Organized by:

Faculty of Civil
and Environmental Engineering
Institut Teknologi Bandung
INDONESIA

In Collaboration with:

AUN/SEED-Net JICA · Indonesian Ministry of Public Works Construction Development Agency · elnusa trusted energy services · JASAMARGA Indonesia Highway Corp · Holcim · BRIDGESTONE

CERTIFICATE

ConCERN 2014

Conference for Civil Engineering
Research Networks 2014

Jointly held with

7TH ACEC

7th ASEAN Civil Engineering Conference
Under AUN/SEED-Net

This is to certify that

Junaedi Utomo

attended the conference as

Presenter

Reini Wirahadikusumah
Chair, ConCERN 2014

Suprihanto Notodarmojo
Dean, Faculty of Civil and Environmental Engineering-ITB

Delivering Sustainable Infrastructure Through Collaborative Research in Civil Engineering

4-5 November 2014,
ITB Campus, Bandung, INDONESIA
concern.itb.ac.id

PROGRAM & ABSTRACTS BOOK

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ConCERN 2014

Conference for Civil Engineering Research Networks 2014

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ACEC

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CONTENT

PREFACE

Civil engineering has been contributing in creating a sustainable world and enhancing the global quality of life. The challenges of sustainable development could be answered by embracing the roles of civil engineers as innovators and integrators of ideas and technology across the public, private, and academic sectors. Hence, civil engineering society are becoming more aware of social, health, environmental and economic issues.

Innovations in civil engineering and integration among the stakeholders of the infrastructure development require continuing collaborations. Despite the fact that collaboration has been an integral part of research in civil engineering for a long time, the nature of collaboration seems to be shifting from focused research theme within a center of excellence to the new trend in broadening research themes which requires partnerships among centers of excellence (e.g. academic, government, private industry).

Facilitating the dissemination of collaboration results, the establishment of new collaboration, and the strengthening of the established collaborations, through a regional conference is the objective of the Faculty of Civil and Environmental Engineering (FCEE), Institut Teknologi Bandung. "Conference for Civil Engineering Research Networks" or ConCERN in 2014 is expected to instigate the research networks in the area of civil engineering that the FCEE have already recognized.

ITB has long been an active member of AUN/SEED-Net and its ASEAN Civil Engineering Conference (ACEC). The ASEAN University Network (AUN) Southeast Asia Engineering Education Development Network (SEED-Net) Project consists of 26 leading Member Institutions from 10 ASEAN countries with the support of 14 leading Japanese Supporting Universities. ACEC is a platform to share the most updated technology and research on common regional issues in order to contribute to the ASEAN community and to draw support from the industrial and the governmental sectors. The regional conference allows opportunities for AUN/SEED-Net members to publicize their research work, exchange ideas and discuss future collaborations and activities related to the civil engineering field. The conference itself is not only to enhance the academic network among the ASEAN universities, but also to strengthen the relationship between ASEAN and Japanese professors of each university.

This year, the 7th ASEAN Civil Engineering Conference (ACEC) is organized jointly with ConCERN 2014.

PREFACE

Participants of the conference include researches, academic staffs, students, industry representatives, public and local governments. The keynote presentations are as follows:

- George Ofori, National University of Singapore, Singapore
- Kazuhiko Kasai, Tokyo Institute of Technology, Japan
- Akimasa Fujiwara, Hiroshima University, Japan
- Susumu Iai, Kyoto University, Japan
- Syahril B. Kusuma, Water Resources Research Group, Institut Teknologi Bandung, Indonesia

Invited Speakers from the industry:

- Djayanta Ginting, Value Added Solution Manager of Holcim Indonesia
- Nobuo Masaki, Bridgestone Corporation, Japan

The conference main theme is 'Delivering Sustainable Infrastructure through Collaborative Research in Civil Engineering'. The selected papers to be discussed in this conference cover research ideas, findings, and innovations in the following sub-themes:

1. Structural Engineering and Materials
2. Geotechnical Engineering
3. Transportation Engineering and Planning
4. Water Resources Engineering and Management
5. Construction Engineering and Management
6. Infrastructure Engineering and Management

While this event is focusing on strengthening research collaborations, there are about 75 papers contributors, from twelve countries. This event also included special meetings for AUN/SEED-Net member representatives and representatives of other universities are central to the objective of the conference. So we are excited that ConCERN 2014 will be an effective event to facilitate research collaborations among our colleagues in the region.

We are very grateful for the support from our sponsors: AUN/SEED-Net-JICA, The Ministry of Public Works, PT. Jasa Marga, Holcim Indonesia, PT. Elnusa, and PT. Bridgestone Engineered Products Indonesia. Finally, we would like to thank you all for your active engagement in the conference. Your contributions throughout this two-day event will be well-considered, insightful and extremely helpful in informing our next steps in building a case for civil engineering regional scheme.

Bandung, October 27, 2014

WELCOMING REMARKS

Prof. SUPRIHANTO NOTODARMOJO
Dean, Faculty of Civil and Environmental Engineering
Institut Teknologi Bandung

Rector of Institut Teknologi Bandung: Prof. Ahmaloka
Chief of Research and Network Promotion Unit of AUN/SEED-Net: Mr. Tokumitsu Kobayashi,
Distinguished guests, ladies and gentlemen,

Assalamu'alaikum Warahmatullahi Wabarakatuh.
Good Morning.

Welcome to Bandung. Welcome to ITB, and Welcome to Conference for Civil Engineering Research Networks/ASEAN Civil Engineering Conference (ConCERN/ACEC 2014).

This conference is organized by Faculty of Civil and Environmental Engineering (FCEE), Institut Teknologi Bandung (ITB) - Indonesia, in collaboration with:

- AUN/SEED-Net-JICA
- The Ministry of Public Works
- PT. JasaMarga
- PT Holcim Indonesia
- PT. Elnusa
- PT. Bridgestone Engineered Products Indonesia
- Kyoto University, Japan
- Hiroshima University, Japan
- Tokyo Institute of Technology, Japan
- Chulalongkorn University, Thailand
- National University of Singapore, Singapore

It is also our great pleasure and privilege to have,

- AUN/SEED-Net members
- Prof. George Ofori from National University of Singapore, Singapore
- Prof. Susumu Iai from Kyoto University, Japan
- Prof. Akimasa Fujiwara from Hiroshima University, Japan
- Prof. Kazuhiko Kasai from Tokyo Institute of Technology, Japan
- Djayanta Ginting, Value Added Solution Manager of Holcim Indonesia
- Muh. Najib Fauzan, Director of Human Resources and General Affairs, Indonesian Highways Corp.
- Nobuo Masaki, Dr.Eng., Bridgestone Corporation, Japan

WELCOMING REMARKS

To join us in ConCERN 2014 and in The 7th ASEAN Civil Engineering Conference (ACEC).

I would like to greet also all of the authors and participants. Thank you for your participation in our event.

Distinguished guests, ladies and gentlemen,

Today, we are gathered here, believing that this conference will be the one with your invaluable contributions and ConCERN 2014 will be an effective event to facilitate research collaborations among our colleagues in the region. In this conference, we will have an opportunity to discuss 'Delivering Sustainable Infrastructure through Collaborative Research in Civil Engineering'.

Moreover, since we are already gathered in this rare occasion, besides discussing issues related to the themes of the conference, I invite all participants to also open a prospect of initiating further collaboration and networking amongst us, the practitioners and researchers, in addressing infrastructure and built environment issues for our world sustainability.

ConCERN 2014 and The 7th ASEAN Civil Engineering Conference (ACEC) was initiated not only to enhance the academic network among the ASEAN universities, but also to strengthen the relationship between ASEAN and Japanese professors of each university and also representatives of other universities in Indonesia.

Faculty of Civil and Environmental Engineering (FCEE) are fully supported this event and we are hoping this event will be held again every four years as a part of the FCEE roadmap as one of the tools to encourage collaborations research and projects among necessitating partnerships across centers of excellence (e.g. academic, government, private industry).

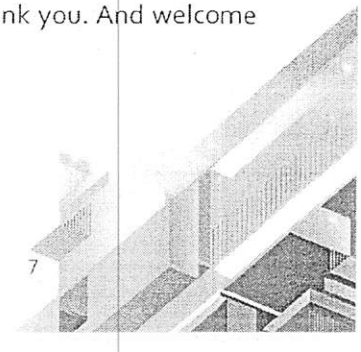
Distinguished guests, ladies and gentlemen,

We are very grateful for the support from our sponsors: AUN/SEED-Net-JICA, The Ministry of Public Works, PT. Jasa Marga, Holcim Indonesia, PT. Elnusa, and PT. Bridgestone Engineered Products Indonesia. We would like to thank you all for your active engagement in the conference.

I also thank to all faculty members and students in the Faculty of Civil and Environmental ITB who have been organizing this event; the synergy between academic program management, faculty members, and students are essential in delivering the success of this conference.

So, I am very grateful to have you all here in this conference. Thank you. And welcome again to ConCERN 2014.

Wassalamu'alaikum Warahmatullahi Wabarakatuh.



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- Akimasa Fujiwara, Hiroshima University, Japan.
- Kazumasa Ozawa, University of Tokyo, Japan.
- Toshio Koike, University of Tokyo, Japan.
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- Ofyar Z. Tamin, Institut Teknologi Bandung, Indonesia.
- Iswandi Imran, Institut Teknologi Bandung, Indonesia.
- Biemo Soemardi, Institut Teknologi Bandung, Indonesia.
- Bigman Hutapea, Institut Teknologi Bandung, Indonesia.
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all graphics in ConCERN 2014 and 7th ACEC are designed and developed by Chandra Tresnadi, nu'un Corner Studio (please follow: @jongchandra)

ConCERN 2014

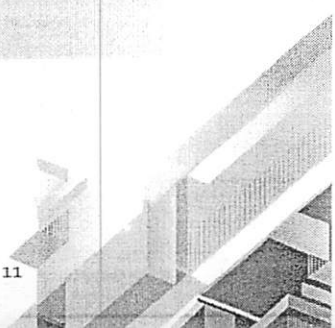
7th ACEC

Theme of ConCERN 2014 and 7th ACEC

The conference main theme and the selected papers to be discussed in this conference would cover research ideas, findings, and innovations in the following:

DELIVERING SUSTAINABLE INFRASTRUCTURE THROUGH COLLABORATIVE RESEARCH IN CIVIL ENGINEERING

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



SPEAKERS

KEYNOTE SPEAKERS

Prof. George Ofori, National University of Singapore, Singapore

Ethics and Personal Responsibility in The Construction Industry

Prof. Susumu Iai, Kyoto University, Japan

Combined Geotechnical Hazards Due to Tsunami and Earthquakes

Prof. Akimasa Fujiwara, Hiroshima University, Japan

Analyzing Air Quality Based on Limited Monitoring Data in Developing City

Prof. Kazuhiko Kasai, Tokyo Institute of Technology, Japan

Japanese Steel Seismic Design for Functional Continuity

Prof. Syahril B. Kusuma, Water Resources Research Group, Institut Teknologi Bandung, Indonesia

Current Issues on Climate Change Adaptation Strategy for Flood Disaster Management

INVITED SPEAKERS

Jiro Takemura, et.al.

Centrifuge Study on Reinforcement of Pile Group by Sheet Piles Against Lateral Loadings

Takashi Matsumoto

Investigation on the Mechanics of CFRP Structural Members

Sucharit Koontanakulvong

Recent Technology Development & Applications in Flood Management-Thailand Case Study

SPEAKERS FORM THE INDUSTRY

Djayanta Ginting, Value Added Solution Manager of Holcim Indonesia

Concrete That Contribute to Sustainable Construction

Nobuo Masaki, Dr.Eng., Bridgestone Corporation, Japan

R&D in Seismic Isolation Rubber Bearing

SPECIAL SPEAKER

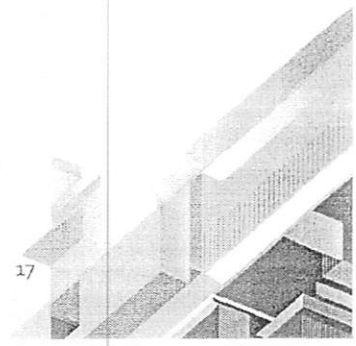
Prof. Adang Surahman, Center for Infrastructure & Built Environment (CIBE) Institut Teknologi Bandung, Indonesia

CONFERENCE SCHEDULE

GENERAL SESSION			DAY 1 Tuesday, 04 November 2014
08:00 - 09:00 AM (1:00)	West Hall	Plenary	Registration
09:00 - 09:40 AM (0:40)	West Hall	Plenary	Opening Ceremony Report from Organizing Committee: Reini Wirahadikusumah, Ph.D. Dean's Welcoming Remarks: Prof. Suprihanto Notodarmojo Chief of Research and Network Promotion Unit AUN/SEED-Net: Tokumitsu Kobayashi Opening by ITB Rector: Prof. Akhmaloka
09:40 - 10:00 AM (0:20)	West Hall		*Coffee Break*
10:00 - 10:25 AM (0:25)	West Hall	Plenary	Keynote Lecture 1 (Moderator: Prof. Rizal Z. Tamin, ITB) Prof. George Ofori - National University of Singapore, Singapore **Ethics and Personal Responsibility in the Construction Industry**
10:25 - 10:40 AM (0:15)	West Hall	Plenary	Sponsor Session (Holcim)
10:40 - 11:05 AM (0:25)	West Hall	Plenary	Keynote Lecture 2 (Moderator: Prof. Bambang Budiono, ITB) Prof. Kazuhiko Kasai, Tokyo Institute of Technology, Japan **Japanese Steel Seismic Design for Functional Continuity**
11:05 - 11:20 AM (0:15)	West Hall	Plenary	Sponsor Session (Bridgestone)
11:20 - 11:45 AM (0:25)	West Hall	Plenary	Keynote Lecture 3 (Moderator: Prof. Ade Sjafruddin, ITB) Prof. Akimasa Fujiwara, Hiroshima University, Japan **Analyzing Air Quality Based on Limited Monitoring Data in Developing City**
11:45 - 12:10 PM (0:25)	West Hall	Plenary	Keynote Lecture 4 (Moderator: Prof. Masyhur Irsyam, ITB) Prof. Susumu Iai, Kyoto University, Japan **Combined Geotechnical Hazards due to Tsunami and Earthquakes**
12:10 - 12:20 PM (0:10)	West Hall	Plenary	Special Session (Center for Infrastructure & Built Environment ITB) Prof. Adang Surahman, Institut Teknologi Bandung, Indonesia
12:20 - 12:45 PM (0:25)	West Hall	Plenary	Keynote Lecture 5 (Moderator: Prof. Sucharit Koontanakulvong, Chula) Prof. Syahril B. Kusuma, Water Resources Research Group, Institut Teknologi Bandung, Indonesia **Current Issues on Climate Change Adaptation Strategy for Flood Disaster Management**
12:45 - 01:45 PM (1:00)	West Hall		*Lunch*
01:45 - 03:05 PM (1:20)		Parallel	Technical Paper Presentations 1 (21 papers)
	CC 4		Construction Management: 4 papers
	West Hall		Structure: 4 papers
	ALSI		Water Resources: 5 papers
	CC 1		Transportation: 4 papers
	CC 2		Geotechnics: 4 papers

CONFERENCE SCHEDULE

GENERAL SESSION		DAY 1 Tuesday, 04 November 2014
03:05 - 03:35 PM (0:30)		*Coffee Break*
03:35 - 04:35 PM (1:00)	Parallel	Technical Paper Presentations 2 (19 papers)
	CC 4	Construction Management: 3 papers
	West Hall	Structure: 4 papers
	ALSI	Water Resources: 5 papers
	CC 1	Transportation: 3 papers
	CC 2	Geotechnics: 4 papers
07:00 - 09:00 PM (2:00)		*Cultural Dinner*
07:00 - 07:30 PM (0:30)		Opening
		Remark: Head of Civil Eng. Graduate Progam (Harun A. S. Lubis)
07:30 - 08:00 PM (0:30)		Dinner
08:00 - 09:00 PM (1:00)		Cultural Performance
09:00 PM		Closing



CONFERENCE SCHEDULE

GENERAL SESSION			DAY 2 Wednesday, 05 November 2014
08:00 - 09:30 AM (1:30)	R. FTSL		Field Management meeting
09:00 - 10:20 AM (1:20)		Parallel	Technical Paper Presentations 3 (20 papers)
	CC 4		Construction Management: 4 papers
	West Hall		Structure 1 : 4 papers
	ALSI		Structure 2 : 4 papers
			Water Resources: 0 papers
	CC 1		Transportation: 4 papers
	CC 2		Geotechnics: 4 papers
10:20 - 10:50 AM (0:30)			*Coffee Break*
10:50 - 12:10 PM (1:20)		Parallel	Technical Paper Presentations 4 (15 papers)
	CC 4		Construction Management: 3 papers
	West Hall		Structure 1 : 4 papers
	ALSI		Structure 2 : 4 papers
			Water Resources: 0 papers
	CC 1		Transportation: 4 papers
			Geotechnics: 0 papers
12:10 - 12:25 PM (0:15)		Plenary	Closing Ceremony
			Closing Remark from Head of Civil Engineering Graduate Program ITB
12:25 - 01:25 PM (1:00)			*Lunch*
01:25 - 02:40 PM (1:15)	West Hall		AUN/SEED-Net Member Institution session - Research Collaboration and Networks Meetings
02:40 PM			Side Events "Bandung Explore Tour"

ConCERN 2014

CONFERENCE SCHEDULE

7TH ACEC

DAY 1
Tuesday, 04 November 2014

A (Campus Center Galery 5)

Construction Management

Moderator: Vachara Peansupap

SESSION 1

01:45 - 02:05 PM	P1-A1	ID-001	I Wayan Muka
(0:20)			*Property Development Risk: Case Study in Indonesia*
02:05 - 02:25 PM	P1-A2	ID-005	Bambang Endroyo, Akhmad Suraji, M Sahari Besari
(0:20)			*Investigation of the Role of Client & Consultant in the Pre-Construction Safety Planning*
02:25 - 02:45 PM	P1-A3	ID-058	R. Wirahadikusumah, B. Susanti, B. Soemardi, M. Sutrisno
(0:20)			*Drivers to Achieve Increased Benefits in Performance-based Contracts of Road Projects*
02:45 - 03:05 PM	P1-A4	ID-059	Dyla M. Octavia, Muhamad Abduh
(0:20)			*Emission-based Simulation Model for Selecting Concreting Operation's Method*
03:05 - 03:35 PM (0:30)			*Coffe Break*

Construction Management

Moderator: Biemo W. Soemardi

SESSION 2

03:35 - 03:55 PM	P2-A1	ID-060	Rezza Falen, Muhamad Abduh
(0:20)			*Project Delivery System for Green Building Projects in Indonesia*
03:55 - 04:15 PM	P2-A2	ID-068	Betty Susanti, Reini D. Wirahadikusumah, Biemo W. Soemardi, Mei Sutrisno
(0:20)			*Road User Cost Assessment Approach in Calculation of Life Cycle Cost for Indonesia National Road Maintenance Projects Contracted Under Performance Based Contract*
04:15 - 04:35 PM	P2-A3	ID-075	Siswanti Zuraida, Dewi Larasati
(0:20)			*Eco-Costs Life Cycle Assessment Of Bamboo Preservation As Local Indigenous Method*
04:35 - 04:55 PM	P2-A4		
(0:20)			

CONFERENCE SCHEDULE

DAY 1
Tuesday, 04 November 2014

B (Campus Center Galery 2)

Geotechnics

Moderator: Erza Rismantojo

SESSION1

01:45 - 02:05 PM	P1-A1		Invited Speaker: Jiro Takemura, et al.
(0:20)			*Centrifuge Study on Reinforcement of Pile Group by Sheet Piles Against Lateral Loadings*
02:05 - 02:25 PM	P1-A2	ID-091	Harianto Rahardjo, Alfredo Satyanaga, Leong Eng Choon, Wang Chien Looi
(0:20)			*Role of Unsaturated Soil Mechanics in Sustainability of Slopes*
02:25 - 02:45 PM	P1-A3	ID-009	Gati Annisa Hayu, Michael Brun, Fabien Delhomme, Endah Wahyuni
(0:20)			*Numerical Study of The Behavior of Shear Walls Subjected to Loads Earthquakes*
02:45 - 03:05 PM	P1-A4	ID-044	Pyi Soe Thein 12, Subagyo Pramumijoyo2, Kirbani Sri Brotopuspito3, Junji Kiyono4, Wahyu Wilopo2, Agung Setianto2
(0:20)			*Seismic Ground Motion Estimation of Alluvium Layers Using Array Microtremor Recordings at Palu City, Indonesia*
03:05 - 03:35 PM (0:30)			*Coffe Break*

Geotechnics

Moderator: Endra Susila

SESSION2

03:35 - 03:55 PM	P2-A1	ID-057	Wawan Budianta, Arifudin, Lutfi Effendi, Jiro Takemura, Hirofumi Hinode
(0:20)			*Preliminary study of the use of natural zeolite as waste disposal liner*
03:55 - 04:15 PM	P2-A2	ID-006	Alexander Preh, Ari Sandyavitri, Frans Tohom
(0:20)			*Assesement and Mitigation of Rockfall Risks (Case Study: Kloch, Austria)*
04:15 - 04:35 PM	P2-A3	ID-093	Nghia Trong LE
(0:20)			*A Failure of Existing Piles Inside The Excavation In Very Soft Clay*
04:35 - 04:55 PM	P2-A4	ID-102	Tze Che Van, Chai Fung Mok, Tze Liang Lau
(0:20)			*Assessment of Ground Motion Attenuation Model for Peninsular Malaysia Due to Sumatra Subduction Earthquake*

ConCERN 2014

ACEC

CONFERENCE SCHEDULE

DAY 1
Tuesday, 04 November 2014

C (Campus Center Galery 1)

Transportation

Moderator: Russ Bona

SESSION 1

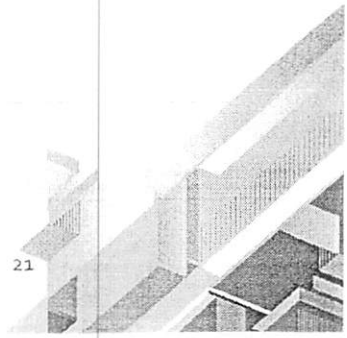
01:45 - 02:05 PM	P1-A1	ID-027	Sulistyorini R
(0:20)			*How Many Cost Losses Caused By Traffic Jam in Term of Fuel Consumption and Value of Time on Main Road in Bandar Lampung*
02:05 - 02:25 PM	P1-A2	ID-029	Agah Muhammad Mulyadi, ST, MT
(0:20)			*Motorcyclist Characteristic and Motorcycle Movement*
02:25 - 02:45 PM	P1-A3	ID-019	Redrik Irawan, Achmad Riza Chairulloh
(0:20)			*Segmental - Orthotropic - Steel Panel Behavior on Citarum 1 Bridge, Bandung Regency*
02:45 - 03:05 PM	P1-A4	ID-040	Iqbal Maulana
(0:20)			*Reduced Traffic Conflict Intersection by Using Median (U-Turn) Case Study: At one intersection Kolonel Soegiono Street In Tegal*
03:05 - 03:35 PM (0:30)			*Coffe Break*

Transportation

Moderator: Nur Sabahiah Bt Abdul Sukor

SESSION 2

03:35 - 03:55 PM	P2-A1	ID-041	Ferdinand Fassa, Fredy Jhon Philip Sitorus, Retno Ambarsari
(0:20)			*Performance Evaluation Study Antasari-Blok M & Tanah Abang-Kampung Melayu Elevated Freeways*
03:55 - 04:15 PM	P2-A2	ID-050	Bambang Sugeng Subagio, Alif Setyo Ismoyo, Harmein Rahman
(0:20)			*Resilient Modulus and Fatigue Performance of Stone Mastic Asphalt (SMA) Mixture Using Polymer Modified Bitumen "Elvaloy"*
04:15 - 04:35 PM	P2-A3	ID-055	Iris Mahani, Rizal Z. Tamin
(0:20)			*Problems Identification of Toll Road Investment in Indonesia*
04:35 - 04:55 PM	P2-A4		
(0:20)			



CONFERENCE SCHEDULE

DAY 1
Tuesday, 04 November 2014

D (West Hall)

Structure

Moderator: Tran Xuan Hoa

SESSION 1

01:45 - 02:05 PM	P1-A1		Invited Speaker: Takashi Matsumoto
(0:20)			*Investigation On The Mechanics of CFRP Structural Members*
02:05 - 02:25 PM	P1-A2	ID-012	Lurohman Mamin Masturi
(0:20)			*Calculation of Hydrodynamic Effects on Structures During Lifting Through Splash Zone*
02:25 - 02:45 PM	P1-A3	ID-015	Qinthara Dinur Rahman, I Putu Jaya1, Dina Rubiana Widarda
(0:20)			*Application of Seismic Isolators on Free Cantilever Method Bridge*
02:45 - 03:05 PM	P1-A4	ID-016	Rita Irmawaty,Rudy Djamaluddin,Yaser,Abd Madjid Akkas,Rusdi Usman
(0:20)			*Bending Capacity of Styrofoam Filled Concrete (SFC) Beam Using Truss System Reinforcement*
03:05 - 03:35 PM (0:30)			*Coffe Break*

Structure 1

Moderator: Ivindra Pane

SESSION 2

03:35 - 03:55 PM	P2-A1	ID-017	Tran Xuan Hoa
(0:20)			*The Effects of Hangers' Failure on the Stability of A Network Arch Bridge*
03:55 - 04:15 PM	P2-A2	ID-022	Laura M Putri,Kevin Q Walsh,Jason M Ingham
(0:20)			*Seismic Vulnerability Assessment of Existing Reinforced Concrete Buildings with Masonry Infill Located in The Auckland CBD*
04:15 - 04:35 PM	P2-A3	ID-024	Anton Surviyanto
(0:20)			*Influence of Cement Fineness on Thermal Behavior of Mass Concrete at Early Ages for Bridge Pile Cap with Finite Element Analysis*
04:35 - 04:55 PM	P2-A4	ID-064	J.Utomo, M. Moestopo, A. Surahman, D. Kusumastuti
(0:20)			*A study on simulation models of seismic energy absorbing steel pipes*

CONFERENCE SCHEDULE

DAY 1
Tuesday, 04 November 2014

E (ALSI)

Water Resources

Moderator: Dhemi Harlan

01:45 - 02:05 PM (0:20)	P1-A1		Invited Speaker: Sucharit Koontanakulvong *Recent Technology Development & Applications in Flood Management – Thailand case study*
02:05 - 02:20 PM (0:15)	P1-A2	ID-021	Henny Herawati *A Structural Equation Model of Participatory Management Swampland in Kubu Raya District*
02:20 - 02:35 PM (0:15)	P1-A3	ID-039	Rita Irmawaty, M.W. Tjaronge *Effects of Sea Water as Mixing Water on the Mechanical Properties of Mortar and Concrete*
02:35 - 02:50 PM (0:15)	P1-A4	ID-062	Aji Pratama Rendragraha, Dhemi Harlan *Modelling of Groundwater Dewatering in Transient Condition on the Area of Well Pemp With Galerkin Finite Element Method*
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ABSTRACTS
Technical Session
Structural Engineering and Materials

ID – 024

INFLUENCE OF CEMENT FINENESS ON THERMAL BEHAVIOR OF MASS CONCRETE AT EARLY AGES FOR BRIDGE PILE CAP WITH FINITE ELEMENT ANALYSIS

Anton Surviyanto

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Abstract

The most important characteristic which differentiates mass concrete from other structural concrete is its thermal behavior. Thermal cracking and/or Delayed Ettringite Formation (DEF) can damage mass concrete caused by high temperature development. In Indonesia, the cement fineness of Ordinary Portland Cement (OPC) products are between 277 – 382 m2/kg with Blaine Fineness Testing according to ASTM C 204. This cement fineness parameter can influence the thermal behavior of mass concrete structure. Thus, it is needed to compare the effect of fine and coarse cements on the thermal behavior of mass concrete at early ages for bridge pile cap. The bridge pile cap was modeled as a three-dimensional transient heat transfer model using finite element analysis to simulate the real structure. As a result, after 80 hours of simulation, the maximum temperature of the fine cement model reached 55°C while the maximum temperature of the coarse cement model did not exceed 47°C. For both cements, the maximum temperature is below 70°C and the thermal gradient between the interior and the surface of the concrete block is below 20°C.

Keywords: Cement Fineness, Thermal Behavior, Mass Concrete, Bridge Pile Cap, Finite Element Analysis.

ID – 064

A STUDY ON SIMULATION MODELS OF SEISMIC ENERGY ABSORBING STEEL PIPES

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Abstract

The aim of this study is to develop simulation models of steel pipe as hysteretic dampers for seismic resistant steel structures. Steel pipe dampers are chosen as energy dissipating device because they are easy to install, maintain and inexpensive. Steel pipes in various positions are able to dissipate seismic input energy in a structure through hysteresis of the metal. Numerical simulation is carried out using non-liniear structural analysis program ABAQUS. Cyclic shear loading is applied to: a) vertical steel pipe dampers positioned in the plane of the frame of the structure; and b) horizontal steel pipe dampers positioned perpendicular to the plane of the frame of the structure. Cyclic axial loading is applied to the horizontal steel pipes postioned in the plane of the frame of the structure; in this case the steel pipes are intended to function as stoppers to backup the main damper in absorbing excessive seismic input energy. The following requirements for steel pipe dampers are taken into account: a) dampers provide stiffness and supplement damping to the structure; b) most part of the dampers yield simultaneously; c) dampers have satisfactory ultra low-cycle fatique (ULCF) capacity. Steel pipes with diameter greater than 100 mm (considered to be useable as dampers) have diameter to thickness ratio more than 20 which is too slender; meaning, steel pipes have less than necessary amount of material to fullfill the above requirements. Various strengthening strategies to bare steel pipes are explored in the simulation models. Ductile fracture in steel that initiates in fewer than twenty constant amplitude loading cycles has been term Ultra Low Fatique Cycle. Under ULCFs load dampers experienced extensive plasticity and limited cyclicity. ULCF has been treated more as a fracture problem than a fatigue problem in micromechanics-based models, which provide accurate criteria for predicting ductile fracture, proposed by Kanvinde and Deierlein (2007). Ductile fracture controls the ultimate strength and ductility of structural components, therefore accurate preliminary prediction of ductile fracture is critical to the perfomance of steel pipe dampers. The finite element simulation models can be utilized to preliminary predict ductile fracture in steel pipes using the criteria from the micromechanics-based models. Several results from studying the behavior and preliminary ductile fracture prediction of the models, which show the potential to be developed further into operational hysteretic steel pipe dampers, will be presented.

Keywords: ductile fracture, micromechanics-based model, steel pipe as hysteretic damper, supplemental damping

ID – 070

FLEXURAL BEHAVIOUR OF MACRO SYNTHETIC FIBER REINFORCED HIGH STRENGTH CONCRETE

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Abstract

Extensive research in the development and application of macro synthetic fiber reinforced concrete has been very active in the last four decades. The primary area of application of these short discrete fibers in reducing shrinkage and thermal cracking has been extended to structural applications. When concrete is stressed, the randomly fiber distribution in concrete matrix plays important role to bridge the cracks. This mechanism is the main benefit to improve the energy absorption capacity of the material (toughness) in the post-peak region. Although most current design codes are still based on strength and stiffness, the practical significance of fiber reinforced concrete (FRC) toughness is being increasingly accepted at least partially as a guide or design consideration in some codes. Bending tests are the most commonly empioyed to characterize pre and post peak flexural behaviour of FRC as toughness because of the apparent simplicity of the test procedure and higher stability of results. This paper

presents a reseach on the flexural behaviour of concrete made with commercially available macro synthetic fibers. Macro synthetic fiber reinforced high strength concrete with 0 - 1.25% volume fraction was conducted on 100x100x350 mm beams of bending test based on ASTM C1609. Flexural load-deflection relationships was carried out and used to determine flexural strength, flexural toughness, equivalent flexural strength, and equivalent flexural strength ratio. The flexural strength was slightly improved due to the present of the fibres, while the flexural toughness and equivalent flexural strength ratio of concrete was found to increase considerably when high dosage of macro synthetic fibres were used.

Keywords: flexural behaviour, toughness, macro synthetic fiber, high strength concrete, volume fraction

ID-071

DAMAGE PROCESS OF REINFORCED CONCRETE STRUCTURES INDUCED BY REINFORCEMENT CORROSION-STATE OF THE ART

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Abstract

Reinforcement corrosion is one of the major durability problems in reinforced concrete structures which can lead to the deterioration of the structures. The formation of rust, as the result of corrosion process, gives additional expansive pressure and generates excessive stress to the concrete which can cause cracking on the concrete cover. Therefore, it needs to analyze the damage process of the concrete induced by reinforcement corrosion to help predict service live of the structure. This paper presents a large number of publications regarding analytical model to analyze damage process of concrete cover induced by reinforcement corrosion. Various mathematical models used by a lot of researcher to produced accurate damage mechanism. Most of the researchers used uniform corrosion to simplify the damage analysis process. However, based on the previous research the rust formed non-uniformly along the perimeter of the reinforcement so, to provide more information regarding this topic, this paper also discuss about the differences between damage analysis of uniform and non uniform corrosion.

Keywords: Damage Analysis, Mathematical Model, Uniform Corrosion, Non Uniform Corrosion

ID-074

PROMOTING LOCAL INDIGENOUS OF BAMBOO COMPONENT TOWARD SUSTAINABLE HOUSING IN INDONESIA

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Abstract

Nowadays, it is needed a way to provide housing and dwellings that not only affordable but also concerns about sustainable environmental aspect. Consider the large number and relatively rapid growth population in Indonesia, the need for the housing availability is increasing year to year. This needs to be fulfilled rapidly without a negative effect on the environment. Bamboo as sustainable material has a lot of potency than other material, such as, its abundance as the result of its fast growth. However, one of the problem in using bamboo as construction material is its perception in the society that bamboo considered to have low durability and low class appearance. Meanwhile in some region of West Java, there are vernacular dwellings that still use bamboo as building component since decades. The local indigenous aspect that are preserved in this vernacular dwellings are local design architectural component with good quality construction and curing technique that enables the housing has a good natural ventilating and natural lighting. This local indigenous bamboo technology could disappear in line with the emergence of new materials. For this reason, the purpose of this study is to explore the potential of traditional village local indigenous for developing prefabricated modern building component. The study will consist of (i) in depth observation and survey to the traditional village regarding the potent of local indigenous in traditional production and construction process of building component (ii) to find possibilities of development local bamboo component as prefabricated building component. This study will try to give recommendation about how to promote the local indigenous building component as prefabricated construction in terms of market possibility and design consideration.

Keywords: Local Indigenous, Bamboo, Sustainable Building, Prefabrication, Vernacular Architecture

ID-079

NUMERICAL ANALYSIS OF THE WIRE-MESHED NET ANCHORAGED

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Abstract

The rockfall hazard in areas such as mountainous regions, quarries and mines needs to be well managed. This is essential in order to avoid fatalities, damage to infrastructure and production losses. Preventing all rockfall events is almost impossible, but the installation of rockfall protection systems is a common and

A Study on Simulation Models of Seismic Energy Absorbing Steel Pipes

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***Abstract*—The aim of this study is to develop simulation models of steel pipe as hysteretic dampers for seismic resistant steel structures. Steel pipe dampers are chosen as energy dissipating device because they are easy to install, maintain and inexpensive. Steel pipes in various positions are able to dissipate seismic input energy in a structure through hysteresis of the metal. Numerical simulation is carried out using nonlinear structural analysis program ABAQUS. Cyclic shear loading is applied to: a) vertical steel pipe dampers positioned in the plane of the frame of the structure; and b) horizontal steel pipe dampers positioned perpendicular to the plane of the frame of the structure. Cyclic axial loading is applied to the horizontal steel pipes positioned in the plane of the frame of the structure; in this case the steel pipes are intended to function as stoppers to backup the main damper in absorbing excessive seismic input energy. The following requirements for steel pipe dampers are taken into account: a) dampers provide stiffness and supplement damping to the structure; b) most part of the dampers yield simultaneously; c) dampers have satisfactory ultra low-cycle fatigue (ULCF) capacity. Steel pipes with diameter greater than 100 mm (considered to be useable as dampers) have diameter to thickness ratio more than 20 which is too slender; meaning, steel pipes have less than necessary amount of material to fulfill the above requirements. Various strengthening strategies to bare steel pipes are explored in the simulation models. Ductile fracture in steel that initiates in fewer than twenty constant amplitude loading cycles has been term Ultra Low Fatigue Cycle. Under ULCFs load dampers experienced extensive plasticity and limited cyclicity. ULCF has been treated more as a fracture problem than a fatigue problem in micromechanics-based models, which provide accurate criteria for predicting ductile fracture, proposed by Kanvinde and Deierlein (2007). Ductile fracture controls the ultimate strength and ductility of structural components, therefore accurate preliminary prediction of ductile fracture is critical to the performance of steel pipe dampers. The finite element simulation models can be utilized to preliminary predict ductile fracture in steel pipes using the criteria from the micromechanics-based models. Several results from studying the behavior and preliminary ductile fracture prediction of the models, which show the potential to be developed further into operational hysteretic steel pipe dampers, will be presented.**

Keywords*—*ductile fracture, micromechanics-based model, steel pipe as hysteretic damper, supplemental damping

I. INTRODUCTION

In this paper, the results of a try-out research to investigate the potential of circular steel pipes as metallic dampers are presented. Energy dissipation of steel pipes in three pipe positions was investigated. Steel pipes dissipate energy : (i) due to cyclic shear loading in vertical position, or in horizontal position perpendicular to the plane of drawing and (ii) due to axial crushing in horizontal position in the plane of drawing. Ductile behavior of circular steel pipe dampers was simulated using finite element analysis. The hysteresis behavior of the circular steel pipe dampers will be shown and discussed.

For component integrity assessment of circular steel pipe dampers, finite element ductile failure simulations based on local approach was conducted. *Stress Modified Critical Strain (SMCS) model* was used to predict fracture. Two criteria were used for fracture analysis: (i) von Mises yield criterion was used to identify spots with intense stresses and (ii) SMCS criterion was used to predict fracture at the identified spots. Component integrity assessment was done for some potential candidate of good dampers.

II. HYSTERESIS BEHAVIOR OF CIRCULAR STEEL PIPE DAMPERS

A good circular steel pipe damper is expected to exhibit: (i) adequate elastic stiffness to withstand in-service lateral load, (ii) a yield strength of the damper exceeding the expected in–service lateral loads, (iii) large energy dissipative capability and (iv) a stable hysteretic force–displacement response which can be modeled numerically.

Maleki and Bagheri (2010) did some tests to the material of steel pipes. For pipe of diameter (d) 114 mm and thickness (t) 5 mm, the results of the test are shown in the Table I. The mechanical properties of this pipe were used in this study. Besides material data, monotonic loading used by Maleki and Bagheri (2010) is also used in this study. Monotonic loading consisted of steadily increasing the displacement up until 30 mm in 64 seconds. This loading consisted of two cycles at $\pm 0.3M$, $\pm 0.6M$, $\pm 0.9M$ (where M is the estimated yielding capacity) and then increasing the displacement up until 30 mm to investigate the hysteresis behavior of the dampers.

TABLE I. PROPERTIES OF STEEL PIPE USED IN THIS STUDY

d (mm)	t (mm)	E (GPA)	σ_y (MPa)	σ_u (MPa)	ε_u (%)
114	5	200	320	385	0.25

A. *Vertical Steel Pipe Dampers*

The size of the pipe damper was determined based on:

- Practical consideration. The damper was assumed to be installed at the apex of Chevron braces. From practical consideration, steel pipes with diameter greater than 100 mm were considered to be useable as dampers. In this study the steel pipe of 114.3 mm diameter was chosen.
- Most part of the pipe yield due to simulated incremental amplitude loading. Abebe, Kim and Choi (2013) demonstrated that in order the developed stresses both bending and shear stresses are occurred simultaneously the height to diameter ratio of the pipe should be equal to $\sqrt{3}$. Therefore the height of the pipe is equal to $\sqrt{3}$x114.3=197.97 mm ~ 200 mm.

The steel pipe having d = 114.3 mm, t = 5.6 mm and h = 200 mm will be used in the elastic-plastic simulation.

The displacement criteria for evaluating the performance of damper were determined based on damage control of structures (Table II). If the typical floor height is assumed to be 3000 mm, the damage limit lateral displacement is15 mm and the collapse limit lateral displacement is 30 mm. Therefore it is expected that the steel pipe dampers are able to dissipate energy through hysteretic deformation of steel up to 15 mm displacement effectively without any fracture, but able to further dissipate energy up to 30 mm displacement in stable manner with some local fractures if they are unavoidable.

The simulation results of the bare pipe due to cyclic loading is shown in Fig. 1. It can be seen that the pipe buckles at the top and bottom supports and the hysteresis loop is unstable. Two strengthening strategies to the bare steel pipe are explored in the simulation models as follows: (i) strengthened with tapered plates welded at outer wall of the pipe as shown in Fig. 2 and (ii) strengthened with tapered plates welded to the outer wall of the pipe and lead filled inside the pipe as shown in Fig. 3. The last one is considered as a good candidate to be verified by specimen test in laboratory.

TABLE II. DAMAGE CONTROL OF STRUCTURES

Drift vs Limit	Damage limit	Collapse limit
Inter story drift	h/200	h/100

B. *Horizontal Steel Pipe Dampers Perpendicular to the Plane of the Drawing*

Maleki and Bagheri (2010) showed that bare steel pipes in horizontal position were able to dissipate energy and were very ductile. The only drawback of bare steel pipes is they are too flexible. Therefore, the pipes need to be strengthened in order to increase their strength and stiffness while maintaining their inherent ductility. The dampers were assumed to be installed at the apex of Chevron braces. The same pipe (114.3 x 5.6 x 200 mm) was used in the simulation. One option of strengthening the horizontal pipe with three inner rings is shown in Fig. 4.

C. *Horizontal Steel Pipe Dampers in the Plane of the Drawing*

Alexander (1959) analyzed a single pipe to absorb energy due to impact loading. He showed that the pipe was able to absorb significant amount of energy through axial crushing. The assumed collapse mode is shown Fig. 5. It can be seen that impact energy are absorbed by many plastic hinges formed at the joints of the folded pipe. He showed that half of plastic folding wave, h, is equal to $h = 1.213\sqrt{(Dt)}$ and the crushing load, P, is equal to $P = KYt^{1.5}\sqrt{D}$; where $K = 6.08$, Y is the yield stress of the steel, t is the pipe thickness and D is the diameter of the pipe.

Therefore pipes in horizontal position could be considered as secondary dampers to resist axial impact load due to earthquake. The secondary damper acts as stopper to back up to the main damper in absorbing energy. When the pipes dissipate energy through axial folding, they create sudden shocks which have harmful effects to the building and its content including the people during earthquakes. The simulation shown in Fig. 6 shows two horizontal pipes in horizontal position experience axial folding due to cyclic lateral load. There are two gaps of 10 mm at both free ends of the pipes. It can be seen that both pipes dissipate energy through axial crushing (folding). Besides sudden shocks, when the pipes fold the pipes shrink rapidly the gaps at the free ends of the pipes get bigger and bigger. Only very thin pipe (about 1 mm) with diameter about 50 mm that can dissipate energy with acceptable shock. However such a thin pipe is not available in the market. Horizontal pipes in the market to day are too thick to be used as stoppers. Therefore the potential of the horizontal pipe as stopper will not be explored further.

III. COMPONENT INTEGRITY ANALYSIS

A simple criterion has been established to predict the failure of the steel pipe dampers due to the interaction effect of fracture and fatigue known as ULCF. Fracture occurs when micro voids initiating at sulphide or carbide inclusions grow under plastic strains, leading to micro void coalescence. Stress Modified Critical Strain (SMCS), developed based on the concept of tracking micro void growth and coalescence, is one of such criteria (Kanvinde and Deierlein, 2007). In SMCS model, a critical value of plastic strain, $\varepsilon_p^{critical}$, is related to stress triaxiality, T, as $\varepsilon_p^{critical} = \alpha \cdot \exp(-1.5T)$. Triaxiality is the ratio between the hydrostatic (dilational) stress, $\sigma_m = (\sigma_1 + \sigma_2 + \sigma_3)/3$, and von Mises (distortional) stress, σ_e. The SMCS criterion, defined as the different between the critical plastic strain and the calculated equivalent plastic strain (ε_p), is SMCS $= \varepsilon_p - \varepsilon_p^{critical}$. Fracture is predicted to occur when SMCS = 0. SMCS model is simple to be applied to preliminary predict when ductile fracture will occur under ULCF condition.

For ductile fracture prediction in this try-out research, the circumferentially notched tension bar (CNT), extracted from the pipe, used by Myers, Deierlein and Kanvinde (2009) was simulated (Fig. 7). Ramberg Osgood model was used to model the strain hardening of the material. Because specimen test has not been done, the fracture displacement (Δ_f=0.92 mm) found by Myers, Deierlein and Kanvinde (2009) was used to calculate the equivalent plastic strain (ε_p=0.8) and the material resistance

to fracture (α=2.39). Once α is determined, it can be implemented through finite element simulations to predict facture initiation in steel pipe dampers. Here is an example, for model in Fig 4 the results of the simulations showed that T = 0.35 and $\varepsilon_p^{critical}$ = 1.41 which corresponding to t = 56.3 sec and fracture initiation is expected to occur at 22 mm of lateral displacement. The stress triaxiality versus time plot is shown in Fig. 8.

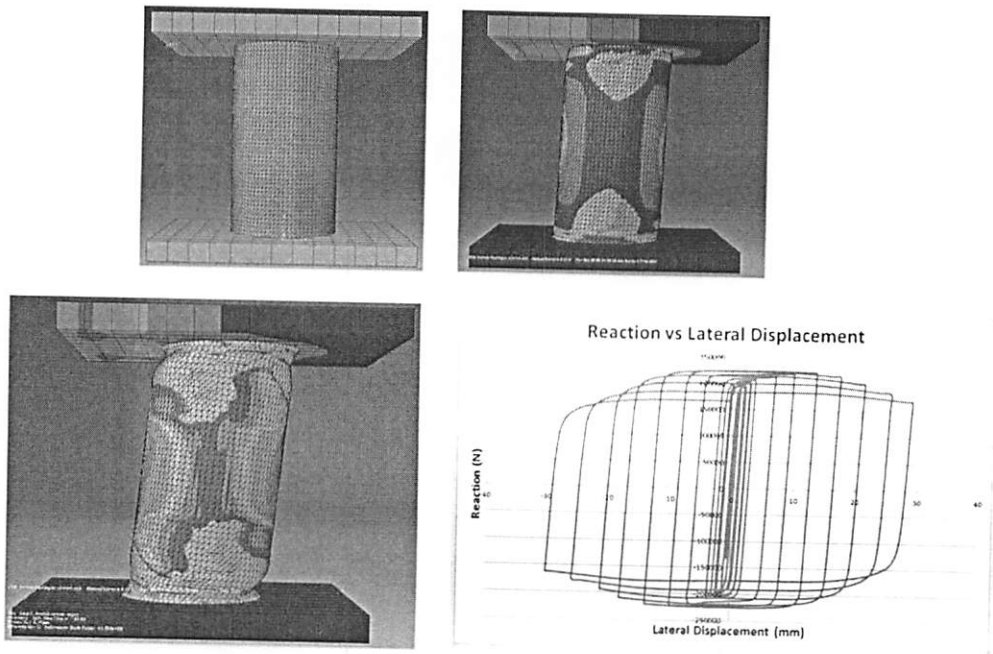


Fig. 1. Vertical steel pipe dampers: bare pipe damper. The Mises plots are for 14 mm and 30 mm of lateral displacement. Severe buckles occur at the top and bottom of the pipe at 30 mm lateral displacement. The hystersis loop is fat but unstable.

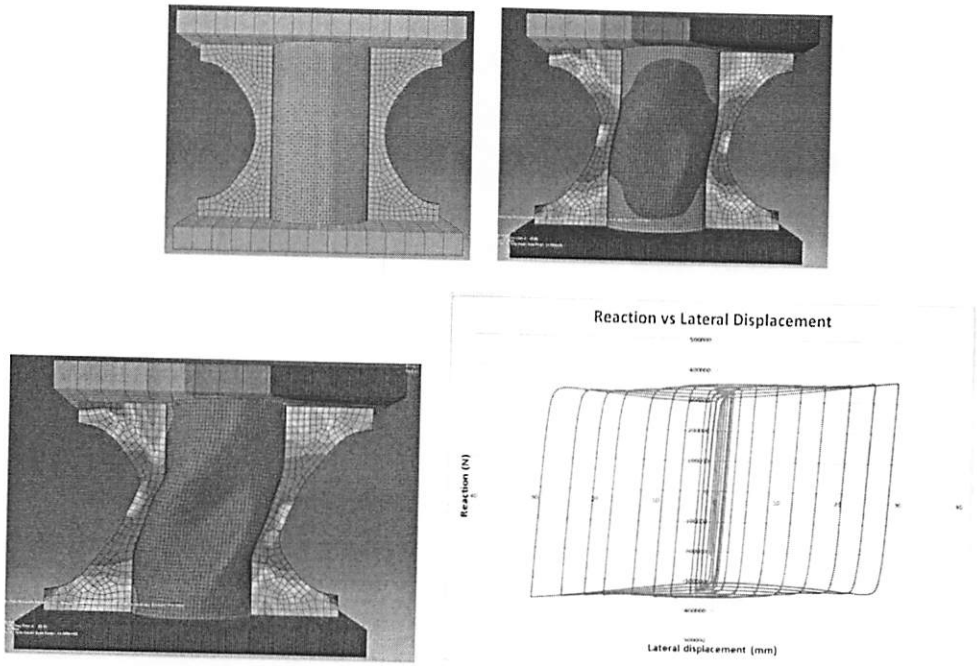
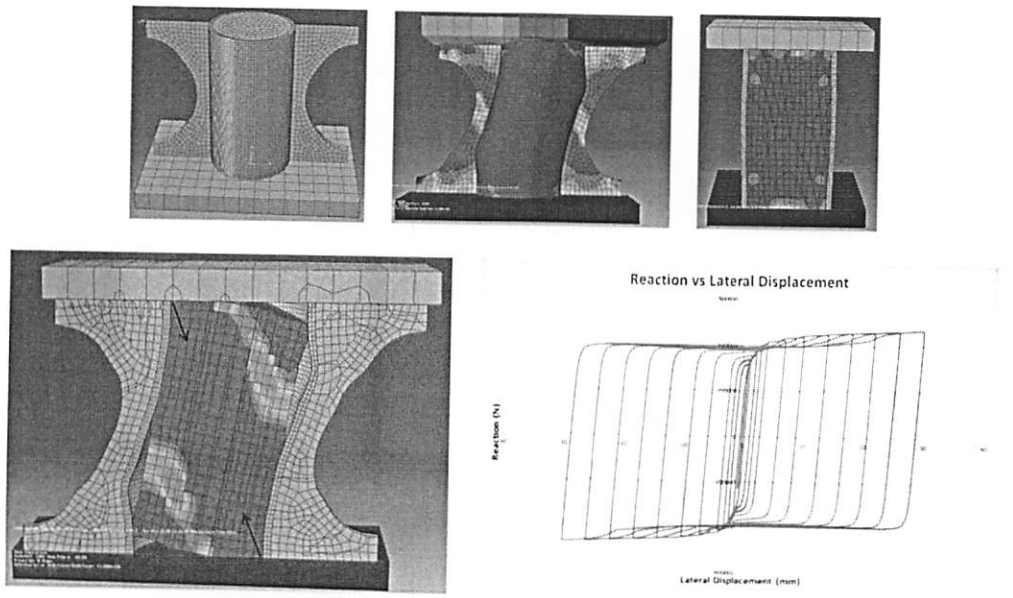


Fig. 2. Vertical steel pipe dampers: strengthened with tapered plates welded at outer sides of the pipe. The Mises plots are for 14 mm and 30 mm of lateral displacement. The tapered plates increase the capacity of the damper, however the middle part of the pipe buckles. The hystersis behavior is better but the loop is still unstable.



3. Vertical steel pipe dampers: strengthened with tapered plates and lead filled inside the pipe (upper support plate is not shown). It can be seen that the lead ...uce the buckle at the middle part of the pipe and dissipate energy through diagonal compression strut.

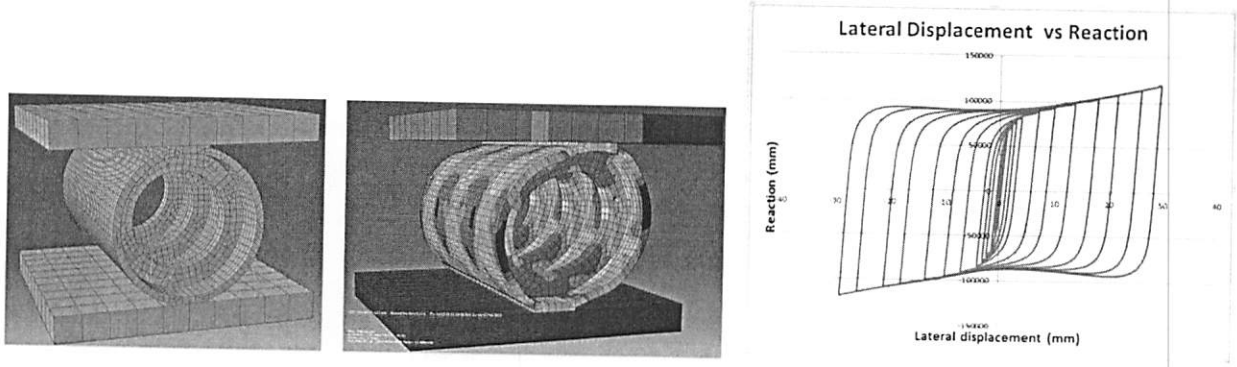


Fig. 4. Horizontal steel pipe dampers strengthened with three inner rings. The inner rings are welded to the pipe.

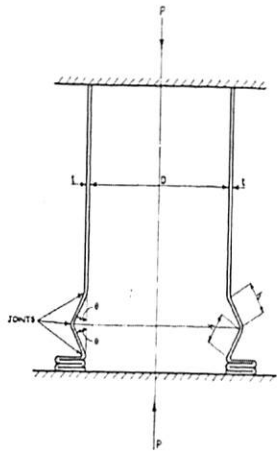


Fig. 5. Assumed collapse mode [3]

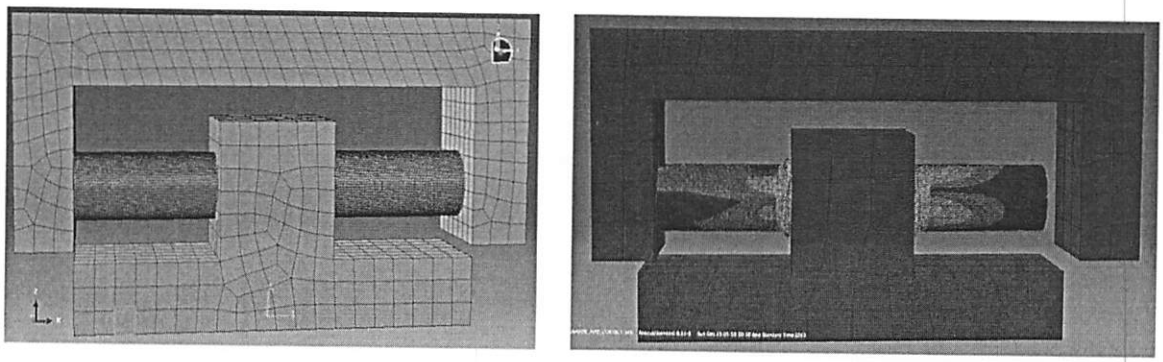


Fig. 6. Horizontal steel pipes as secondary dampers (axial crushing)

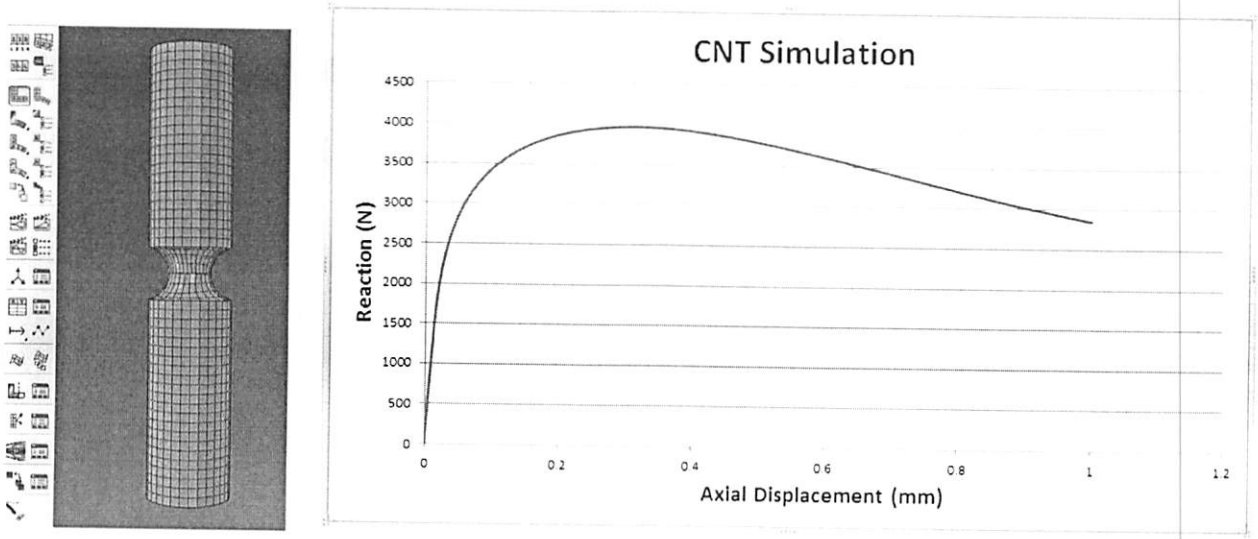


Fig. 7. Circumferentially notched tension bar (CNT) simulation

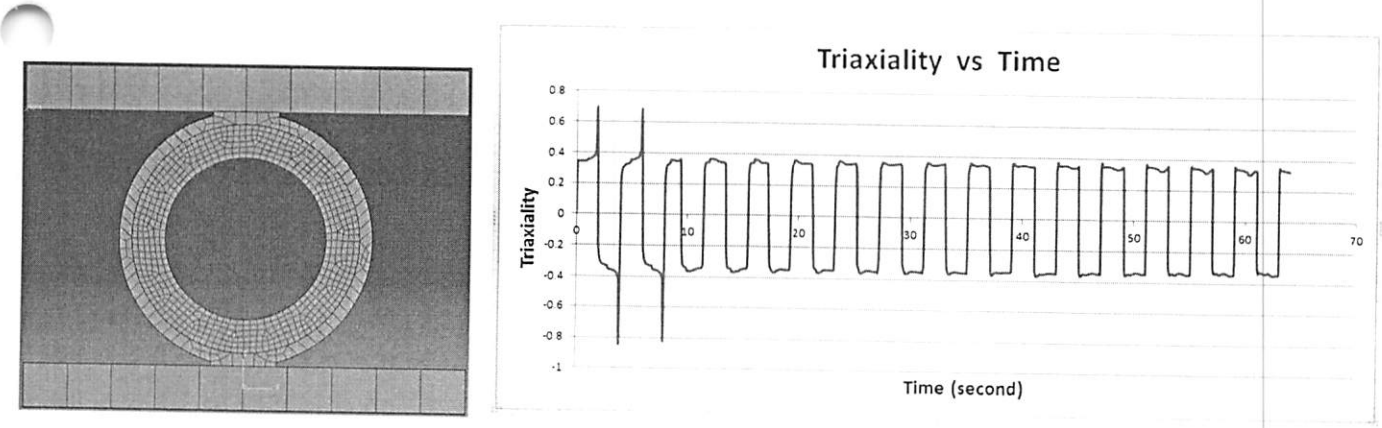


Fig. 8. Stress triaxiality vs time plot for the point of intense stress at the inner side of the ring (at the proximity of top and bottom supports). It can be seen in the right part of Fig. 8 that the stress triaxiality is constant ($T \sim 0.35$). The micro voids due to cyclic deformation grow and shrink repeatedly in the ring-pipe damper.

IV. Conclusion

This paper presented the results of numerical simulation conducted on circular steel pipe dampers in vertical and horizontal positions. The main findings of this study may be summarized as follows:

(1) The steel pipes have the potential as excellent metallic dampers in vertical and horizontal positions at the apex of Chevron braces. The dampers have fat and stable hysteretic curves. Therefore the dampers can be expected to reduce earthquake forces, lateral deformations, and to reduce or eliminate ductility requirements.

(2) Some strengthening strategies to the bare steel pipes are needed to improve the hysteresis behavior of the dampers and to postpone the onset of the ductile fracture in the dampers. For steel pipe damper strengthen with lead filled inside the pipe, if local fractures occur in the pipe the additional energy dissipation by the lead will substitute the loss of energy dissipation capacity of the damper due to the local fractures in the pipe (Fig. 3).

(3) To verify the actual hysteretic behavior of the studied steel pipe dampers specimen tests in laboratory are needed.

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