



ICSTD Bali 2012

Developing Sustainable Technology for a Better Future



PROCEEDINGS

2nd International Conference on
Sustainable Technology Development
(ICSTD)

*“Developing Sustainable Technology
for A Better Future”*

Bali, October 31st 2012



UDAYANA UNIVERSITY PRESS
2012

PROCEEDINGS

2nd International Conference on
Sustainable Technology Development

*“Developing Sustainable Technology
for A Better Future”*

Bali, October 31st, 2012

Editors:

Putu Alit Suthanaya, PhD
I Nyoman Satya Kumara, PhD
Ngakan Putu Gede Suardana, PhD
Yenni Ciawi, PhD
Dewi Jayanti, PhD

Published by

Udayana University Press

Kampus Universitas Udayana, Denpasar

ISBN: 978-602-7776-00-0

PROCEEDINGS

2nd International Conference on
Sustainable Technology Development

*“Developing Sustainable Technology
for A Better Future”*

Bali, October 31st, 2012

Scientific Committee:

Prof. I Wayan Redana (Udayana University, Indonesia)
Prof. Sayiqh (President of World Renewable Energy)
Prof. Dai Kue Choi (Chonbuk National University, South Korea)
Prof. Budhima Indraratna (University of Wollongong, Australia)
Prof. Jae Kyoo Lim (Chonbuk National University, South Korea)
Prof. Hu Ruihua (Huanghe University of Science and Technology, China)
Prof. Montasser Dewidar (South Valley University, Egypt)
Prof. Alexander Cuthbert (University of New South Wales, Australia)
Prof. Tjok Gd. Tirta Nindhia (Udayana University, Indonesia)
Prof. I Made Alit Karyawan S. (Udayana University, Indonesia)
Prof. I.A. Giriantari (Udayana University, Indonesia)
Dr. Vu Cong Hoa (Ho Chi Minh City University of Technology, Vietnam)
Dr. G.A.M. Suartika (Udayana University, Indonesia)
Dr. W.Gede Ariastina (Udayana University, Indonesia)
Dr. D.M. Priyantha W. (Udayana University, Indonesia)
Dr. I.K.G. Dharma Putra (Udayana University, Indonesia)

Published by:

Udayana University Press
Kampus Universitas Udayana Denpasar

ISBN: 978-602-7776-06-7



PREFACE

FOREWORD HEAD OF ORGANIZING COMMITTEE

This proceedings compiles all papers presented in the 2nd International Conference on Sustainable Technology Development (ICSTD) held at the Udayana University, Bali on 31st October 2012.

Three plenary presentations were delivered by keynote and invited speakers with international reputations from Japan, Germany, Singapore and Indonesia and a total of 78 papers (oral presentation) compiled in this proceedings, which were presented in the conference from thirteen countries (Indonesia, Japan, Australia, India, Korea, Malaysia, Iran, Egypt, Libya, China, Thailand, Sri Lanka and Bangladesh).

We thank those who involve in the organizing committee for their hardworking. While it was a huge task, it was a privilege for us in editing this proceedings and work together with the referees who reviewed papers.

We hope that the papers contained in this proceeding will prove useful in developing further study.

Editors



FOREWORDS-HEAD OF ORGANIZING COMMITTEE

I would like to sincerely thank to all of the authors who contribute their papers in this proceedings. I would therefore give my high appreciation on all of those effort and dedication.

The conference was held by Faculty of Engineering, Udayana University, in relation to the 50th Udayana University Anniversary and in collaboration with International Institute of Management, Energy and Environmental Management, University of Flensburg, Germany. This conference was aimed to gather scientists, academics, engineers and industries in engineering related areas to discuss and share their expertise and ideas in the field of Sustainable Technology Development. The conference theme "**Developing Sustainable Technology for a Better Future**" has appealed participants presenting their studies on four major fields of **Architecture, Civil Engineering, Mechanical Engineering and Electrical Engineering**. This 2nd ICSTD also focused on development of technology to achieve sustainable city. The conference was financially supported by Engineering Faculty of Udayana University and several sponsors.

I hope this International Conference has created an international networking and collaboration and open up new ideas in maintaining world prosperity in all aspects in sustainable development.

I will use this opportunity to invite you again to join us in The 3rd International Conference on which will be held in the year 2014 in conjunction with the anniversary of Udayana University.

Last but not least, I would like to highly appreciate all of the members of the Organizing Committee for the good teamwork to make the 2nd International Conference on Sustainable Technology Development (ICSTD-Bali 2012) possible and the team of editors for the hard work compiling and editing 78 papers presented in this book.

See you again in Bali at 3rd ICSTD 2014

Putu Alit Suthanaya, ST, MEngSc, PhD



FOREWORDS

RECTOR OF UDAYANA UNIVERSITY

I would like to express my great appreciation to the organizing committee who worked so hard to make the 2nd International Conference on Sustainable Technology Development (ICSTD-Bali 2012) to happen smoothly. This conference was held in conjunction to the 50th Anniversary of Udayana University and being our bi-annual agenda. The main aim of this conference was to respond the problems related to the sustainability in a city, i.e. reduction of the city's use of natural resources and production of wastes, while simultaneously improving its livability.

I was so happy to have you all in Bali which is well known in the world as a favorite tourist destination as well as recently a favorite site for holding International events, such as International Conference. As this conference was designed to gather scientists, engineers, practitioners, and industries in Engineering related disciplines, I expected intense discussion has happened among them so that some brilliant ideas to be used to improve the quality of human life in a city have been formulated and published in this proceeding.

Here, I would also like to acknowledge the National and International invited speakers for their willingness to come miles away to Bali and present their high standard papers. I understand that you all spent much time for this conference, and therefore I must give high appreciation on all of those effort and dedication.

I hope this International Conference was an ideal forum for communication and sharing ideas as well as experience in Engineering-related disciplines in the future. I also hope that this forum served as a forum for promoting advanced technological development with regard to economic growth, environment and social welfare.

Finally, I wished you most successful conference and hope that it provided new ideas and strategies for the application of Engineering in all aspect of our life.

See you again in Bali in 2014

Prof. Dr. dr. I Made Bakta, SpPD.(KHOM)
Rector of Udayana University



TABLE OF CONTENT

PREFACE		<i>i</i>
FOREWORDS-HEAD OF ORGANIZING COMMITTEE		<i>ii</i>
FOREWORDS-RECTOR OF UDAYANA UNIVERSITY		<i>iii</i>
TABLE OF CONTENT		<i>iv</i>
ARCHITECTURE		
A 01 (ID 101)	Implementation Concept of Ecological Architecture and Ecotourism in Wonorejo's Mangrove Ecotourism, Surabaya	A-1
	M.Nelza Mulki Iqbal, Yeremia Azarya Dimpudus	
A 02 (ID 102)	Braga Street: A True Representation of Art Deco	A-9
	Adinya Rossiyana and Team	
A 04 (ID 106)	The role of Government/Governance to sustain Heritage sites in Denpasar	A-16
	Tri Anggraini Prajnawrdhi, Alpana Sivam, Sadasivam Karuppannan	
A 05 (ID 112)	Sustainable Development in the Border Region Plan: An anticipation of border areas development to small towns	A-25
	I Dewa Gede Agung Diasana Putra	
A 08 (ID 124)	Learning from Sustainable Landscapes of Death in Bali: Landscape Planning and <i>Tri Hita Karana</i>	A-32
	Ni Made Yudiantini	
A 11 (ID 132)	The Application of The Modular System in The Linear Rise Residential Buildings	A-40
	E. J. Krishna M. O.	
A 12 (ID 133)	Identification of Pabrik Coklat Tjenderawasih as a Potential Conservation Object of Authentic Indonesian <i>Jengki</i> Architecture ...	A-50
	Rizky Darmadi, Adiar Ersti Mardisiwi, Alifia Nurrizky Virrayani	
A 13 (ID 134)	Sustainable Architectural Design of Heinz Frick Home: Coping with the Global Challenges in the Asian Cities	A-57
	Lo Leonardo Agung Mulyono, Devi Calista Silvanus, and Gunawan Tanuwidjaja	
A 18 (ID 145)	Kinds of Decoration of Toraja's Housing in South Sulawesi Indonesia	A-70
	Hendri Gunawan, Irdham Hirangga	
A 20 (ID 150)	Save the Lost World's Monumental Dwelling: Is It Necessary?	A-78
	DESTIANA RITANINGSIH, VALENCIA TANDY	
A 21 (ID 151)	Roofs of Building in Indonesia as Architecture Local Identity	A-86
	Ade Amelia, Ana Fitriyani, Annisa Dienfitriah, Maryam Ahmad Assegaf, Vania Dwi Amanda Surya	
A 22 (ID 152)	Interiority: The Real Soul of Architecture	A-94
	Nadita Amalia ^a , Shilta Finella ^a , Thaza Theresia Georly, Yohana P. F. Silitonga	
A 23 (ID 155)	Corelation between Gunung Padang and Sundanese Architecture	A-100
	Nadia Absharina Idris, Adinda Putri Maharani, Miftah Tri Nur Fauzi	

A 24 (ID 156)	Indonesian Airports: A Symbol of Local Representation Lee Maw Jia , Veronica Ng Foong Peng	A-108
A 25 (ID 157)	Overwhelming Presence of Foreign Architecture in China Michele Lim Chui Yee Jia, Nor Hayati Hussain	A-116
A 26 (ID 158)	The Application of Traditional Malay Architectural Elements in Modern Museums of Malaysia Lee Shing Yi, Veronica Ng Foong Peng	A-124
A 30 (ID 162)	Concepting The Historical Site 'Braga' as The Pleasant Main Pedestrian of Bandung City Dewi Anisa Auriani PRIBADI, Indyrta CHRISYADEWI, Mariyam YASMIN, Sheiren Felicia JAYA	A-133
A 31 (ID 163)	Preserving Agriculture and Fish Breeding in Modern Indonesia Dewi Anisa Auriani PRIBADI, Indyrta CHRISYADEWI, Mariyam YASMIN, Sheiren Felicia JAYA	A-141
A 33 (ID 167)	Dual Faces Architecture of Nias Meridiani Trianandari Winanto Ayu Putri, Angga Kusumah Sukarya, Afina Rahmani, Dadi Satria Ginandjar	A-148
A 34 (ID 168)	Influence Behavior and Environment Towards Dwelling Form and Spaces in Eastern Indonesia. Case Study : Fak-fak, Papua Andreas D. Handoyo, Gabriella Sabatini Wijaya, Irma Paramitha, Steven Ardianto, Samuel T. Handoyo	A-156
A 35 (ID 169)	The Combination Culture of Architectural Features. Case Study: Residential House and Buddhist Temple in Kampung Karangturi, Lasem..... Lola Charista, Helen Primalia, Carissa, Augusta Diana E, Valeria Theresia W	A-168
A 36 (ID 170)	Application of Green Building Concept in Indonesia Forest JIEPRANG, Yoedhistira ANDRI PUTRA, Edu ISKANDAR, Reo FAROGA, Randy PISON	A-178
A 37 (ID 171)	Acculturation In Kampung Kulitan Semarang..... CERIA Ginting, FAIZAL Rahman, JIMMY Andreas, JULIUS Richard, OCTAVIA Maryanche, VIVIN Rosalyn	A-184
A 40 (ID 174)	The Heritage Zoning Determination Criteria of Cimahi's Town Square and Its Surroundings Ega KARTIKAWATI, Astrid Austranti YUWONO, Pia Praptidita SURATMAN, Rianto PRABOWO, Wahyu Edi SUWARNO	A-192
A 41 (ID 175)	The Landscape of Kampung Naga Developed by the Village Culture..... Abdul Said Ahtar, Diba Aththaariq, Iqbal Adam, Oka Kartika, Steffie Prilianty, Prathito Andy Wisambodhi, Tera Wednes Oktireva Harsa	A-200
A 42 (ID 176)	For the Sake of Past, in Bandung We Trust: The Development of Braga and ABC Street Annisa Kusumadewi A, Bellarida Febriyanti, Clara Emmanuela, Erna Rosmawati, Heny Ira Mustika, Meskhi Malida D, Prysha Novika, Rahajeng Sekar Putri	A-208
A 43 (ID 177)	Culture Control in Toraja's Traditional Architecture Development .. Amanda Erika Isdyati, Arina Resyta Rahma, Aszafaika Ladidinanda, Dewanti Ashariani, Ivan Winanto, Reina Rivenska Dissa, Sayyida Lathifa Tiara Rossyda Sahara	A-215
A 44 (ID 178)	Renarrativization of Bengal Jatra: through the Eye of Architecture... ASHRAFI, Farhin , DIPTA, Talha Mahmud, AHMED, Tahsin , ISLAM, Md. Tauhidul	A-221

A 45 (ID 180)	Topography Restoration of Historic City..... HAN Dong soo, LEE Sung ho	A-229
A 46 ID190	Persitency of Architecture in Traditional Village of Kuta, West Java Lucky Fachrurrozi, Cindy Novita, and Team	A-238
A 47 (ID 121)	Sustainable Innovative Design Practice in India..... Kishor P.REWATKAR, Priyanka K.REWATKAR,	A-247
A48 (ID 137)	Local Wisdom in Urban Protected Areas: Case of Collective Consciousness in Caring for Mangrove Forest in Denpasar Metropolitan Area, Bali Province, Indonesia..... Hilwati Hindersah	A-258
A 49 (ID 191)	Local Wisdom of Kasepuhan Ciptagelar..... Emilia Rahmawati, Fachrurrozi Ramadhan, Raden Muhamad Lutfi	A-266
A 50 (ID 192)	Tropical Architecture: Discover The Characteristic Of Indonesian Vernacular Architecture..... Dian Eka Pertiwi, Mustofa	A-275
A 51 (ID 193)	A Method for Discovering Regional Resources with Five Senses.... Manami Fujiwara, Kita Yusuke, Maki Onishi	A-283
A 53 (ID 198)	Sri Lankan Vernacular Architecture L.M RATHNAYAKE, P.P.G.D.S.KULATHUNGA, K. RATHNAHARAN, H.P JAYAKODY	A-293
A 55 (ID 202)	Traditional Architecture Of Nias : It's Developing For The New Buildings In The Present Era..... Benonius Servistan Bidaya, Susanti Muvana Nainggolan	A-301
A 56 (ID 201)	Understanding and re-incorporating lessons of vernacular architecture in contemporary Malaysian dwellings..... Amira Nabila bt Raduwan, Chan Huey Hoong, Mohamad Sadeeq bin Mohamad Said, Ili Syahirah bt Zainal Abidin, Yap Chee Chaw	A-309
A 57 (ID 203)	A Method for Discovering Regional Resources with Five Senses A Case Study in Kyoto Arashiyama..... Manami Fujiwara, Kita Yusuke, Maki Onishi	A-320
A 58 (ID 205)	For whom we build and preserve? Human-based cultural approach towards sustainable architectural design and heritage..... LAM Sai Chin	A-330
A 59 (ID 206)	Blue House: Preservation of vernacular architecture and living habitat..... WONG Sze Kan	A-339
A 60 (ID 208)	Adaptive Re-Use: The Conservation of a Building and Restoration of a Culture..... H.E MADDEWITHANA, T.S HEWAGE, M.S.N De ZOYSA	A-347
A 61 (ID 209)	Using Plastered Bamboo for Housing as the Innovative Eco- Construction in Asia..... Patriot Negri, Alicia Tiffany, Decia Widyasinta, Henry Hadathia, Karina Wiriadidjaja	A-356
A 62 (ID 210)	Student investigation in urban space; Urbanization, regional identity and Architecture. Bandara V. Y. J, Abeykoon A. J. M. P. A, Gunawardhana A. W. D. J	A-365

A 63 (ID 211)	STAGE HOUSE AS GORONTALO'S VERNACULAR ARCHITECTURE..... Inda Putri Julianty, Wadira Syabilla Utami	A-375
A 64 (ID 212)	Introduction to Lasem Architecture, Java's Forgotten Little China (<i>Le Petite Chinois</i>) Luke Theodorus, Auri Evan, Aglis Dhamar	A-383

CIVIL ENGINEERING

C 01 (ID 105)	Studies on Transport-Modes in the Region of Southern Bali I Wayan Suweda, Achmad Wicaksono, Indrasurya B. Mochtar	C-1
C 06 (ID 117)	Characteristics of Sand Sheet Asphalt Mixture Utilizing Waste Aggregates I Nyoman Arya THANAYA, Putu Preantjaya WINAYA , Putu Anggi WEDAYANTI	C-10
C 10 (ID 127)	The Effect Of Rainfall Characteristic Change For The Result Of Global Climate Change and The Impact To Flood Phenomenon I Gusti Bagus Sila Dharma, I Putu Gustave Suryantara Pariartha	C-18
C 12 (ID 138)	Islamic Bank Participation in Indonesia Infrastructure Provision Ayomi Dita Rarasati, Eric Too, Bambang Trigunarsyah, Fiona Cheung	C-24
C 13 (ID 139)	Identification of Factors of Road Safety Problems in Indonesia and Recommended Solutions to Improve Road Safety A. Caroline SUTANDI, Efraim Mtimanta SURBAKTI	C-33
C 14 (ID 146)	Concrete Wall Panel From Styrofoam Waste with Wiremesh Reinforcement Andi Prasetyo Wibowo	C-40
C 15 (ID 153)	Numerical Modeling of Reinforced Concrete Beams Repaired with Polymer-Modified Mortars Luthfi M Mauludin, Fransesca da Porto	C-48
C16 ID 181	The addition of <i>Canggahwang</i> and <i>Sunduk</i> to the <i>Saka</i> of Balinese Traditional Houses Increases the Residents' Safety Arising from Earthquake Load..... I Nyoman Sutarja	C-55
C17 (ID 182)	Geometry Non-Linearity and Performance Base Design Procedure Relevant to Predict the Seismic Performance of Low-Rise Building and a Structures in a Developing Country (Indonesia)..... G.A. SUSILA , P. MANDAL & T. SWAILES	C-61
C18 (ID	RESTRUCTURING PUBLIC TRANSPORT NETWORK FOR KRENENG STATION IN DENPASAR CITY..... Putu Alit Suthanaya, Ratih Pradnyawati	C-70
C19 (ID213)	RECLAMATION ENVIRONMENT VISION AS AN ALTERNATIVE DEVELOPMENT FOR PORT FACILITY: Literature Review Case application..... I Nyoman Budiarta R.M	C-78

MECHANICAL ENGINEERING

M 01 (ID 104)	Fuzzy-PID Ratio Controller of An Electro-Mechanical Continuously Variable Transmission for Automotive Application..... B. Supriyo, K.B. Tawi, H. Jamaluddin, H. Nasution, A. Budianto, M.S. Che Kob and S. Ariyono	M-1
M 02 (ID 109)	The variation of blade number and the rotational operation in the various wind occurrence distributions of the clean and renewable wind power machine Ridway Balaka, Aditya Rachman, Yuni Aryani Koedoes	M-12
M 03 (ID 110)	Prospect of Iran Natural Gas Export Projects Hedayat Omidvar	M-21
M 05 (ID 120)	Performance of Diamond Cutting Tool in the Turning Process of Stainless Steel, Copper and Aluminium Ida Bagus Puspa Indra, Tjokorda Gde Tirta Nindhia, I Nyoman Gede Antara	M-31
M 06 (ID 123)	Time Study Analysis of Food Services Using Man Machine Mapping I Wayan Sukania, Oktaviangel, Julita	M-42
M 07 (ID 125)	Comparison Vickers Hardness of Welding Alumunium-MG 5083 with Welded for Metal Inert Gas (MIG) and Tungsten Inert Gas (TIG) I Gusti Ngurah Ardana, Tjokorda Gde Tirta Nindhia, I Made Widiyarta	M-48
M 10 (ID 130)	Performance of Repetitive type of Biogas Desulfurizer Made from Steel Chips Waste..... Tjokorda Gde Tirta NINDHIA, Komang Metty Trisna NEGARA, I Made SUCIPTA, I Wayan SURATA, I Ketut Adi ATMIKA, Dewa Ngakan Ketut Putra NEGARA	M-63
M 12 (ID 142)	A Green Manufacturing Process For Small Vertical Axis Wind Turbine blade..... Rui-Hua Hu, Ai-Yun Jiang, Zhi-Guo Ma, Cai-Xia Fan, Jing-ChaoZou	M-70
M 13 (ID 143)	Study Physical and Mechanical Properties of Vegetal Material on composite structures..... Abdalla Abdal-hay, Ngakan Putu Gede Suardana, Jong-Woo Kim, Cheol In Kim, Jae Kyoo Lim	M-76
M 16 (ID 154)	CFD as Aiding Tool to Predict Airflow and Thermal Performance of Buildings. Case Study: Airflow Pattern and Thermal Performance in Classroom, University of Atmajaya J. Ade Prasetya S.	M-83
M 17 (ID 179)	Effect of chemical treatments on the tensile strength and flammability of paper mulberry fiber reinforced PLA composites Jian-Guo Cui, NPG. Suardana, Hyun-Chel Kim, Jae-Kyoo Lim	M-92
M 18 ID 187	Line Assembling Investigation of Three Wheels Bicycle Using Time Measurement Method at Pt X..... I Wayan Sukania, Iwan Susanto	M-101
M 19 (ID 188)	Tensile And Impact Strength of Bamboo Fiber Reinforced Epoxy Composites As Alternative Materials For Above Knee Prosthetic Socket..... Agustinus Purna Irawan, I Wayan Sukania	M-109

M 20 (ID189)	Experimental Study of Dynamic Vibration on Prototype Auditory Membrane Made of PVDF..... Harto Tanujaya, Susilodinata, Adianto, Hirofumi Shintaku, and Satoyuki Kawano	M-116
M 21 (ID196)	Simulation On Characteristic Of Fluidization Phenomena Using Waste Particles..... I Nyoman Suprapta Winaya, I Nyoman Gede Sujana, I Made Agus Putrawan	M-121
M 22 (ID202)	Quality Improvement of Dried Seaweed by Using Cabinet Dryer..... I Wayan Surata, Tjokorda Gde Tirta Nindhia, I Ketut Adi Atmika	M-129

ELECTRICAL ENGINEERING

E 01 (ID122)	The Role of University in Improving the Quality Sustainable Technological Development (IQSTD)..... Yuda Bakti Zainal, Een Taryana, Rohani Jahja Widodo	E-1
E 02 (ID165)	Development of Mobile Application for Theater Booking System Andik Setyono , Md. Jahangir Alam, and Amit Roy	E-9
E 03 (ID166)	Study and Design of the Video for Mobile Communication Andik Setyono	E-16
E 04 (ID194)	APPLICATION OF HYBRID ACTIVE POWER FILTER TO REDUCE LOSSES DUE TO HARMONICS DISTORTION: A CASE STUDY IN A CITY HOTEL I M. E. Purwa Antaka, W. G. Ariastina, I N. S. Kumara, and R. S. Hartati	E-24
E 05 (ID195)	Special Pattern Development for Feature Extraction In Balinese Print Character Recognition System Base on Localized Arc Pattern Method..... AA. K. Oka Sudana; Ni Kadek Ayu Wirdiani; Gusti Agung Ayu Putri	E-32
E06 (ID204)	Mixed Reality in Tele-operation Using Virtual Environment Second Life..... I Nyoman Piarsa, Putu Wiryadi Sastraningrat	E-41

C 14 (ID 146)
Concrete Wall Panel From Styrofoam Waste
With Wiremesh Reinforcement

Andi Prasetyo Wibowo^a

^aFaculty of Engineering, University of Aina Jaya Yogyakarta, Yogyakarta-Indonesia
E-mail : andiprasetyowibowo@yahoo.com

Abstract: Wall is part of the room divider that influence the structural aspects of weight and rigidity. Based on these reasons we need wall that has some characters such as light but also environmentally friendly. Manufacture of lightweight concrete wall of styrofoam is an effort to utilize waste of styrofoam. Styrofoam concrete wall panel study using specimens measuring length 1000 mm, width 300 mm and 70 mm thick, with the addition of 15 mm thick layer of plaster / mortar on both sides. The composition of 1 m³ styrofoam concrete consisted of 300 kg cement with 0,5 water-cement ratio, 60% styrofoam, and 40 % sand. Testing and research produced the following data : the average of flexural strength specimens without wiremesh : 3,77 MPa. The average flexural strength specimens with wiremesh : 5,84 MPa. The results showed that the strengthening of wiremesh increased the flexural strength of the panel.

Key Words: utilization of waste styrofoam, wall panel, flexural testing

1. PREFACE

Concrete is a material that commonly used in building structure. Most of the current building using concrete as its main component. This is not surprising because concrete has advantages when compared with other materials, like wood and steel. Some concrete advantages are relatively cheap, has high compressive strength, resistance to corrosion, relatively simple in construction, and relatively resistant to fire. However, concrete density is high enough so that influence the dead load on a structure.

Concrete is a building material created by the mixing of coarse aggregate (gravel), fine aggregate (sand), portland cement, and water, which is hard as a rock. This type of building material called concrete with normal weight range 2400 kg/m³, a relatively heavy weight for buildings with concrete structure. To reduce the dead weight of a structure using concrete materials, much has been done, including the use of alternative building materials in the form of lightweight concrete (Tjokrodimuljo, 2007).

In a house or a building, the weight of brick wall can reach 250kg/m², while the concrete weight could reach 2400kg/m³. If the total, will reach tens or hundreds of tons of even more, depending on the height and building area. if an earthquake happens, each will have a mass movement or displacement. The higher the building, the greater mass movements. Therefore, the selection and use of building materials that have a lighter weight, are expected to reduce the effects of earthquakes on buildings.

In the SMARTek journal 2011, Ramadhani describe some of the lightweight concrete definition quote from Dobrowolski, Neville and Brooks, Murdock. Dobrowolski in Ramadhani (2011) explains that the lightweight concrete is concrete with weight below 1900 kg/m³, it is lower than weight of normal concrete. while Neville and Brooks providing

concrete limits light weight concrete under 1800 kg/m^3 . According to Murdock, light weight concrete volume ranged from 1360 to 1840 kg/m^3 and the weight per volume to 1850 kg/m^3 regarded as the the limit of the concrete lightweight, although this value are sometimes exceeded.

This study is intended to use styrofoam waste as a replacement for coarse aggregate in lightweight concrete is applied to the manufacture of wall panels, and then try to increase the flexural strength by providing a layer of $\varnothing 3 \text{ mm}$ wire mesh and plaster (mortar) on the outside. As we all know, Styrofoam has quite light weight. Therefore, the basis of these considerations is expected that the resulting wall panels will be lighter and yet still has the power equivalent to the strength of the wall in general.

This study uses assumptions and limitations are as follows: The amount of styrofoam used as a lightweight concrete mix is 60%: 40% sand, with a cement content of 300 kg/m^3 . Type of cement used Portland Composite Cement (PCC). The initial planning value of water cement ratio is set at 0.5. Styrofoam is in use is that the styrofoam waste shaved/crushed by using a chopper, and in dry conditions at the time of blending/mixing concrete. Fine aggregate (sand) taken from the river Progo, Yogyakarta. Thick styrofoam lightweight concrete panel set 7 cm. Wiremesh pattern used is a form of grid size $50 \times 50 \text{ mm}$, 3 mm diameter reinforcement. Variation distance between the layers of wiremesh connector wire is 15 cm, 25 cm and 35 cm. On the 15 mm thick outer layer of the composite wall panels used a mixture of cement and sand (mortar) with a ratio of 1pc: 2Ps, with a w/c ratio value determined at the initial planning is 0.5. Test specimen wall panel is restricted to the bending behavior of the wall panel

2. METHODE

The research was carried out by experimenting/testing in the laboratory. The experiment was conducted with the following stages: Preparing materials and tools to be used, examination of the base material (sand, cement, water, styrofoam, wiremesh), preparing and making the test specimens, treatment/curing test specimens, testing the specimens, and then analyze and discussion the test results. To carry out experiment, the basic ingredients needed are: sand, cement, styrofoam waste, water, wiremesh, connector. In order for testing, both for measuring the compressive strength and flexural strength, is used compression testing machine.

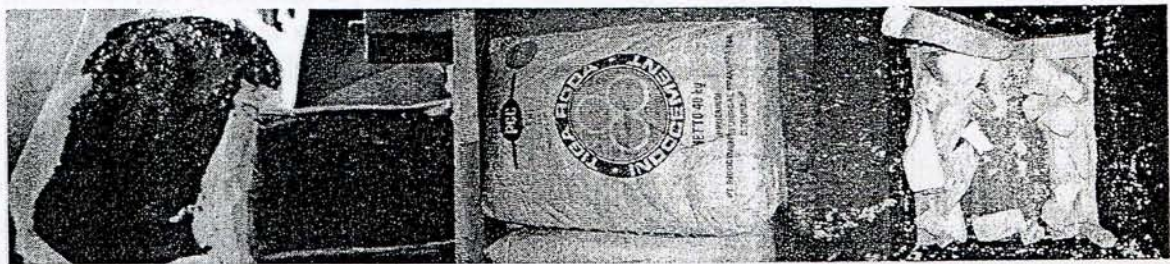


Figure 1 basic ingredients: sand, cement, styrofoam waste

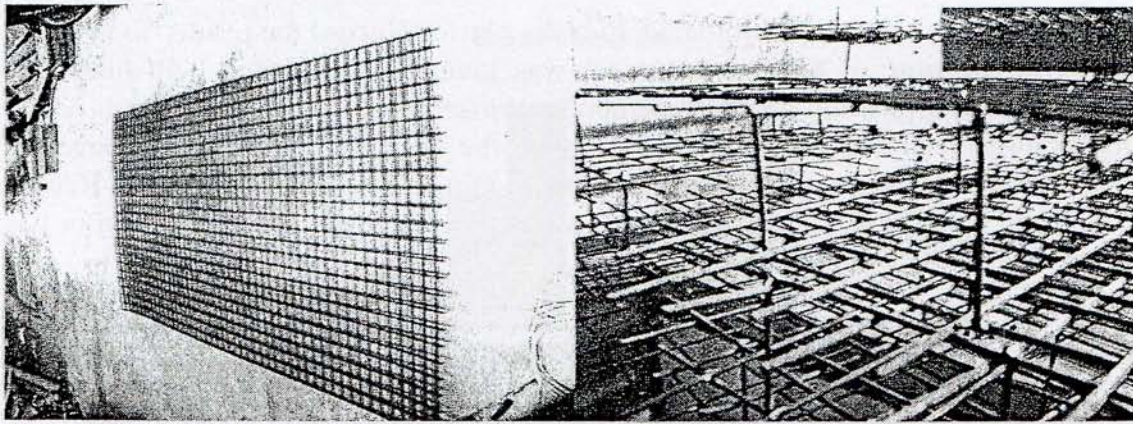


Figure 2 wiremesh and connector

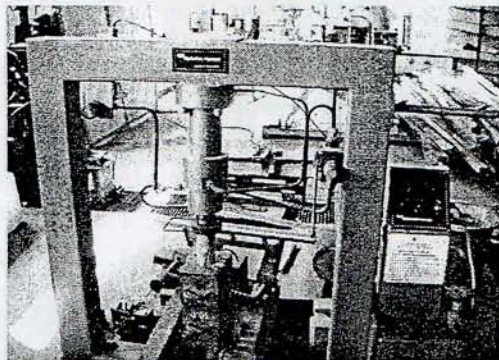


Figure 3 compression testing machine (CTM)

The number of specimens in this experiment as many as 12 pieces. 3 pieces without retrofitting wiremesh reinforcement, while nine other pieces by wiremesh reinforcement, with variations within connector 15 cm, 25 cm and 35 cm of each of 3 pieces. More detail can be seen in Figure 4.

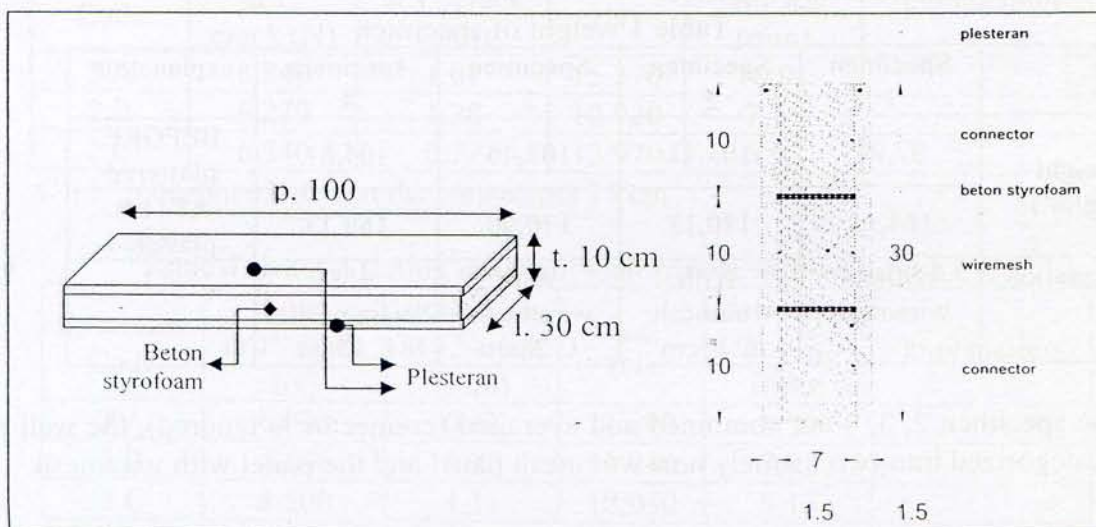


Figure 4 The shape and size of the specimen styrofoam concrete panel

Flexural testing steps consisted of several stages. first, the panel is measured to determine the

weight and dimensions of the panel before and after the plaster. Record the results. to be more easily observed at the time of testing, the panel was given the paint and help lines that describe the location and position of reinforcement wiremesh wire connector on each panel. testing tools are organized and prepared before laying the specimens. After that, place the panel on the pedestal and be ready for loading. Give loading with constant velocity. Record the peak load or the crack first when it happened. Stop charging if the panel is broken or has declined approximately 20% of peak load.

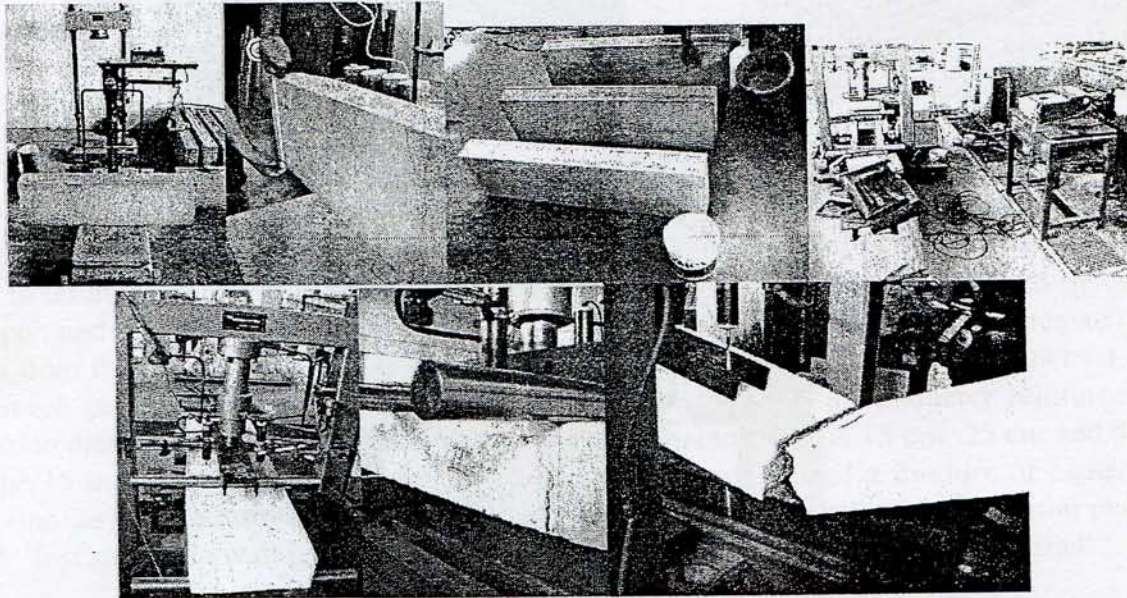


Figure 5 the sequence of flexural testing

3. RESULT AND DISCUSSION

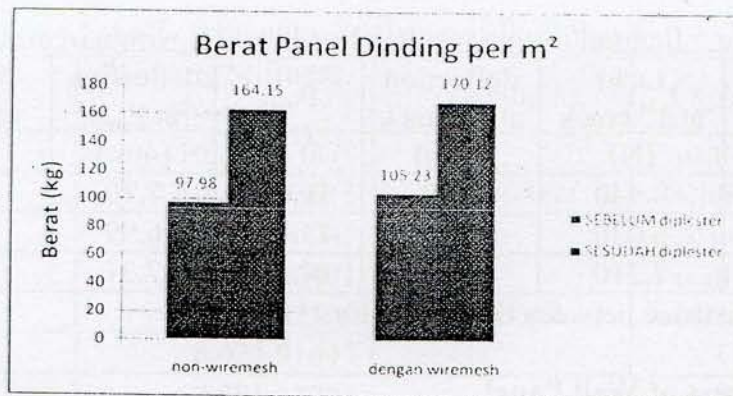
3.1 Weight of Wall Panel

Weight of the wall panel is obtained by comparing the weight and volume and area of the panel, as shown in Table 1 and Figure 6.

Table 1 weight of specimen

	Specimen 1	Specimen 2	Specimen 3	specimen 4	explanation
weight (kg/m ²)	97,98	103,43	107,46	104,81	BEFORE plastered
	164,15	170,12	170,90	169,33	AFTER plastered
explanation	Without wiremesh	With wiremesh, C.15cm	With wiremesh, C.25cm	With wiremesh, C.35cm	

If the the specimen 2, 3, 4 are combined and averaged (connector is ignored), the wall panels can be categorized into two, namely non-wiremesh panel and the panel with wiremesh.



Gambar 6 weight of wall panel (kg/m^2)

3.2. Flexural Testing Results

The results of flexural testing of each panel are as follows:

Table 2 flexural testing results of wall panels without the wiremesh

Specimen Code	Load at 1 st crack (N)	deflection at 1 st crack (mm)	P_{\max} (N)	deflection at P_{\max} (mm)	explanation
1.A	9.000	1,18	9.000	1,18	Suddenly broken
1.B	7.560	0,68	7.560	0,68	Suddenly broken
1.C	7.420	0,89	7.420	1,18	Suddenly broken

Table 3 flexural testing results of wall panels with wiremesh C-15^{*)}

Specimen Code	Load at 1 st crack (N)	deflection at 1 st crack (mm)	P_{\max} (N)	deflection at P_{\max} (mm)	explanation
2.A	8.840	1,07	15.270	10,91	
2.B	6.270	1,28	10.920	7,36	
2.C	6.340	0,77	13.970	6,92	

C-15^{*)} = distance between the connectors 15 cm

Table 4 flexural testing results of wall panels with wiremesh C-25^{**)}

Specimen Code	Load at 1 st crack (N)	deflection at 1 st crack (mm)	P_{\max} (N)	deflection at P_{\max} (mm)	explanation
3.A	6.000	0,63	11.090	6,59	
3.B	4.430	0,72	11.810	7,92	
3.C	8.500	1,11	12.050	5,17	

C-25^{**)} = distance between the connectors : 25 cm

Table 5 flexural testing results of wall panels with wiremesh C-35^{***)}

Specimen Code	Load at 1 st crack (N)	deflection at 1 st crack (mm)	P _{max} (N)	deflection at P _{max} (mm)	explanation
4.A	8.440	0.80	11.630	7.70	
4.B	6.020	0.87	13.700	6.99	
4.C	7.210	0,92	14.430	7.31	

C-35^{***)} = distance between the connectors : 35 cm

3.3. Bending Stiffness of Wall Panel

Bending stiffness is the ratio between the load with the deflection/deflection that occurs. This value is obtained by using the secant method to graph panel bending test until the time of the break /first crack.

Stiffness according to Timoshenko (1996) defined as the force required to produce a deflection of a single unit, such as the following equation:

$$k = \frac{P_{cr}}{\delta_{cr}} \dots\dots\dots (1)$$

Explanation : k = Bending Stiffness (N/mm)
 P_{cr} = Load at 1st crack (N)
 δ_{cr} = Deflection at 1st crack (mm)

Formula in Equation (1) can also be defined as secant method of stiffness formula (Figure 6). With this method the stiffness of the structure can be calculated based on the condition of crack initiation or at maximum loading.

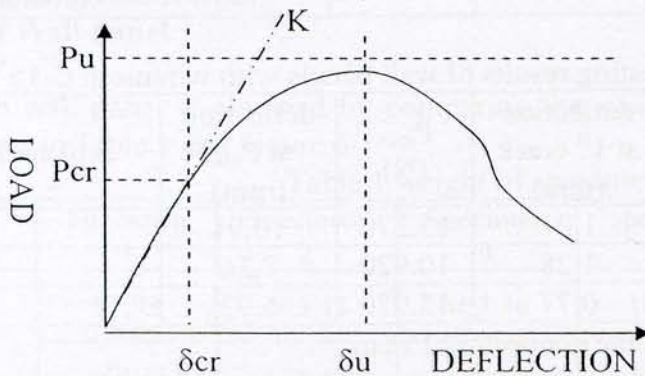


Figure 6 secant method of stiffness formula

The value of the bending stiffness of each the specimen panel in Table 6.

Table 6 Bending Stiffness of Wall Panel

Specimen Code	Bending Stiffness (N/mm)	Average	Explanation
1.A	10.127,83879	9.476.06	wall panels without the wiremesh
1.B	10.372,93615		
1.C	7.927,40045		
2.A	7.943,06491	7.283.67	wall panels with wiremesh C-15
2.B	5.884,02120		
2.C	8.023,91647		
3.A	7.881,37083	7.209.42	wall panels with wiremesh C-25
3.B	6.169,95308		
3.C	7.576,93157		
4.A	8.550,02119	6.936.23	wall panels with wiremesh C-35
4.B	7.130,87483		
4.C	5.127,79509		

based on result above, it can be concluded that non-wiremesh wall panels tend to be more rigid than the wall panel with wiremesh reinforcement. The closer distance of connector, may result in a higher bending stiffness.

3.4. Flexural strength of Panel

Value of the maximum bending stress styrofoam concrete wall panel (f_{maks}) test results obtained with the approach in accordance with Third Point Loading procedure based on SNI 03-4431-1997 which was adapted from ASTM C78-94.

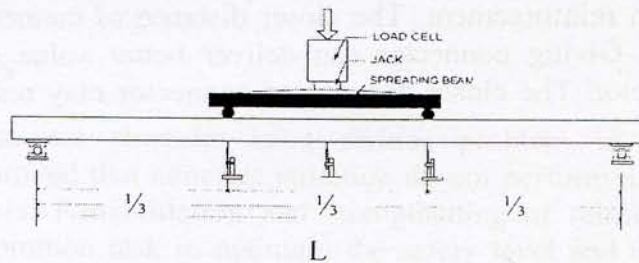


Figure 7 Illustration of flexural strength testing of the wall panel

$$f_{maks} = \frac{M_{maks} \cdot y}{I} \dots\dots\dots (2)$$

$$M_{maks} = 1/8 \cdot q \cdot t \cdot L^2 + 1/6 \cdot P \cdot L \dots\dots\dots (3)$$

explanation:

- f_{maks} = Maximum Flexural Strength (MPa)
- M_{maks} = Maximum moment (KNm)
- L = length of panel (m)
- q = weight per volume of panel (KN/m³)
- t = thick of panel (m)

- P = load (KN)
 y = distance of the outer portion from the neutral line (m)
 I = cross-sectional moment of inertia (m⁴)

The results of calculation of the value of panel flexural strength can be seen in Table 7.

Table 7 Flexural strength of Panel

Specimen Code	Max. Flexural Strength of Panel (MPa)	Average	Explanation
1.A	4,23	3,77	wall panels without the wiremesh
1.B	3,58		
1.C	3,51		
2.A	6,64	5,84	wall panels with wiremesh C-15
2.B	4,78		
2.C	6,08		
3.A	4,86	5,10	wall panels with wiremesh C-25
3.B	5,17		
3.C	5,27		
4.A	5,09	5,78	wall panels with wiremesh C-35
4.B	5,97		
4.C	6,28		

4. CONCLUSION

Wall panels of Styrofoam materials included in the category of lightweight concrete, because it has a weight of below 1800 kg/m³. non-wiremesh wall panels tend to be more rigid than the wall panel with wiremesh reinforcement. The closer distance of connector, may result in a higher bending stiffness. Giving connector can deliver better value of flexural strength, compared with no connector. The closer distance of connector may result a higher flexural strength.

5. REFERENCES

- Gere and Timoshenko, 1996, Mekanika Bahan Jilid I, Erlangga, Jakarta.
- Ramadhani, S, 2011, SMARTek Journal Vol. 9 No. 1. Pebruari 2011 p.29, Universitas Tadulako, Palu
- SNI 03-4431-1997, 1997, Metode pengujian lentur beton normal dengan dua titik pembeban, BSN, Jakarta
- Tjokrodinuljo, K, 2007, Teknologi Beton, Biro Penerbit, Teknik Sipil Universitas Gadjah Mada, Yogyakarta

The 2nd International Conference on
Sustainable Technology Development



ICSTD
Bali 2012

Developing Sustainable Technology
for a Better Future

The International Conference on Sustainable Technology Development (ICSTD) is a biennial international conference organized by the Faculty of Engineering, Udayana University (Bali-Indonesia)

The International Conference on Sustainable Technology Development is designed to provide a platform for exchange of ideas, information and experiences among academics, researchers, consultants, engineers, manufacturers and postgraduate scholars in engineering; to promote cooperation and networking amongst researchers and professionals.

Organized by:



Faculty of Engineering
Udayana University

in collaboration with:

International Institute of
Management Energy and
Environmental Management
University of Flensburg
Germany

Udayana University Press
2012

ISBN 978-602-7776-06-7



9 786027 776067