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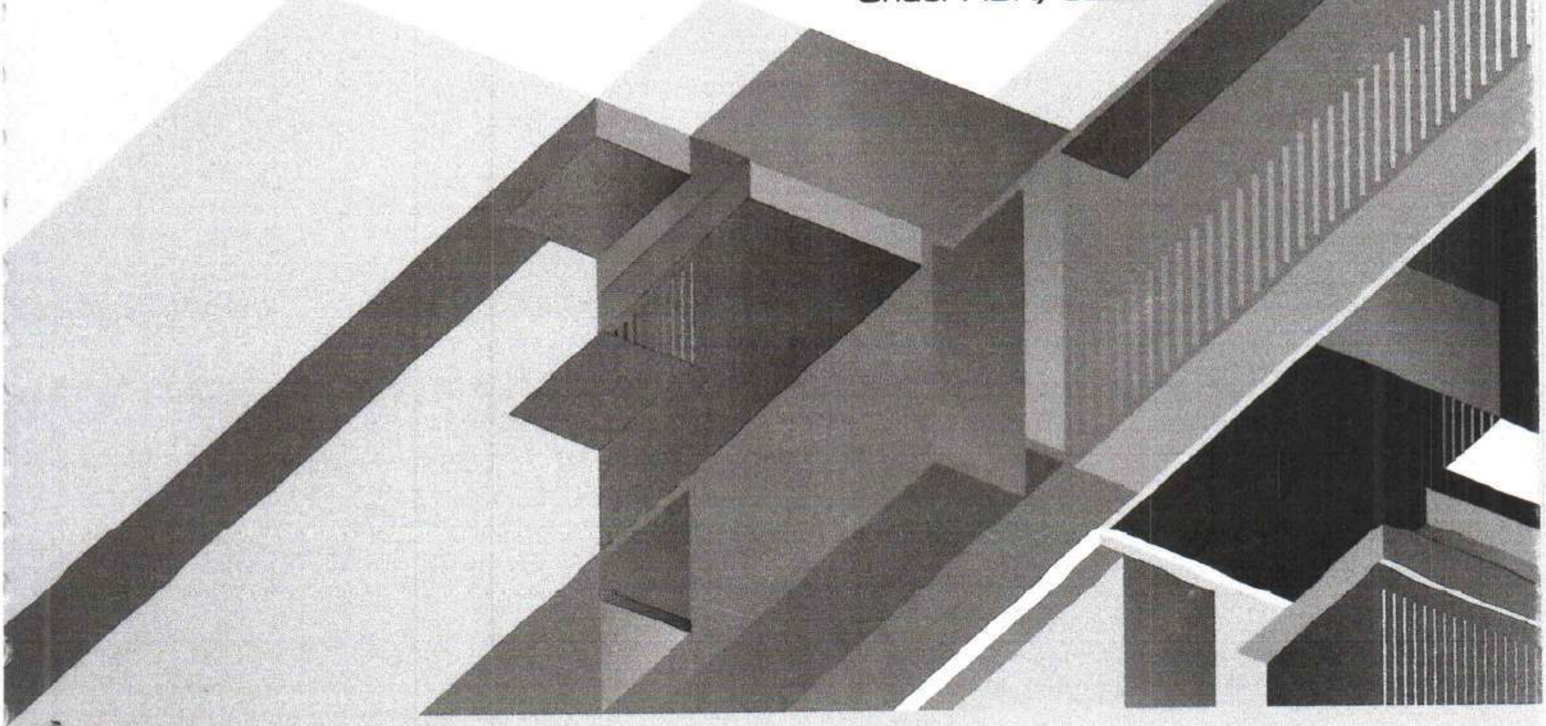

4-5 November 2014,
ITB Campus, Bandung, INDONESIA

Delivering Sustainable Infrastructure Through Collaborative Research in Civil Engineering

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Delivering Sustainable Infrastructure Through Collaborative Research in Civil Engineering

4-5 November 2014
ITB Campus, Bandung, INDONESIA

Keynote Speakers

Prof. George Ofori (National University of Singapore, Singapore)
ETHICS AND PERSONAL RESPONSIBILITY IN THE CONSTRUCTION INDUSTRY

Prof. Susumu Iai (Kyoto University, Japan)
COMBINED GEOTECHNICAL HAZARDS DUE TO TSUNAMI AND EARTHQUAKES

Prof. Akimasa Fujiwara (Hiroshima University, Japan)
ANALYZING AIR QUALITY BASED ON LIMITED MONITORING DATA IN DEVELOPING CITY

Prof. Kazuhiko Kasai (Tokyo Institute of Technology, Japan)
PAPER TITLE TO BE ANNOUNCED

Prof. Kusuma, et al. (Water Resources Research Group, Institut Teknologi Bandung, Indonesia)
PAPER TITLE TO BE ANNOUNCED

Invited Speakers

Djayanta Ginting (Value Added Solution Manager of Holcim Indonesia)
CONCRETE THAT CONTRIBUTE TO SUSTAINABLE CONSTRUCTION

Muh. Najib Fauzan (Director of Human Resources and General Affairs, Indonesian Highways Corp.)
PAPER TITLE TO BE ANNOUNCED

Nobuo Masaki, Dr Eng. (Bridgestone Corporation, Japan)
COMPUTING ALGORITHM OF HYSTERESIS MODEL OF DEFORMATION-HISTORY FOR ISOLATOR

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- Structural Engineering and Materials
- Geotechnical Engineering
- Transportation Engineering and Planning
- Water Resources Engineering and Management
- Construction Engineering and Management
- Infrastructure Engineering and Management

Programs

Day 1: Tuesday, 4 November 2014

Time: Morning
Opening Ceremony & Guest Speakers

Time: Afternoon
Technical Paper Presentations

Time: Evening
Cultural Dinner

Day 2: Wednesday, 5 November 2014

Time: Morning
AUN/SEED-Net Field Management Meeting
Technical Paper Presentations & Closing Ceremony

Time: Afternoon
Research Collaboration and Networks Meetings
Side Events

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The registration will be closed in **18 October 2014**

Category
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Local student participant: **IDR 1.000.000**

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Important Dates (in 2014)

Deadline of full paper submission: **15 Sep**
Full paper acceptance notification: **29 Sep**
Deadline of registration: **18 Oct**
20 Oct Deadline of revised full paper submission
4-5 Nov Conference for Civil Engineering Research Networks (ConCERN 2014)

- *Prof. George Ofori, National University of Singapore, Singapore*

  Ethics and Personal Responsibility in The Construction Industry

- *Prof. Susumu Iai, Kyoto University, Japan*

  Combined Geotechnical Hazards Due to Tsunami and Earthquakes

- *Prof. Akimasa Fujiwara, Hiroshima University, Japan*

  Analyzing Air Quality Based on Limited Monitoring Data in Developing City

- *Prof. Kazuhiko Kasai, Tokyo Institute of Technology, Japan*

  Paper Title to be Announced

- *Prof. Kusuma et al., Water Resources Research Group, Institut Teknologi Bandung, Indonesia*

  Paper Title to be Announced

Effect of River Stream Velocity on Vessel Speed Along A Riverway

Edi Kadarsa, Harun al-Rasyid S. Lubis, Ade Sjafruddin, Russ Bona Frazila
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***Abstract*—Highway transportation problems such as road damage, congestion, pollution and high transport cost can be solved by dividing the traffic load of the highway to river transport, considering that Indonesia has many wide and deep river network. To achieve efficient and safe river transport, it is necessary to study the traffic streams of the river which can ben used to analyse the fairway capacity, determine level of service and also transport safety. At the moment, the river transport in Indonesia does not develop and even tended to decline, so the volume of vessels that sailed is slightly. River traffic stream analysis for the congested fairway is performed using a simulation model, where the interaction between successive vessels is to follow an adapted car following model, which has been adjusted to be used for river traffic. The adjustments were made to ensure the simulation model represent the reality. One of the adjustments in the following car model is the vessel speed will be affected by stream velocity along the riverway. In this paper the affect of river steam velocity is determined through empirical study.**

Keywords*—velocity; vessel; stream; river; fairway

I. INTRODUCTION

Highway transportation problems such as road damage, congestion, pollution and high transport cost can be solved by dividing the traffic load of the highway to river transport, considering that Indonesia has many wide and deep river networks [1]. Because the volume of vessels that sailed is slightly, the traffic analysis should be performed using a simulation model, so the analysis can be done for the amount of vessels traffic that reaching capacity.

This study is part of a larger study about Simulation Model of Riverway Capacity in Indonesia where the vessels movement and interaction in the system are set by using car following model where one of the main variables is the vessel speed. In contrast to the speed vehicles on the highway that are affected by vertical alignment, a vessel sailing speed on fairway is influenced by the stream velocity along the riverway. Manuver of sailing vessels in the opposite direction to the river stream will be hampered by the river stream, but the vessels are easier to controlled. Conversely sailing vessels in the direction of stream, manuver of the vessels are caused by the rotation of the engine and velocity stream so they will go faster, but the vessels are more difficult to be controlled. [2]. River stream velocity is always changes depending on many variables, including the slope of the river bed, the depth and width of the river. PIANC divide the stream velocity to fairway into:

- River stream velocity is suitable for fairway (< 0.77 m/s).
- River stream velocity which is tolerable for fairway (0.77 m/s – 1.54 m/s).
- River stream velocity is not feasible for the fairway (> 1,54 m/s).

Because river stream velocity always changes and affects the vessel speed, hence to the analysis of traffic flow especially the capacity, necessary to study the influence of river stream velocity to the vessel speed.

In addition to the river stream velocity, wind speed can also affect the vessel speed, but the winds can affect the manuver of the vessel are strong winds or storms. Generally storms are rare in riverway in Indonesia. In the event of a storm, then almost all of the drivers does not sail or resting on the banks of the river until the storm subsides (interview with the captains of the vessel). Some literatures state that the strong winds blowing crosswise the vessel hull affect the maneuver of the vessels namely cause the hull of sailing vessel is not straight with longitudinal axis of the river, especially for empty vessels. In the literatures are not mentioned the effect of strong winds on vessel speed [3][4], so the effect of strong winds on vessel speed is not taken into account in this study.

II. LITERATURE REVIEW

Several studies have been conducted to see the influence of several factors or variables on the capacity of transportation facilities, such as highway and fairway. To determine the influence of variables or factors on the capacity of the fairway (in this study is determined river stream velocity) can refer to several studies that have been conducted.

A. U.S. Highway Capacity Manual

May [5] stated that the Highway Capacity Manual divides analysis of the road capacity into two, namely the analysis of road capacity in ideal and nonideal conditions. Ideal conditions for a multi-lane road is as follows:

- Straight roadway

- The highway is divided for different directions in which each flow does not affect each other.
- Full acces control
- Design speed of 50 miles perhour or higher
- The minimum lane width of 12 feet
- Minimum lateral clearance from the edge of the road lane to the closest object or barrier at least 6 feet
- only passenger cars in the traffic flow
- Drivers are regular users of such roads

Data of vehicles speed, flow and density of traffic are collected for a predetermined road in ideal conditions. Then the datas are plotted into curves and regression conducted to see the relationship between average speed and traffic flow. Basic capacity equation and level of service under ideal condition are:

$$SF_i = \left(\frac{v}{c_j}\right)(c_j N) \qquad (1)$$

Where:
i = lecel of service
SF_i = maximum service flow rate for level of service i (vehicle per hour)
j = design speed (miles per hou)
C_j = lane capacity under ideal condition for design speed j (vehicle per hour per lane)
N = number of directional lanes
$(v/c_j)_i$ = maximum volume to capacity ratio associated with LOS i

If the road conditions are considered less than ideal road conditions, then the capacity is analyzed as a nonideal condition. Lane capacity should be smaller or less than ideal road conditions, hence lane capacity is reduced through several factors where each factor reflects the condition that causes the road is not ideal. The value of these factors will be multiplied to obtain the value of the capacity reduction factor, with proviso the factors must be independent and the influence of each factor can be multiplied. Furthermore, the capacity reduction factors are multiplied by the lane capacity under ideal conditions. Based on the above, Equation (1) which indicates the condition of the road under ideal conditions can be developed into Equation (2) which reflects the condition of the road under nonideal conditions.

$$SF_i = \left(\frac{v}{c_j}\right)(c_j N)[f_1 x f_2 x f_3 x \ldots f_n] \qquad (2)$$

Where f1, f2, f3,..., fn are reduction factors for nonideal conditions

Reduction factors obtained by comparing the value of the capacity of the ideal road with nonideal through relationship curves the average speed of vehicles with traffic flow [5].

B. Indonesia Highway Capacity Manual

Indonesian Highway Capacity Manual determines method to measuring the lane capacity and the performance of road sections for the urban road,rural road and freeway where each road type is determined based on standard capacity. The standard capacity defined as follows:

- Urban roads: the lane width of 3.5 meters,flow evenly split in both directions , the side friction of low with the shoulder width of 1.5-2.0 meters and city size of 1-3 million.
- Rural roads: the lane width is 3.5 meters, flow evenly split in both directions, the side friction of low with the shoulder width of 1.5-2.0 meters.
- Freeway: the lane width of 3.5 meters and flow evenly split in both directions

Roads that show characteristics such as above or roads with a standard capacity, influence factors have value equal to 1. If the characteristics of a road is not the same as the standard road, then the effect on the capacity will be calculated. Variation of the characteristics considered in Highway Capacity Manual include [6]:

- Geometric: lane width and shoulder width
- Traffic: directional split
- Enviromental: side friction and city size

Basic capacity equations of urban road is:

$$C = C_o FC_W FC_{SP} FC_{SF} FC_{CS} \qquad (3)$$

Where:
C = lane capacity (pcu per hour)
C_o = standard capacity (pcu per hour)
FC_W = the effect factor of lane width
FC_{SP} = the effect factor of directional split
FC_{SF} = the effect factor of side friction
FC_{CS} = the effect factor of city size

Rural capacity is not effected by city size, while freeway is effected only by side friction and the size of the city.

For the characteristics of the road beyond the standard conditions, the capacity will be determined by multiplying the influence factors with the a standard lane capacity. In general, the determination of the capacity of the road based on traffic flow, therefore if the characteristics of non-standard lane, then the curve will shift to the right when factor greater than one or better than standard conditions and left shift if factor is less than one or worse. Exceptions to the procedure of determining the capacity of the road is not standard for side frictions [7].

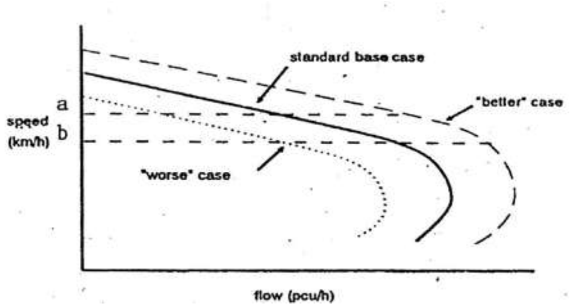

Figure 1 Adjustment factors for non standard cases (Source :[6])

C. The Effect of Side Frictions to Vehicle Speed

Munawar (2011) conducted a study on urban roads of Yogyakarta at peak hours. Chosen roads are the urban road with a high side friction. This study was conducted to determine the effect of side frictions on road capacity and vehicles speed. Survey datas collection were conducted on 2 roads in a city with a high side frictions, namely Gejayan Road and Kaliurang Road. Analysis using Multiple Regression to predict the speed at which the regression equation was first proposed [8] :

$$Y = a1x1 + a2x2 + a3x3 + a4x4 + a5x5 + a6x6 + a7x7 + a8x8 + a9x9 + a10x10 + k \quad (4)$$

Where :
Y = speed (km/hour)
X1 = number of unmotorized (vec/hour)
X2 = number of stopping city buses (veh/200 m/hour)
X3 = pedestrian movement (pedestrian/200 m/hour)
X4 = number of parking/stopping passenger car (veh/ 200 m/hour)
X5 = number of entry vehicles into the street (veh / 200 m/hour)
X6 = number of exit vehicles from the street (veh/ 200 m/hour)
X7 = number of passenger car per hour (vec/hour)
X8 = number of heavy vehicles per hour (vec/hour)
X9 = number of motorcycles per hour (vec/hour)
X10 = number of total vehicles per hour (vec/hour)
a1, a2,a3, … , a10 = coefisient factor
k = constant factor

D. The Equation of Waterway Capacity in the Three Gorges Reservoir

For comparison will be explained the correction factor to the equation proposed by Li ying (2005) to determine the waterway capacity in the Three Gorges Reservoir, namely:

$$Q = 24x \sum_{i-1}^{m} \left(\prod_{r=1}^{6} k_r \sum_{j=1}^{n} \frac{P_j V_j}{l_j} \right) \quad (5)$$

Where :
Q = the number of passing ships in the reservoir area a day (vessels per day)
m = the number of ships channel upstream or downstream
n = the number of ship's type in waterway
P_j = the distribution of type j ship (team) of ship flow
V_j = the average speed of type j ship (team) of ship flow (km per hour)
l_j = the ships field lengthwise of type j ship (team) of ship flow (km)

Some changes in the conditions that must be adjusted so that equation 5 can be used are:
k_1 = shipping period correction factor
k_2 = navigational regulation correction factor
k_3 = officer correction factor
k_4 = large ships correction factor
k_5 = ships' interference correction factor
k_6 = reservoir shipping correction factor
Value of the correction factor refers to the Chinese River navigable Standards 2004.

This equation was derived in 2005 at waterway conditions, traffic flow and the characteristic of the vessels at the time. Li ying and Liu Mingjun anticipated changes by using correction factors [9].

III. METHODOLOGY

Study in this research based on literatures study conducted with comprehensive on the effect of road geometric, traffic flow and the environment to lane capacity. The influences are considered as a multiplication factor, factor correction or adjustment factor to lane capacity. Based on the literatures study, will be developed a method to taking into account the influence of the river stream velocity to vessel speed. For completing information on vessels manuver and the influence of river stream velocity, conducted in-depth interviews with the captains of vessel and inland waterway researchers.

IV. ANALYSIS

In the simulation model of traffic flow, the manuver and interaction of vessels in the system are regulated by car following model that adopted from highway traffic.

Vessel Speed at the condition of low river stream velocity can be determined based on the engine rotation speed. Engine rotation speed indicates how far the vessel can sail in a certain time unit. But at higher stream velocity conditions, vessel speed is affected by river stream velocity where the stream will encourage or inhibit vessel movement. Referring to some of the studies that described above, changes in one or several factors will cause vessel speed changing which affect the increase or decrease in capacity (Figure 2).

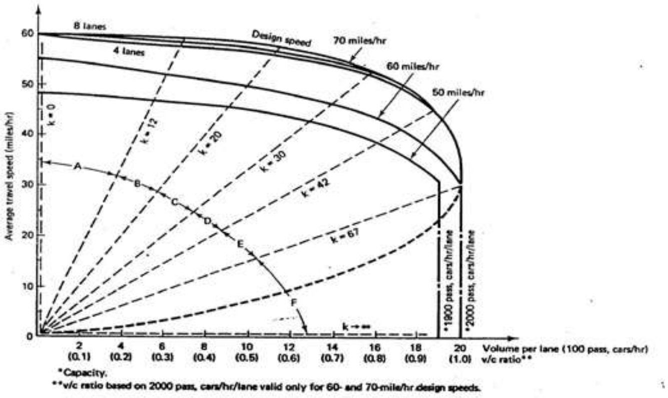

Figure 2 Speed-Flow Relationship for Multilane Facilities under Ideal Conditions (Source [5])

The picture above shows the changes in speed due to changes in the characteristics of standard road becomes a non standard (non Ideal road), consequently traffic flow that can pass through a point or segment road into smaller.

The results of the Munawar study [8] also shows the effect of side frictions as a factor that reduces the average speed of vehicles. The higher side frictions cause lower average speed. Figure 2 above explains that the traffic flow can pass on the road will be reduced if the average speed of the vehicles are reduced. Researches were conducted for composing of the Highway Capacity Manual in America and Indonesia performed with empirical method and analyzed using regression. For comparison, Li ying (2005) considered changes traffic flow conditions and vessels characteristic in the future can changing the vessels speed and capacity. Determining capacity in the future uses correction factors [9].

Vessel speed is affected by river stream velocity. The influence of the stream velocity to vessel distinguished for vessel moving in the direction and resisting of river stream. For the purposes of analysis of the influence of river stream velocity to vessel speed, hence done the collection of empirical data. The data collected are as follow:

- Vessel speed based on the engine rotation speed.
- Vessel speed total , namely Vessel speed based on the engine rotation speed and river stream velocity.
  Surveyors go up to vessel carrying GPS and timer. They record the vessel positions for any period of time to determine the actual vessel speed.
- River stream velocity
  After the ship through the observation point and the stream due to the movement of the ship begin to disappear, the stream velocity is measured using a current meter.

To determine vessel speed in the field due to the influence of the stream can be done in two ways, namely:

1. By using a regression where the independent variable is determined as vessel speed that is affected by river stream(v_n), while the dependent variables are determined as vessel speed based on the engine rotation speed (v) and river stream velocity (v_{as}).
2. Vessel speed which are influenced by river stream (vn) is determined by using a correction factor that is multiplied by vessel speed at the time of low stream velocity (a river in a state of calm).

$$v_n = v \times f_p \quad (6)$$

Where
V = Vessel speed based on engine rotation speed or vessel speed at the time of low river stream velocity.
Vn = vessel speed based on the engine rotation speed and river stream velocity.
fp is a correction factor that shows the influence of river stream on the vessel speed. When the river stream quietly, then fp is declared 1.

For purposes of determining the multiplier factor, river stream velocity that feasible for the fairway is divided into three intervals, namely 0 - 0.25 m / sec, 0.25 - 0.50 m / sec and 0.50 - 0.77 m / sec. River stream in a calm state is determined at the stream velocity < 0.25 m / sec, whereas when the river stream velocity > 0.25 m / sec, the vessels speed is determined by Equation (5) or Equation (6). Determining of correction factor is proposed using calibration method commonly used.

Regression method to determine vessel speed simpler and easier to be done in the field because river stream velocity is not split into several intervals. In addition, this method can produce a more accurate value because vessel speed based on a stream velocity value that read by device directly (current meter).

Determination of acceleration or deceleration, speed and the vessel position for update time interval can follow equation (7), (8) and (9) in which the vessel speed was calculated based on the river stream for two different directions.

$$a_{n+1}(t+T) = \alpha \frac{[v_{n+1}(t+T)]^m}{[x_n(t) - x_{n+1}(t)]^l} [v_n(t) - v_{n+1}(t)] \quad (7)$$

$$v^t_n = v_n^{t+\Delta t} + a_n^{t+\Delta t} \times \Delta t \quad (8)$$

$$x^t_n = x_n^{t+\Delta t} + v_n^{t+\Delta t} \times \Delta t + \tfrac{1}{2} a_n^{t+\Delta t} \Delta t \quad (9)$$

V. CONCLUSION

Speed sailing vessel is determined by engine rotation speed and river stream. Vessels are moving in the direction of river stream will be pushed by stream so that move faster, but it is more difficult to be controlled. if the vessels are move in the opposite of stream will be hampered by the river stream in the opposite direction even though the vessel is easier to be controlled.

The influence of river stream on vessels speed can be determined in two ways, namely:

1. Regression analysis, namely relationship the vessel speed to engine rotation speed and river stream.
2. Correction factor based on the engine rotation speed during calm stream.

Predicted regression method is easier to be implemented and accurate, because the vessel speed value in field based on the river stream velocity that be read by device directly.

References

[1] E. Kadarsa, H. al-Rasyid S. Lubis, A. Sjafruddin, and R.B. Frazila "Aplikasi Car Following untuk Model Simulasi Lalu Lintas Alur Pelayaran Sungai," 17th International Symposium of Indonesian Inter University Transport Studies Forum, Jember University, Indonesia, 22nd -23rd August 2014.

[2] Soebekti, Intisari Olah Gerak Kapal. Djadajat Maritim Academy, Deepublish, Jogjakarta, November 1955.

[3] B.L. McCartney, L.L. Ebner, L.Z. Hales, and E.E. Nelson, Ship Channel Design and Operation: Manuals and Reports on Engineering Practice No. 107. ASCE, 2005.

[4] Rijkswaterstaat, Centre for Transport and Navigation, Waterway Guideline, Directorate-General for Public Works and Water Management, December 2011.

[5] A.D. May, Traffic Flow Fundamentals. Prentice Hall, Englewood Cliffs, New Jersey, 2005.

[6] Sweroad and PT Bina Karya, Highway Capacity Manual-Work Package Report. Directorate General Bina Marga, Directorate of Urban Road Development, December 1990.

[7] A. Munawar, "Speed and Capacity for Urban roads, Indonesian Experience" 6th International Symposium on Highway Capacity and Quality of Service, Stockholm, Sweden June 28 – July 1, 2011.

[8] Ming Huang, Gan Weidong, Liu Mingjun, " Research on the Navigating Capacity of Ship in the Three Gorges Reservoir Waterway" ICTIS, ASCE 2011.