



PROCEEDING

The 4th International Conference on Sustainable Built Environment
“Sustainable Bulding and Environment for Sophisticated Life”



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The 4th International Conference on Sustainable Built and Environment
Sustainable Building and Environment for Sophisticated Life
October 12-14, 2016
Yogyakarta

Editorial Boards:

Prof. Dolores Foley
University of Hawaii at Manoa

Prof. Thomas Boving
University of Rhode Island, USA

Prof. Shunitz Tanaka
Hokkaido University, Japan

Prof. Tsair Fuh Lin
National Cheng Kung University, Taiwan

Dr. Widodo Brontowiyono
Universitas Islam Indonesia, Indonesia

Eko Siswoyo, Ph.D.
Universitas Islam Indonesia, Indonesia

Dr. Is Fatimah
Universitas Islam Indonesia, Indonesia



Welcome Speech

The Dean - Faculty of Civil Engineering and Planning, Universitas Islam Indonesia

Assalamu'alaikum warrahmatullahi wabarakatuh

The honorable:

- Rector of UII, Dr. Harsoyo,
- Conference Partners: University of Hawai'i at Manoa – USA, University of Rhode Island – USA, Hokkaido University – Japan, University of Rhode Island (URI), - USA, National Cheng Kung University – Taiwan, PT. Waskita Sangir Energi, Persatuan Insinyur Indonesia (PII) and Intakindo
- Keynote speakers: Prof. Dolores Foley, Prof. Thomas Boving, Prof. Masahiko Fujii, Prof. Tsair Fuh Lin, Mr. Ibnu Sina and Mr. Surahman
- Participants of the 4th ICSBE 2016
- Distinguished Guests, ladies and gentlemen,

First of all, praise be to Allah, the Cherisher and Sustainer of the world, for His blessing for all of us. He who has provided us a chance so that we could be here to share knowledge, ideas, solutions and experiences in the Fourth International Conference on Sustainable Built Environment (ICSBE) 2016. To the academicians, our colleagues from overseas universities, guests, participants, students and so on, please accept our gratitude, warm welcome and appreciation.

The sustainability of green infrastructure and environment is a common thing to be realized without compromising the ability of future generation. It must be done to prevent any adverse impacts on our lives such as air and water pollution, land use and contamination, material depletion, impacts on human health, and climate change. Therefore, it is expected that the incorporation of sustainable development concept in terms of research, product, and values will enhance the energy performance of environment development and bring about building sustainability as well as disaster management. The needs should merge with the improvement of global development to create a sophisticated life.

The Fourth International Conference on Sustainable Built Environment (ICSBE) 2014 takes issues in this urgent agenda of **Sustainable Building and Environment for Sophisticated Life**". The conference plays role as the media to share wisdom and experiences, and develop knowledge as well as skill and recent technologies on the application of built environmental sciences and technologies.

Let me deeply express a special appreciation to the speakers: Prof. Dolores - University of Hawai'i at Manoa, USA, Prof. Thomas Boving – University of Rhode Island (URI), USA, Prof. Masahiko Fujii - Hokkaido University, Japan, Prof. Lin – Cheng Kung University, Taiwan, Mr. Surachman-PT. Waskita Sangir Energy, Mr. Ibnu Sina- Major of Banjarmasin. Our appreciation is also for all the participants who have actively written excellent research papers.

Finally, my special thanks go to the Rector of UII, all the steering and organizing committees for making this conference possible. It is desired to have a sustainable conference to be continuously held in the future times, as we are challenged to make a sustainable building and environment for a sophisticated life.

Wassalamu'alaikum warrahmatullahi wabarakatuh

Yogyakarta, October 12, 2016

Faculty of Civil Engineering and Planning (FCEP), Universitas Islam Indonesia

Dr.-Ing. Widodo Brontowiyono.

The Dean



Welcome Speech

The Rector - Universitas Islam Indonesia

The Honorable:

- Dean of Faculty of Civil Engineering and Planning Universitas Islam Indonesia, Dr. -Ing. Ir. Widodo, M.Sc
- All the keynote speakers of this conference: Prof. Dolores Foley (from University of Hawaii at Manoa, USA), Prof. Thomas Boving (from University of Rhode Island, USA), Prof. Tsair Fuh Lin (from National Cheng Kung, Taiwan), Ibnu Sina S.Pi., M.Si., (as a Mayor of Banjarmasin), Prof. Masahiko Fujii (from Hokkaido University), Ir. Surachman, M.Tech. (Director of PT. Waskita Sangir Energi)
- Distinguished participants, ladies, and gentlemen

Assalamu'alaikum Warahmatullahi Wabarakatuh,

On this special occasion, let me invite you to praise Allah SWT for His mercy and grace that we are able to attend the 4th International Conference on Sustainable Built Environment (ICSBE) today.

On behalf of the university, I warmly welcome you, all the impressive keynote speakers and participants. Welcome to Universitas Islam Indonesia, the oldest national university in the country.

Distinguished guests, ladies, and gentlemen,

In September 2015, The United Nations (UN) held The UN Development Summit that formally adopted the agreement "Transforming our World: The 2030 Agenda for Sustainable Development". The summit embraced the three dimensions of sustainability, such as economic, social and environment. The summit also aimed at ending global poverty and building a life of dignity for all. That was a generally accepted concept of Sustainable Development Goals (SDGs) in the world. The report of the 1987 World Environment and Development Committee argues that "Sustainable development is development that meets the needs of present without compromising the ability of future generations to meet their own needs".

Three dimensions of sustainable development which consist of society, economy and environment should exist together. Economic development should not depend on excessive resource consumption; meanwhile, environmental sustainable development should be considered more important. This 4th ICSBE 2016 is conducted to provide the opportunity for government officials, researchers, academicians, industry practitioners, non-governmental and multinational organization staffs and other stakeholders to share their views and experiences to build international collaborative networks on managing sustainable development.

Some important issues that will be presented on this seminar are about how to manage sustainable development through Green Infrastructure, Sustainable Resources Management, and Sustainable City. I do hope that this conference will inspire us to enhance our awareness to explore any possibilities in involving sustainable development. Also, I look forward to hearing discussions (on these topics) and I hope we can be inspired by the best practices we will hear from our distinguished speakers.

Finally, by reciting "Bismillahirrahmanirrahim" hereby I officially open the event of the 4th International Conference on Sustainable Built Environment (ICSBE). May Allah always guide us and lighten our step.

Thank you.

Wassalamu'alaikum Warahmatullahi Wabarakatuh.

Yogyakarta, October 12-14, 2016

Dr. Harsoyo

Rector



Preface

Dear Readers and Participants,

The 4th International Conference on Sustainable Built Environment (ICSBE), held in Yogyakarta on October 12-14, 2016, is biannual international conference organized by the Faculty of Civil Engineering and Planning, Islamic University of Indonesia (UII), Yogyakarta since 2010. The conference is aimed at nurturing the study, comprehension, and appreciation of the built environment.

The conference is intended to provide a forum for exchanging of ideas, sharing of knowledge, and dissemination of information on the study of the built environment from different parts of the world. It seeks to further develop regional and international network of academicians, professionals, and policy makers on the management of the built environment.

The first ICSBE was held in May 2010 in Yogyakarta, with the theme 'Enhancing Disaster Prevention and Mitigation', which attracted participants from 8 countries, who presented 74 selected papers. In response to the interests of the participants, the second was held in July 2012 with the theme "Livable Cities in Fast Growing Cities" and the third was held in October 2014 by theme "Resilience and Risk Reduction towards Well-being Society." There were more than 150 abstracts submitted and presented in the conference from several countries such as Indonesia, Malaysia, Philippine, Turkey, Thailand, USA, etc. Since the 4th ICSBE, ISSN (International Standard of Serial Number) is used instead of ISBN because the conference is organized regularly once in two years. In order to improve the quality of ICSBE, we select excellent papers and submit to international journal indexed by scopus (selected papers only).

The fourth ICSBE is supported by Hokkaido University, Japan, University of Hawaii at Manoa, USA, University of Rhode Island, USA, National Cheng Kung University, Taiwan, Government of Banjarmasin, PT. Waskita Sangir Energy, PII and Intakindo.

The theme of 4th ICSBE 2016 is **Sustainable Building and Environment for Sophisticated Life** and the sub-themes are: **Green Infrastructure, Sustainable Resources Management, Sustainable City and Special Issues on Disaster management.**

The 4th ICSBE is attended by worldwide participants such as Indonesia, Malaysia, Philippines, Thailand, India, Bangladesh, Australia, USA, Japan, Taiwan, etc. More than 140 abstracts and full papers were submitted and about 95 papers were selected to be presented during the conference.

Finally, on behalf of the organizing committee and organizing institution, we would like to deliver our gratitude to the participants and various parties for their financial support, especially to the Ministry of Research, Technology and Higher Education (RISTEK DIKTI).

Eko Siswoyo, Ph.D

Chairman of 4th ICSBE



Conference Organization

Organizing institutions

Universitas Islam Indonesia, Indonesia
Hokkaido University, Japan
University of Rhode Island (URI), USA
National Cheng Kung University, Taiwan
University Hawaii at Manoa, USA

Supporting Organization

Ministry of Research, Technology and Higher Education, the Republic of Indonesia
Persatuan Insinyur Indonesia (PII)
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Table of Content

Cover Page	2
Welcome Speech	3
Conference Organization	6
Table of Content	7
Editorial	14
Keynote Speakers' Abstract	
1. THE RESILIENCE IMPERATIVE: STRENGTHENING COMMUNITY RESILIENCE THROUGH TRAINING <i>Dolores Foley</i>	15
2. STORMWATER RUNOFF AND NONPOINT SOURCE POLLUTION MANAGEMENT WITH TREE FILTERS IN RHODE ISLAND, USA <i>Thomas Boving</i>	16
3. EXPLORING AND DEVELOPING THE POTENCIAL OF RIVERS IN BANJARMASIN CITY <i>Ibnu Sina</i>	17
4. ASSESSMENT OF THE POTENTIAL FOR DEVELOPING MINI/MICRO HYDROPOWER: A CASE STUDY IN BEPPU CITY, JAPAN <i>Masahiko Fujii, Soichiro Tanabe, Makoto Yamada, Taketoshi Mishima, Takahiro Sawadate, and Shinji Ohsawa</i>	18
5. BIOMASS AS A MODEL OF SUSTAINABLE RENEWABLE ENERGY AS A SUBSTITUTE FOR COAL-BASED THE COMMUNITY ECONOMY <i>Surahman</i>	19
6. HARMFUL CYANOBACTERIA AND THEIR METABOLITES IN DRINKING WATER SYSTEMS: BIOMOLECULAR MONITORING AND OXIDATION TREATMENT <i>Tsair-Fuh Lin, Yi-Ting Chiu, Yi-Ting Chen, Che-Wei Chang, Yi-Hsuan Chen, and Hsiu-Lien Lin</i>	20
7. RESTORATION OF URBAN RIVER AREA BASED ON THE M3K CONCEPT <i>Widodo Brontowiyono</i>	21
Topic: Green Infrastructure	
1. THE STUDY OF THE COURTYARD EFFECTIVENESS AS SOLUTION FOR THE HOUSE DESIGN TRANSFORMATION PROBLEM ON NATURAL VENTILATION <i>Silfia Mona Aryani, Ahmad Yusuf, Iik Endang Siti Wahyuningsih, Soepono Sasongko</i>	22
2. COMMUNITY PUBLIC SPACE AND CHILD DEVELOPMENT: A POST OCCUPANCY EVALUATION <i>Mahargyantari P. Dewi, H. Prabowo, A. R. Fauziah</i>	30
3. FLEXURAL DISPLACEMENT ASSESSMENT OF LIGHTLY REINFORCED CONCRETE COLUMN	38



Ari Wibowo, John L. Wilson, Nelson TK Lam, Emad F. Gad

4. PERFORMANCE OF BRICK WITH SAGO HUSK AS FILLER ON GREEN BUILDING MATERIALS 48
Kurniati Ornam, Masykur Kimsan, La Ode Ngkoimani
5. IDENTIFYING RESISTIVITY VALUE OF CHARCOAL WOOD AND CHARCOAL SKIN FRUITS: ALTERNATIVE SUBSTITUTE RESISTANCE MATERIAL ON RESISTOR 55
Intan Kusumawati
6. PILED EMBANKMENTS FOR ROAD CONSTRUCTION ON SOFT SOIL 61
Slamet Widodo
7. VERNACULAR APPROACH IN PROVIDING PASSIVE HEATING SYSTEM FOR HOUSING IN TROPICAL GAYO HIGH LAND 68
Laina Hilma Sari, Izziah Hasan, Mirza Irwansyah, Erna Meutia
8. OPTICAL PROPERTIES OF 1 X 4 WEAKLY COUPLED FIBERS 78
Dedi Irawan, Hartono, Rado Yendra, Ismu Kusumanto
9. STUDY OF DWELLING CONSTRUCTION IN WET LAND AREA OF WEST COAST ACEH IN TERMS OF SUSTAINABLE SETTLEMENT (CASE STUDY: SETTLEMENT OF KRUENG TRIPA WATERSHED AREA) 85
Cut Nursaniah, Izziah, Laila Qadri
10. THE USAGE OF NATURAL ZEOLITE AS FILLER ON MIXTURING ASPHALT CONCRETE-BINDER COURSE (AC-BC) MIXTURE AND ASPHALT PEN.60/70 MATERIALS OBSERVED FROM CANTABRO TEST RESULT 93
Alfian Saleh
11. THE STUDY OF GREEN CONSTRUCTION IMPLEMENTATION FOR BUILDING CONSTRUCTION AT BANDUNG 101
Fandy, Anton Soekiman
12. MARSHALL CHARACTERISTICS OF ASPHALTIC CONCRETE UTILIZING REFINE BUTONIC ASPHALT AS AN ASPHALT MODIFIER 111
Miftahul Fauziah, Happy D. Asih
13. PHENOMENOLOGICAL INTERPRETATION OF CONTEMPORARY BAMBOO ARCHITECTURE IN INDONESIA 120
Tony Sofian, Iwan Sudradjat, Baskoro Tedjo
14. FINITE ELEMENT MODELING TO REDUCE THE FAILURE ON REINFORCED CONCRETE WALL UNDER HARD MISSILE IMPACT 132
Faiza, Herman Parung, M.W. Tjaronge, and R. Jamaluddin
15. THE CHARACTERISTIC AND GREEN DESIGN FOR MOTORCYCLE PARKING AT UNIVERSITY 141
Prima J. Romadhona, Nadiani Rachmah



16. IDENTIFICATION OF COMPOST POTENTIAL ON DEGRADED SOLID WASTE IN TPA PIYUNGAN LANDFILL, BANTUL, YOGYAKARTA AS A STEP OF LANDFILL MANAGEMENT OPTIMIZATION BY USING LANDFILL MINING METHOD 151
Hijrah P. Putra, Marzuko, Kartika. Sari, Tria. Septhiani, Fika. Rahmadani
17. THE ASSESSMENT OF RIVER PERFORMANCE (CASE STUDY: PEPE RIVER, SURAKARTA) 160
Agus H. Wahyudi, Suripin, Suharyanto
18. DEFORMATION ANALYSIS OF PILE FOUNDATION AT SOFT SOIL USING SOFT SOIL CREEP MODEL 173
Edy Purwanto, Hanindya Kusuma A.
19. DUCTILITY ESTIMATION OF FIXED-HEAD LATERALLY LOADED PILE: AN ANALYTICAL MODEL 186
M. Teguh, F. Saleh
- Topic: Sustainable Resources Management**
1. IDENTIFICATION OF URBAN SPACE OF RIVERSIDE SETTLEMENT, CASE STUDY : 3-4 ULU PALEMBANG 201
Tutur Lusetyowati, Edy Sutriyono, Ridhah Taqwa, Widya Fransiska
2. DEVELOPMENT OF ENVIRONMENTAL INDICATORS OF WEST JAVA PROVINCE 210
Iwan Juwana, Mohammad R. Sururi
3. WASTE MANAGEMENT OF TOLL ROAD TOWARDS GREEN INFRASTRUCTURE IN INDONESIA 221
A. Caroline Sutandi
4. EARNED VALUE MANAGEMENT AS THE BASIS PROJECT PERFORMANCE MONITORING 229
Ipak Nm. Bukit, Ellida N. Lidya, Lely Masthura
5. THE POTENTIAL USE OF TITANIUM TETRACLORIDE ($TiCl_4$) AS AN ALTERNATIVE FOR COAGULANT IN TEXTILE WASTEWATER TREATMENT 238
Wulan Safrihatini Atikah, Octianne Djamaluddin, Radyan Manggala
6. EFFECTIVENESS OF RAW WATER POLLUTANTS REMOVAL BY AERATED PLASTIC HONEYCOMB AND QUARTZ SAND BIOFILTERS 244
Suprihatin, Nisa U. Wiryastuti, Mohamad Yani
7. COMPARISON OF GOME 2 METOP-A SATELLITE-BORNE TROPOSPHERIC NO_2 AND GROUND MEASUREMENTS 254
Arka Romadona Pujaardana, Arie Dipareza Syafei, Rachmat Boedisantoso, Abdu Fadli Assomadi, Joni Hermana, Agus Slamet
8. BIOREMEDIATION OF LEAD [Pb II] CONTAMINATED SEA WATER BY MARINE DIATOM *SKELETONEMA COSTATUM* 263
Thin Soedarti, L.R. Maryono, Sucipto Hariyanto



9. STUDY OF INTER-COUNTRIES FREIGHT TRANSPORT USING ACTIVITY BASED METHOD (CASE STUDY: WEST KALIMANTAN, INDONESIA – SARAWAK, MALAYSIA) 271
Said Basalim, Firstya. R. Hernovianty
10. TREATMENT OF WASTE WATER OF TEXTILE INDUSTRY BY USING OZONE TECHNOLOGY 279
Kris Tri Basuki, Nurimaniwathy, Agus Purwadi, Dyah Ayu Wulandari
11. ADVANCE OXIDATION TREATMENT OF DYE WASTE USING ZNO/AC UNDER UV ILLUMINATION 289
Is Fatimah, Septian P. Yudha
12. DEVELOPMENT OF BIKE-SHARING STATIONS BY APPLYING SMART CARD TECHNOLOGY 298
Sony Sulaksono Wibowo, Widyarini Weningtyas, Yan Syafri Hidayat, Rahmad Wandu Putra
13. PROPOSED IMPLEMENTATION OF COGENERATION REGENERATIVE CYCLE IN SUGAR FACTORY WASTE RECYCLE SYSTEM 306
Gigieh R. Budyanto, Ade T. Iftahaq, Prabowo
14. SUSTAINABLE DEVELOPMENT AT MALAYSIAN LOCAL GOVERNMENTS FROM MANAGEMENT'S VIEW OF THE KNOWLEDGE TRANSFER PRACTICES 314
Sulzakimin Mohamed, Ta Wee. Seow, MD Asrul N. Masrom
15. WORK-TIME WASTE IN THAI CONSTRUCTION ACTIVITIES: A CASE STUDY OF THE CONSTRUCTION PROCESS OF RED BRICK WALL 322
Natchapol Thanakanya, Vachara Peansupap
16. A RELIABILITY STUDY: CISADANE RIVER AS A DOMESTIC WATER SOURCE OF TANGERANG CITY 332
Arya Rezagama, Hariyanto, Mochtar Hadiwidodo
17. BIOSORPTION OF Cu (II) BY *SCENEDESMUS OBLIQUUS*: KINETICS ADSORPTION STUDY AND OPTIMIZATION IN PH-CONTACT TIME 342
Astri Rinanti, Melati Ferianita Fachrul, Rositayanti Hadisoebroto, Mawar Silalahi, Bambang Iswanto, Putrikusumaningayu
18. THE ANALYSIS OF GEOTECHNICAL AND TOPOGRAPHICAL ASPECTS BASED ON GIS AS INITIAL IDENTIFICATION OF ROAD ALIGNMENT DETERMINATION ON SWAMP AREAS 351
Indrayani, Erika Buchari, Dinar D.A. Putranto, Edward Saleh
19. IMPROVING THE EFFLUENT QUALITY OF PAPER MILL TO SUPPORT A SUSTAINABLE ENVIRONMENT 361
Yusup Setiawan
20. INTEGRATING STANDARD OPERATING PROCEDURES AND OCCUPATIONAL SAFETY FOR COLUMN CONCRETE REINFORCEMENT WORK 370
Adwitya Bhaskara, Fitri Nugraheni



21. PERFORMANCE OXIDATION DITCH ALGAE REACTOR (ODAR) FOR ORGANIC COMPOUND REMOVAL OF GREY WATER 378
Rafika R. Ardhiani, Aulia Ulfah Farahdiba, Any Juliani
22. DEVELOPING SUSTAINABILITY INDEX MEASUREMENT FOR RECLAMATION AREA 386
Andi Yurnita, Slamet Trisutomo, Mukti Ali
23. ANALYSIS OF AMBIENT AIR QUALITY FOR PARAMETERS OF NITROGEN DIOXIDE (NO₂) TO CERAMIC TILES COMBUSTION PROCESS WITH GAUSS DISPERSION MODELS IN SIDOLUHUR, GODEAN, SLEMAN, D.I YOGYAKARTA 396
Supriyanto, Yonatan Hafid
24. RAINWATER HARVESTING APPLICATION IN YOGYAKARTA 406
Alva Dian Fadhila, Widodo Brontowiyono, Any Juliani
25. UTILIZATION OF WATER HYACINTH (EICHHORNIA CRASSIPES) AS PHYTOREMEDIATION PLANT IN VANNAMEI SHRIMP AQUACULTURE SEWAGE TREATMENT 414
Widodo Brontowiyono, Eko Siswoyo, Adam Ikhya A., Erwin K. W.

Topic: Sustainable City

1. UNDERSTANDING RESIDENT'S PREFERENCES FOR MORE SUSTAINABLE HOUSING DEVELOPMENT IN RIPARIAN MUSI, PALEMBANG 423
Maya Fitri, Sugeng Triyadi, Ismet B. Harun
2. THE EFFECTS OF RAPID DEVELOPMENT TO THE VISUAL AND IMAGE TRANSFORMATION OF THE HERITAGE AREA (CASE STUDY OF BENTENG KUTO BESAK PALEMBANG) 433
Listen Prima
3. FUNCTION OF KANA (CANNA.SP) AS LANDSCAPE PLANTS OF CITY PARK SURABAYA 441
Hamidah
4. THE RELATIONSHIP BETWEEN SYSTEM ARRANGEMENT OF PUBLIC OPEN SPACE AND LIVABILITY BASED ON USER PERCEPTION IN PUPUTAN BADUNG SQUARE DENPASAR 449
Nurjannah Irma, Saleh Sjamsu Arief, I Made Krisna, Siti Belinda
5. THE PERCEPTION OF THE HERITAGE VILLAGE IMPACTS DUE TO URBANIZATION: EVIDENCE FROM MALAYSIA 459
Indera Syahrul Mat Radzuan, Yahaya Ahmad
6. URBAN SCALE MAPPING OF CO CONCENTRATIONS DUE TO THE TRANSPORT SECTOR IN PADANG CITY 469
Vera S. Bachtiar, Taufiq Hidayat, Purnawan, Heru D. Laksono
7. THE POTENTIAL OF *TRANSIT ORIENTED DEVELOPMENT* CONCEPT IN REGIONAL CENTER: CASE STUDY IN MALIOBORO DISTRICT, YOGYAKARTA SPECIAL REGION, INDONESIA 477
Arissa Sukardi, Suparwoko



8. SCENARIO FOR CLIMATE CHANGE MITIGATION FOR TWO BIG CITIES IN CENTRAL JAVA, INDONESIA 488
Evi Gravitiani, Suryanto, Rosalina
9. OVERVIEW OF URBAN QUALITY INDICATORS: TOWARDS A SUSTAINABLE AND SOPHISTICATED URBAN LIFE IN INDONESIA 495
Arif Budi Sholihah
10. CHANGE ANALYSIS OF THE CULTURAL HERITAGE BUILDING FUNCTION AND FACADE IN KOTABARU, YOGYAKARTA, INDONESIA 504
Suparwoko, Nur Ain Lagonah
11. SIMULATION OF GAS TEMPERATURE VARIATION AND DIFFUSION EFFECTS IN AN AIR CORONA DISCHARGE FOR NO_x POLLUTION CONTROL 514
Nanang Arif Guntoro
12. BASIC PLANNING OF E-BIKE SHARING SYSTEM AT SEBELAS MARET UNIVERSITY 522
Lydia N.N. Hidayati, Djumari, Fajar S. Handayani
13. THE STUDY OF VULNERABLE ROAD USER FACILITIES IN MAGELANG CITY TOWARDS SUSTAINABLE TRANSPORT SYSTEM 531
E. Puspitasari, W. Maryunani
14. THE DEVELOPMENT OF TOURISM WATERFALL TUMBURANOAREA BASED ON ECOREGION APPROACHES IN KONAWE ISLAND 541
Santi, Kurniati Ornam, Masykur Kimsan, Siti Belinda Amri
15. SUSTAINABLE LANDSCAPE FOR LIVABLE VILLAGES IN MANDAILING (CASE STUDIES : SINGENGU AND HUTAGODANG VILLAGE, NORTH SUMATERA) 549
Cut Nuraini
16. CHARACTERISTICS OF PEAT SOIL IN HOUSING AREA, TANJUNG API-API, BANYUASIN - INDONESIA 559
Andriani, Eddy Ibrahim, Dinar DA Putranto, Azhar Choliq
17. EVALUATION OF MODEL DEVELOPMENT OF URBAN ECO-DRAINAGE IN REGION SCALE 568
Sih Andayani, Bambang E. Yuwono
18. DEVELOPMENT OF BIO-ADSORBENT BASED ON TOFU WASTE TO ADSORB IRON (Fe) AND LEAD (Pb) IN WATER 579
Eko Siswoyo

Topic: Disaster Management

1. PEOPLE'S SENSE OF BELONGING AND ITS ROLES IN ENHANCING THE HABITABILITY OF PUBLIC EVACUATION SHELTERS 586
Lucia A. Rudwiarti, Ariadne K. Nataya
2. THE COMPARISON OF FATALITIES DISTRIBUTION ON THE KRB MAP WITH FATALITIES DISTRIBUTION ON THE ISOVULCANIC MAP OF THE 2010 MERAPI ERUPTION 594



Meassa M. Sari

3. ANALYSIS OF COMMUNITY CAPACITY INDICATORS AND DISASTER PREPAREDNESS USING STRUCTURAL EQUATION MODELING 602
Jaka Nugraha, Fitri Nugraheni, Irwan N. Kurniawan
4. SOFT MITIGATION IN AREAS OF REOCCURRING NATURAL DISASTERS: FLOODS IN QUEENSLAND, AUSTRALIA AND THE VOLCANIC ERUPTIONS OF MT. MERAPI IN YOGYAKARTA, INDONESIA 611
Chittayong Surakitbanharn
5. MODELING OF TSUNAMI RUN-UP ONTO SLOPING BEACH AND ITS INTERACTION WITH LOW STRUCTURE 622
Benazir B. Iska, Radiana Triatmadja, Adam Pamudji Rahardjo, Nur Yuwono
6. THE COMPARISON SPATIAL ANALYSIS OF STORM BEHAVIOR IN PENINSULAR MALAYSIA DURING MONSON SEASONS BY NEYMAN SCOTT RECTANGULAR PULSE MODEL 631
Rado Yendra, Dedi Irawan
7. TEACHING URBAN RESILIENCE THROUGH COLLABORATIVE CONSTRUCTION: THE EXPERIENCE OF ODENSE 3 PROJECT IN JAPAN 639
Wiryono Raharjo
8. EVALUATION OF DISASTER PREPAREDNESS LEVEL OF AN OIL COMPANY (CASE STUDY OF PERTAMINA REFINERY UNIT IN WEST PAPUA PROVINCE,INDONESIA) 651
Sarwidi, Rama B. Perkasa, Fitri Nugraheni
9. SEISMIC VULNERABILITY ASSESSMENT OF HOSPITAL BUILDING AS CRITICAL FACILITIES IN NORTH SIDE OF JAKARTA USING HAZUS METHOD 660
Yunalia Muntafi



EDITORIAL

Nowadays, green infrastructure has been flourishing extensively worldwide so as to improve the quality of life. As what is seen from the conference, there are countless number of presented papers focused on this issue.. The widely studied green material to develop construction by covering the variation of filler on the building and pavement, the usage of wood, fiber usage, GGBS and slag in concrete, etc is one of the examples of such studies on green infrastructure. In addition, some studies also address the aspect of methodology, by aiming to shed light on design and assessments of green infrastructure.

Besides green infrastructure, the management of sustainable resources also has considerable significance to preserve the wellness of the earth. There were 35 papers written about the result of the optimization of some management methods for environmentally friendly surroundings with few papers aimed to focus on the aspect of assessment. Some of the papers presented the result of the management of waste, reservoir, raw water, and standard operating procedure. Hence, the material to support the management was also discussed from several types of chemicals particularly.

Those researches were expected to create sustainable city in some parts of the world extending from Some issues such as sustainable housing development and the activities that support sustainable city have been presented in this conference. Moreover, some breakthrough concepts to create a green city have also been developed such as sustainable transport system, climate change mitigation, and sustainable city planning. Altogether were expected to succeed the sustainable building and environment for sophisticated life.

Furthermore, there was also a theme of disaster management since Indonesia is renowned as prone to disaster areas and that many other parts of the world are also experiencing the same thing. These researches extend from disaster preparedness and the application of some tools for disaster resilience, and the disaster simulation to find the worst possible effect which may take place. These researches proposed people sense of belonging of the disaster and mitigation in areas of disaster. Lastly, the evaluations for all of which were conducted to know the best strategy to manage the disaster.

During discussion in the plenary session, some questions such as how to prevent and minimize the impact of disaster, what should be done to deal with crisis of energy, what is the most suitable water treatment technology in Indonesia and what will Kalimantan do to protect rivers were addressed to the keynote speakers. Answering these questions, Professor Dolores mentioned that people in Indonesia should get an insight and understanding on the potency of natural hazard in their area. Professor Fujii said that Indonesia should consider about microhydro energy for power plant. Furthermore, Mr. Surachman suggested that biomass energy will provide us with huge benefit because the sources were abundant in this country. Prof. Boving from Rhode Island University who was totally familiar with the condition in Indonesia proposed the filtration system for water supply. In the parallel session, the discussion was well organized by each moderator in four different rooms based on each topic. The participant from Thailand was interested on the development of bioadsorbent prepared from tofu waste in Indonesia. Questions such as what was the recent condition about green infrastructure in Indonesia, the impact of rapid land use change, the potential energy sources, etc were discussed extensively.



KEYNOTE SPEAKERS' ABSTRACT

THE RESILIENCE IMPERATIVE: STRENGTHENING COMMUNITY RESILIENCE THROUGH TRAINING

Dolores Foley

University of Hawaii at Manoa, USA

Abstract: Earthquakes, hurricanes, tsunamis etc. have all caused enormous damage and suffering over the last century. As we consider climate change, sea level rise but also the movement of populations to coastal areas and hazard zones the combination of factors – geologic, climatic, environmental, social and economic- threatens an unprecedented risk of the loss of lives, homes, jobs, and businesses. In this time of great environmental and economic uncertainty, resilience has emerged as a key aspiration in long-range development and planning. The argument is, if communities are to become resilient and minimize the cost of disasters in terms of lives and economic losses they will first need to develop a culture of preparedness and adaptation. Communities need to have access to the planning tools, data, and resources to learn and adapt to changing climate and environments.

Keywords: Adaptability; Disaster risk reduction; Planning tools



STORMWATER RUN-OFF AND NONPOINT SOURCE POLLUTION MANAGEMENT WITH TREE FILTERS IN RHODE ISLAND, USA

Thomas Boving

Dept. of Geosciences, Dept. of Civil and Environmental Engineering, University of Rhode Island, USA

Laura Schifman

Dept. of Civil and Environmental Engineering, University of Rhode Island, USA

Abstract: Stormwater runoff is one of the main contributors of non-point source pollution in many countries, introducing high loads of contaminants into surface water bodies and posing a threat to the ecosystem and human health. In the United States, stormwater treatment standards have not yet been introduced on a federal level, however increasingly more states require at least primary treatment of stormwater runoff to prevent water quality degradation of surface waters. Rhode Island, located in the Northeastern part of the U.S., has set contaminant reduction standards for stormwater runoff that has been treated by structural best management practices (BMP). Those standards require nutrients (nitrate and phosphate) to be reduced by 30%, pathogens by 60%, and total suspended solids by 85%. As BMP performance depends on geographical location and climate, and the Northeastern United States experiences broad ranges of temperatures throughout the year along with long intermittent periods between precipitation events, stormwater treatment can be challenging. At the University of Rhode Island, a Stormwater Technology Demonstration facility is used for testing BMP practices under real world conditions. Besides permeable pavement, bioswales and retention BMPs, the demonstration facility also features tree filter (TF) technology.

In a year-long field study, two tree filters were evaluated: a conventional unit (CTF) with sand/shale mix as filter media, and a modified tree filter (ITF) with an added layer of red cedar wood chips amended with 3-(trihydroxysilyl)propyldimethyloctadecyl ammonium chloride. Based on laboratory tests, the addition of amended wood enhances the removal of bacteria, dissolved heavy metals and petroleum hydrocarbons. Twelve constituents were analyzed (pH, specific conductance, chloride, nitrate, phosphate, total suspended solids, copper, nickel, lead, zinc, and a special focus on *Escherichia coli* and polycyclic aromatic hydrocarbons). Both tree filters met or outperformed RI's standards for bacteria removal (60%) and TSS (85%), making them a good choice for BMP use in this climate. Total suspended solids, *E. coli*, PAHs, nitrate, and phosphate removal is higher in ITF. A controlled field scale tracer test using *E. coli* confirmed these results. The results suggest that Tree Filter BMPs are a robust stormwater treatment technology that can be easily integrated into stormwater management plans inside and outside the study area.



EXPLORING AND DEVELOPING THE POTENTIAL OF RIVERS IN BANJARMASIN CITY

Ibnu Sina

Mayor of Banjarmasin, Indonesia

Abstarct: Since several years ago, the existence of rivers in Banjarmasin is well retained in order to support the social cultural and economic of public in the city. River transportation for daily life and activities along the river in Banjarmasin makes this city become very unique and gives benefit for tourism. In the other hand, the presence of the rivers is also urgent and most effective for flood control. Therefore, as a city for trading and service, in the future Banjarmasin is expected to become a comfortable city which is free of flood. In addition, the development of the tourism sector is expected to contribute significantly for the economy of the city.

Exploring the potencial and uniqueness of Banjarmasin city is important for the growth and development of the city. Having called as "River City", it is necessary that the rivers in Banjarmasin to have an added value and become a strategic thing for Banjarmasin. Thus, this is unseparable from the socio cultural as well as the economic life of the residents of Banjarmasin city as the character and identity of Banjarmasin.

At the present time, approximately 75% of the area in Banjarmasin city is covered by the residential buildings, office, service trade buliding, etc. This makes many of the rivers become not functioning as they should. The surface of the rivers is affected by the tide with the height difference of 2 meter and this is worsen by the flood coming from Barito and Martapura rivers as well as the intense rainfall which is 300 milimeter. The location of the city, which is in the down stream area of the rivers, makes the city become prone to flooding when those 3 above phenomena occur simultaneously.

Due to the rapid development and the characteristic of the city area, flood becomes a latent threat that must be wary of. The programs for disaster mitigation must be arranged and well prepared to face this.

However, until today, there are 102 rivers which are still functioning well and can be used as the water sources for the residents. So, the role and function of rivers as the basis for the development of the city is of importance. The arrangement of the riverbanks and the management of the rivers must be conducted by the city organizer and the residents of the city because the rivers have an important role and function to support the life of the city residents.



ASSESSMENT OF THE POTENTIAL FOR DEVELOPING MINI/MICRO HYDROPOWER: A CASE STUDY IN BEPPU CITY, JAPAN

Masahiko Fujii
Soichiro Tanabe
Makoto Yamada
Taketoshi Mishima
Takahiro Sawadate
Shinji Ohsawa

Faculty of Environmental Earth Science, Hokkaido University, Japan

Abstract: This study aims to provide quantitative guidelines necessary for capacity building among various stakeholders to minimize water-energy conflicts in developing mini/micro hydropower (MHP), a baseload renewable energy that is socially necessary, not only to reduce greenhouse gas emissions but also to vitalize local economies by creating jobs related to MHP operations. Using three different methods to calculate river water levels and discharges, the potential power generation by MHP was estimated for six rivers in Beppu City, Japan. Our results show that installation of MHP facilities can provide stable electricity for tens to hundreds of residents in local communities along the rivers. However, the results are based on the existing infrastructure, such as roads and electric lines. This means that greater potential is expected if additional infrastructures are built to develop further MHP facilities. On the other hand, in Japan, river laws and irrigation right regulations currently restrict new entry by actors to rivers. Therefore, to further develop MHP, deregulation of the existing laws relevant to rivers and further incentives for business owners of MHP facilities, along with the current feed-in tariffs, are required. Meanwhile, possible influences to riverine ecosystems when installing new MHP facilities should also be taken into account.

Keywords: Generated power; Hot spring water; Mini/micro hydropower (MHP); Riverine ecosystem



BIOMASS AS A MODEL OF SUSTAINABLE RENEWABLE ENERGY AS A SUBSTITUTE FOR COAL-BASED THE COMMUNITY ECONOMY

Surahman

Waskita Sangir Energy, Indonesia

Abstract: According EBTKE (2015) Program of the National Electricity 35,000 MW is a government project to build power plants reached 35,000 Mega Watt up to 35 thousand MW 2019. The program aims to meet the demand of Indonesia electricity needs from *Sabang* to *Merauke*. This will certainly have a significant impact on economic growth outside Java, which was previously a shortage of electricity supply.

The Government has committed to realize the supply of electricity of 35,000 Megawatts (MW) within a period of 5 years (2014-2019). Throughout the next 5 years, the government and private together with PLN will build 109 plants; each comprising 35 projects by PLN with a total capacity of 10 681 MW and 74 projects by private / Independent Power Producer (IPP) with a total capacity of 25 904 MW. And in 2015 the company will sign a contract of 10 thousand MW power plants as the first phase of the total 35 thousand MW.

With a projected economic growth of *6% up to 7% per year*, additional electricity capacity in the country needs at least 7,000 megawatts (MW) per year. That is, in the next five years, 35,000 MW additional capacities becomes a necessity. The need for 35 thousand MW has been confirmed in the document of the National Medium Term Development Plan (RPJMN) 2015-2019.

The average energy consumption of 199 TWh, while production of 228 TWh of electrical power (only *PLN* and *IPP*). National electrification ratio stood at 84.35%. The electricity consumption for household categories, *namely by 43%, followed by industry at 33%, 18% and last business 6% public.*

As for the energy mix to procure electricity mix are as follows: *coal 52%, gas 24%, fuel oil 11.7%, water 6.4%, geothermal 4.4% and other energy amounted to 0.4%*, thus the use of coal in Indonesia is still very large although Coal belongs to the group of renewable energy instead of (*Non renewable energy*).

The use of coal for electricity demand in Indonesia is still very large, while the power plant using coal is not included in a group of environmentally friendly energy due to the impact of burning coal is likely to cause environmental pollution such as *air pollution, resulting in acid rain and can damage marine life due to damage coral reef ecosystems.*

Based on the above conditions it is necessary to find a replacement for environmentally friendly fuels to be used as a substitute for coal which has a heat rate (heat content) is nearly equal to coal, which is about *4800 up to 6500 kilo calories.*

One of the natural resources which are environmentally friendly and renewable is an organic fuel that contains carbon, so that the resulting combustion only emit *CO2* that can be neutralized and absorbed by plants and vegetation in the vicinity.

One of the plants that have the potential of biomass energy has a heat rate is high and can be used for other needs is *Calliandra red flower (Calliandra colothyrsus)*, because in addition to the stem used for biomass energy, the leaves can be used as animal feed (goat / cow) because has a high protein and interest to the needs of beekeeping (*calliandra honey*).

When all the land as "idle" throughout Indonesia *Calliandra* planted by the people, the people will benefit a lot for planting only once until the age of 25-30 next years. Thus it can be said *Calliandra Colothyrsus* Investment based democratic economy, because then it is the people who will be as owners of "mine" coal substitutes, during which only are owned by the large investors.



HARMFUL CYANOBACTERIA AND THEIR METABOLITES IN DRINKING WATER SYSTEMS: BIOMOLECULAR MONITORING AND OXIDATION TREATMENT

Tsair-Fuh Lin
Yi-Ting Chiu
Yi-Ting Chen
Che-Wei Chang
Yi-Hsuan Chen
Hsiu-Lien Lin

Department of Environmental Engineering, National Cheng Kung University, Taiwan

Abstract: Presence of cyanobacteria in lake and reservoirs has become an important issue to public water supply in many countries. Many cyanobacteria may produce harmful cyanotoxins and/or taste and odor compounds, posing potential risk to human and diminishing the aesthetic value of the water. Therefore, monitoring and treatment of cyanobacteria and their metabolites are important for safeguard the quality of drinking water. In this presentation, two topics will be covered: (1) biomolecular monitoring of toxin and taste and odor producing cyanobacteria in reservoirs, and (2) modeling the oxidation treatment of harmful cyanobacteria and their metabolites in water.

A qPCR based biomolecular monitoring approach was developed for monitoring the producers of five cyanotoxins and T&O compounds, including microcystin, cylindrospermopsin, saxitoxin, geosmin, and 2-MIB in reservoirs. The approach has been applied in *on-site* monitoring of 38 reservoirs in Taiwan for more than 4 years. Field results suggested that the abundance of the producing genes correlates with corresponding metabolites reasonably well. Since the developed method is able to be conducted *on-site* and the results can be obtained within three hours, the biomolecular monitoring scheme may provide timely and useful information for water utilities and reservoir managers to justify the risk of the cyanotoxin and T&O compounds in their source waters and to trigger appropriate response actions.

Two typical oxidants used in water treatment plants and/or reservoirs for the control of cyanobacteria, including hydrogen peroxide and chlorine, are studied and modelled for their effect of on cell integrity and destruction of metabolites during the oxidation processes. Sequential kinetic models were successfully developed to simulate the concentrations change of chlorine decay, radical production, and cell rupture during chlorination and hydrogen peroxide oxidation. The model also successfully predicts the degradation of microcystin during the oxidation processes. The developed models may provide a simple means to estimate the dose and contact time required when oxidants are used for the control of cyanobacteria in water treatment plants and reservoirs.



RESTORATION OF URBAN RIVER AREA BASED ON THE M3K CONCEPT

Widodo Brontowiyono

Environmental Engineering Department, FCEP, Universitas Islam Indonesia

Abstract: Urban problems have become more complex as time goes by. Urbanization rate seems uncontrolled, and population growth is augmenting. It implies that the need for land and living space is growing. On the other hand, land availability has remained static or even declined. It means there has been a deficit or crisis of environmental carrying capacity. One of the areas that become the object of urban problem complexity is the riverbank. This area should ideally function as green open space, but it has in fact been covered by settlements that go run-down. As a data sample, the area of slums in Yogyakarta City has reached 278.7 hectare or 8.17% of the city extent. Approximately 90% of the slums are located along riverbanks. Therefore, riverbank area requires a restoration effort to revitalize its function and condition in accordance with the principles of conservation as well as humanity. The proposed concept was then *M3K* (*Mundur, Mungghah, Madhep Kali*) or retreating settlements from the riverbank, building vertical settlements, and facing towards the river. The implementation of M3K should be integrated and sustainable. The harmony among related aspects and sectors is performed through systematic and participative phasing. The affected community ought to be involved from the start during the identification and stocktaking, economic study of the land, as well as area planning. This program can be optimized, for example, through a Community-Based Environmental Planning (*PLBK*) that is preceded by the establishment of Action Plan for Settlement Environmental Planning (*RTLPL*). In addition, the leaders' political commitment is required in order to optimize the implementation of this M3K-based program.

Keywords: *M3K*; Restoration; River; Slum



PEOPLE'S SENSE OF BELONGING AND ITS ROLES IN ENHANCING THE HABITABILITY OF PUBLIC EVACUATION SHELTERS

Lucia A. Rudwiarti^{1*}, Ariadne K. Nataya¹

¹ *Department of Architecture, University of Atma Jaya Yogyakarta, Indonesia*

ABSTRACT

Since the eruption of Mount Merapi in 2010, the Government of Sleman Regency has determined three zones of disaster prone area in order to enhance the mitigation attempts. Within these zones, there are public evacuation places, either temporary shelters or permanent camps. Cangkringan District as one of these disaster prone zones also has some public buildings that are functioned as sheltering for the evacuees. Not all types of public buildings are appropriate and habitable for accommodating them. This research aims at finding out how habitable the buildings are and the roles of people's sense of belonging in increasing the habitability of the buildings. The investigation methods consisting of interviews and questionnaires were conducted to collect the data. The review of the documents and the mapping observation were also carried out to support the data for the crosscheck analysis. The sampling techniques for respondents used the purposive snowball sampling, whereas the sample of shelters employed some kinds of public buildings that were functioned as the evacuation camps such as schools and neighborhood office halls. The initial findings showed that the habitability of public evacuation shelters was dependent on the people's sense of belonging of those places and the way people got involved in the daily activities on those places. Thus, enhancing the habitability of places and the adaptability of people onto various alternative place designs will psychologically support their continuation of life in the evacuation camps.

Keywords: Disaster prone areas; Evacuation shelters; Sense of belonging

1. INTRODUCTION

Indonesia is located inside the Pacific Ring of Fire. Furthermore, it is also verified as a prone area for the mountain eruptions. One of the most active mountains is mount Merapi. Mount Merapi is located in Java Island, at the border of Sleman Regency in Yogyakarta Special Province, and the regencies of Magelang, Boyolali, and Klaten in Central Java. The eruption of mount Merapi regularly takes place in the cyclical span of 2 to 10 years. The big eruption of mount Merapi in the year of 2010 affected the agriculture activities as well as the physical infrastructures in the surrounding areas. It also changed the morphological top surface of the mountain. The transformation of the surface leads to some different predictions of the disaster prone zones to which the direction of volcanic emission will flow.

Since the 2010 eruption, the Government of Sleman Regency has determined 3 (three) zones of disaster prone areas in order to build up the specific mitigation services (Peraturan Bupati Sleman, 2011), i.e: (a) disaster prone area I is the potential area affected by the lava flow; (b) disaster prone area II is the potential area affected by the

* Corresponding author's email: lucia@mail.uajy.ac.id

volcanic mass such as magma and molten rock; and (c) disaster prone area III is the closest area to the disaster resources to which the volcanic emissions stream.

Cangkringan district is a zone which mostly included in the disaster prone area III. It is situated approximately 400 meter above the sea level, with tropical climate. It consists of 5 (five) villages i.e Wukirsari, Argomulyo, Glagahardjo, Kepuhardjo, and Umbulharjo. Within this prone area, there are public buildings which are used to accommodate the evacuees when the eruption disaster happens. Despite the fact, the success of public evacuation buildings is influenced by several aspects, including the habitability of the places itself. This purpose of this research is to observe the people's sense of belonging and its roles in the framework of disaster mitigation attempts, especially in increasing the habitability of the physical and non-physical qualities of the evacuation buildings where the evacuees are sheltered. The investigation took place and focused in Umbulharjo Village area (see figure 1a and 1b), in which many public evacuation buildings are located.

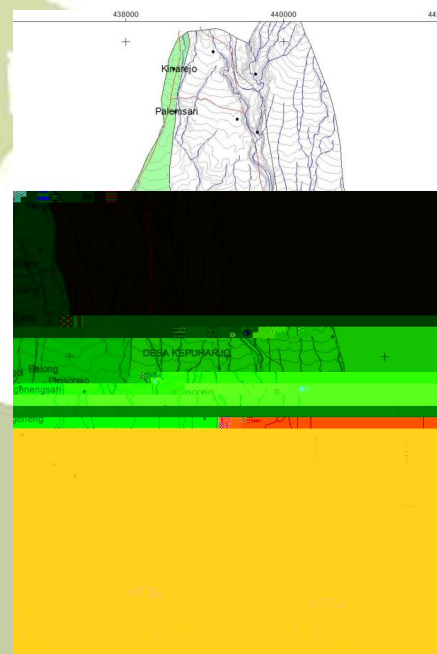
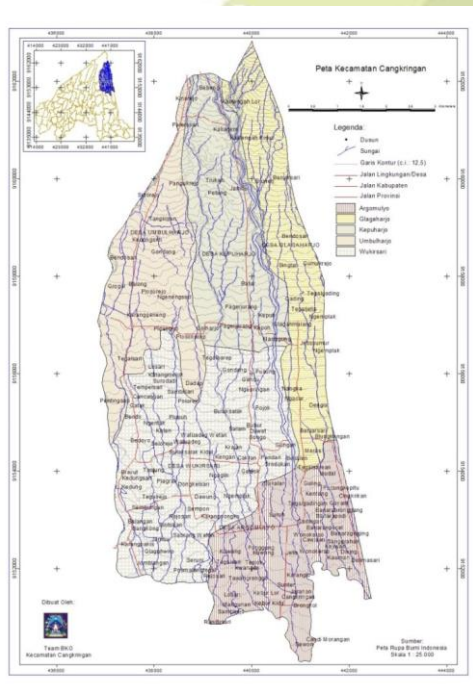


Figure 1a. map of Cangkringan district

Figure 1b. map of Umbulharjo Village

Source: Profil Kecamatan Cangkringan (Cangkringan District Profile), 2013

The next part of this paper is about the sense of belonging and its nature in the sense of community to support people's attempts of adaptation during the evacuation period. Then third part of this paper is the research design and methodology followed by the analysis and discussion. The last part is the conclusions drawn from the investigation of the results.

2. SENSE OF BELONGING AND SENSE OF COMMUNITY

Any disaster will leave stress to the individual, family, the part of the society, and even to the whole community. Cassidy (1997) explained that disaster as a cataclysmic event is described as high severity events, affecting large number of people and generally of limited duration (p. 108). Such immediate shock, grief, and psychological disturbance will often follow this traumatic event. It seems that it does not only need the rescue

services to evacuate the victims, but also it requires psychological support services to build the people's self-esteem to survive. In terms of how people respond to the disaster, there are individual differences to cope it. In another part of his explanation, Cassidy (1997) identified that the implication variables to respond to disaster have three levels. They are: in the person, in the traumatic event itself, and in the recovery environment. In the person, the aspect of cognitive of the person will mediate the process. In the traumatic event, the degree of loss and the level of threat in that situation can essentially give a huge impact. While in the recovery environment, the social support is necessary. (p. 113).

In the case of Merapi eruption disaster, that phenomenon after disaster also occurred in some villages within Cangkringan District, including Umbulharjo. Various public buildings such as neighborhood halls or neighborhood multi-purposes buildings, schools, religious buildings, and other government offices, are considered to be used as shelters for the evacuees. Physically, the buildings, with many modifications of spatial and functional rooms, are quite appropriate to accommodate a certain number of people for a temporal duration.. Nevertheless, other non physical aspects of life seem to be lack of services, for example in terms of the traumatic event and the belongings they had loss. It affected the social behavior among them. Thus, a good affection relationship between the evacuees and the place itself is important. From the psychological aspect, the behavior setting concept to be considered during the evacuation period is needed. As the social support in the evacuation buildings mainly came from their former surrounding communities, the sense of community principle is essential. The social framework among the evacuees helps the people to adapt to a new situation in the evacuation camp. Loosing something valuable after the disaster is very sorrowful. On the other hand, the feeling of the people is very significant in life and it strongly relates to how the people will cope with intensely awful emotions. Having sense of belonging regarding the place or the people around is experienced by every individual.

A sense of belonging is basically a human need. To build a sense of belonging, the efforts and practices are needed. CIDREE/ UNESCO, (1983) in its publication about 'A Sense of Belonging: Guidelines for values for the humanistic and international dimension of education' indicates that a sense of belonging implies that all should have a secure physical, emotional, and political locus within the society (p. 13). In order to encourage every individual in a community to develop a sense of belonging, the experiences sharing and opinions among others, fostering a sense of membership, creating an atmosphere of emotional security, and taking part in the special ceremonial activities or occasion can be carried out (p. 18). In addition to that, the Social Issues Research Centre/ SIRC highlighted that "alongside social interactions, physical space is a fundamental marker of belonging, both in traditional communities and in modern nation states" (SIRC, 2007, p.18).

A spirit of belonging together is experienced as a sense of community (McMillan, 1996). Whereas, McMillan and Chavis (1986) explained that a sense of community itself consists of 4 elements i.e. (1) membership, a feeling of belonging or of sharing a sense of personal relatedness; (2) influence, a sense of mattering, of making a difference to a group and of the group mattering to its members; (3) integration of fulfillment of needs, a feeling that members' needs will be met by the resources received through their membership in a group, and (4) shared emotional connection, the commitment and belief that members have shared and will share. According to them as well, one element of sense of belonging includes an expectation of belonging.

This research investigated about the roles of sense of belonging that influence the evacuees to have a sense of community within the public evacuation building due to the Mount Merapi eruption based on what McMillan and Chavis (1986) had defined above. This will be explored in the research design and methodology of the research.

3. RESEARCH DESIGN AND METHODOLOGY

This research utilized the quantitative approach to measure the sense of community in the public evacuation building where people were sheltered during the evacuation period, using a part (means not all criteria) of the sense of community index (SCI) developed by McMillan and Chavis (1986).

The location of the research was in Cangkringan District, Sleman Regency. The research population was focused on the residents of Umbulharjo Village, who had been evacuated and accommodated in the public evacuation buildings. Sampling technique for respondents used the purposive snowball sampling which directing to other people who were available for respondents. The number of respondents was limited to 50 (fifty), mostly adults, some of them are the head of households, coming from almost all neighborhoods over the village. From the respondents' experience, the near public evacuation buildings in which they had been sheltered were determined.

The methods of data collection data were questionnaire, interview, and observation. The types of data that were gathered were dependent on the criteria given in SCI, although not all criteria were used. The chosen criteria were expected to be able to indicate the habitability of the public evacuation buildings, and the adaptation of the people. Table 1 shows the data criteria that were explored from the element of sense of community used in the investigation.

Table 1 SCI, element and criteria

No	Element	Criteria
1	membership	<ul style="list-style-type: none"> ▪ member of activity groups ▪ frequencies of activities involved
2	influence	<ul style="list-style-type: none"> ▪ feeling of losing place or people around
3	integration of fulfillment of needs	<ul style="list-style-type: none"> ▪ involvement of daily activities ▪ frequencies of involvement
4	shared emotional connection	<ul style="list-style-type: none"> ▪ expectations in consuming the place ▪ degree of enjoyment in consuming the place ▪ degree of comfort in consuming the place

Source: McMillan and Chavis, 1986. (selected and modified by the author).

4. ANALYSIS AND DISCUSSION

The initial findings of the investigation can be explained from the data analysis, firstly from the identification of respondents, identification of the public evacuation buildings, and secondly from the relationship of what the places provide for daily or occasional activities and how they can get involved in the provided spaces. The discussion will take the sense of community in order.

The neighborhood origin of the identification respondents in Umbulharjo Village is shown in table 2 below:

Table 2 Neighborhood origin of respondents

Name of neighborhood origin	Number of respondents
Pangkurejo	5
Tangkisan	2
Kedungsriti	10
Kinahrejo	1
Balong	8
Plosokerep	5
Balong wetan	2
Gondang	5
Grogol	6
Grambetan	4
Bendosari	2
Total	50

Table 3 below indicates the public evacuation buildings around the Cangkringan District, the places where the respondents have been sheltered. The table shows that not all Umbulharjo citizens was evacuated in Umbulharjo Hall, some were sheltered in other public evacuation buildings near the surrounding the areas within Cangkringan District.

Table 3 Name of public evacuation buildings

Name of public evacuation building	Number of respondents
Hall of Umbulharjo Village	24
Hall of Wukirsari Village	21
Kiyaran elementary school	5
Total	50

The analysis of data using some criteria in Sense of Community Index (SCI) was categorized into 4 elements i.e. (1) membership; (2) influence; (3) integration of fulfillment of needs; and (4) shared emotional connection.

4.1. Membership

From 50 respondents, only 24% of them got involved as the organization members. All of them were in the community of Umbulharjo Hall Building. Other 76% of respondents had no membership of any organization. They were respondents who stay in Wukirsari Hall and Kiyaran Elementary School. They might not get involved in any organization there because the places itself are not in their own administrative village, so they were not familiar enough with the situation. It can be shown in table 4 below.

Table 4 Membership of any organization

Membership	Respondent	Percentage	Evacuation Building
women organization	7	14%	Umbulharjo
social organization	1	2%	Umbulharjo
bank staff association	1	2%	Umbulharjo
art society	3	6%	Umbulharjo
no activities	38	76%	Wukirsari, Kiyaran

The frequency of activities as a member of organization mostly one in a month, some others are weekly. If the evacuation duration is quite long, the membership or organization may be significant to support their sense of belonging because people will feel to be accepted in the community. On the other hand, if the duration of evacuation is just for a short period, the membership of organization is considered as not an essential support.

4.2. Influence

The influence includes a range of effect among others those have some bearing on control the place. This range of influence spreads from very difficult to very easy of the affection feeling of loosing the place and in persuading or encouraging themselves and others to survive. Most people in Umbulharjo Hall Building felt very difficult if they lost the place for living. They had got along with the places because the place is located in their own administrative village. However, people who were sheltered in Wukirsari and Kiyaran School found that it was not very difficult to move to other places because they were used to stay in an area other than their own villages. The influence of the place did not significantly affect their life. Table 5 shows the influence of the affective places and people in public evacuation buildings.

Table 5 Range of influence

Feeling of loosing the place to stay survive	Respondents
very difficult	10
difficult	19
easy	17
very easy	4
Total	50

4.3. Integration of Fulfillment of Needs

The integration of fulfillment of needs consists of the involvement in daily activities in the camp, and the frequency of such activities. There are almost 80% of the respondents who did not get involved in the daily activities in the evacuation buildings. It is a very a disappointing situation that the evacuees did nothing in the camp. This condition implies that the place is not quite conducive to do some useful activities to stay survive. It may due to the lack amount of facilities which can encourage people to be actively doing various activities. It may also because of the not so close interrelationship among others. Another 20% of the respondents got involves in the daily activities such as servicing mails for others, encouraging others to be responsible for their own belongings, etc.

4.4. Shared Emotional Connection

The shared emotional connection includes expectations in consuming the place, degree of enjoyment in consuming the place, and degree of comfort in consuming the place. The data shows that 68% of the respondents did not have expectation of the place to be consumed for doing something. This condition indicates that the people did not expect to be in the camp for long time duration. They only hoped to stay in the camp for a short evacuation period. The rest 32% respondents hoped to have something to do to survive in the camp.

The degree of enjoyment in consuming the place in the camp presents quite a good result. Only 18% of the respondents did not enjoy living in the camp. The others were easily adaptable to the place where they were sheltered for a short evacuation period. It means that the place is habitable enough to naturally accommodate them.

In terms of the degree of comfort, 54% of the respondents said that they can adapt the physical condition of the place and felt comfortable enough to stay during the evacuation period. Another 46% of respondents experienced uncomfortable feeling in the camp, mostly in the Wukirsari Village Hall. This may due to respondents were less familiar with the place which is outside of their own administrative village area. This may also because the place was less habitable to live for a certain duration of evacuation period.

4.5. Correlation Between Elements

The integration of fulfillment of needs gives effects onto the shared emotional connection in terms of the expectation of doing some activities together with other evacuees in the camp. The ones who had expectation are the ones who got involved in some activities. The developing potential and prospective activities mainly depend on the places where the people stay. It means that the development of some facilities and spacious spaces to accommodate various activities in the camp can support the degree of habitability of the place. It was shown in the Umbulharjo Hall Building.

The respondent who did not get involved in any activities in the camp, did not have a better expectation for a longer evacuation duration as happened in Wukirsari Hall Building and Kiyaran Elementary School. It can be concluded that providing various activities is a significant aspect to create the attachment of the people towards a certain place. The attachment of the people to a place attachment also affects the degree of enjoyment as well as the degree of comfort in the case of Umbulharjo Hall Building. However, it is not reliable to the cases of Wukirsari Hall Building and Kiyaran Elementary School. In these two buildings, regardless getting involved in any activities or not, the evacuees can still adapt to the physical condition so they feel enjoy and comfortable for a certain short duration of the evacuation.

The correlation between the integration of fulfillment of needs and the influence indicates that the more various needs fulfilled in the camp, the bigger opportunity to the people to have a sense of belonging of the place.

The element of membership gives relational effect to the shared of emotional connection. The member of an organization can share experiences, expectation in consuming the place, and also the hopes of more enjoyable and comfortable place to live.

It seems that element of membership does not give effect on the element of influence. It does not matter whether the respondents are a member of an organization or not. They still found it difficult to imagine the losing of their homes and the possibility of moving to the new places as the shelters.

5. RESEARCH RESULTS AND CONCLUSIONS

In general, from the results, it can be concluded that the people's sense of belonging of the public evacuation shelters in Cangkringan District only appears in the elements of shared emotional connection and influence. This is mainly due to the effects of the membership element and the integration of the fulfillment of needs within the sheltered camps.

The aspect of communities' residence significantly influences the people's sense of belonging of the public evacuation shelters where they are accommodated during the evacuation period of time. The sense of familiarity of the area will make it easier for the people to survive. The people need to have a better attachment to the place in order to survive.

Further researches are still needed. A broader area of study with a bigger number of respondents and a deeper qualitative investigation about the people's sense of belonging in public evacuation shelters need to be developed.

In addition, the integrated facilities and services towards a better quality of life in public evacuation buildings need to be provided, not only to complete the habitability of physical settings but also the social spaces to support the evacuees' psychological concerns.

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