, so it has a most potential in the possibility of a traffic accident.

It needs to be done to reduce traffic accidents is to orderly traffic, especially motorcycles, better switch to another vehicle with more safety than the motorcycle. Pressing the use of motorcycles can also reduce traffic accidents, only it is difficult to do because the growing use of motorcycles in

Indonesia continues to increase every year, if explored further, the cause of the increasing use of motorcycles in Indonesia is inadequate transportation facilities and infrastructure available, thus forcing people to choose motorcycles as a practical means of transportation without realizing that death continue to haunt of the use of motorcycles on the road

2.6 The Cost Of Traffic Accident Victim

Table 1,2 and 3 show us the unit cost of accident victims (dead, serious injuries and minor injuries).

Table 1. The unit cost of dead victims

The Name of Hospital	Treatment Cost (Rp)	Productivity Losses (Rp)	Unit Cost of Accident Victims (Rp/Victim)
Bumi Waras	2.873.811,00	905.118.319,24	907.992.130,24
Abdul Muloek	1.450.840,16	957.683.265,87	959.134.106,03
Immanuel	9.660.000,00	-	9.660.000,00
Urip Sumoharjo	13.167.514,25	832.528.631,02	845.696.145,27
Advent	8.953.395,00	970.198.729,36	979.152.124,36
Average	7.221.112,08	733.105.789,10	740.326.901,18

Table 2. The unit cost of seious injuries victims

The Name of Hospital	Treatment Cost (Rp)	Productivity Losses (Rp)	Unit Cost of Accident Victims (Rp/Victim)
Bumi Waras	7.619.468,35	621.563,82	8.241.032,17
Abdul Muloek	5.023.661,32	699.826,61	5.723.487,93
Immanuel	17.948.421,88	1.060.999,50	19.009.421,38
Urip Sumoharjo	15.955.486,27	1.515.713,57	17.471.199,84
Advent	15.767.750,32	702.009,24	16.469.759,56
Average	12.462.957,63	920.022,55	13.382.980,18

Table 3. The unit cost of minor injuries victims

The Name of Hospital	Treatment Cost (Rp)	Productivity Losses (Rp)	Unit Cost of Accident Victims (Rp/Victim)
Bumi Waras	1.428.581,25	254.423,35	1.683.004,60
Abdul Muloek	2.649.512,93	346.448,82	2.995.961,75
Immanuel	2.314.421,33	490.802,78	2.805.224,11
Urip Sumoharjo	1.914.247,67	173.224,41	2.087.472,08
Advent	2.126.000,00	346.448,82	2.472.448,82
Average	2.086.552,64	322.269,63	2.408.822,27

Average unit cost of dead victims is Rp. 740.326.901,18/victim, serious injuries is Rp.13.382.980,18/victim, and minor injuries is Rp. 2.408.822,27/ victim. The overall cost to victims of traffic

accidents that occurred in 2011 can be observed in the table below.

Table 4. Accident cost in Bandar Lampung year 2011

Accident Level	Unit Cost of Accident Victims (Rp/Victims)	Accident Victims in 2011 (Victims)	Cost of Accident Victims in 2011 (Rp)
Dead	740.326.901,18	65	48.121.248.576,70
Serious Injuries	13.382.980,18	105	1.405.212.918,90
Minor Injuries	2.408.822,27	523	1.259.814.047,21

Amount of cost the accident victims in Bandar Lampung for 2011 was calculated by using The Gross Output method. At a cost of Rp.48.117.994.556,45 for the death victims, Rp. 1.405.228.196,4 for victims who suffered serious injuries, and Rp. 1.259.866.864,98 for victims who suffered minor injuries.

3 Cost of Losses Due to Congestion

Based On Value of Travel Time Congestion is a common problem in transportation. Congestion will cause delays and queues that increased travel time. The value of travel time is the amount of costs incurred someone who is willing to save travel time. Congestion will certainly cause a reduction in travel time savings. This can lead to an increase in travel costs and losses due to congestion. This study was conducted to quantify the cost of losses due to congestion in the city of Bandar Lampung. This study was carried out during peak hour on Monday, Thursday and Sunday at the intersection of roads leading from the Urip Soemoharjo street to the Terminal Rajabasa along± 3.7 km.

3.1 Value of Travel Time Analysis

The method used to analyze the value of travel time is The Income Approach Method. This method is used to calculate value of travel time based on two factors, such as Gross Domestic Regional Bruto and

amount of working time pe year. The formula of this method is as follows:

$$\lambda = (\text{GDRB/person}) / \text{amount of working time in one year per person} \quad (2)$$

Where:

A.= Travel Value of Time

GDRB = Gross Domestic Regional Bruto

The population of Bandar Lampung based on age groups in the year 2012 is as follows:

Table 5 The population based on age groups in the year 2012

No	age groups (year)	Population (person)
1	0 - 4	85.144
2	5 - 9	79.464
3	10 - 14	78.286
4	15 - 19	91.563
5	20 - 24	94.357
6	25 - 29	84.544
7	30 - 34	78.123
8	35 - 39	70.343
9	40 - 44	63.345
10	45 - 49	53.539
11	50 - 54	43.553
12	55 - 59	30.268
13	60 - 64	19.768
14	> 65	30.618
Total		902.885

From this table, based on Age Groups, the population is 629.403 people and GDRB Bandar Lampung is Rp. 25.532953.000.000,00 . Working time pe year with assumption 1 people work for 8 hour pe day with woking time 25 day pe month, so, totaly amount of working time per year = $8 \times 25 \times 12 = 2400$ hour / people. The travel value of time, λ . = Rp. 16.902,89 / hour

3.2 Cost of Losses due to Congestion

The amount of losses due to congestion time traveler, review of the value of can be calculated in ways as follows:

Cost of Losses = Traffic volume x congestion time x travel value of time (3)

The cost of losses due to congestion with The Income Approach Method for direction Rajabasa - Tanjung Karang for 1 year in the peak hour is Rp. 1.879.876.153 for private cars, Rp. 231.909.565,6 for urban transportation, and Rp. 22.010.625,52 for BRT. As for the direction of Tanjung Karang - Rajabasa is Rp. 1.285.653.758 for private cars, Rp. 176.017.605,9 for urban transportation and Rp. 11.608.735,84 for the BRT. The result can be information and input for highway users and the government on the amount of loss due to congestion so that the existence of serious treatment to the problem of congestion in the city of Bandar Lampung.

4 Cost of Losses Due to Congestion Based On Pollution

Community activities reside and works in city, access the overall activities of the center goverment, education nor economy into one point travel communities in the city. Access of main roads that connect to city center direction of traffic occurring on Teuku Umar street - Raden Intan street and Kartini street- Teuku Urnar street. Traffic jams often appears to occur in the way of this happening, congestion caused by traffic volume approaches the road capacity arises due to the high activity of society in meeting the necessities of life that happens in the big city.

Congestion caused of high volume vehicles in the way would result in increased motorcycle vehicle emissions and cost of emission losses that occur on air pollution. This research was conducted to analyzed the magnitude of

pollutants concentrations generated emissions of motorcycle vehicles in the city of Bandar Lampung with calculation methods of emissions using emission factors for loads of Indonesia as well as assessing level of damage cost emissions generated for reduction of greenhouse gas emissions (GRK). The survey was conducted during hour busy on Monday, Wednesday and Friday on the direction Teuku Umar street- Raden Intan street and Kartini street - Teuku Umar street. Factors substances pollutants motorcycle vehicles in this study is limited to pollutants such as Carbon Monoxide (CO), Carbon Dioxide (CO₂), Hydrocarbons (HC), Nitrogen Oxides (NO_x), Particulates (PM₁₀), Sulfur Dioxide (SO₂), found in the content of motorcycle vehicle fuel.

Based on Data Survey on Table 6, the vehicles is more dominant rapid growth in 1 year is motorcycle of 20.845.517 vehicle per year compared with other vehicles. Whereas the lowest quantities on public transit (Bus Rapid Transit) amounted to 62.313 vehicles/year.

Table 6 Vehicle Volume in Bandar Lampung 2014

No	Vehicle Type	Traffic Volume 2014	(%)
1	Motocycle	20.845.517	67,5772
2	Private Car (Gasoline)	7.936.457	25,8008
3	Private Car (Diesel)	834.071	2,7115
4	Transit	1.082.120	3,5179
5	Bus Rapid Transit (BRT)	62.313	0,2026
Total (Σ)		30.760.479	100 %

4.1 The Calculation of Load Emissions

In determining the burden of emissions from each vehicle can be calculated through the calculations using the method of approach to the length of the journey, the emission factor (FE) and traffic volume is as follows:

$$E_j = \sum_{i=1}^n E_{ij} = \sum_{i=1}^n l \cdot P_i \cdot V \cdot C_{ij} = lV \sum_{i=1}^n P_i \cdot C_{ij}$$

$$E_i = \sum_{j=1}^n VKT_j \cdot FE_{i,j} \cdot 10^{-6} \quad (4)$$

Where:

E_i = Emission Buden for polutan i (ton/year)

VKT_j = Total length of traveling for vehicle type j (km vehicle/year).

FE_{i,j} = Polutan i for each (kilometer) traveling for vehicle type j (g/km veh).

V = total volume in a path.

Table 7. Data Emission factor in Indonesia based on vehicle type

vehicle type	CO (g/km)	HC (g/km)	NO _x (g/km)	PM ₁₀ (g/km)	CO ₂ (g/km)	SO ₂ (g/km)
Motocycle	14	5,9	0,29	0,24	3180	0,008
Private Car (Gasoline)	40	4	2	0,01	3180	0,026
Private Car (Diesel)	2,8	0,2	3,5	0,53	3172	0,44
Bus	11	1,3	11,9	1,4	3172	0,93
Microlet	43,1	5,08	2,1	0,006	3180	0,029
Truck	8,4	1,8	17,7	1,4	3172	0,82

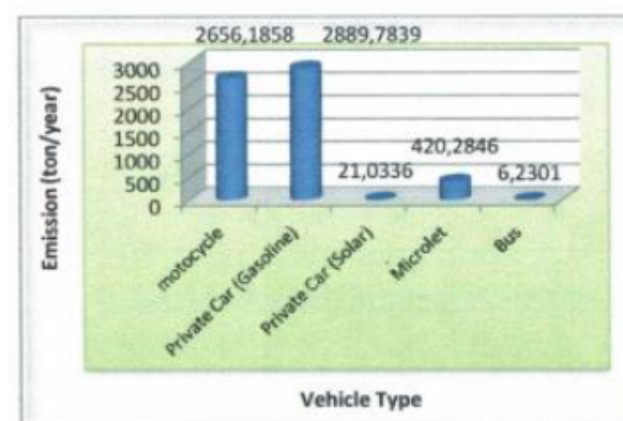


Fig. 5 Charts result of emission carbon monoxide (CO) in 2014

Based on a survey and analysis of calculation emissions load as well as the cost of the losses showed that dense traffic flow going in the direction of Teuku Umar street - Raden Intan street by generating larger volumes of vehicle and load the resulting emissions at the summit Monday. Note that the total volume of emissions factors affect the vehicle and load the resulting emissions. Losses that cost impact on the burden of emission amounts at that level also influence the load of emissions that occur per year in the city of Bandar Lampung. That the predicted losses caused by

1 congestion which affects vehicle emissions within 1 year of Rp. 169.333.469.136 in 2014 and reached Rp. 525.924.051.729 in 2024.

5. Conclusion

1. Financial Losses caused by congestion base on value of travel time using Income Approach for Rajabasa - Tanjung Karang per year in peak time is Rp. 1,879,876,153 for private, Rp. 231,909,565.6 for mikrolet, and Rp. 22,010,625.52 for BRT. As for the direction of Tanjung Karang - Rajabasa is Rp. 1.285.653. 758 for private car, Rp. 176.017.605,9 for mikrolet dan Rp.11.608.735,84 for BRT.
2. From the direction of the vehicle the biggest losses occurred in the direction of Rajabasa - Tanjung Karang visible from losses on the private car premium fuel produced by Rp.2.449.262.920, - than in the reverse direction with the same vehicle is Rp. 1473281160, -. This is due to the high volume of vehicles, especially private cars premium fuel and vehicle travel time is longer in the direction of Rajabasa - Tanjung Karang cause of side barriers and traffic light that is much more in that direction.
3. The cost of accidents viewed from treatment's costs from 5 hospitals as a sample and lost productivity charges. In one year with 65 mortality accident, 105 mayor accident and 523 minor accident, totally accident cost is Rp 50,8 Billion.
4. Total cost losses caused by pollution within 1 year due to traffic volume on two main road along 9,1 km as a sample in CBD area of Bandar Lampung is Rp. 169 Billion. We can imagine if the calculation of time, fuel consumption and pollution take fom all roads segment in Bandar Lampung.

5. The amount of congestion loss in terms of the travel time value for 1 year at a busy hour, is very large and will increase from year to year. Expected action, resetting traffic management, and policy - the policy of the government to tackle congestion not only prevention for a while but if it can for long periods of time and it also requires support from the entire community as well.

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