EACEF 2011

The 3rd International Conference of European Asian Civil Engineering Forum

Yogyakarta, INDONESIA, 20 - 22 September 2011

Organized by:

UNIVERSITAS ATMA JAYA YOGYAKARTA

Universitat Stuttgart Germany

UNIKASSEL VERSITÄT

UPH UNIVERSITAS PELITA HARAPAN

Certificate

Is presented to:

Ade Lisantono

for participating in the Third International Conference of European Asian Civil Engineering Forum (EACEF) as the

Presenter

Yogyakarta, 20 September 2011

Organizing Committee
European Asian Civil Engineering Forum (EACEF)

EACEF 2011

Dr. Ir. AM. Ade Lisantono, M.Eng.
Dean - Faculty of Engineering
Universitas Atma Jaya Yogyakarta

Anastasia Yunika, S.T., M.Eng.
Chairwoman

Main Menu

- Home
- About Us
- Founders
- Partner Universities
- Partner Institution
- Honorary Members
- Past Conference
  - Conference 2017 Seoul, KOREA
  - Conference 2015 Surabaya, INDONESIA
  - Conference 2013 SINGAPORE
  - Conference 2011 Yogyakarta, INDONESIA
  - Conference 2009 Lankawi Island, MALAYSIA
  - Conference 2007 Jakarta, INDONESIA
- Publication
  - 6th EACEF 2017 Seoul - Korea
  - 5th EACEF 2015 Surabaya
  - 4th EACEF 2013 SINGAPORE
  - 3RD eacef 2011 Yogyakarta
  - 2nd EACEF 2009 Langkawi Island
  - 1st EACEF 2007 Jakarta

EACEF 2019

- NEWS

EACEF 2017

- Gallery
- News EACEF 2017

EACEF 2015

- NEWS
- BROCHURE
- GERMAN DAAD ALUMNI EVENT

THE 3rd INTERNATIONAL CONFERENCE OF EUROPEAN ASIAN CIVIL ENGINEERING FORUM (EACEF) 2011, GERMAN ALUMNI NIGHT, and Half Day Seminar of German Professors

Theme: Designing and Constructing in Sustainability

Organized by:

Universität Stuttgart Germany | UPH Universitas Pelita Harapan | Universitas Atma Jaya Yogyakarta | Universität Kassel

Supported by:

DAAD Deutscher Akademischer Austausch Dienst German Academic Exchange Service

Yogyakarta, 20 - 22 September 2011

Introduction:

This report is consisted of three activities, joint cooperation between Universitas Atma Jaya Yogyakarta (UAJY), Universitas Pe Harapan (UPH), University of Stuttgart, University of Kassel, supported by DAAD through Grant for Alumni Events.

The committee has been also supported by The Ministry of Public Works of Republic of Indonesia and The Embassy of Fed Republic of Germany.

1. THE 3rd INTERNATIONAL CONFERENCE OF EACEF 2011

In September 2010, Prof. Dr.-Ing. Harianto Hardjasaputra set up the International Scientific committee, chaired by Prof. Dr.- Michael Schmidt (University of Kassel).

INTERNATIONAL SCIENTIFIC COMMITTEE

Chairman: Prof. Dr.-Ing. Michael Schmidt (University of Kassel, Germany)

Structural and Construction Engineering

Prof. Dr.-Ing. Dr.-Ing. E.H. Werner Sobek (University of Stuttgart, Germany)
Prof. Dr.-Ing. Harianto Hardjasaputra (Universitas Pelita Harapan, Indonesia)
Prof. Yoyong Arfiadi, Ph.D. (Universitas Atma Jaya Yogyakarta, Indonesia)
Prof. Ir. Dr. Mahmood Md. Tahir, B.Sc. (Universiti Teknologi Malaysia, Malaysia)
Prof. Dr.-Ing. Johannes Tarigan (Universitas Sumatera Utara, Indonesia)
Prof. Dr.-Ing. Karl-Heinz Reineck (University of Stuttgart, Germany)
Prof. Ir. Iswandi Imran, Ph.D (Institut Teknologi Bandung, Indonesia)
Prof. Kuo-Chun Chang (National Taiwan University, Taiwan)
Prof. Andy Chit Tan, Ph.D. (Queensland University of Technology, Australia)

Construction Management and Project Management

EACEF 2013

- Gallery

EACEF 2011

- Gallery

EACEF 2009

- Gallery

EACEF 2007

- Gallery

Prof. Weng Tat Chan (National University of Singapore, Singapore)
Prof. Dr.-Ing. Michael Korn (University of Karlsruhe, Germany)
Prof. Khrisna Mochtar, Ph.D. (Institut Teknologi Indonesia, Indonesia)
Prof. Dr.-Ing. Hans Wilhelm Alfen (Bauhaus-University of Weimar, Germany)
Prof. I-Tung Yang Ph.D (National Taiwan University of Science and Technology)

Infrastructure (environmental, coastal, transportation, water) Engineering
Prof. Nur Yuwono, Ph.D. (Universitas Gadjah Mada, Indonesia)
Prof. Dr.-Ing. Jürgen Hothan (Leibniz-University of Hannover, Germany)
Prof. Tawatchai Tingsanchali (Asian Institute of Technology, Thailand)
Prof. Shunji Kusayanagi (Kochi University of Technology, Japan)

Geotechnical Engineering
Prof. Ir. Masyhur Irsyam, PhD (Institut Teknologi Bandung, Indonesia)
Prof. Chang-Yu Ou, Ph.D (National Taiwan University of Science and Technology, Taiwan)
Prof. Jianye Ching, Ph.D (National Taiwan University, Taiwan)
Prof. Horn-Da Lin, Ph.D (National Taiwan University of Science and Technology, Taiwan)

Building Materials Engineering and Nanotechnology
Prof. Dr.-Ing. Michael Schmidt (University of Kassel, Germany)
Prof. Yin-Wen Chan, Ph.D (National Taiwan University, Taiwan)
Prof. Dr. Ir. Irwan Katili (Universitas Indonesia, Indonesia)
Prof. Hilmi Bin Mahmud, Ph.D (Universiti Malaya, Malaysia)
Prof. Dr.-Ing. Ludger Lohaus (Leibniz University of Hannover, Germany)

The member of ISC comes from the international universities in Europe, Asia, and Indonesia. They were assigned based on their expertise each to review the submitted abstracts & papers.

The civil engineering department of Universitas Atma Jaya Yogyakarta was the host of this conference. They set up the organizing committee, chaired by Ms. Ir. Anastasia Yunika M.Eng. The lecturers from both universities were involved in this committee.

Organizing Committee (OC):

STEERING COMMITTEE	:	Dean of Faculty of Engineering of UAJY
		Dean of Faculty of Design and Planning of UPH
		Director of Executive of EACEF
		Prof. Dr.-Ing. Harianto Hardjasaputra (Alumni)
ORGANIZING COMMITTEE		
Chairwoman	:	**Anastasia Yunika, S.T., M.Eng.** (anasyunika@yahoo.com)
Treasurer	:	Sumiyati Gunawan, S.T., M.T.
Vice Chairman 1	:	Cilcia Kusumastuti, S.T., M.Eng.
Sponsorship & Promotion/ Exhitibition	:	Ir. Hendra Suryadharma, M.T.
		Ir. Y. Lulie, M.T.
		Joey Tirtawijaya S.T., M.T.
Registration	:	Cilcia Kusumastuti, S.T., M.Eng.
		Maya Nainggolan
Proceeding & Paper	:	Ferianto Raharjo, S.T., M.T.
		Siswadi, S.T., M.T.
		Dr. Ir. Wiryanto Dewobroto, M.T.
		Merry Natalia, ST, M.Eng
Publication	:	Lukas Widya
		Agung Pradjaka
Venue and equipment	:	Ir. Wiryawan Sarjono, M.T.
		Januar Sudjati, S.T., M.T.
Vice Chairman 2	:	Ir. Junaedi Utomo, M.Eng.
Plenary & Technical Session	:	Ir. Junaedi Utomo, M.Eng.
		Dr.-Ing. Jack Widjajakusuma
Program/ Master of Ceremony	:	Prof. Dr. Manlian Ronald A. Simanjuntak, S.T., M.T., D.Min.

Logistic/consumption/	:	Eva Lianasari, S.T., M.T.
banner/conference Kit		Etik Rukmini
		Supiyati
Transportation	:	Ir. Arief Sudibyo
		Sribowo
Accomodation of speakers	:	Anastasia Yunika, S.T., M.Eng.
		Vincent, ST
Documentation	:	Wiko Retnanto
Technical visit & Farewell Dinner	:	Ir. Harijanto Setiawan, M.Eng.
		Ir. Eko Setyanto, MCM
Website Administrator	:	Hendy Wijaya, S.Kom

Program Schedule of Conference

Conference preparation

In December 2009 the OC announced the coming conference through flyer and website for **call for papers.**

We launch the conference website www.eacef.com, equipped with on line registration, to ease the authors in registration and submission their scientific paper.

The participants were welcomed to contribute the paper on the conference with following key dates:

1. Submission of a brief one-page abstract : 28 February 2011
2. Acceptance of the abstract : 31 January – 28 February 2011
3. Submission of the complete manuscripts : 1 July 2011
4. Review of the manuscripts : 15 June 2011 - 30 June 2011
5. Final submission of the Complete manuscripts : 1 July 2011

Conference date and venue:

Date : 20 – 22 September 2011

Venue :

September 20 ,2011

- Grand Quality Hotel, Yogyakarta

September 21 ,2011

- St. Thomas Aquinas Auditorium, Universitas Atma Jaya Yogyakarta

September 22 ,2011

- Technical Visit – Borobudur Temple & Prambanan Temple

The main theme of the conference is:

Designing and Constructing in Sustainability

The Scientific Committee has accepted 131 scientific papers from 20 countries. 91 papers were presented in 4 Plenary Sessions and 8 parallel technical sessions. They were divided into five groups, as such:

1. Structural and Construction Engineering
2. Construction Management and Project Management
3. Infrastructure (environmental, coastal, transportation, water) Engineering
4. Geotechnical Engineering
5. Building Materials Engineering (Nanotechnology)

Promotion

To promote the conference, the Organizing Committee has made one flyer and conference website: www.eacef.com

The Organizing Committee published the accepted scientific papers in the form of **Digital Proceeding** and **Printed Proceed** and also **Program Book/Abstract**.

Keynote Speakers

- Ir. Agus Widjanarko, MIP (German Alumni- University of Stuttgart), Secretary General of Public Works Ministry of Republic of Indonesia
- Dr. Norbert Baas, **His Excellency, the Ambassador of Republic Federal of Germany**

Invited Speakers

8 Invited Speakers from world class universities were invited to present their state of the art of research:

1. Dr.-Ing. Alexander Wetzel on behalf of Prof. Dr.-Ing. habil. Michael Schmidt (University of Kassel, GERMANY)
2. Dipl.-Ing. Linus Klein on behalf of Prof. Dr.-Ing. habil. Christian Moormann (University of Stuttgart, GERMANY)
3. Prof. Jong Sung Sim (University of Han Yang - KOREA)
4. Klaus Thorsten, M.Sc. on behalf of Prof. Dr.-Ing. habil. Werner Sobek (University of Stuttgart, GERMANY)
5. Dr. Keiji Ando (The Japan Iron and Steel Federation, JAPAN)
6. Prof. Shunji Kusayanagi (Kochi University of Technology, JAPAN)
7. Prof. Chan Weng Tat (National University of Singapore, SINGAPORE)

Conducting a two-day Conference

1st Day, September 20, 2011

Time: 8.00 – 17.00

Program: Plenary & Technical session

Welcoming and opening Speeches of the conference was delivered by:

1. Prof. Dr.-Ing. Harianto Hardjasaputra (UPH-Indonesia), Chairman of European Asian Civil Engineering Forum (EACEF)
2. Ms. Ir. Anastasia Yunika, M.Eng (UAJY-Indonesia), Chairwoman of Organizing Committee
3. Dr. Nils Wagenknecht, on behalf of Director of DAAD Jakarta Office
4. Dr. Rogatianus Maryatmo, Ph.D (Rector of UAJY-Indonesia)
5. Ir. Agus Widjanarko, MIP (German Alumni- University of Stuttgart), Secretary General of Public Works Ministry of Republic of Indonesia

Prof. Dr.-Ing. Harianto Hardjasaputra (Director of LPPM Universitas Pelita Harapan), Chairman of European Asian Civil Engineer Forum (EACEF)

Main Menu

- Home
- About Us
- Founders
- Partner Universities
- Partner Institution
- Honorary Members
- Past Conference
  - Conference 2017 Seoul, KOREA
  - Conference 2015 Surabaya, INDONESIA
  - Conference 2013 SINGAPORE
  - Conference 2011 Yogyakarta, INDONESIA
  - Conference 2009 Lankawi Island, MALAYSIA
  - Conference 2007 Jakarta, INDONESIA
- Publication
  - 6th EACEF 2017 Seoul - Korea
  - 5th EACEF 2015 Surabaya
  - 4th EACEF 2013 SINGAPORE
  - 3RD eacef 2011 Yogyakarta
  - 2nd EACEF 2009 Langkawi Island
  - 1st EACEF 2007 Jakarta

EACEF 2019

- NEWS

EACEF 2017

- Gallery
- News EACEF 2017

EACEF 2015

- NEWS
- BROCHURE
- GERMAN DAAD ALUMNI EVENT

EACEF

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Designing and Constructing in Sustainability

Keynote Speakers

- Ir. Agus Widjanarko, MIP (German Alumni- University of Stuttgart), Secretary General of Public Works Ministry the Republic of Indonesia
- Dr. Norbert Baas, His Excellency, the Ambassador of Republic Federal of Germany

Invited Speakers

The Development of Nanotechnology for Construction Materials

Prof. Dr.-Ing. habil. Michael Schmidt (University of Kassel)

Real-Time Rainfall and Flood Forecasting in Ta Tapao River Basin, Thailand

Prof. Tawatchai Tingsanchali, D.Eng. (Nakhon Pathom Rajabhat University)

Designing the Future

Klaus Thorsten, M.Sc. on behalf of Prof. Dr.-Ing. habil. Werner Sobek (University of Stuttgart, GERMANY)

New Structural Systems Employing Innovative Structural Materials

Keiji Ando (The Japan Iron and Steel Foundation, Japan)

Optimisation of Sustainable Geotechnical Structures in Urban Civil Engineering

EACEF 2013

- **Gallery**

EACEF 2011

- **Gallery**

EACEF 2009

- **Gallery**

EACEF 2007

- **Gallery**

Prof. Dr.-Ing. habil. Christian Moormann (University of Stuttgart)

The Development of Construction Safety Management Systems

Prof. Chan Weng Tat (National University of Singapore)

Construction Management Research and Education Activities Moving Up Asian Universities Collaboration

Prof. Shunji Kusayanagi (Kochi University of Technology, Thailand))

BM - Building Materials Engineering (Nanotechnology)

The Use of Local Materials in the Flexible Pavement Structure Towards the Sustainable Pavement Materials in Indonesia

Bambang S. Subagio

Multiphases Hydration of the Activated Binary Blend Portland Cement – Trass

Vera Indrawati Judarta

Utilisation of Soft Drink Can as Fibre Reinforcement in Concrete

A.S.M. Abdul Awal, Dianah Mazlan, and Md Latif Mansur

Another Looks: Application of Stick Scanner in RC Structures Assessment

Achfas Zacoeb, Yukihiro Ito, and Koji Ishibashi

The Comparison of Microscopic and Macroscopic Characteristics between Low Calcium Fly Ash Geopolymer Binder and High Calcium Fly Ash Geopolymer Binder Using Indonesian Fly Ash

Simatupang, P.H., Pane, I., Sunendar, B., and Imran, I.

Mechanical Properties of Concrete Using Rubber Tire Chips as Partial Coarse Aggregate Replacement

Ezahtul Shahreen A.W., Nor Ashikin M.K., and Roslina O.

Material Development of Nanosilica Based on Indonesia Silica Sand for Concrete Mix

Jonbi, Harianja, B., Imran, I., and Pane, I.

The Characteristic of Durability in High Performance Concrete

Chao-Lung Hwang, Chun-Tsun Chen, Fransiscus Mintar Ferry Sihotang, and Tuan Le Anh Bui

Self-Compacting Concrete in Its Durability Performance

Chao-Lung Hwang, Chun-Tsun Chen, Fransiscus Mintar Ferry Sihotang, and Tuan Le Anh Bui

The Utilization of Tailing Sand Ex Bangka Island for Rehabilitation Materials of Rigid Pavements

A. Setyawan, K.A. Sambowo, and Z. Senaring

Evaluation of Current Models for Estimating Long-Term Shrinkage of Lightweight Aggregate Concrete

S.A. Kristiawan

Multi Criteria Decision of Type and Building Material for Simple House Construction

Wahyu Wuryanti

Properties of Building Block Incorporating Waste Aggregates Bound With Alternative Binders

I Nyoman Arya Thanaya

Behavior of Baggage Ash – Cement Stabilized Soil with Fiber Inclusion

John T. Hatmoko and Yohanes Lulie

Analysis of the Use of Brackish Sand for Making Mortar in Mutun Beach, South Lampung Regency

Lilies Widojoko

The Effect of Carbon Black and Natural Rubber Latex on Rheological Characteristics of Bitumen

Ismail bin Yusof, Madi Hermadi, Saad, and Abdulqader Ali Joda

Strength and Sulphate Attack Resistance of Roller Compacted Concrete with Circulating Fluidized Bed Combustion Ash

Mao Chieh Chi and Run Huang

Reaction between Alkaline Metal Ions and ASR Reactive Aggregate and Behavior of Na+ and K+ in Cement Paste Replaced by

Wei-Chien Wang, Chih-Chien Liu, and Chau Lee

Mechanical Properties of Concrete Containing Recycled Steel Fibres (RSF)

Noralwani Modtrifi and Izni Syahrizal Ibrahim

Enhancement on Strength Properties of Steel Fibre Reinforced Concrete

Noor Nabilah Sarbini and Izni Syahrizal Ibrahim

The Compressive Strength of Baggase Ash-Based Geopolymer Concrete

Ade Lisantono and John Tri Hatmoko

Comparison of Infrastructure Designs for Quay Wall and Small Bridges in Concrete, Steel, Wood and Composites with Regard to the CO2-Emission and the Life Cycle Analysis

David Dudok van Heel, Trude MAAS, Jarit de Gijt, and Mozafar Said

Maturity Function to Predict Strength of Mortars Containing Ground Granulated Blast Furnace-Slag Cured at Different Curing Temperatures

Gidion Turuallo and M.N. Soutsos

Rutting and Fatigue Behavior of Nanoclay Modified Bitumen

Saeed Ghaffarpour Jahromi

The Effect of Cold Lava Aggrate as a Filler Material of Concrete

Ika Bali and Oskar Sitorus

Experimental Study to the Load-Displacement Response of The Interfacial Transition Zone in Concrete

Han Ay Lie and Parang Sabdono

The Influence of Compaction Methods on the Properties of Hollow Concrete BricksUtilizing Fly Ash and Bottom Ash

Djwantoro Hardjito and Antoni

The Use of Spent Catalyst RCC-15 as Powder on Environmental-Friendly High-Performance Self-Compacting Concrete

Bernardinus Herbudiman and Ayu Setyaning Pijar Kemala

Influence of Curing Method on High Strength Self Compacting Concrete

Bernardinus Herbudiman and Ruli Adi Prasetia

Flexural Performance of High Strength Concrete Containing Steel Fibres

Sholihin As'ad and Andreas Saxer

Shear-Friction Strength of Recycled Aggregate Concrete

Khaldoun Rahal, Abdul Lateef Al-Khaleefi

A Fundamental Study on the Diagnosis Method of Existing RC Structures Using the Characteristics of Hammering Sound

Yuki Fukui and Yoshimi Sonoda

The Recent Development of Ultra High Performance Concrete (UHPC) in Indonesia

Harianto Hardjasaputra, Joey Tirtawijaya, and Giovano Tandaju

CM - Construction Management and Project Management

The Productivity Analyzes of Bored Pile Foundation in the Main Bridge Area

Sentosa Limanto, Jonathan HK, Stephen H.S, and Hendri W

Best Practice for Safer Construction from Designers' Perspective

Abdul Rahim Abdul Hamid, Bachan Singh and Tan Kin Liang

Best Practice for Safer Construction from Contractors' Perspective

Abdul Rahim Bin Abdul Hamid,Bachan Singh and Mazni Binti Mat Zin

Optimal Bid Price in a Competitive Bidding under Risk Aversion

Andreas Wibowo

Project Financing and Risk Management in Transportation Projects: A Public Private Partnerships Framework

I Putu Mandiartha Colin F. Duffield, and Gigih U Atmo

Fault Tree Analysis of Work Accident Cause Factors in Mud Volcano Sidoarjo Disaster Management

Cahyono Bintang Nurcahyo Farida Rahmawati,and Diar Farobi

Productivity Problems Encounted by Indonesian Construction Foremen

Peter F. Kaming

Relationship Between Implementation of Safety Policy and Craftsmen's Productivity

Peter F. Kaming and Martino Ardianto

Risks Analysis in Public Private Partnership (Case Study: Traditional Market Development Projects in Surabaya)

Farida Rahmawati and Carla Widha Permatasari

The Implementation Effect of Aspects Relating to the Issues of Occupational Safety and Health Against Productivity in Constructi

Anton Soekiman and Syamsuduha

Cost of Quay Walls

J.G.de Gijt

Knowledge Management and Corporate Performance in Construction

Mochamad Agung Wibowo and Rudi Waluyo

Exploring Contractors' View on Green Construction

Jati Utomo Dwi Hatmoko, Ferry Hermawan, And Tia Putriani Styianingsih

Preliminary Study on Pre-Project Planning Activities of Public Infrastructure Projects

Febrina P.Y. Sumanti and M. Agung Wibowo

The Analysis of Building Reliability in Karawaci

Manlian Ronald A. Simanjuntak and Mukhodas Syuhada

GT - Geotechnical Engineering

Effective Reuse of Fly Ash as Fill Materials for Embankment Construction

MuhardiAminaton Marto, Khairul Anuar Kassim,and Wan Suhairi Yaacob

Peak Base Acceleration of Semarang City with Three Dimensional Seismic Source Model

Abdul Rochim

Dimension Effects of Upstream Filter of Rockfill Dam Against Hydraulic Fracturing

D. Djarwadi, K.B. Suryolelono, B. Suhendro, and H.C. Hardiyatmo

Improvement of the Load Carrying Capacity of UTHM Soft Clay Soil by Electro Osmotic Consolidation

Khairul Nizar Mohd Yusof and Abdul Kaharudin Arsyad

Analysis of Basal Heave Stability for Excavations in Soft Clay Using the Finite Element Method

Aswin Lim, And Chang- Yu Ou

Squeezing Potential Evaluation of Tunnel in Tropical Area

Vahed Ghiasi, Husaini Omar, Bujang Kim Huat, Zainuddin b. Md. Yusoff, Sina Kazemian, Mehrdad Safaei, Samad Ghiasi, Zainab Bakhshipour, and Ratnasamy Muniandy,Habibeh Valizadeh

Predicting Erosion Rate During the Hole Erosion Test as Affected by Clay Concentration and Wall Roughness

Kissi Benaissa, Khamlichi Abdellatif, Bezzazi Mohamed, and Miguel Angle Parron Vera,Rubio Cintas Maria Dolores

Validating the Juang Method in Order to Assess Liquefaction Potential of Soils in the Northern Moroccan Region of Tangier

Touil Noufal, Bezzazi Mohammed, Khamlichi Abdellatif, and Jabbouri Abdellah

Overview on Remotely Sensed Earthquake Precursors

Habibeh Valizadeh Alvan and Farid Haydari Azad

Influence of Construction Stages on Surface Settlement in NATM Tunnelling

H. Sohaei, M. Hajihassani, A. Marto, And M Karimi Shahrbabaki

IS - Infrastructure (environmental, coastal, transportation, water) Engineering

Exploring the Passenger Loyalty: An Integrated Framework for Service Quality, Satisfaction and Loyalty for Informal Public Transportation

Taslim Bahar, Ofyar Z Tamin,and Russ Bona Frazila

Financial Innovation for Toll Road Infrastructure Development

Lukas B. Sihombing, Ismeth S. Abidin, and Yusuf Latief

The Influence of Land Use in Transportation Planning

J. Dwijoko AnsusantoAhmad Munawar, Sigit Priyanto, and Bambang Hari Wibisono

Modeling Freight Transportation for Crude Palm Oil (CPO) in Central Kalimantan

Noor Mahmudah, Danang Parikesit, Siti Malkhamah, Sigit Priyanto, and Mark Zuidgeest

History, Conservation, and Development of Rail Transport in Indonesia

R. Didin Kusdian

Transportation Performance Indicator Survey on Transportation Agencies at Nanggroe Aceh Darussalam Province

Medis Sejahtera Surbakti, and Prof Yuwaidi Away

The Comparison of V/C and Travel Time Reliability Factor Affecting Daily RouteChoice Behavior at Medan City

Medis Sejahtera Surbakti

Considerations of Composite Signalised Intersection Control System

Ben-Edigbe J. and Mashros N.

Travel Expenditure of Urban Transportation in Yogyakarta

Imam Basuki, Siti Malkhamah, Ahmad Munawar, and Danang Parikesit

Land Value and Transportation Provision Modeling (Case Study: Yogyakarta City)

Muiz Thohir and Ofyar Z. Tamin

Binder Type Selection for Foamed Cold Mix Asphalt

Sri Sunarjono

Trend of Rainfall Pattern and Extreme Rainfall in Jakarta

Cilcia Kusumastuti and Sutat Weesakul

Formulating Model to Separate Liquid Terminal Operation

Anwarudin and Ofyar Z. Tamin

Informal Settlement Mapping and Urban Riverside Poverty Analysis Case: Kahayan Urban Riverside Area

Noor Hamidah

Probabilistic Roughness Progression as a Measure of Road Network Pavement Maintenance Effectiveness

I Putu Mandiartha, Colin F. Duffield, Russell G. Thompson

Properties of Porous Asphalt Mixed Subjected to Laboratory Ageing

Che Norazman Che Wan, Meor Othman Hamzah, Ramadhansyah Putra Jaya, Mohdzuan Ahmad

Simulation of Shore Protection Structures Layout

Slamet Hargono

Using Geographic Information System for Flood Reduction in Bekasi City, Indonesia

Trihono Kadri

High Rate Water Treatment Plant System: Successful Implementation and Financial Prospect

Mohajit

Potential Application of Biomembrane System for Wastewater Reuse in Urban Housing Area

Elis Hastuti and Haryo Budi

Modeling Groundwater Flow and Salinity Intrusion by Advective Transport in the Regional Unconfined Aquifer of Southwest Bangladesh

Sajal Kumar Adhikary, Ashim Das Gupta, and Mukand S. Babel

Indonesian Water Capacity Building Programme

J.Q.J.C. Verberk. R. Garsadi, S. Notodarmojo, and A. Maenhout

Performance Analysis of Hydrology and Water Management for Flood Control System (A Case Study of Solo)

A. Padma Lakstaningty

SC - Structural and Construction Engineering

Partial Capacity Design, an Alternative to the Capacity Design Method

Benjamin Lumantarna and Ima Muljati

Finite Element Modeling for Reinforcing Steel Subjected to Reversed Cyclic Loading with Moderate Compressive Stress and Stra Demands

Data Iranata

The Effect of Structural Modelling on the Analysis of P-Delta Effect Case Study: Second-Order Analysis by a Commercial Compu Program, SAP2000

Wiryanto Dewobroto

Seismic Reinforcement Against Shear Failure by “Post-Installed Rebar” on Walls of Existing Underground Structures

Kensuke Yamamura and Osamu Kiyomiya

Lateral Torsional Buckling of Web Tappered I Beam

Paulus Karta Wijaya

Numerical Analysis of Circular Concrete Columns Confined with FRP Sheets Under Concentric Axial Load

Nico Nirwanto Laban and Andreas Triwiyono

Shear Strengthening Effect of RC Beams Retrofitted by Steel Reinforcement and PCM Shotcrete

A. Arwin Amiruddin

Analysis on the Contribution of Cross Beam to a Torsional Buckling of Thin, Rectangular Beam Section

Sri Tudjono, Windu Partono, and Joko Purnomo

Seismic Performance of Steel Special Moment Resisting Frame Using Reduced Beam Section

Ima Muljati and Hasan Santoso

Bonding Capacity of Self Compacting Concrete Containing Fly Ash and MIRHA

Agus Kurniawan, Nasir Shafiq,

Steel Fiber Concrete Slab Application as Replacement of Ordinary Roof Tiles

Agus Kurniawan

Analysis of Structural Healthiness Using Hilbert Transform

Jack Widjajakusuma

Seismic Performance of Structure with Vertical Set-Back Designed Using Partial Capacity Design

Pamuda Pudjisuryadi Benjamin Lumantarna, S. Teddy, And H. Wijoyo

Analysis of Factors Influencing Elevation of Balanced Cantilever Structure for Precast Segmental Box Girder Bridge Constructior

Gambiro and Heru Purnomo

The Analysis of Slab Beam in Tall Buildings with Earthquake Load

Ernie Shinta Yosephine Sitanggang and Johannes Tarig an

A Proposal of Tensile Test of Pultruded GFRP Plate

Jongsung Sim, Hyunjoong Kim, and Kihong Lee

Performance Based Design Review of 16-Story Twin Tower with Connecting Bridge-Way

Amelia Kusuma and Naveed Anwar

Lesson and Learning from 5 Big Earthquakes in Sumatra 2004 - 2010

Johannes Tarigan

The Flexural Strength And Rigidity Of Composite Plywood-Meranti Stress Skin Panel

Johannes Adhijoso Tjondro, Dina Rubiana Widarda, Leonardus Eka Dharma

Parametric Study of Modified Continuous Bang-Bang Controller

Yoyong Arfiadi

Reconstruction of Distributed Force Characteristics in Case of Non Punctual Objects Impacting Elastic Beams

A. Elbakari, F. El Khannoussi, A. Khamlichi, R. Dkiouak, A. Hajraoui, M. Bezzazi, A. Limam, E. Jacquelin

Bolts Connections in Steel Bridge Structure Theory and Facts

Lanny Hidayat and Demson Sihaloho

Composite Columns in Low-to-Medium-Rise SCBFS with Braces in the Two-Story X-Configuration

Junaedi Utomo

Empirical Modeling of Storm Processes

B.M. Nguyen, J. A. Roelvink, and P. H. A. J. M. van Gelder

A Fundamental Consideration of Defect Evaluation of Concrete Structures Using Infrared Thermography

Tatsuro Watanabe and Yoshimi Sonoda

Dynamic Behaviour of Footbridges Subjected to Human-Induced Dynamic Loads; A Case Study of Footbridges in Surabaya

Endah Wahyuni, asdamnu, Ananta S.Sidharta and Dicky Ardhian Prasetya

Mechanical Behavior of GFRP Rock Bolt for Permanent Support of Tunnel

Jongsung Sim and Hyunjoong Kim

The Development of Green Structural Concrete In Indonesia

Hadi Rusjanto Tanuwidjaja

A Discussion on Durability of High Strength Concrete (HSC) in View Point of Micro Pore Structure

Rita Irmawaty, Hidenori Hamada, Yasutaka Sagawa and Sho Yamatoki

The Aerodynamic Derivatives of Suramadu Cable Stayed Bridge

Sukamta

Shear Capacity of the Composite Styrofoam Filled Reinforced Concrete Beams

Rudy Djamaluddin

The Flexural Strength of African Wood Flange–Plywood Web I-Joist

Johannes Adhijoso Tjondro and Michael Pio

Ductility Performance of Precast Concrete Beam Confined by Nylon Mesh

Rr. M.I. Retno Susilorini, Kusno Adi Sambhowo and Budi Waluyo

Bond and Strength Properties of Recycled Aggregate Concrete with Replacement Ratio of Recycled Aggregate

J. Sim, C. Park, Y. Kim, H.G. Lee and M. Shahid

Flexural Buckling Resistance of Laminated Glass Columns

M. Feldmann and K. Langosch

Use Technique of Solidifying Fly Ash to Make Aggregate for Pervious Concrete

Le Hoang Thanh Nam and Nguyen Van Chanh

Sustainable Development of Construction Works in Bangladesh

Mohammed, T. U., Hasnat, A., Sarwar, N., Das, H. K., Miah, J. M., and Awal, M. A.

Ductility of Timber Beams Strengthened Using Glass Fiber Reinforced Polymer Bars

A. Yusof

THE COMPRESSIVE STRENGTH OF BAGGASE ASH-BASED GEOPOLYMER CONCRETE

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Ade Lisantono[1*], and John Tri Hatmoko[2]

[1]*Department of Civil Engineering, Atma Jaya Yogyakarta University, Yogyakarta, Indonesia*
[2]*Department of Civil Engineering, Atma Jaya Yogyakarta University, Yogyakarta, Indonesia*
**e-mail of corresponding author: adelisantono@mail.uajy.ac.id*

ABSTRACT

To reduce the effect of carbon dioxide, geopolymer concrete was extensively developed. The development of geopolymer concrete, generally used material synthesized from the materials of geological origin or by product material such as fly ash which rich of silicon and aluminium. Baggase ash is one of the waste of sugar mill now has been developed to be a potentially material and used as pozzolan for concrete. The baggase ash contains high silicon and aluminium after burning in a certain temperature. This paper present results of experimental program on the density and compressive strength of baggase ash-based geopolymer concrete. The specimens in this research using cylinder with the size of (70 mm x 140 mm). The curing after casting the cylinder uses room temperature. The results show that the density of baggase ash-based geopolymer concrete is lower than ordinary portland cement concrete, and the compressive strength is very low. Therefore, it needs to be developed for the future research to get higher compressive strength of geopolymer concrete.

Keywords: Baggase ash, geopolymer concrete, density, compressive strength.

1. INTRODUCTION

In this decades, concrete becomes a famous material for building construction. There are several reasons to use concrete as a material for building, such as (1) easily to make because the material for making concrete are not so difficult to find; (2) easily to form in the mould as we desire to make it; (3) the cost of maintenance is very low as long as the procedure in making concrete is in the proper way. Generally, conventional concrete composes of ordinary portland cement as a primary binder, water, fine aggregates, and coarse aggregates. Sometimes were added with other material such as fiber, fly ash, silica fume in order to get a specific properties of the concrete.

Currently, conventional concrete has been discussed by researchers who care in environmental issues. This issue is related to carbon dioxide as a side effect in the producing of ordinary portland cement. According to Roy (1999), in producing 1 ton ordinary portland cement will produce 1 ton carbon dioxide that releases to the air and gives contribution to global warming. Geopolymer concrete becoming as a green concrete to reduce global warming, because geopolymer concrete does not use ordinary portland cement for binder, but uses natural material such as fly ash and rice hush ash as a binder. Davidovits (1994) stated that natural materials for replacing ordinary portland cement in geopolymer concrete must contain high of silica and alumina. These elements will react with alkaline liquid to make polymerisation process in geopolymer concrete. Hardjito and Rangan (2005) had developed geopolymer concrete by using low calcium fly ash (fly ash type F which contains 80 to 85 % of silica and alumina).

Baggase ash is one of the waste of sugar industry. As the waste of sugar industry, the baggase ash is useless material and just put in the area around the sugar industry and made pollution. In the present, the baggase ash has been developed to be a potentially material and used as pozzolan for concrete. Wibowo and Hatmoko (2001) carried out research to make high strength concrete using baggase ash for partial replacing of ordinary portland cement. This research stated that replacing 10 % and 20 % of ordinary portland cement can increase compressive strength 16.16 % up to 23.01 %. In this research also found that the optimum burning of baggase ash is 500^0 Celsius during 25 minutes. In this research, the compressive strength of concrete using baggase ash for partial replacing of ordinary portland cement can reach up to 39.7 MPa.

When this research began, the published literature regarding to the use of baggase ash in geopolymer concrete was not available. So, this research try to make baggase ash-based geopolymer concrete and this research is preliminary research for the basis of the future research to develope baggase ash-based geopolymer concrete.

2. METHODOLOGY

2.1. Materials

Fine aggregates were taken from Krasak River, Muntilan which located in the North of Yogyakarta Province. The properties and gradation of fine aggregates can be seen in Table 1 and Table 2, respectively.

Table 1. Properties of fine aggregates

Properties	According to ASTM	Result
Bulk specific grafity	C. 127 - 79	2.6645
Bilk specific grafity SSD (saturated surface dry basic)	C. 127 - 79	2.7412
Apparent specific grafity	C. 127 - 79	2.8860
Absorbtion (%)	C. 127 - 79	2.8807
Unit weight SSD : a. rodded b. shoveled	C. 29 – 78T	1.5653 1.3275

Table 2. Gradation of fine aggregates

Sieve size	Percentage retained in the sieve	Total percentage retained in the sieve	Total percentage passing the sieve	According to ASTM C.33-82
50	-	-	-	-
37.5	-	-	-	-
25	-	-	-	-
19	-	-	-	-
12.5	-	-	-	-
9.5	-	-	100	100
4.75	1.64	1.64	98.36	95 - 100
2.36	5.46	5.46	94.54	80 - 100
1.18	17.46	22.92	77.08	50 - 85
0.6	34.64	57.56	42.44	25 - 60
0.3	23.18	80.74	19.26	10 - 30
0.15	12.18	92.92	7.08	2 - 10
0	5.44	-	-	-
Total	100	261.24	-	-
Fineness modulus of fine aggregates = 2.6124				

It can be seen that the gradation of fine aggregates comply with the grading requirement for fine aggregates in accordance with ASTM C.33-82.

Coarse aggregates were taken from Clereng, Kulon Progo which is located in the West part of Yogyakarta Province. The properties and gradation of coarse aggregates can be seen in Table 3 and Table 4.

Table 3. Properties of coarse aggregates

Properties	According to ASTM	Result
Bulk specific grafity	C. 127 - 81	2,5304
Bilk specific grafity SSD (saturated surface dry basic)	C. 127 - 81	2,7996
Apparent specific grafity	C. 127 - 81	2,7233
Absorbtion (%)	C. 127 - 81	2,8000
Unit weight SSD : a. rodded b. shoveled	C. 29 – 78T	1,5653 1,3669

Table 4. Gradation of coarse aggregates

Sieve size	Percentage retained in the sieve	Total percentage retained in the sieve	Total percentage passing the sieve	According to ASTM C.33-82
37.5	-	-	-	-
25	0	0	100	100
19	3,72	3,72	96,28	90 - 100
12.5	20,07	23,79	76,21	-
9.5	49,34	73,13	26,87	20 - 55
4.75	22,56	95,69	4,31	0 - 10
2.36	2,05	97,74	2,26	0 - 5
1.18	1,81	99,55	0,45	-
0.6	0	-	-	-
0.3	0	-	-	-
0.15	0	-	-	-
0	0.45	-	-	-
Total	100	-	-	-

Table 5 shows that the gradation of coarse aggregates comply with the grading requirement for fine aggregates in accordance with ASTM C.33-82.

Material of baggase ash was taken from Madukismo Sugar Mill which is located in the South part of Yogyakarta Province. Baggase ash is waste of sugar mill, and had been used to burn molasses in sugar mill. Wibowo and Hatmoko (2001) stated that these baggase ash has very low silica and needs to be burned to increase the contain of silica. Deposit of baggase ash in the area around sugar mill can be seen in the Figure 1.

Figure 1. Deposit of baggase ash.

According to Wibowo and Hatmoko (2001) that the optimum burning temperature is 500^0 Celsius during 25 minutes, where the contain of SiO2 + Al_2O_3 + Fe_2O_3 can reach 85.21 % (the chemical composition see Table 5).

Table 5. Chemical composition of baggase ash burning in temperature of 5000 Celsius during 25 minutes. (Wibowo and Hatmoko, 2001)

Chemical element	Content (%)
SiO2	64.110
Al_2O_3	15.110
Fe_2O_3	5.990
SiO2 + Al_2O_3 + Fe_2O_3	85.210
Lost of ignition	0.440
CaO	5.810
MgO	2.260
SO_3	0.000
K_2O	3.620
Na_2O	2.660
H_2O	0.050

In this research the baggase ash was also burned at temperature of 500^0 Celsius during 25 minutes. After the burning process, the baggase ash must be sieved passing through No. 200 sieve (75 μm). The baggase ash after burning and passing through No. 200 sieve can be seen in the Figure 2.

Figure 2. The baggase ash

2.2. Mix Design of Geopolymer Concrete.

According to Vijai et al. (2010) in the design of geopolymer concrete mix that the coarse and fine aggregates were taken as 77 % of entire mixture by mass, and the fine aggregate was taken as 30 % of total aggregates. Vijai et all also stated that from the past literature the average density of fly ash-based geopolymer concrete is similar to that of Ordinary Portland Cement concrete. In this research, it was also assumed that the density of baggase ash-based geopolymer concrete is similar to the density of Ordinary Portland Cement concrete. By knowing the density of concrete, the combined mass of alkaline liquid and baggase ash can be arrived. Assuming the ratios of alkaline liquid to baggase ash as 0.4, mass of baggase ash and mass of alkaline liquid were found out. To obtain mass of sodium hydroxide and sodium silicate solutions, the ratio of sodium silicate solution to sodium hydroxide solution was fixed as 2.5. Concentration of NaOH solution was taken as 8M. The mix proportion of baggase ash-based geopolymer concrete can be seen in the Table 6.

Table 6. Details of proportion baggase ash-based geopolymer concrete

Alkaline Liquid to Baggase Ash Ratio	Baggase Ash (gr)	Fine Aggregate (gr)	Coarse Aggregate (gr)	NaOH (gr)	Na_2SiO_3 (gr)	Water (gr)	Total Solids (gr)	Water to Solid Ratio
0.4	1875	2636.4	6151.6	214.3	535.7	787.5	2625	0.3

2.3. Preparation of Specimen.

To make sodium hydroxide solution of 8 molarity (8M), take 320 grams of sodium hydroxide flakes was dissolved in one litre of water. After sodium hydroxide was dissolved with water, then keep it at least one day before mix with sodium silicate solution. The sodium hydroxide solution is mixed with sodium silicate solution one day before mixing the concrete to get the alkaline solution. To make baggase ash-based geopolymer concrete in this research follow the procedure in the research done by Vijai et al. (2010). First the baggase ash and the aggregates were dry mixed in the pan mixer for about three minutes. Second, after dry mixing, alkaline solution was added to the dry mix and wet mixing was done for 4 minutes. After that casting the cylinder specimens. In this research, cylinder with diameter of 70 mm and height of 140 mm was used to make specimen of cylinder. After casting the specimens, the cylinders specimens were kept for five days before demoulding. After demoulding, the specimens were kept for curing at room temperature.

3. RESULTS AND DISCUSSION

3.1. Density of Geopolymer Concrete

Density of baggase ash-based geopolymer concrete can be seen in Table 7.

Table 7. Density of baggase ash-based geopolymer concrete

Type of Curing	Density (kg/m^3)			
	14 Days	Average	28 Days	Average
Room Temperature	1940.64	1984.11	1988.01	2001.13
	1999.44		1992.73	
	2012.24		2022.64	

Table 7 shown that the density of baggase ash-based geopolymer concrete in the range of 1940.64 kg/m^3 and 2022.64 kg/m^3. The average density of 14 days and 28 days are 1984.11 kg/m^3 and 2001.13 kg/m^3, respectively. It was found that the density of baggase ash-based geopolymer concrete is lower that the density of Ordinary Portland Cement concrete. So, for future research it is better to make the mix design of baggase ash-based geopolymer concrete by using the density result of this research.

3.2. Compressive Strength

The compressive strength at 14 and 28 days is presented in Table 8.

Table 8. Compressive strength of geopolymer concrete at 14 and 28 days.

Specimen	Compressive Strength (N/mm^2)			
	14 days	Average	28 days	Average
1	0.336	0.325	0.366	0.344
2	0.425		0.329	
3	0.213		0.336	

Table 8 shows that the average compressive strength of baggase ash-based at 14 days and 28 days are 0.325 N/mm^2 and 0.344 N/mm^2, respectively. It can be seen that the compressive strength of 28 days is only about 1.06 times of 14 days compressive strength. Because of the cylinders in this research used size of (70 mm x 140 mm), so according to Troxell and Davis (1956), the results must be converse by the factor 0.86. Hence, the average compressive strength of 14 days and 28 days are 0.2795 N/mm^2 and 0.2958 N/mm^2, respectively.

4. CONCLUSION

Base on the result of experimental program, it can be drawn that the density of baggase ash-based geopolymer concrete is little bit lower than density of Ordinary Portland Cement concrete. The average density of baggase ash-based geopolymer concrete at 28 days is 2001.13 kg/m^3. The compressive strength of room temperature cured of baggase ash-based geopolymer concrete has not increased after 14 days, The average compressive strength of baggase ash-based geopolymer concrete at 28 days is only 0.2958 MPa. Therefore, it needs to be developed for the next research to get higher the compressive strength than this results.

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