Analysis Service Indicator of Speed Bumps for Support Safety movement Vehicle on Port Road in Ternate City

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Abstract
This research was carried out to study and proven ineffective speed bumps are low-down in Port Street. The effectiveness can be seen in degrees services indicator (LOS = Level of Service) compared before and after speed bumps was set. Analytical relation among variable .i.e speed vehicles, volume, and street capacity must be obtained to break the problem of inefficiency . In Ternate City region speed bumps usually be placed in local street/community areas. This phenomenon born in port street, speed bumps who have set in that area absolutely disturb the conformity and accessibility, for the street usage. The outcome of the study declares that : Velocity free flow in non area facility Vfree = 29,424 km/H, meanwhile in the street in facility area Vfree = 5,147 km/H. Flow maximum in non area facility Fmax = 8,112 vehicles/H, in the facility area Fmax = 1,157 vehicles/H. Decreasing flow maximum occurred in the street by facility speed bumps.Irrational planning on traffic engineering in Port street, by setting speed bumps, caused lowered degre service (LOS).

Keywords
Speed bumps, safety, LOS, Velocity, and Vehicle

1. Introduction
A port according to legal terminology, is something related to the implementation of port functions to support the smooth, safe and orderly flow of ship, passenger, goods traffic, sailing safety and security, intermodal transfer places and to encourage the national economy and regions and while still paying attention to regional spatial planning (Deng et al., 2013). The port itself is a place consisting of land and waters with certain boundaries as a place for government activities and business activities that are used as a place for ships to dock, boarding and unloading passengers, loading and unloading goods, in the form of terminals and berths equipped with safety and security facilities for shipping and port support activities as well as a place for intra-and inter-transportation transfer (UU No. 17, 2008).

Ports have roles and functions based on various points of view . A port is a node in the transportation network, as a gateway for economic activity, a place for transfer of transportation modes, supporting industrial , trading activities, and a place for distribution, production and consolidation of cargo or goods (Liu et al., 2018). Politically, ports play a role in realizing Archipelago Insights and state sovereignty. In terms of transportation, ports are part of the total transportation chain (transportation system) (Hsu, 2012). The total transportation chain is a series of transport transfer processes from the sender to the recipient of the goods involving various points of the transfer process and modes of transportation (Monios & Wilmsmeier, 2013).

To carry out the port function, the port itself is a complex system that includes various elements such as port authority, warehousing facilities, forwarders, transportation operators, shipping agents, stevedoring, trains, tally officers, mooring men, tugboats), pilots, customs, storage, distribution, cargo handling, container terminals, as well as port police (Ekasari, 2017).
In Indonesia According to Law Number 17 of 2008 concerning Shipping, legally, service businesses that can be carried out to support the smooth running of port activities can include several types, especially related to the movement of vehicles, namely (Parola et al., 2017 ; Kadir et al., 2017 ; Alises et al., 2014) :
a. refueling and clean water services
b. facilities for boarding and disembarking passengers and / or vehicles

c. Jetty services for the implementation of container loading and unloading activities, liquid bulk, dry bulk, and roro
d. warehouse and stockpiling transportation services, loading and unloading equipment, and port equipment
e. firefighting facilities
f. storage / warehouse facilities and waste and B3 management office vehicles for the benefit of port service users
g. public transportation to and from the port
h. car rental
i. The road network and waiting areas for motorized vehicle
j. industrial activities
k. loading and unloading of goods
l. transportation management services.

Drive at more speed high on the harbor with hope shorten the travel time to be steps taken by motorists to make the travel time more efficient destination. Without realizing it, apart from giving benefits for vehicle users in the form of a shorter travel time, other things that happen can incur losses frequently an accident on the port road due to the driver's carelessness both wheels two or four wheels (Feng et al., 2012). For pedestrians such as ship passengers, workers, and the people around the port, they are part of traffic that is very vulnerable to accident, because they're on a weak position if the movement mixed with vehicles. Movement consists of walking, tracing and cutting roads (Devapriya et al., 2016). Most are inattentive (negligent) road conditions when crossing and walking feet (Zulfikri et al., 2019).

The permissible speed on port roads ranges from 25 km/h to 30 km/h. However, in general, motorized vehicle riders run their vehicle beyond the specified speed even though there is a speed limit sign, so a real speed limiting device is needed (Pau & Angius, 2001). To solve this problem, the port administrator installed Speed Bumps (barrier devices speed) or better known as name of the lump with shape, size and material variety with the aim of reducing speed of passing vehicles, the problem that occurs speed bumps is sometimes not clearly visible, wider, or higher, and using the wrong material, so that it can cause accidents. whereas the function of this device is protect pedestrians, material damage or oil spills from vehicles in the port environment (Salau et al., 2004). From these descriptions and based on observations, the researcher will Try to be thorough about speed bumps or shapes speed bumps to control vehicle speed and provide driver comfort vehicles crossing the area Port.

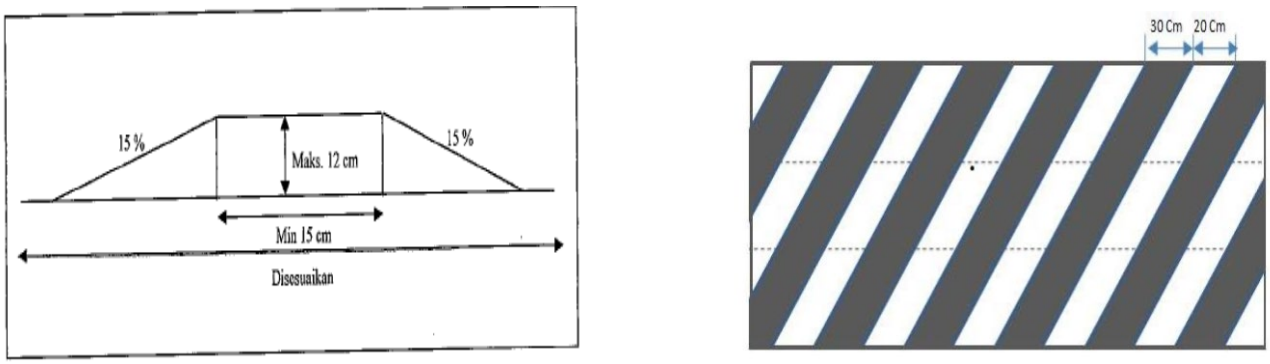
2. Literature Review

Speed is a quantity that shows the distance traveled vehicle divided by travel time. Usually expressed in per kilometer hour (km / h). Speed on generally divided into three types, namely (Lav et al., 2018):

a. **Local speed** (Spot Speed) is the speed the vehicle is at one moment measured from somewhere which is determined.
b. **Moving Speed** (Running Speed) is the average vehicle speed -flat on a path at a time-vehicles move and get by dividing the path length divided by the length of time the vehicle move down that path.
c. **The speed of travel** (Journey Speed) is the effective speed of the vehicle that is in travel between two places,and represents the distance between two places divided by the length of time for vehicle to finish travel between two places time, with this length of time includes each stop time brought about by obstacles (delay) traffic.
   the speed formula is :
   $S = V.T$
   Where V = Speed (Meters / second)
   S = Distance traveled (meters)
   t = Time (seconds)

Speed limiting device or speed bump can be defined as additional equipment on the road that serves to make motorized vehicles reduce speed the vehicle. This additional feature is in the form of a raised part of the road body that crosses the roadway witha certain width, height, and slope (KM. No. 3 of 1994 Article 3 paragraph (1), Ministry of Transportation). Based on the Minister's decree Transportation No. 3 of 1994 regarding road controllers and road safety for road users that speed control is additional equipment on the road that functions to make motorized vehicle drivers reduce their speed. Speed bumps are the elevation of a part of the road that crosses the axis of the road with a certain width, height and slope. The speed bump is placed in a transverse position perpendicular to the traffic lane. The installation of Speed Bumps signs and signs is considered very important for all residential complex road users

(Lav et al., 2018). This is stated in the Decree of the Minister of Transportation no. 3 of 1994 concerning Control and Safety Equipment for Road Users in article 5 paragraph 2 which states that "The placement of speed limiting devices in traffic lanes must be marked with an oblique line of white paint".



(a) (b)

Figure 1 a. form speed bump. b. line of white paint (KM. 3 / 1994)

Capacity analysis using parameters is often called service level analysis (level of services = LOS). There are six levels of service, namely: A, B, C, D, E, F. Service level A has the characteristics of free current flow, due to lower vehicle volume and vehicle speed high. While the level F decreases the speed of the current, low speed and queue occur (Jain et al., 2012). The level of service of a road at any time may vary depending on the activity or road disturbance being evaluated. The Speed Bump may cause interrupted flow on the highway (Lindsey, 2012). Ternate city Speed Bump are installed on local roads /neighborhood, and are often also installed on the road arteries and collectors (Ansari Ardeh et al., 2008). This is clearly visible in the Port street with a Speed Bump very disturbing accessibility and convenience. It should be the Way Such can provide a good level of service, but the opposite effect is given the police sleep level service to be low (Pau & Angius, 2001) .

The problem here is the result of the installation of the Speed Bump on the street which decreases the level of road service at any time such as low speed and vehicle volume. It is necessary to identify the level of service on the street due to the effects of the sleeping police, before and after speed bump (Lav et al., 2018). Furthermore, there is a result solution that provides for future improvement. This study has the objective of assessing the ineffectiveness of installed Speed Bump on Port Street. Ineffectiveness can be seen from the level of service (LOS) before and after being installed by the Speed Bump (Teodorović & Janić, 2017). Furthermore, from the analysis of vehicle traffic speed and the ratio of volume / capacity and solutions to overcome inefficiencies in the future (Zulfikri et al., 2016).

The road capacity is the maximum traffic flow through a point on the road can be maintained under certain conditions (MKJI 1997). Road capacity, according to MKJI 1997 influenced by several things, i.e. the width of the traffic lane of the road, the direction factor traffic, side barrier factors and city size. Spot speed vehicles are when a vehicle passes somewhere or point on the highway. The average speed of all traffic at a particular point is also known as time mean speed. One of the basic methods of spot speed study is to determine the distance space and measure the travel time of the vehicle that passes side barriers are the impact on the traffic performance of side activities road segments, such as pedestrians, public vehicles / other vehicles are stopped, vehicles in and out of road-side and slow vehicle (MKJI 1997).

In the capacity determination want to know the existence of different operating conditions when volume of ongoing traffic (Dowling et al., 2008). This leads to a conceptual level of service that can be interpreted extensively, any amount of different combinations of operating conditions will occurs on existing road traffic paths according to variations in traffic volume (Teodorović & Janić, 2017).
Service level is a qualitative measure of the influence of various factors, includes:
a. speed of operation and travel time,
b. traffic disturbance and stop frequency,
c. freedom of maneuver,
d. safety,

e. comfort driving,
f. vehicle operating costs.

Six service levels are marked with letters A through F, which are determined in the form of the value of the speed limit and the ratio of the demand (or service) volume tocapacity. In practice, any road or part of the road will operate on a wide range level of service, depending on the time of day, day of week and period of year. States a good path, with high capacity and only used only a few vehicles, the vehicle will be found in a road condition nice (Salauet.et. al ,2004). This is an 'A' service level. As traffic increases the speed decreases, drivers encounter more crowded roads (Dowling et al., 2008). Furthermore, when traffic volume reaches or beyond capacity from the road, service levels fall at the lowest level 'F' or condition forced flow. Service level volumes for different types of roads in ideal conditions can be seen in table 1.

Table 1. Level of services of various road type elements under ideal conditions

Level of Service	Wo Way Street, Two Lane (smp)
A	400
B	900
C	1400
D	1700
E	2000
F	< 2000

3. Methodology

The various sizes of Speed Bumps installed by the community in the neighborhood where they live, of course, it has a different effect on the speed of vehicles passing in the area. The speed of vehicles passing on a road with Speed Bump, both light vehicles and motorbikes, generally forms a speed distribution in each area consisting of the speed in area 1 (Normal speed), and area 2 (Speed at Speed Bump). The speed distribution is different from one another. The speed distribution shows the speed profile of passing vehicles (Jateikiene et al., 2016). If the distribution shows the same tendency of speed figures, it indicates that the speed of vehicles passing on the road is almost uniform, and vice versa .

Identification of service levels on the road before and after interruption is installed speed bump. Primary data: speed of traffic flow, volume, and density, and road capacity (Syam et al., 2017). Traffic data moving from the south to the north before and after the police sleep. Secondary data include: Site plan lay out of research area, characteristics of vehicle types (Jateikiene et al., 2016). Personnel surveyors in this study as many as 4 people in each location. before and after the speed bump. Surveyor in charge of finding parameters parameters: speed traffic flow, volume, density, and data determinant of Port Street capacity by method digital. Study area at the location before (first location) and in the existing area of the sleeping police (second location). Each type of passing vehicle is recorded and then converted unity passenger car (Kokowski & Makarewicz, 2006). The distance of vehicle speed data collection is carried out within a distance of 50 meters before speed bumps and 10 meters when passing speed bump that is at the observation location (Varma et al., 2018). The survey was conducted for one day ie Monday, 07 August 2017. Survey time at WIB, morning at 07.00-09.00 WIB. Every hour of research time is divided again being a 15 minute duration.

4. Data and Analysis

Maximum speed for motorized vehicles is differentiated by road class, in order to be able to set the speed limit for the government to make regulations. Speed limits are general or specific rules to limit lower speeds due to crowds, around schools, many activities around the road, energy savings, or geometric reasons for roads (Salau et al., 2004). The maximum speed limit is determined based on residential areas, urban areas, intercity roads, and expressways. Due to safety considerations or other special considerations, the Regional Government may determine the highest local speed limit which must be declared with Traffic Signs .

LOS (Level of Service) or road service level is one of the methods used to assess road performance which is an indicator of congestion. A road is categorized as having congestion, the calculation results of the LOS calculation

result in a value of 1. In calculating LOS on a road segment, you must first know when the road is (C) which can be calculated by looking at how far the road is, the factors that determine the direction, the dividing factor of the direction, factors of side drag, and factors determining the size of the city. Road capacity (C) itself actually has a definition as the definition of the maximum number that can be accommodated on a road section during certain conditions. Relation between density velocity variables, and flow with density Next will determine the level of service (LOS) for in the first location (no Speed Bump) and second (in the Speed Bump area).

4.1. Service Level (LOS)

Service Level in First Location (Area Before Speed Bump):
a. Analysis of service levels in the first location
Stoping sight distance, SSD $= 0{,}28Vt + 0{,}01V^2$
$= (0{,}28 \times 29{,}424 \times 1) + (0{,}01 \times 29{,}424^2)$
$=16{,}8966$ second
Basic capacity $= (1000 \times V) / (L + SSD) = (1000 \times 29{,}424) / (4{,}055 + 25{,}1788)$

$= 1.006{,}5061$ smp
Volume = 1.172 vehicle/hour
Volume / Capacity = 1.172 / 1.006,5061 = 1,1
Value of speed V = 29,424 km/hour dan V/C = 1,1 level of service (LOS) F.
b. Service Level in second Location (Area Speed Bump):
Volume = 194 Vehicle/hour
Volume / Capacity = 194 / 601,7683 = 0,3224 ≈ 0,32 value of speed V = 5,147 km/hour
and V/C = 0,32 .Level of service (LOS) F.

4.2. Analysis of Traffic Characteristics and Level of Service (LOS)

From the results of the analysis of traffic analysis and level of service (LOS) in Jalan Port without the Speed Bump and in the Speed Bump area can be seen ie both in the no area (before entering) and there are Speed Bumps waiter level (LOS) F. The effect of the Speed Bump makes the driver at close range has reduced speed. Free flow velocity in the area there is no Vfree Speed Bump = 29,424 km / h, while in the VFree Speed Bump area = 5,147 km / hour. Maximum flow in area no Speed Bump Fmak. = 8.112 vehicles / hour, while in the Speed Bump area Fmak. = 1.157 vehicles/hour. There was a maximum flow in the Speed Bump area. The results of the above analysis show that the change in vehicle speed before Speed Bumps is different from the speed of the vehicle when passing Speed Bumps. The decrease in speed that occurs in vehicles is between 0% - 69 %, this shows that the presence of Speed Bumps is significantly able to reduce vehicle speed.

5. Conclusion and Recommendations

The absence of a standard size of Speed Bumps in the study area causes the decrease in speed between Speed Bumps installed by the community and the decrease in speed that can be produced by standard sized Speed Bumps (as stated in KM No.3 of 1994 concerning User Control and Safety Equipment. Street). On Port road after installing Speed Bump service level (LOS) F, the influence of Speed Bump makes the driver reduce speed, free flow velocity in the area no Speed Bump Vfree = 29,424 km / h, while in the free bed police area = 5,147 km / h, the maximum flow in the area is no Speed Bump Fmak. = 8.112 vehicles / hour, while in the Speed Bump Fmak. = 1.157 vehicles / hour. There is a maximum flow in the Speed Bump area.

The installation of Speed Bumps should be followed by the installation of signs or signs indicating the existence of Speed Bumps on the port road, so that their presence does not surprise passing road users. It is necessary to do further research on the analysis of Speed Bumps on speed, in order to obtain the factors that influence the speed at Speed Bumps and ideally the interval distance between installed Speed Bumps. when passing Speed Bumps which have been installed in port.

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