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PREFACE

Transportation has contributed significantly to the well-being of mankind economically and socially by enhancing mobility, connectivity and interaction of people and movements of goods. However, adverse impacts of transportation operations on the environment and the society are well recognized, some of which are revere and require urgent remedial actions. The transportation community must take up the responsibility and do our parts to mitigate such adverse impacts. The progress in this aspect has not been all encouraging globally, partly because of economic constraints and factors beyond the control of the transportation sector.

We as transportation professionals must contribute by promoting sustainable developments and operations in all aspects of the transportation sector. Research and developments are needed to improve the safety, efficiency, effectiveness and environmental friendliness of transportation operations, including transportation planning, design, construction, management, maintenance and rehabilitation. Promoting research and development of environmentally green transportation is the key objective of the APTE Conference series which was first launched in Singapore in 1998.

The APTE Conferences encourage the research and applications of environmentally and socially friendly technologies in this part of the world, through interactions and exchange of ideas and experience among the transportation researchers and practitioners. To this end, APTE Conferences actively promote two major tracks of the program, namely a Green Transportation Technology track, and a Traffic and Road Safety track. I am glad to see that the 11th APTE conference continues this tradition in attracting good papers that address these two very critical issues towards achieving sustainable transportation developments in this part of the world.

On the organization of the conference, we thank the Conference Host and the Conference Organizing Committee for the outstanding efforts, and the Universitas Brawijaya for the great support to make this Conference possible. I believe all participants will benefit from this conference and have an enjoyable stay in Malang.

Professor T. F. Fwa
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Physical and Mechanical Properties of Asphalt Concrete Contain Reclaimed Asphalt Pavement from National Road in East Java Province Indonesia

Ari Widayanti, Ria Soemitro, Januarti Ekaputri, Hitapriya Suprayitno

Reclaimed Asphalt Pavement (RAP) is a paving stripping material with Cold Milling Machine. The RAP accumulation in East Java Province is estimated 50,000 m3 per-year. The RAP usage can decrease RAP accumulation, natural material, damage rate by mining or excavation. RAP mixture produced an optimum performances...

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New Low-Speed Testing Device for Skid Resistance of Highways and Airfields

Sen Han, Tien Fwa, Mengmei Liu

Low speed skid resistance measurement is of great significance to analyse the actual causes of insufficient friction of pavement, and to formulate appropriate maintaining measures. At present, the British Pendulum Tester (BPT) and Dynamic Friction Tester (DFT) are commonly used to measure the low-speed...

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Characteristics of Asphalt Concrete Mixed Using Aggregates Coated by Low Density Polyethilene (LDPE) Plastic Waste

Ni Luh Setyarini, Anissa Tajudin

Road is one of the important infrastructures in facilitating the mobility of goods and services in order to improve the national economy, but most of the roads are damaged by the effects of weather. The rain water interusion into the pavement layer make accelerates erosion process. The asphalt erosion...

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Mode Choice Analysis between Bus Rapid Transit and the Alternate Public Transit in Semarang City

Amelia Indriastuti, Djoko Purwanto, Kani Basuki

Since 2011, Government of Semarang City has planned the construction of a rail-based Mass Public Transportation System. This discourse is getting closer to realization in mid-2018, where the Semarang government sets Light Rail Transit (LRT) as the rail-based Mass Public Transportation System that will...

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Evaluation of Performance Satisfaction Level of Tawang Alun Green Terminal in Jember

Agung Sedayu

Tawang Alun Terminal is a terminal type A that located in Jember Regency, East Java, which serves as a transit node for inter-provincial inter-city public transport connect the western and eastern parts of East Java. This study aims to evaluate the performance satisfaction level of Tawang Alun terminal...

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Evaluation of Public Transport Performance Supporting Monorail Planning

Lasmini Ambarwati, Amelia Indriastuti

Public transport (PT) performance in some big cities in Indonesia is not accordance with passenger satisfaction. This condition is revealed by investigation of public transport performance declining continually. This condition causes the number of PT's passenger decreasing and increasing in use of private...

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The Analysis of Problem Solving Priority of Semi Paratransit Services in Developing Countries

Evi Puspitasari, P. Maryunani

The development of public transport in developing countries is inversely compared to the developed countries. The problem of low quality of service, lack of information, accidents, comfort, and pollution is a threat to the sustainability of public transport. Management of semi-paratransit transport individually,...

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Satisfaction and Expectation Analysis of Surabaya-Porong Commuter Line Users

Hera Widyastuti, Ahmad Soimun, Anggit Putri

The people of Sidoarjo who are doing the activities at Surabaya need a mode of transportation that can serve their mobility from home to their office and vice versa. To meet those need, it is necessary to provide a better transportation and quality that includes security, comfort, timely, efficient and...

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Analysis of Bus Trans Semarang Corridor VI through Monitoring System and Passenger Information System

Mudjiastuti Handajani, Andi Kuriniawan, Harmini

The Smart City being expedient and reliable is safe, convenient, cheap, regular, scheduled as well as modern city transportation system. The Trans Semarang buses run simultaneously on public roads, there is bound to be inaccurate arrival time information. Consequently, there is the need for a system...

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Parking Management System Optimization on the Street In Order To Reduce Transport Problems By Using A Prototype Of Integrated Parking Management System (Case Study : Parking Area at Alun-Alun Utara Kota Pekalongan)

Sahid Bismantoko, Asep Haryono, Tri Widodo

These the problem of parking systems on the streets is a classic problem that occurs from year to year, many solutions are offered in solving parking problems on the street. The problem is not only related to congestion due to exit and enter the vehicle from the parking lot but also the problem of parking...

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Traffic Conflict Modelling at Six Leg Unsignalized Intersection

Purnawan, Febrian Qadri

Traffic conflicts at six leg unsignalised intersection could produce traffic accident, this is because of complex traffic interaction in this area. This paper describes the result of analysis and modelling on traffic conflict at six leg unsignalised intersection. The data was captured using handycam,...

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Application of Fuzzy Logic and Smartphone Accelerometer for DrivingCycle Determination

Adityo Suksmono, Abdul Halim, Mulyadi Harjono

Smart driving and eco driving now become an important issue which they integrate environment, comfort, and safety riding. To achieve this condition, it is needed measurements or evaluations on our riding behaviour. One of parameters that describes our riding behaviour

is driving cycle. The variable that...

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Analysis of Free Flow Speed on Urban Road

Made Mahendra, Harnen Sulistio, Ludfi Djakfar, Achmad Wicaksono

Congestion has become a problem of traffic on urban road segments in several major cities in Indonesia, it will have a negative impact on the driver or users of the road due to the longer travel time. Congestion resulting in economic and immaterial losses such as cause stress due to fatigue, and congestion...

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The Influence of Systematic Bottleneck Segment on Traffic Characteristics

Medis Surbakti, Kristian Napitupulu

The transportation problem causing a traffic jam in this study is a bottleneck of the road, where downstream traffic capacity is smaller than the upstream, usually, happen in the bridge entrance and where the road geometric changes such as four lanes 2 line into two lanes 2 line. This study aims to find...

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Determinant Variables behind Motorcyclist Daily Favored Speed

Don Cost, Siti Malkhamah, Latif Suparma

Unbalanced in mobility and safety is a latent issue because although speeding has been associated with fatal crash but excessive speed without having been punished still occurs. This study focuses on how to bridge it by identifying the reason, triggering variables and explanatory variables of speeding...

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Assessment of Curbside Roadway Level of Service of The Bandaranayke

International Airport – Sri Lanka: A Comparison of The Analysis Tools in ACRP 40

Hadunneththi Pasindu, Kaushan Devasurendra, Pathiraja Udayanga

This study utilizes the most recent data set available on Bandaranaike International Airport Curbside Operations, collected in 2012, in assessing the curbside roadway level of service. The level of service of both the departure and arrival curbside roadways are evaluated using the guidelines presented...

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Travel Time Map for Identifying The Quality of Airport Access: Case Study Juanda International Airport

Rizky Istighfaroh, Nursakti Pratomoadmojo, Ervina Ahyudanari

Air traveler require high reliability time to reach airport, especially for traveler with connecting flight. The airport access may not have an exclusive lane to support the reliability time. Therefore, this research attempted to make a map of the travel time to the airport from districts in airport...

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Model of Queuing in the Railway Level Crossings (Case Study: Railway Level Crossings in Jemursari Surabaya)

Hera Widyastuti, Adita Utami, Mahardika Putra

Population growth and the development of economic in Indonesia affect the increase in vehicle volume, especially in the city of Surabaya. The increasing of vehicle volume resulting in increased of direct-access to the city centre and causing arise of new railway level crossings. Furthermore, the increasing...

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ITS Design Priority at Large Bus Terminal in Indonesia in Supporting Sustainable Transportation

Anastasia Sutandi, Wimpy Santosa, Felix Hidayat, Aini Zahiyah

Intelligent Transportation Systems (ITS) is an important part of sustainable transportation. Implementation of ITS at large bus terminal is needed in order to increase the service quality to the passenger and encourage people to use public transportation. Unfortunately, not all of large bus terminal...

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Optimization Big Data Real-time Analytics Using Mobile Phone Data in Origin Destination National Transportation (ATTN) Survey

Okkie Putriani, Sigit Priyanto

The ATTN 2018 data collection process is obtained from the data collection of the sample OD-matrix using cellular data, carried out with the aim of obtaining data on the Origin Destination Matrix (movement) of the mobile phone user movement for a given period to get the sample OD-matrix. Data signals...

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Adequacy of Parking Provisions Based on The Trip Generation Patterns for Urban Commercial Developments

M. Priyadarshanie, H. Pasindu, S. Senevirathne, D. Jayaratne

Urban commercial developments are an integral part of the urban land use which affect the trip generation and attraction pattern in the city. More importantly, these developments increase the demand for parking, which by law should be provided within the development. Lack of adequate parking facilities...

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Analyse of CI Behavior due to Independent Variable Value Variation, Case of Simple Linear Zonal Regression Trip Production Model

Hitapriya Suprayitno, Dio Hananda, Jimi Aditya

Good Transportation Planning needs a good and accurate Transport Model. Trip Production Modeling, as the first step, needs to be accurate also. A new Trip Production Accuracy measure, incorporating R2 and Confident Interval values, has been proposed. An experiment to investigate the CI Behavior, due...

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Intersection Performance Study Using PTV VISTRO (Case Study : Jember)

Willy Kriswardhana, Sonya Sulistyono

Vistro is an abbreviation of Vision Traffix and Optimization developed by PTV AG Germany. Vistro is one of the transportation applications developed for traffic engineering. This application was introduced first the end of 2012 and entered in the Asia Pacific market including in Indonesia in early 2013....

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Static and Fatigue Bending Strength Analysis of Flash Butt Welding Join for Light Rail Transportation

Puguh Triwinanto, Tri Handayani, L. Baskoro

Light Rail transportation (LRT) in Indonesia is built first time in 2016. Rail is one of the important components for track at LRT. One of joint of rail for LRT is uses flash butt welding joint. The requirement of flash butt welding joint is based on BS EN 14587-2:2009. Requirements include static...

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Accident Model for Car on the Road Section of Highlands Region

Sobri Abusini, Lasmini Ambarwati

Motorcycles as a mode of transportation its use continues to increase in the Surabaya City. One of the negative impacts is motorcycle accidents to increase. Based on IRSMS data are the involvement of motorcycles in the accidents of 82.6% (2,490 motorcycle accidents out of 3,014 accidents in Surabaya...

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The Evaluation of Road Safety Programs District Level at Banyumas and Pasuruan

Bambang Istiyanto

Sustainable development Goal serves as a guideline for the implementation of regency/city government in Indonesia. One of the indicators is the reduction in the number of deaths caused by traffic accidents. With a five-pillar safety instrument from the decade of action for road safety, data collection...

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Seafarer's Stress and Long Distance Relationship with Family

Hendro Prabowo, Firda Fatimah, Alia Fauziah, Ira Prabawati, Maria Chrisnatalia

The purpose of this research is to know the work pressure faced by modern Indonesian seafarers and their long distance relationship with their family. Five seafarers who originally lived in Jakarta participated in this qualitative study. Data were gathered through interviews by mobile phone. Thematic...

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Effectiveness of the Use of Personal Protective Equipment (Ppe) by Cadet on Board

Iksiroh Husna, Wisnu Handoko, Sarifudin, Anissofiah Wijinurhayati

Work accidents according to Heinrich 88% are caused by human factors so that they can be prevented, so improving the behavior of workers becomes very important. The study was conducted on cadets post-sea practice, against the use of personal protective equipment (PPE). The research method was carried...

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Development of Indonesian Driving Anger Scale

Leksmono Putranto, Dwi Suryana, Sunu Bagakara

This paper is intended to develop Indonesian Driving Anger Scale by adopting several items of driving anger short scale developed by Deffenbacher et al in the USA. The respondents were

asked to rate the amount of anger that would be provoked from none at all, a little, some, muc and very much if the...

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Motorcycle Accident Probability Based on Characteristics of Socio-Economic, Movement and Behaviors in Surabaya City

Muhammad Arifin, Achmad Wicaksono, Sonya Sulistyono

Motorcycles as a mode of transportation its use continues to increase in the Surabaya City. One of the negative impacts is motorcycle accidents to increase. Based on IRSMS data are the involvement of motorcycles in the accidents of 82.6% (2,490 motorcycle accidents out of 3,014 accidents in Surabaya...

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Identifying Black Spots in Southeast Sulawesi Province, Indonesia: A Combination Method of Equivalent Accident Number and Road Safety Survey Value

Budi Susilo, Rhenato Geovan, Ivan Imanuel

Road traffic accidents still become major problems for Indonesia causing more than 25,000 deaths per year. One of the challenges faced in making road betterments is how to identify and prioritize black spots with minimal accident data. This study offers an innovative approach to combine Equivalent Accident...

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The Effect of Road Infrastructure on Traffic Accidents

Ardilson Pembuain, Sigit Priyanto, Latif Suparma

Planning, Designing and constructing road infrastructure should give priority to the safety and comfort for road users. Ironically, road infrastructure often becomes the cause of traffic accidents. However, such problem can be solved with a profound understanding in the effect of road infrastructure...

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Evaluation of Emissions from Delayed Departure Flights at Bandaranaike International Airport (BIA)

D.M.M.S Dissanayaka, V. Adikariwattage, H.R. Pasindu

Avoiding flight delays has become a crucial factor in each airport and airline since a huge economic cost results as consequences. Researches are conducted to measure aviation delay and its economic cost [1] while its environmental cost is sparsely addressed. In this research, the delay of departure...

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The CO2 Emissions Distribution Due to Contribution of Transportation Activities in Tegal City, Central Java

Yan Unziletirrizqi, Bambang Istiyanto, Andrea Maulana

The temperature increasing on earth has triggered drastic climate change. Motor vehicle emissions, especially CO2, are a major source of pollutants in major cities in Indonesia. This greatly affects the transportation sector whose estuary affects the contribution of carbon dioxide (CO2) which is predicted...

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Sun-to-Heel Energy Efficiency of Transportation Fuels

Leo Jia, Ong Ghim

Life cycle analysis (LCA) is a technique to assess the environmental impact of a product or service throughout its life cycle and is used commonly to evaluate transport decisions at the planning level. Well-to-Wheel (WtW) is a subset of LCA that focuses on the efficiency of transport fuels by measuring...

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Regional Well-to-Wheel Carbon Energy and Water Footprint Analysis of

Regional Well-to-Wheel Carbon, Energy, and Water Footprint Analysis of Electric Vehicles

Nuri Onat, Murat Kucukvar, Omer Tatari

Adoption of alternative vehicle technologies such as electric vehicles (EVs), plug-in hybrid electric vehicles (PHEVs), and hybrid electric vehicles (HEVs) have the potential of reducing some of the environmental impacts and reducing oil-dependency of the U.S transportation sector. However, this potential...

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Eco-Fishing Port Assessment Model as an Environmental Management Tool on Coastal Fishing Port 'Pondokdadap' - Indonesia

Achmad Wicaksono, Bagyo Yanuwiadi, Agus Dwiyanto

To manage fishery resources in Indonesia with the principle of sustainability, it is necessary to apply the eco-fishing port concept. This study aims to develop a model for assessment of eco-fishing port with prevailing conditions and regulations in Indonesia. From the model that prepare, the application...

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Traffic Impact Assessment due to Green Campus Concept Implementation

Andrean Maulana, Oka Purwati

Green campus is a concept for the implementation of sustainable policies within the scope of campus. One of them is for transportation aspect. One example of green campus guidance is UI Greenmetric, The policy on transportation in the guidelines is parking area reduction for private vehicles. The micro...

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Study Of The Implementation Of Regulations In The Framework For Sustainable Transportation

Juanita Kombaitan, Iwan Kusumantoro, Heru Putro

Here discussed aspects of existing regulation in Indonesia related to the implementation of

Here discussed aspects of existing regulation in Indonesia related to the implementation of traditional modes. The main aim of the research is to show the importance of regulatory aspects and the regulatory framework for the implementation of traditional transportation as a form of protection. Approach...

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Traffic Accident Cost Analysis Using Willingness-to-pay Method in Surabaya

Ahmad Utanaka, Hera Widyastuti

There are some methods to determine accident cost, one of which is the willingness-to-pay method. Willingness-to-pay method use in this research because this method more recommended by developed countries than gross output method which is still used in developing countries, especially Indonesia. Road...

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A case study on economic cost increment in urban highway work zones

Sasika Ranawaka, Handunneththi Pasindu

Highway work zones are present in most urban and rural road networks due to road rehabilitation, maintenance, utility installation works that are carried out on roadways. The impacts related to highway work-zone include traffic delays, vehicle operating cost increase, increase in road accidents, accessibility...

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The Relationship of Passenger Characteristics to Electrical Train Modes Selection in Jakarta

Adhi Muhtadi, Indrasurya Mochtar, Hera Widyastuti

Electric Railway (KRL) is the backbone of public transportation in Jakarta. But KRL share capital is still 4.1%. Therefore this paper seeks to reveal what characteristics play a role for travellers to use KRL regularly or temporarily. The study was conducted in October 2017 at several Jakarta KRL stations....

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Aircraft and High Speed Train Using the Logit Model A Case Study of The Jakarta-Surabaya Route

Asep Nurhidayat, Djoko Utomo, Rizqon Fajar, Sucipto, Hera Widyastuti

This research was conducted to analyze the model of transportation mode selection between aircraft and high speed train of Jakarta-Surabaya route as an empirical case study, assuming the construction of high speed train infrastructure has been completed and ready to operate connecting Jakarta-Surabaya....

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Analysis of Ability to Pay and Willingness to Pay of Aircraft passengers toward Jakarta Surabaya High-Speed Train

Prasetyaning Lestari, Djoko Utomo, Asep Nurhidayat

The number of aircraft passengers who travel from Jakarta to Surabaya based on data from PT. Angkasa Pura II is increasing rapidly every year within 2012-2017. This amount is much greater when compared with the number of executive train passengers that also increased in the same period of the years....

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Application of high performance PMBs in Asia Pacific Airport Projects

Yandi Nurkama, Lu Jia, Vincent Guwe, Jeyan Vasudevan, Dennis Quek

Asia's rapid growth in the commercial aviation sector in recent decades has positioned the region as the largest and fastest-growing one in the world. However, aviation infrastructure in this region is struggling to keep pace with this growth, with many airports operating above their planned capacity,...

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The Influence of GDP Value and Overloading on Flexible Pavement

The Influence of CBR Value and Overloading on Flexible Pavement Mechanistic Response

Anissa Tajudin, Ni Luh Setyarini, Devy Darmawati

Flexible pavement distresses are often caused by overloading with the combination of other factors, such as subgrade strength. Therefore, this study was conducted to investigate and analyze the effect of subgrade strength on flexible pavement mechanistic response with normal traffic loading and overloading...

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Lu Chu, Tien Fwa

Traffic noise is a major form of environmental noise pollution today in most densely populated urban areas. The noise generated from motor engines, transmission and exhaust systems of modern vehicles has been very much reduced due to various advancements in design technologies of modern automobile industry....

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Development of Environmental Friendly Rubberized Asphalt

Moe Lwin, Lee Kelvin, Ho Yong, Wang Xuechun

Greenhouse gas emission from the construction of asphalt pavement affect the environment during the production and laying of hot mix asphalt which are carried out at high temperatures. Asphalt mixes be produced and compacted at about 20oC to 40oC lower than the corresponding hot mix asphalt mixes. The...

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Surface Distress Index Updates to Improve Crack Damage Evaluation

Bagus Setiadji, Supriyono, Djoko Purwanto

Road pavement is one of infrastructures that is currently getting most attention due to its important role in accelerating the economic growth rate of an area, opening up isolated regions and improving the connectivity among them. A road infrastructure has a life-cycle

which starts from design to reconstruction....

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Evaluation of Flood Water Damage on Asphalt Concrete Using Elastic Modulus Ratio

Arief Setiawan, Latif Suparma, Agus Mulyono

Urban floods are a frequent disaster in Indonesia and cause road damage with the relatively high cost of repairs every year. Durability test of water damage of asphalt mixture on mild temperatures, such as indirect tensile test did not show the weakness of asphalt mixture. Therefore, this study aims...

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Mitigating Overloading Vehicle Effects in Relation to the Liddle Power Equations for Designing Road Pavement Lifespan

Ari Sandhyavitri, Arief Aditya, Muhamad Yusa

This paper objective is to mitigate to what extent the Liddle empirical formula (which the initial power equation of 4th order) may suit in designing road pavement lifespan for overloading vehicle roads. A case study was conducted in the Meredan highway, Siak, Riau, Indonesia. It was identified that...

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Digital sieving of pervious concrete air voids using X-ray computed tomography

Ajay Jagadeesh, Ghim Ong, Yu-Min Su

The design and quality assessment of the pervious concrete mixtures based on its structural and functional performance are greatly influenced by the microstructural properties of the internal pore structure. The main objective of this study is to investigate the internal pore structure properties of...

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Development of a Highway Performance Index for Upgrading Decision Making – Case Study for a Provincial Road Network in a Developing Country

H. Pasindu, Lalith Sirisumana, D. Jayaratne

Provincial level and Local roads comprise nearly 50% of the road network in mileage in Sri Lanka. They play a pivotal role in providing access to the local communities especially in rural areas and an essential component of the economic development of those areas. These roads are under the purview of...

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Bridge Structure from Bamboo Reinforced Concrete Frame

Muhtar, Sri MurniDewi, Wisnumurti, As'ad Munawir

The use of bamboo to replace the steel reinforcement starts from the fact that bamboo has high tensile strength as high as steel. As a renewable material bamboo has much benefit for green construction material. Bridge frame structure is one of structure that can use the bamboo reinforced concrete. The...

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Impact Analysis of Oversize Cylinder Liner on Piston Ring and Surging for Main Engine

Agus Tjahjono, Vega Andromeda, Afdolludin Tazani

Cylindrical liner is the place of burning to generate power or effort inside the Mother Machine. The size of the oversized diameter will affect the incomplete combustion. The purpose of this study was to determine the causes of broken piston rings and surging, the impact of oversized liners and strategies...

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Traffic Impact Assessment due to Green Campus Concept Implementation

Andrean Maulana, and Oka Purwati

***Abstract*— Green campus is a concept for the implementation of sustainable policies within the scope of campus. One of them is for transportation aspect. One example of green campus guidance is UI Greenmetric, The policy on transportation in the guidelines is parking area reduction for private vehicles. The micro simulation model was developed to conduct traffic impact analysis after the implementation of the policy. Scope of traffic impact are travelling speed in road section and walking times in pedestrian crossing, name Safety School Zone (SSZ) Area. The model results show that the application of green campus concept does not improve the transportation performance around the campus**

***Index Terms*—** UI Greenmetric, **.micro simulation model, travelling speed, walking speed.**

I. Introduction

A. Background Study

A developing city will have an increase in activity movement by its citizens, and often cause problems. World Commission for Environment and Development (1987) explains that transportation is a problem that often occurs in developing cities, because this aspect is closely related to economic and other activities conducted by the community on a regular basis.

Choi (2017) explains that the university is a small scale of a developing city. Often the university becomes an experiment for testing the effectiveness of policies on sustainable issues, so that it can be applied on a larger scale later. In addition, students as one university community will become experts, policy-makers or other professions after graduation, so it becomes important to familiarize life sustainably. Sisriany (2017) explains that the concept of green campus is a concept to make the campus community to live sustainability and friendly to the surrounding environment.

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O. Purwati is with the Department of Civil Engineering, Institut Teknologi Nasional Bandung, 40192, Bandung, West Java, Indonesia.

Examples of transportation problems within the university's scope are the number of vehicles driving down or raising the passengers, the need for parking spaces that are unable to service the demand, the university community using private vehicles or the number of road buffers in any place. UI Greenmetric (2016) is a tool to measure the level of sustainability in universities from various categories, one of which is transportation. Transport categories are divided into sub-sections, which can be seen in Table 1.

There are eight sub-sections, which aim to reduce the use of private vehicles within the campus, so that the concept of sustainable transportation can be applied. One of the sub categories to be studied is the impact of green campus policy in the form of parking area reduction for private vehicles on transportation performance around ITENAS.

TABLE I
TRANSPORTATION CATEGORIES IN UI GREEN METRIC

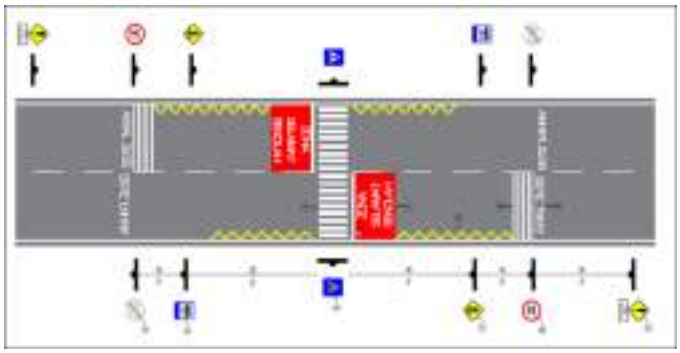
Code	Categories and Indicator
TR1	The ratio of vehicles (cars and motorcycles) towards campus population
TR2	The ratio of campus bus services towards campus population
TR3	The ratio of bicycles found towards campus population
TR4	Parking area type
TR5	Initiatives to decrease private vehicles on campus
TR6	Parking area reduction for private vehicles within 3 years
TR7	Campus bus services
TR8	Bicycle and pedestrian policy on campus

B. Scope and Study Area

This study aims to identify the impacts that occur due to parking area reduction for private vehicles around the university, in this case is the campus of National Institute of Technology Bandung (ITENAS). ITENAS is in Hajj Hasan Penghulu Mustopa (PHH Mustafa) Street. From the function of land use, it is including into the education area. There is an elementary school across from ITENAS and some high schools alongside ITENAS. In addition, there are eating places, stationery and student residence across from ITENAS. This certainly has an impact on the high intensity of road crossing, which has been facilitated by the government with the School Safety Zone (SSZ) Area.

Fig 1 Map of ITENAS

According to the Department of Transportation (2009), SSZ Area is an innovative program in the form of time-based velocity zones that can be used to regulate vehicle speed in the school area. The use of traffic engineering such as traffic signs and road markings and speed restrictions aimed at increasing the driver's attention to decreasing speed limits in the school safe zone and providing a sense of security to students who will cross the street. The SSZ illustration can be seen in Fig 2



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PHH Mustafa Street is the primary arterial road with type 4/2 UD as delivered in Fig 3. The result of traffic volume calculation obtained by vehicle volume equal to 2,737 veh /hour and 2.819 veh/hour each for direction of movement toward Surapati and direction of movement toward PHH Mustafa with proportion of vehicle delivered on Fig 4.

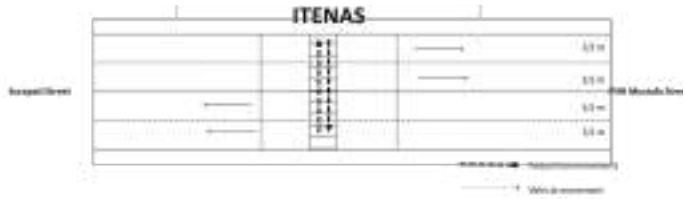

Fig 3 Road Geometric Condition

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Based on sample standard deviations, that is explained in Quiroga (1998), with permitted error of 5 km / hour, sample standard deviations (s) is 3 and confidence level 95%, 60 sample each vehicle and pedestrian.

Spot speed survey at the location indicates that the average spot speed of motorcycles, light vehicles and vehicles is 36 km/h, 30 km/h and 23 km / h, respectively. Next Fig 5 displays the percentage of vehicles that move at a speed above a certain speed value. For example, 44.9% of motorcycles travel at speeds of more than 37 km/h, while for light vehicles and heavy vehicles, 34.5% move at speeds of more than 32 and 24 km / h.

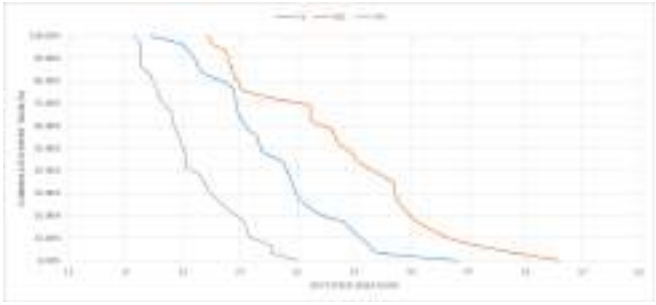

Fig 5 Percentage Cumulative Spot Speed for each Vehicle

The pedestrian counting survey of the crossers show that during the rush hour there are 295 people crossing from Itenas campus to SDN Sukasenang whereas as many as 458 people crossing from the opposite direction. In addition, the average speed of the pedestrian is 1.1 4,8 km/hour.

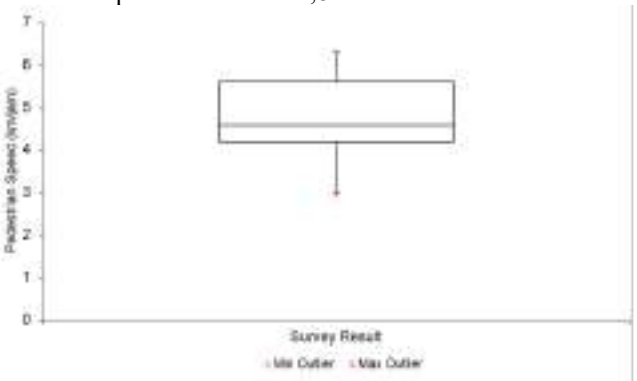

Fig 6 Box Plot in Pedestrian Speed Survey

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III. Analysis and Discussion

ODOT (2011) explained that the development of micro-simulation model with VISSIM software can be network and control coding, dynamic vehicle routing, speed control coding and defining driving behavior model. Network coding is the step of making the link in accordance with the scope of the study area, giving the signal time (if there is a signal

intersection) and setting the priority rule on the intersection of the intersection. Geometric data obtained from the survey is used in the network coding stage. Dynamic vehicle routing is the stages of setting the origin and destination routes in accordance with the data of origin of destination. There are five zoning of origin of destination made in this study, as can be seen in Figure 7.

Fig 7 Road Network and Zone

Speed control coding is the speed setting of each vehicle in accordance with the data obtained at spot speed survey results. Zhang (2016) also entered the desired speed data input using the cumulative frequency spot speed. ODOT (2011) also explains about driving behaviour model consisting of car following and lane changing. Qiao (2012) makes it clear that the two parts of behaviour model have 192 parameters that can be modified in the VISSIM software. Qiao (2012) recommends the 14 most important parameters, and is a representation of car-following model, lane changing model and lane properties. Irawan (2015) also recommends 7 parameters performed calibration. Based on the recommendations of Qiao (2012) and Irawan (2015), the following are the parameters that can be seen in Table 2.

TABLE II
PARAMETERS THAT IMPORTANT TO CONSIDER IN ANALYSIS

No	Parameters	Data Range
1	Average Standstill Distance (m)	0,8
2	Additive Part of Desired Safety Distance	0,09
3	Multiplicative Part of Desired Safety Distance	0,02
4	Desired position at free flow	Any
5	Overtake on same lane: on left & on right	on
6	Distance standing (at 0 km/h) (m)	0,01
7	Distance driving (at 50 km/h) (m)	0,01

ODOT (2011) explains the next stage is calibration that is the process used to attain adequate parameter or validity of the model by establishing appropriate parameter values so the model replicates the local traffic conditions as closely as possible. There two step in calibration process. First, comparing observed and modelled traffic volume. The best universal to compare is GEH formula. For hourly, GEH formula is:

$$GEH = \sqrt{\frac{(M-O)^2}{0.5\ X\ (M+O)}}$$

with .
M : simulated flow
O : observed flow

There are six spot that considered in to be compared. Average GEH value is 1,9, which means model acceptable fit (GEH < 5,0) and at list 85% links within the calibration area and also with five times iteration. Further output can be seen at Table 3. Illustration of traffic condition can be seen at Fig.8.

TABLE III
GEH VALUE

No	Movement Type	Spot	Value		GEH
			Observed	Modelled	
1	Vehicle Movement	To PHH Mustafa Street	2819	2508	6.0
2		To Surapati Street	2737	2783	0.9
3		Exit Access Road ITENAS	35	39	0.7
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5	Pedestrian Crossing	Crossing from exit ITENAS	295	264	1.9
6		Crossing from entry ITENAS	458	450	0.4
		Average			1.9


Fig 8 Illustration of Existing Traffic Condition

IV. ANALYSIS OF GREEN CONCEPT IMPLEMENTATION

The developed scenario comes from the reduction parking area policy for private vehicles within 3 years. UI Greenmetric (2016). In the explanation, there are three stages to reduce private vehicle, which is 10% reduction of parking area, followed by 30% parking area and there should be no parking inside the campus, hereinafter named as shown in Table 4.

TABLE IV
SCENARIO DEVELOPMENT

No	Scenario Name
1	Do Nothing (DN) : Existing Condition
2	Do Something (DS 1): Less than 10% decrease
3	Do Something (DS 2): Between 10% - 30% decrease
4	Do Something (DS 3): Parking is not permitted in campus

Performance to be measured are average speed, signalised intersection and walking speed, with the location can be seen at Figure 9 and 10. Traveling speed is measured along 227 m, for an average of all vehicles and both directions, which pass through two road side friction namely the ITENAS Entry-Entry Access Road and SSZ Area. Walking speed is measured along the 14 m, when it begins to cross to completion. Table 5 and Table 6 show the performance results for each development scenario.

Fig 9 Travel Speed Measurement

Fig 9 Signalised Intersection near ITENAS

TABLE V
TRAVELLING SPEED FOR EACH SCENARIO

No. Iteration	Travelling Speed (km/hour)				Walking Speed (km/hour)			
	DN	DS1	DS 2	DS 3	DN	DS1	DS 2	DS 3
1	7.54	7.54	7.70	7.55	0.54	0.54	0.54	0.54
2	7.52	7.52	7.59	7.37	0.52	0.52	0.52	0.52
3	7.38	7.68	7.35	7.42	0.54	0.54	0.54	0.54
4	7.31	7.37	7.59	7.41	0.53	0.53	0.53	0.53
5	7.19	7.29	7.18	7.19	0.53	0.53	0.53	0.53
Average	7.38	7.48	7.47	7.38	0.53	0.53	0.53	0.53

TABLE VI
SIGNALISED INTERSECTION PERFORMANCE FOR EACH SCENARIO

No. Iteration	Average Queue Length (m)				Average Delay (s)			
	DN	DS1	DS 2	DS 3	DN	DS1	DS 2	DS 3
1	164.52	162.35	164.30	161.64	100.35	94.53	118.85	98.51
2	164.31	164.34	163.15	163.53	100.97	99.9	115.79	102.37
3	164.97	163.12	164.77	161.54	102.57	100.46	118.95	99.94
4	165.41	163.75	163.47	162.10	102.61	99.4 6	116.64	101.90
5	164.46	164.73	166.08	163.23	104.25	101.69	125.74	103.86
Average	164.74	163.66	164.36	162.41	102.15	99.23	119.32	101.32

The results show that between DN and DS conditions, there is no difference in performance, both for traveling speed and walking speed. The average traveling speed ranges from 7.19-7.54 km / h. For signalised intersection performance, DN condition have higher queue length and delay toward DS condition, with percentage difference 1.2%.

This is an indication that the category under which green campus is based on UI Greenmetric (2016) is not related to the improvement of transportation performance around the campus. It is necessary to develop categories in other parameters for the assessment of green campus aspects, so that it can have direct benefits, especially on the aspects of transportation.

V. CONCLUSIONS

Transportation problems that occur in developing cities often occur as the impact of increased community activity. The university, as a small part of the city, is often a test site for testing the effectiveness of policies on sustainable issues, so that it can be applied on a larger scale later.

The policy review to address the ongoing problems on campus is set out in the Green Campus concept, for example UI Greenmetric (2016). One of the sub categories in the Greenmetric UI is parking area reduction for private vehicles, which will further examine their impact on transport performance around ITENAS. Transport performance is limited to road performance in front of ITENAS, PHH Mustafa Street and pedestrian performance in SSZ Area, with indicator of traveling speed and walking speed.

Microscopic traffic modelling with VISSIM is done to find out the two performance. The developed scenarios come from parking policy. The results show that there is no difference in performance, both for traveling speed at PHH Mustafa Street and walking speed SSZ Area.

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Traffic Impact Assessment due to Green Campus Concept Implementation

By Andrean Maulana

WORD COUNT 2203
TIME SUBMITTED 08-MAR-2021 11:11AM
PAPER ID 69708157

Traffic Impact Assessment due to Green Campus Concept Implementation

Andrean Maulana[1,*], *Oka* Purwati[1]

Abstract. Green campus is a concept for the implementation of sustainable policies within the scope of campus. One of them is for transportation aspect. One example of green campus guidance is UI Greenmetric, The policy on transportation in the guidelines is parking area reduction for private vehicles. The micro simulation model was developed to conduct traffic impact analysis after the implementation of the policy. Scope of traffic impact are travelling speed in road section and walking times in pedestrian crossing, name Safety School Zone (SSZ) Area. The model results show that the application of green campus concept does not improve the transportation performance around the campus..
Keywords: **UI Greenmetric,** .micro simulation model, travelling speed, walking speed

1 INTRODUCTION

1.1 Study Background

A developing city will have an increase in activity movement by its citizens, and often cause problems. World Commission for Environment and Development (1987) explains that transportation is a problem that often occurs in developing cities, because this aspect is closely related to economic and other activities conducted by the community on a regular basis.

Choi (2017) explains that the university is a small scale of a developing city. Often the university becomes an experiment for testing the effectiveness of policies on sustainable issues, so that it can be applied on a larger scale later. In addition, students as one university community will become experts, policy-makers or other professions after graduation, so it becomes important to familiarize life sustainably. Sisriany (2017) explains that the concept of green campus is a concept to make the campus community to live sustainability and friendly to the surrounding environment.

Examples of transportation problems within the university's scope are the number of vehicles driving down or raising the passengers, the need for parking spaces that are unable to service the demand, the university community using private vehicles or the number of road buffers in any place. UI Greenmetric (2016) is a tool to measure the level of

sustainability in universities from various categories, one of which is transportation. Transport categories are divided into sub-sections, which can be seen in Table 1.

Table 1. Transportation Categories in UI Green Metric.

Code	Categories and Indicator
TR1	The ratio of vehicles (cars and motorcycles) towards campus population
TR2	The ratio of campus bus services towards campus population
TR3	The ratio of bicycles found towards campus population
TR4	Parking area type
TR5	Initiatives to decrease private vehicles on campus
TR6	Parking area reduction for private vehicles within 3 years
TR7	Campus bus services
TR8	Bicycle and pedestrian policy on campus

There are eight sub-sections, which aim to reduce the use of private vehicles within the campus, so that the concept of sustainable transportation can be applied. One of the sub categories to be studied is the impact of green campus policy in the form of parking area reduction for private vehicles on transportation performance around ITENAS.

1.2 Scope and Study Area

This study aims to identify the impacts that occur due to parking area reduction for private vehicles around the university, in this case is the campus of National Institute of Technology Bandung (ITENAS). ITENAS is in Hajj Hasan Penghulu Mustopa (PHH Mustafa) Street. From the function of land use, it is including into the education area. There is an elementary school across from ITENAS and some high schools alongside ITENAS. In addition, there are eating places, stationery and student residence across from ITENAS. This certainly has an impact on the high intensity of road crossing, which has been facilitated by the government with the School Safety Zone (SSZ) Area.

Fig 1 Map of ITENAS

According to the Department of Transportation (2009), SSZ Area is an innovative program in the form of time-based velocity zones that can be used to regulate vehicle speed in the school area. The use of traffic engineering such as traffic signs and road markings and speed restrictions aimed at increasing the driver's attention to decreasing speed limits in the

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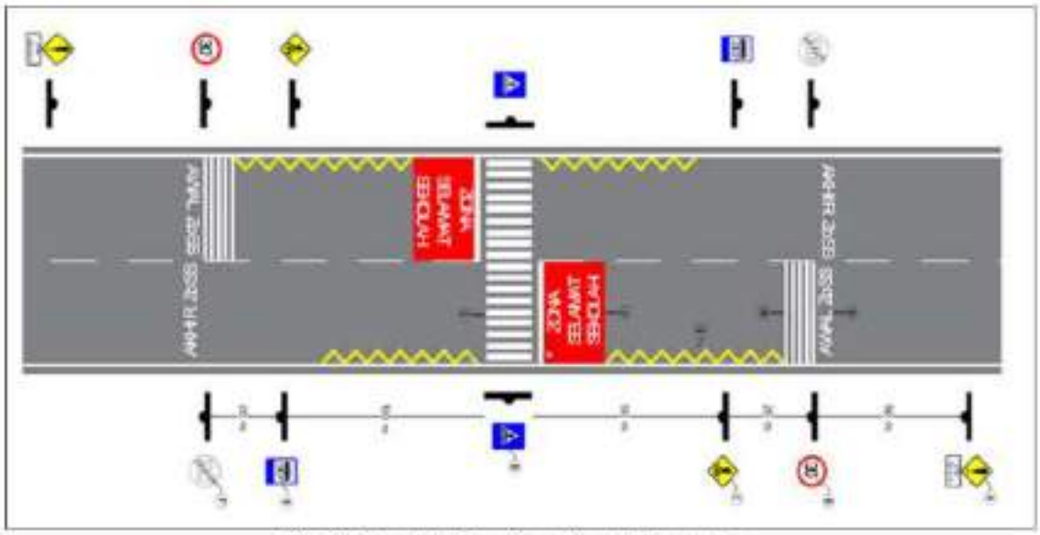
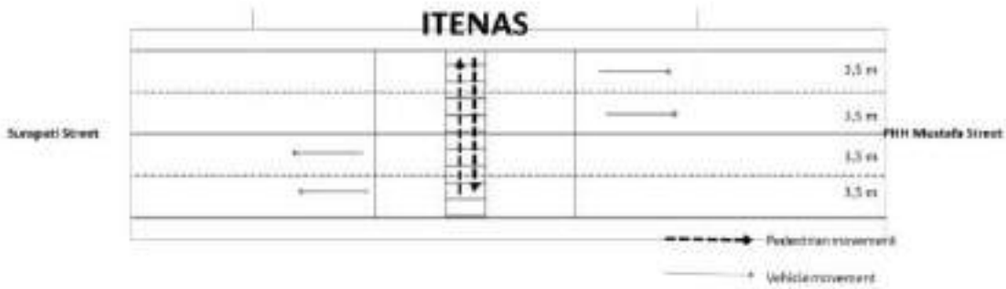


Fig 2 School Safety Zone Area Illustration

Based on the location of the study, the scope of transportation problems is Penghulu Haji Hasan Mustafa (PHH Mustafa) Street and crossing in SSZ Area. Microscopic traffic modelling is used for indicators of both scopes. Cvitanic (2012) uses speed to as an indicator of road performance. Marisamynathan (2013) explains that pedestrian behaviour can be described as walking speed (km/h). Both indicators will be used in this study as road and crossing performance.

2 DATA COLLECTION

PHH Mustafa Street is the primary arterial road with type 4/2 UD as delivered in Fig 3. The result of traffic volume calculation obtained by vehicle volume equal to 2,737 veh /hour and 2.819 veh/hour each for direction of movement toward Surapati and direction of movement toward PHH Mustafa with proportion of vehicle delivered on Fig 4.



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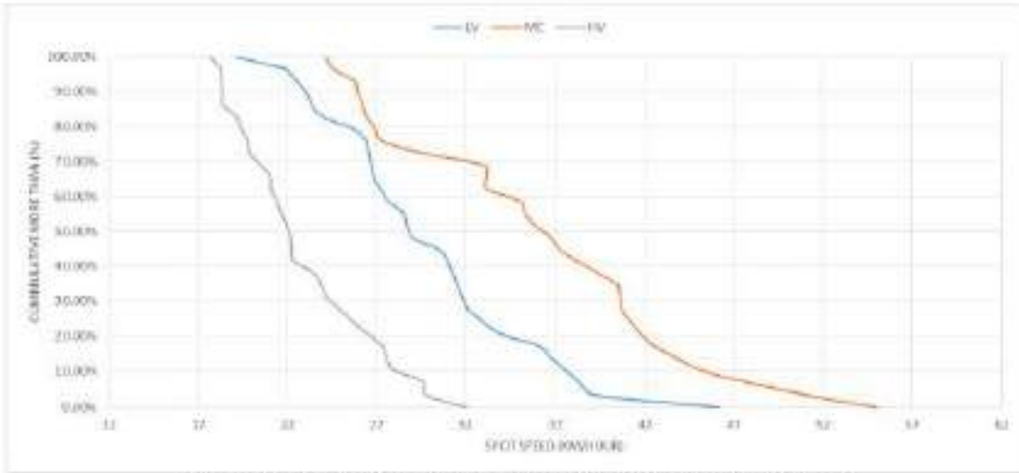
Spot speed survey at the location indicates that the average spot speed of motorcycles, light vehicles and vehicles is 36 km/h, 30 km/h and 23 km / h, respectively. Next Fig 5 displays the percentage of vehicles that move at a speed above a certain speed value. For example, 44.9% of motorcycles travel at speeds of more than 37 km/h, while for light vehicles and heavy vehicles, 34.5% move at speeds of more than 32 and 24 km / h.



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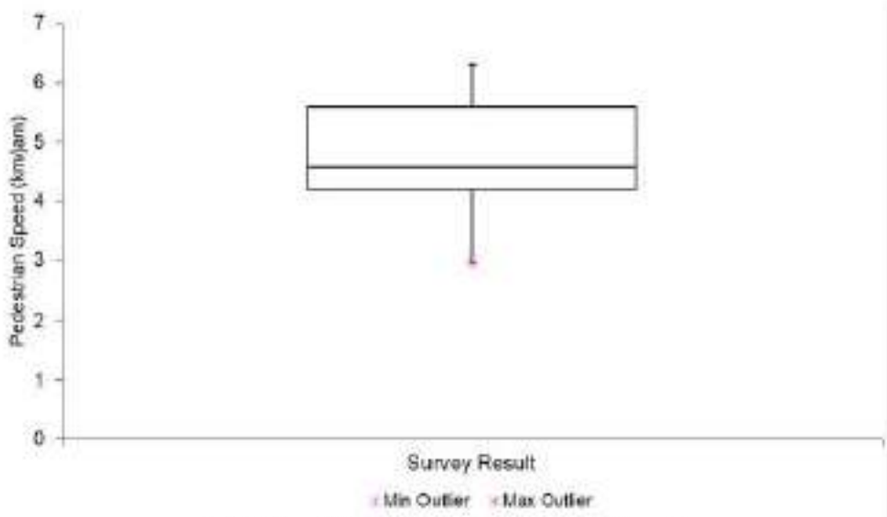
The pedestrian counting survey of the crossers show that during the rush hour there are 295 people crossing from Itenas campus to SDN Sukasenang whereas as many as 458 people crossing from the opposite direction. In addition, the average speed of the pedestrian is 1.1 4.8 km/hour.



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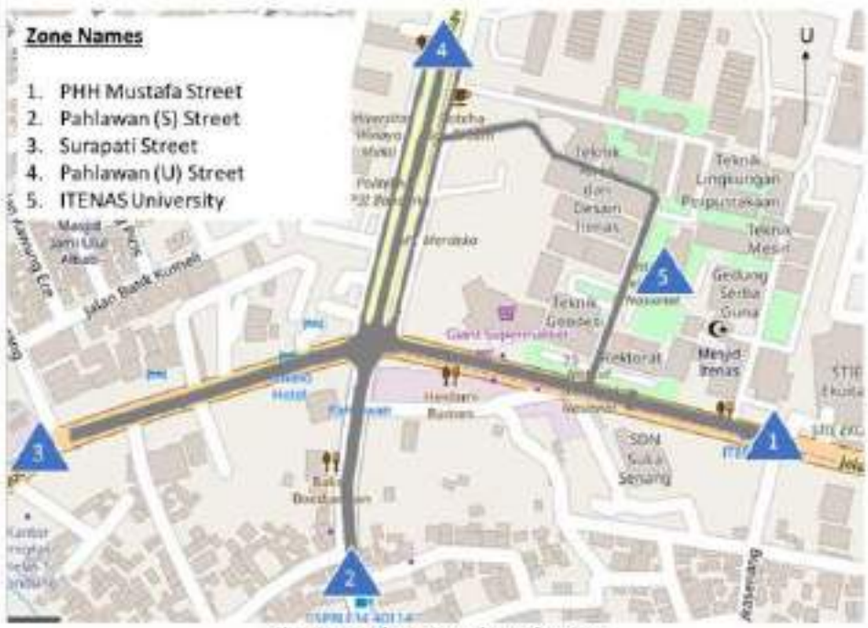

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No	Parameters	Data Range
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- M : simulated flow
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No	Movement Type	Spot	Value		GEH
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The developed scenario comes from the reduction parking area policy for private vehicles within 3 years. UI Greenmetric (2016). In the explanation, there are three stages to reduce private vehicle, which is 10% reduction of parking area, followed by 30% parking area and there should be no parking inside the campus, hereinafter named as shown in Table 4.

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Fig 9 Travel Speed Measurement

Fig 9 Signalised Intersection near ITENAS

Table 5. Travelling Speed for Each Scenario

No. Iteration	Travelling Speed (km/hour)				Walking Speed (km/hour)			
	DN	DS1	DS 2	DS 3	DN	DS1	DS 2	DS 3
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3	7.38	7.68	7.35	7.42	0.54	0.54	0.54	0.54
4	7.31	7.37	7.59	7.41	0.53	0.53	0.53	0.53
5	7.19	7.29	7.18	7.19	0.53	0.53	0.53	0.53
Average	7.38	7.48	7.47	7.38	0.53	0.53	0.53	0.53

Table 6. Signalised Intersection Performance for Each Scenario

No. Iteration	Average Queue Length (m)				Average Delay (s)			
	DN	DS1	DS 2	DS 3	DN	DS1	DS 2	DS 3
1	164.52	162.35	164.30	161.64	100.35	94.53	118.85	98.51
2	164.31	164.34	163.15	163.53	100.97	99.99	115.79	102.37
3	164.97	163.12	164.77	161.54	102.57	100.46	118.95	99.94
4	165.41	163.75	163.47	162.10	102.61	99.46	116.64	101.90
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Average	164.74	163.66	164.36	162.41	102.15	99.23	119.19	101.32

The results show that between DN and DS conditions, there is no difference in performance, both for traveling speed and walking speed. The average traveling speed ranges from 7.19-7.54 km / h. For signalised intersection performance, DN condition have higher queue length and delay toward DS condition, with percentage difference 1.2%.

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Traffic Impact Assessment due to Green Campus Concept Implementation

ORIGINALITY REPORT

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SIMILARITY INDEX

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