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2023 ICCIM

Accepted papers will be published in Scopus indexed Proceeding
Scopus

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# THE THIRD INTERNATIONAL CONFERENCE of Construction, Infrastructure, and Materials

## CIVIL ENGINEERING FOR A LIVEABLE ENVIRONMENT

Venue: Campus 1, Let. Jend. S. Parman No. 1, West Jakarta

**27 JULY 2023**

## CALL FOR PAPER

### Topics:

- Structural Engineering and Materials
- Geotechnical and Earth Sciences
- Sustainable Transportation Systems
- Green-construction Management
- Hydrological and Environmental Engineering
- Energy-friendly Infrastructures

### Important Dates

- Abstract submission
  ~~5 February 2023~~ 15 February 2023
- Full paper submission
  ~~9 April 2023~~
- Notification of full paper acceptance
  ~~12 May 2023~~
- Camera ready manuscript
  ~~4 June 2023~~
- Registration and payment
  28 June 2023

### Conference Fee

| | before 15 May 2023 | after 15 May 2023 |
|---|---|---|
| Local | | |
| Presenter : | Rp 1.500.000,- | Rp 2.000.000,- |
| Participant : | Rp 700.000,- | Rp 800.000,- |
| International | | |
| Presenter : | USD 150 | USD 200 |
| Participant : | USD 50 | USD 75 |

**Registration Link**
https://bit.ly/ConferenceRegistrationICCIM2023

### *Distinguished Keynote Speaker*

**Prof. Dawn E. Lehman**
University of Washington, USA
*2022 Pulitzer Prize-winning collaboration*

### *Keynote Speakers*

**Li Hai-Ting, Ph.D.**
Shanghai Jiao Tong University, China

**Wikke Novalia, Ph.D.**
Monash University, Australia

**H.R. Pasindu, Ph.D.**
University of Moratuwa, Sri Lanka

**Alfred J. Susilo, Ph.D.**
Universitas Tarumanagara, Indonesia

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27 JULY 2023

# THE THIRD

## INTERNATIONAL CONFERENCE

of Construction, Infrastructure, and Materials
Civil Engineering for a Liveable Environment

2023 ICCIM

## PROGRAM BOOK

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# Program Book


## THE THIRD INTERNATIONAL CONFERENCE of Construction, Infrastructure, and Materials

Civil Engineering
for a Liveable Environment

27 July 2023

Universitas Tarumanagara

Jakarta – Indonesia

The Third
International Conference
of Construction, Infrastructure, and Materials

# Contents

# Forewords by Rector of Universitas Tarumanagara

Distinguished Guests, Colleagues, Ladies, and Gentlemen

I am honoured to welcome you to the Universitas Tarumanagara (UNTAR) at the Third International Conference of Construction, Infrastructure, and Materials (ICCIM) in 2023. This event is the biennial event that has been held since 2019. I would like to congratulate the Department of Civil Engineering, which has been working very hard to make this event held successful. As you may know, UNTAR has events similar to ICCIM conducted annually, such as TICATE, TICASH, SERINA, and many other academic events. We are proud that these events have elevated UNTAR's reputation nationally, regionally, and internationally as our goal to be a world-recognized university.

ICCIM has been the medium for academics to exchange their knowledge through their research knowledge and experience. Since the first ICCIM, all papers that were disseminated have been published by Scopus-indexed publishers, which shows the importance of the research outcomes. The outcomes have contributed to the construction and infrastructure developments as well as advancement in Indonesia. The Third ICCIM in 2023 has chosen the topic of Civil Engineering for A Liveable Environment, realizing the environmental impact and sustainability issues coming from the Civil Engineering industry. It is an ongoing challenge for civil engineers to produce a living creature that is more humanistic and environmentally friendly. All the papers accepted in the Third ICCIM will offer a real solution to the problems coming from the negative impact of the rapid construction and infrastructure developments relating especially to environmental sustainability.

On this occasion, I would like to take this opportunity to extend my great appreciation to all keynote speakers and thank their institutions. The Third ICCIM would not have been more special without these keynote speakers: Prof. Dawn E. Lehman (University of Washington, USA); Assoc. Prof. Li Hai-Ting (Shanghai Jiao Tong University, China); Prof. H. R. Pasindu (University of Moratuwa, Srilanka); Dr. Wikke Novalia (Monash University, Australia); and Dr. Alfred J. Susilo (Universitas Tarumanagara, Jakarta). Also, UNTAR is grateful for all the funding and support provided by the sponsors involved in the Third ICCIM.

I conclude my foreword by expressing my gratitude to 9 university partners of the Third ICCIM: Massey University (New Zealand), Nihon University (Japan), Universiti Tun Hussein Onn (Malaysia), Ubon Ratchathani University (Thailand), Universitas Kristen Petra (Surabaya), Universitas Atma Jaya Yogyakarta, Universitas Muhammadiyah Yogyakarta, Universitas Katolik Parahyangan (Bandung),

# Forewords by Rector of Universitas Tarumanagara

and Universitas Katolik Soegijapranata (Semarang). I also thank all authors coming from the various countries that have been invited to present the paper. Your paper has enriched our knowledge, and your presence has brought new inter-institution relationships. I wish you all a great conference.

Rector of Universitas Tarumanagara


Prof. Dr. Ir. Agustinus Purna Irawan, M.T., M.M., IPU., ASEAN Eng.

# Forewords by Civil Engineering Program

It is my distinct honor and privilege to welcome you to the Third International Conference of Construction, Infrastructure, and Materials, of the Civil Engineering Undergraduate Study Program at Universitas Tarumanagara. This conference encapsulates the collective knowledge, discoveries, and discussions that have unfolded during this esteemed event.

Civil engineering lies at the heart of societal development, playing a pivotal role in shaping the infrastructure that sustains our modern world. This conference serves as a beacon, illuminating the path to progress through the exchange of ideas, research findings, and experiences among scholars, researchers, and practitioners in the field.

I extend my heartfelt gratitude to the dedicated organizing committee for their exceptional efforts in orchestrating this conference. Their unwavering commitment and meticulous planning have created an environment conducive to intellectual growth and collaboration. I would also like to express my deepest appreciation to the distinguished speakers who have graced this event, sharing their expertise and inspiring us with their profound insights.

To the participants of this conference, your presence here signifies your dedication to advancing the field of civil engineering. By engaging in thoughtful discussions, exploring innovative approaches, and presenting your research, you are contributing to the collective knowledge that drives our profession forward. As you navigate through this conference, I encourage you to absorb the wealth of information it holds, allowing it to spark your imagination and ignite your passion for civil engineering.

Together, let us embrace the challenges and opportunities that lie ahead. May this conference be a source of inspiration and a catalyst for collaboration, fostering a vibrant community of civil engineering professionals who are dedicated to building a sustainable and resilient future for generations to come
We hope to see you again at the next ICCIM.

Head of Civil Engineering Undergraduate Program

Dr. Daniel Christianto, S.T., M.T., IPM

# Forewords by Conference Chair

Dear Distinguished Speakers, Guests, and Colleagues,

We are pleased to welcome you to the Third International Conference of Construction, Infrastructure, and Materials (ICCIM), held in 2023. After two-year restrictions due to the COVID-19 pandemic, we are glad to hold this offline conference at our campus, Universitas Tarumanagara, Jakarta. The Third ICCIM follows the success of the previous ICCIM, while this year, we chose the conference theme: "Civil Engineering for A Liveable Environment". The topic has been brought to the attention of civil engineering to create a more humanized living environment.

We have received hundreds of abstracts and papers, which have been categorized into five different interests:

- Structural Engineering and Materials
- Geotechnical and Earth Sciences
- Green-construction Management
- Sustainable Transportation System
- Hydrological and Environmental Engineering
- Energy Friendly Infrastructure

Therefore, we acknowledge all authors that have dedicated their time to writing the papers and presenting them to this conference. Our gratitude is also conveyed to the distinguished keynote speakers who delivered an excellent speech: Prof. Dawn E. Lehman (University of Washington, USA); Assoc. Prof. Li Hai-Ting (Shanghai Jiao Tong University, China); Prof. H. R. Pasindu (University of Moratuwa, Srilanka); Dr. Wikke Novalia (Monash University, Australia); and Dr. Alfred J. Susilo (Universitas Tarumanagara, Jakarta).

We also appreciate the contributions from 9 university partners: Massey University (New Zealand), Nihon University (Japan), Universiti Tun Hussein Onn (Malaysia), Ubon Ratchathani University (Thailand), Universitas Kristen Petra (Surabaya), Universitas Atma Jaya Yogyakarta, Universitas Muhammadiyah Yogyakarta, Universitas Katolik Parhyangan (Bandung), dan Universitas Katolik Soegijapranata (Semarang), together with all sponsors of the ICCIM event.

We wish you a great conference and an enjoyable time in Jakarta. We hope to see you again at the next ICCIM.

# Forewords by Conference Chair

Jakarta, 27 July 2023

Prof. Ir. Leksmono Suryo Putranto, M.T., Ph.D., IPM

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| 7. | Parallel Session | : | Ir. Aniek Prihatiningsih, M.M.<br>Dr. Mega Waty, S.T., M.T. |
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# General Information & Guidelines

## Onsite Registration Counter

Registration Counter is located at **8th Floor of M Building, Universitas Tarumanagara, Jakarta**

## Registration Hours

27 July 2023, 07:20 – 07:55

## Conference Badge

Conference badge are given after completing registration process. Registered Presenters and Participants are always to wear their badges during the Conference for identification and security purposes.

## Coffee Breaks

27 July 2023

09:40 – 09:55, M Building 8th Floor

14:45 – 15:15, Civil Engineering Department, L Building 5th Floor

## Lunch

27 July 2023, 11:50 – 13:00

Lunch buffet will be served at M Building 7th Floor

## E-Certificate

E-Certificate of Presenters and Participants will be emailed to all registered delegates after the conference. Presenters and Participants who do not attend the conference will not receive their E-Certificate and they cannot claim their paid conference fee.

## Liability

The Organizing Committee will not assume any responsibility for accidents, losses, or damages, as well as delays or modifications of the conference program.

# General Information & Guidelines

## For Parallel Session Presenters

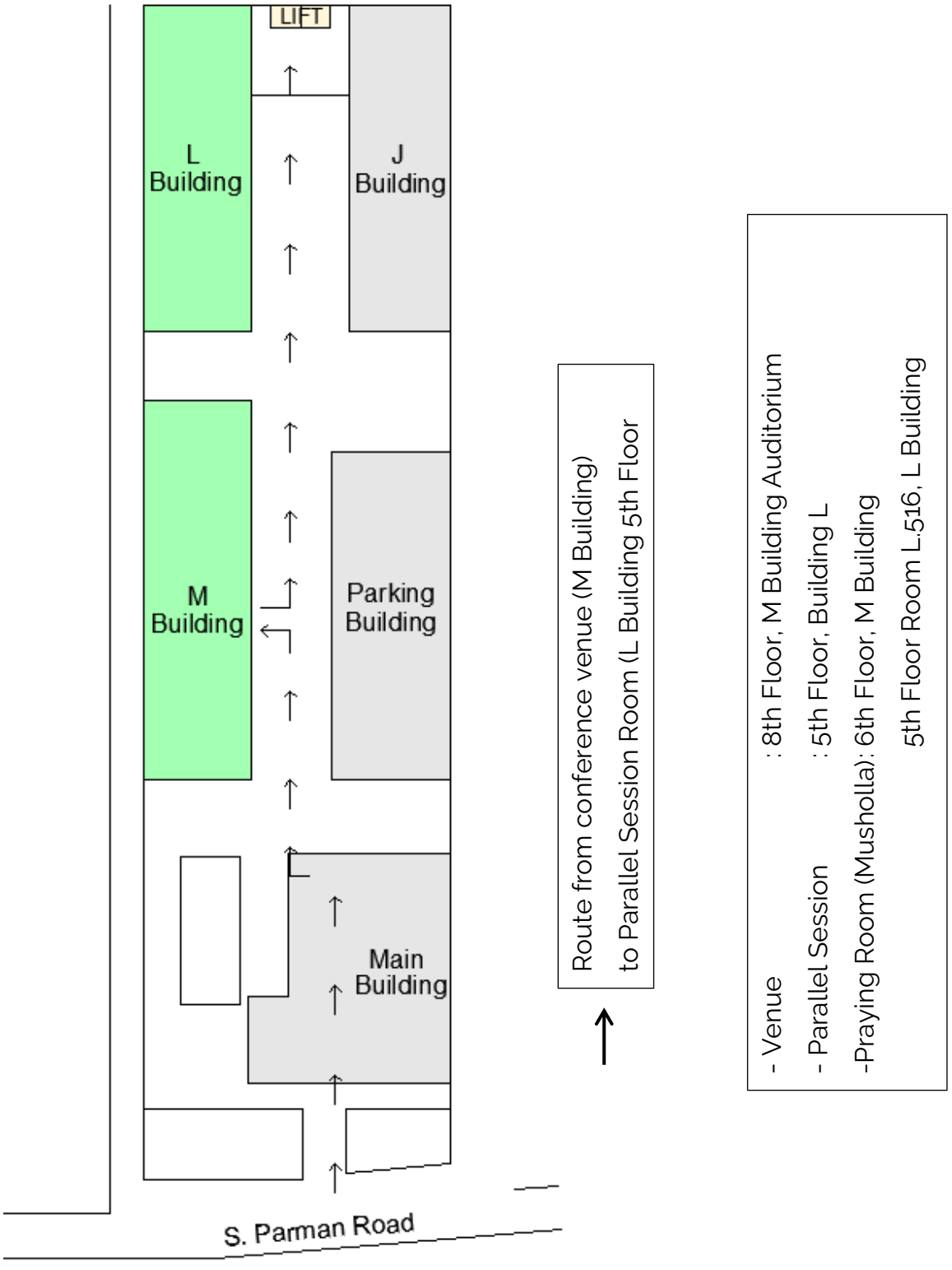
1) You are required to submit your final presentation materials through this online form: https://bit.ly/PresentationICCIM2023 starting from July 26th at 12.00 pm until July 27th at 10.30 pm. Alternatively, you could also share your presentation files at the Parallel Session Room by 12.50 pm on July 27th.
2) Audio-visual testing facilities are available at the Parallel Session Room. The staff on duty will assist you in testing and installing your presentation materials.
3) Please be present at your session room at least 15 minutes prior to the start of the session.
4) For oral presentation - please remember that the time allocated for each oral session is ten (10) minutes for presentation and five (5) minutes for questions and answers. The timekeeper will give notification on 7 min (1st reminder), 9 min (2nd reminder), and 10 min (session end).
5) The standard Audio Visual & IT equipment provided consist the following:
   - Laptop (Microsoft Power Point, Microsoft Office, & Window Media Player)
   - Projector with Screen
6) If you are late to give your presentation slide and/or if it is found incompatible with our system, the Organizing Committee has the right to reschedule your presentation. You are encouraged to test your presentation slide prior to the start of the session.

# ICCIM 2023 Conference At a Glance

| July 26th - 27th | July 27th, 2023 | | | DURATION (min) | Programme |
|---|---|---|---|---|---|
| Washington (GMT -4) | Jakarta (GMT +7) | China/Singapore (GMT +8) | Melbourne (GMT+10) | | |
| 20.20-20.55 | 07.20-07.55 | 08.20-08.55 | 10.20-10.55 | 40 | Registration |
| 20.55-21.30 | 07.55-08.30 | 08.55-09.30 | 10.55-11.30 | 30 | Opening Ceremony |
| 21.30-22.05 | 08.30-09.05 | 09.30-10.05 | 11.30-12.05 | 25 | **Keynote Speech 1: Prof. Dawn E. Lehman – University of Washington**<br>Moderator: Prof. Tavio, Ph.D. |
| | | | | 10 | QnA |
| 22.05-22.40 | 09.05-09.40 | 10.05-10.40 | 12.05-12.40 | 25 | **Keynote Speech 2: Dr. Li Hai-Ting – Shanghai Jiao Tong University (China)**<br>Moderator: Prof. Tavio, Ph.D. |
| | | | | 10 | QnA |
| 22.40-22.55 | 09.40-09.55 | 10.40-10.55 | 12.40-12.55 | 15 | Coffee Break |
| 22.55-23.30 | 09.55-10.30 | 10.55-11.30 | 12.55-13.30 | 25 | **Keynote Speech 3: Dr. Wikke Novalia – Monash University (Australia)**<br>Moderator: Dr. Oei Fuk Jin |
| | | | | 10 | QnA |
| 23.30-00.05 | 10.30-11.05 | 11.30-12.05 | 13.30-14.05 | 25 | **Keynote Speech 4: Prof. H. R. Pasindu – University of Moratuwa (Srilanka)**<br>Moderator: Dr. Oei Fuk Jin |
| | | | | 10 | QnA |
| 00.05-00.40 | 11.05-11.40 | 12.05-12.40 | 14.05-14.40 | 25 | **Keynote Speech 5: Dr. Alfred J. Susilo – Universitas Tarumanagara (Indonesia)**<br>Moderator: Dr. Oei Fuk Jin |
| | | | | 10 | QnA |
| 00.40-00.50 | 11.40-11.50 | 12.40-12.50 | 14.40-14.50 | 10 | Parallel Session Technical Briefing |
| 00.50-02.00 | 11.50-13.00 | 13.00-14.00 | 14.50-16.00 | 60 | Break |
| 02.00-03.45 | 13.00-14.45 | 14.00-15.45 | 16.00-17.45 | 105 | Parallel Session 1 |
| 03.45-04.15 | 14.45-15.15 | 15.45-16.15 | 17.45-18.15 | 30 | Break |
| 04.15-06.00 | 15.15-17.00 | 16.15-18.00 | 18.15-20.00 | 105 | Parallel Session 2 |
| 06.00-06.30 | 17.05-17.30 | 18.05-18.30 | 20.05-20.30 | 30 | Closing |

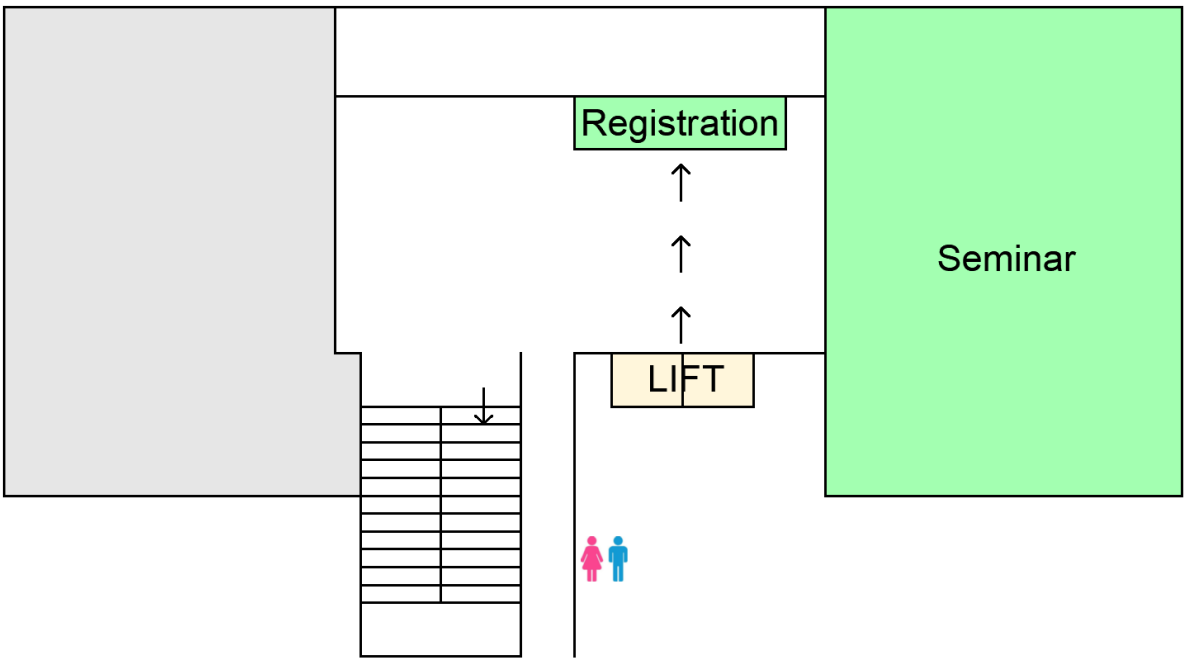
# ICCIM Conference Venue

## Ground Level Plan View



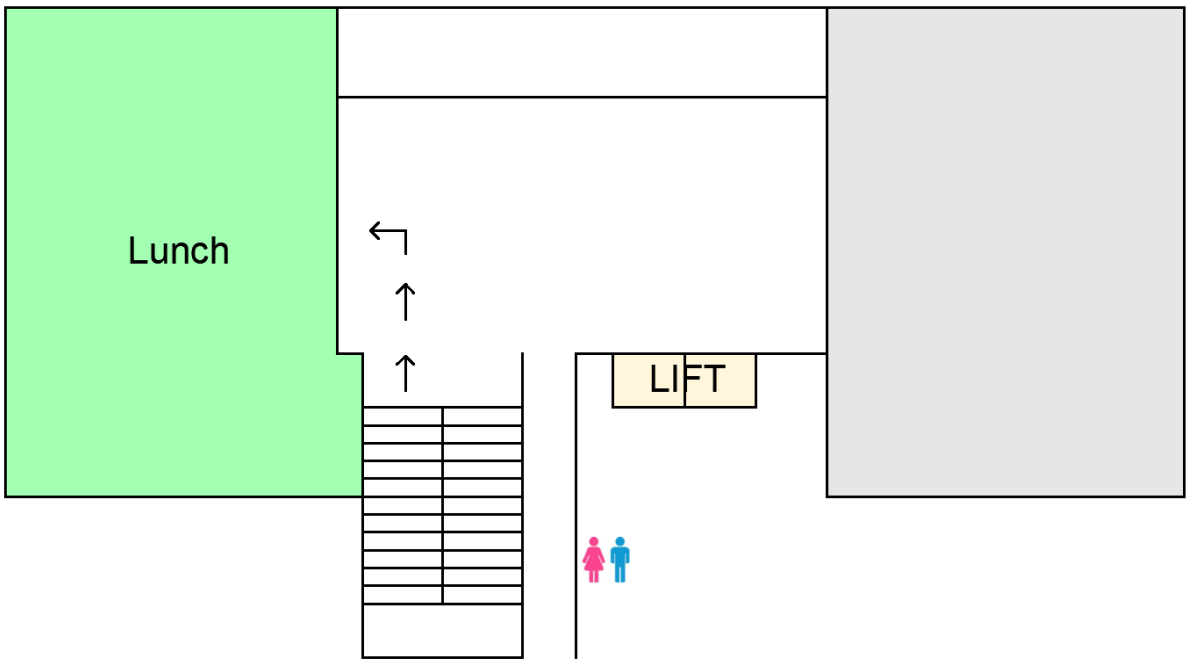
# Conference Venue

## 8th Floor, M Building

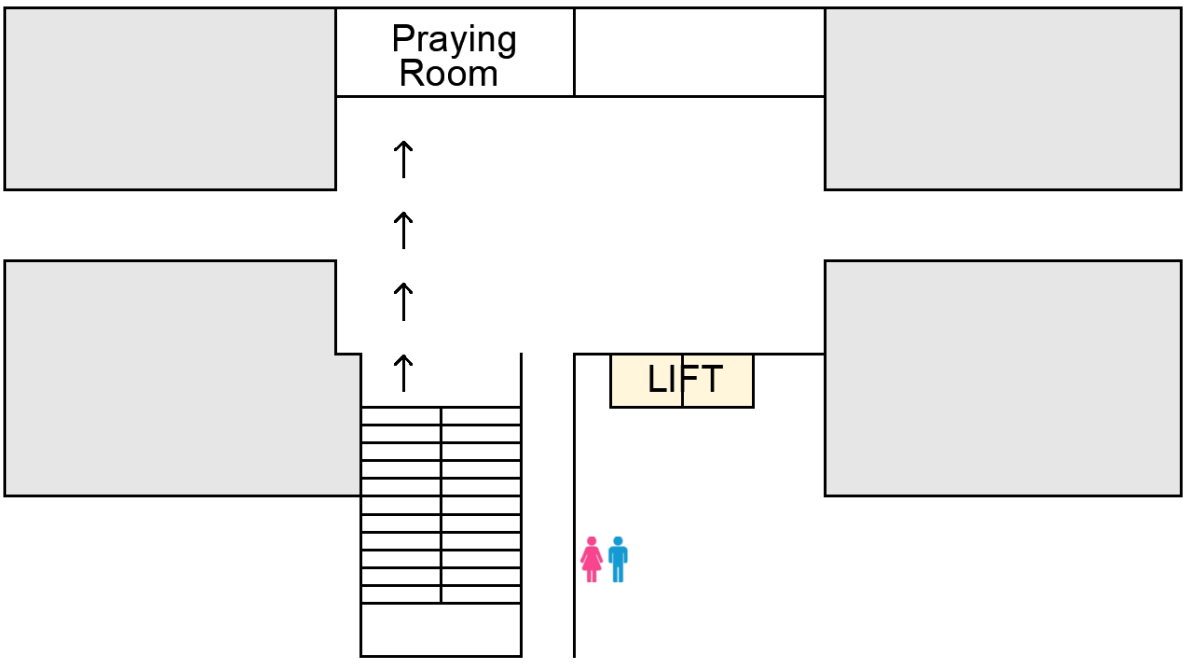


# ICCIM Conference Venue

## 7th Floor, M Building

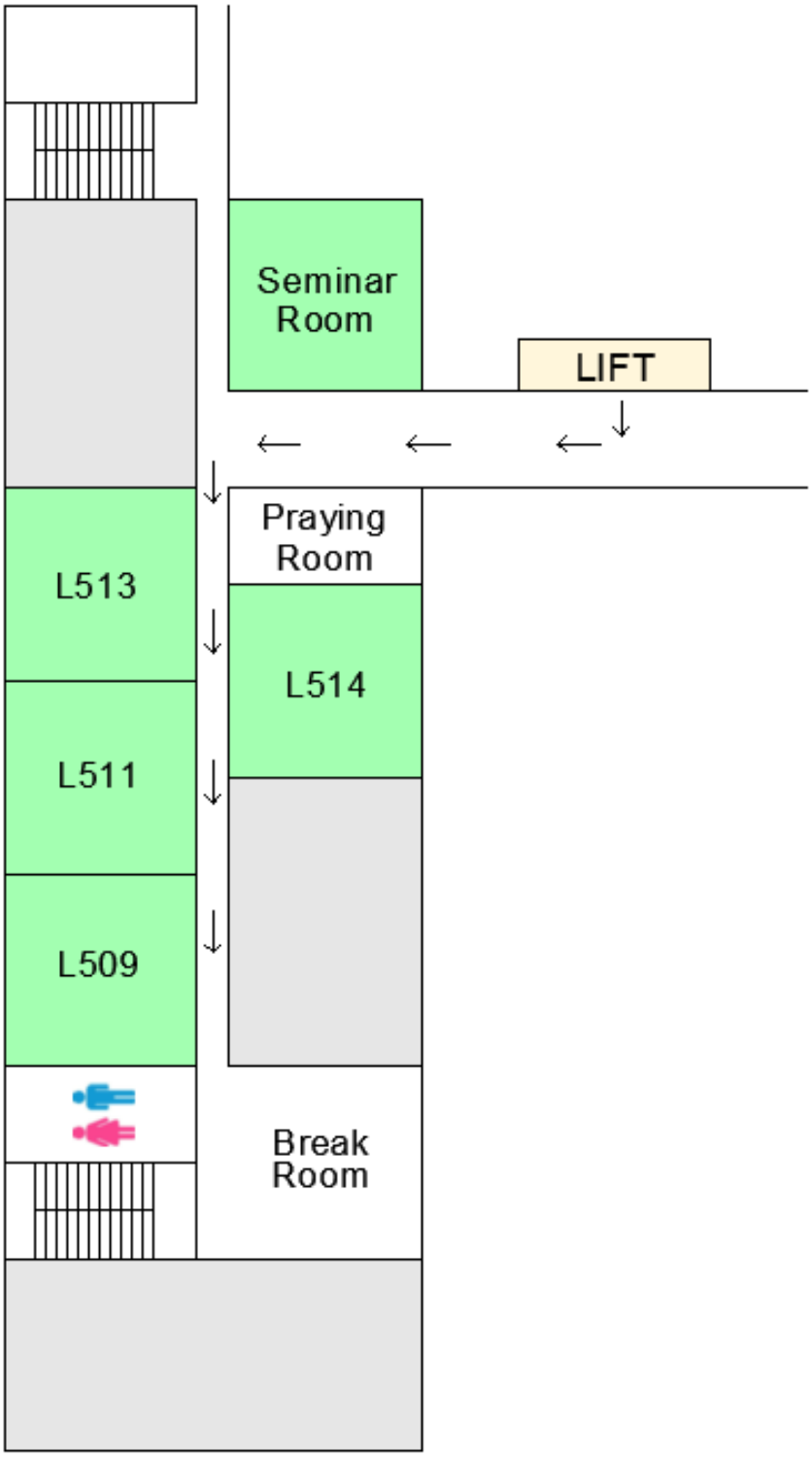



## 6th Floor, M Building



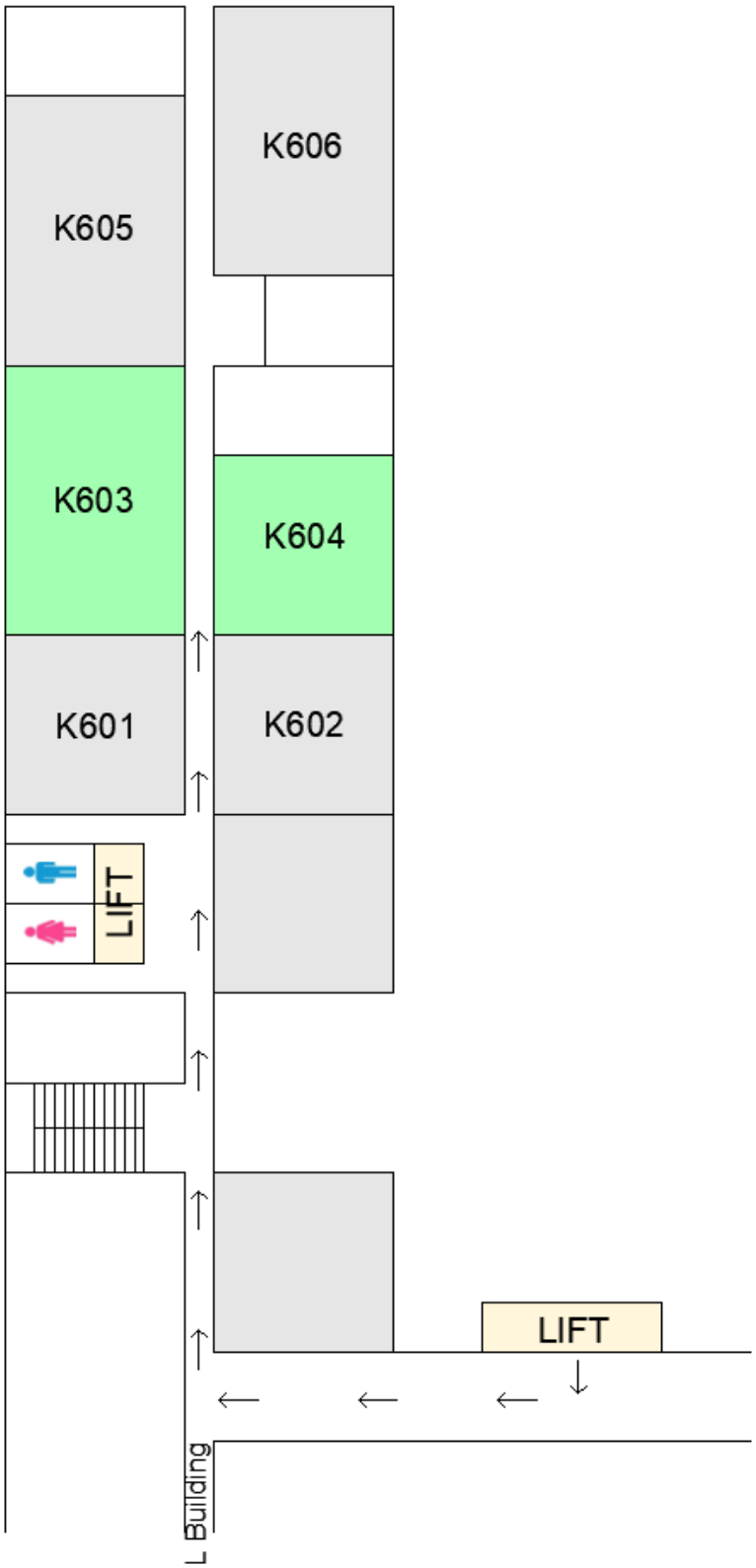
# ICCIM Conference Venue

## 5th Floor, L Building



# ICCIM Conference Venue

## 6th Floor, Building K



# Parallel Session Schedule: Geotechnical & Earth Sciences (A)

**Time** : 13.00 - 15.00 **Moderator** : Dr. Aswin Lim

**Room** : L514

| No | Time (UTC +7) | Paper ID | Paper Title | Authors |
|---|---|---|---|---|
| 1 | 13:00 | 112 | Analysis of Peat Soil Testing Errors Based on Its Characteristics and Appropriate Recommendation of Peat Soil Testing | Annisa Khoerani, Dewi Amalia and Stephanus Alexsander |
| 2 | 13:15 | 181 | Consolidation Settlement Prediction and Monitoring of Toll Road Embankment at STA 23+650 Semarang – Demak Toll Road Section | Undayani Cita Sari, Sri Prabandiyani Retno Wardani, Agus Setyo Muntohar and Windu Partono |
| 3 | 13:30 | 167 | Unconfined Compressive Strength Test on Geopolymer Fly Ash Stabilized Clay Shale | Edi Hartono, Willis Diana and Farid Nur Bahti |
| 4 | 13:45 | 152 | Effect of Fiber Length on the Consolidation Parameters of Coir Fiber-Reinforced Soft Clay | Anita Widianti, Willis Diana and Farid N. Bahti |
| 5 | 14:00 | 160 | Shear Strength Characteristic of Geopolymer Fly Ash and Egg Shell Powder Stabilized Clay soil | Willis Diana, Edi Hartono, Wahyu Pratama and Weny Wardani |
| 6 | 14:15 | 88 | Dynamic Pore Water Pressure in Saturated Soil due to Turbine Engine's Vibration | Aniek Prihatiningsih, Ali Iskandar and Veronica Veronica |
| 7 | 14:30 | 6 | Identification of Liquefaction Potential Using Empirical and Numerical Approach on Maranatha Area, Sigi Regency | Muhammad Ikhsan, Ahmad Rifa'I and Adam Pamudji Rahardjo |
| 8 | 14:45 | 8 | Numerical Study on Pile Group Efficiency for Piles Embedded in Cohesive and Cohesionless Soils | Ignatius Tommy Pratama, Budijanto Widjaja and Kelvin Agustinus Budianto |

# Parallel Session Schedule: Geotechnical & Earth Sciences (B)

**Time : 13.00 - 15.00** **Moderator : Dr. Daniel Tjandra**

**Room : L513**

| No | Time (UTC +7) | Paper ID | Paper Title | Authors |
|---|---|---|---|---|
| 1 | 13:00 | 31 | Identification of Re-Liquefaction Potential Based SPT and MASW Data in Mpanau, Sigi After the Earthquake 2018 | Bayu Kusumajati, Ahmad Rifa'I and Istiarto Istiarto |
| 2 | 13:15 | 64 | Scale Effects on Viscosity Determination Using Flume Channel Based on Vallejo and Scovazzo Method | Budijanto Widjaja, Ignatius Tommy Pratama and Ian Hartono |
| 3 | 13:30 | 97 | Liquefaction Potential Hazard Study at UIN Datokarama, Palu City, Central Sulawesi | Azmi Mulki, Ahmad Rifa'I and Sito Ismanti |
| 4 | 13:45 | 33 | Analysis of Liquefaction Potential in Opak Fault Nearby Area (Case Study: Solo – Yogyakarta – Nyia Kulon Progo Toll Road Section I.2) | Aryo Wicaksono, Hary Christady Hardiyatmo and Iman Satyarno |
| 5 | 14:00 | 119 | Substitution of Sand Ditch System Method on Vacuum Preloading (Study Case: Land Preparation Project in Kalimantan) | Josh Kevin, Bella Koes Paulina Cantik and Kisindi Nur Afifah |
| 6 | 14:15 | 32 | Liquefaction Potential in the Governor's Office of West Sulawesi After the 2021 Mamuju-Majene Earthquake | Sabra El Satilah, Hary Christady Hardiyatmo and Iman Satyarno |
| 7 | 14:30 | 106 | Simple house foundation models in potential landslide area (Case Study: Bojong Koneng Village, Babakan Madang Sub-District, Bogor District) | Mauliyatul Hasanah, Fajrina Citra and Muhammad Hamzah |
| 8 | 14:45 | 102 | Analysis of Different Elevation Buildings with Heights of 4, 8, 12, 16, 20, and 24 Floors on Friction Piles | Alfred Jonathan Susilo and Kevin Anderson |

# Parallel Session Schedule: Geotechnical & Earth Sciences (C)

**Time** : **15.00 - 17.00** **Moderator** : **Dr. Alfred J. Susilo**

**Room** : **L514**

| No | Time (UTC +7) | Paper ID | Paper Title | Authors |
|---|---|---|---|---|
| 1 | 15:00 | 29 | Three-Dimensional Finite Element Analysis of Bio-Inspired Root Anchored Pile in Clay | Yonathan Prasetya Ongkowijoyo, Aswin Lim and Ryan Alexander Lyman |
| 2 | 15:15 | 11 | Effectiveness of Soil Improvement for Deep Excavation in Under-Consolidated Soil: a Case Study | Yoshua Thendar, Aswin Lim and Ryan Alexander Lyman |
| 3 | 15:30 | 100 | Liquefaction Potential Evaluation on Reconstruction Project of Irrigation Canal in the Jono Oge and Lolu Village | I Made Widyanata, Sito Ismanti and Angga Fajar Setiawan |
| 4 | 15:45 | 101 | Correlation of Excess Pore Water Pressure Ratio on Flow Liquefaction Phenomenon in Sibalaya – Central Sulawesi Province | Oktarina Purbawati, Fikri Faris and Istiarto |
| 5 | 16:00 | 120 | Liquefaction Potential Analysis in Yogyakarta – Bawen Toll Road Section 3 | Shine Farroh Purba, Sito Ismanti and Angga Fajar Setiawan |
| 6 | 16:15 | 153 | Designing a Drilled Pile Foundation in a Dual System Structure | Daud Rahmat Wiyono, Deni Setiawan, Asriwiyanti Desiani, Andrias Suhendra Nugraha, Anang Kristianto, Jimmy Agustian Loekito, Agus Prijono and Jonathan Chandra |
| 7 | 16:30 | 154 | Static and Dynamic Story Shear in Split Level Building on Sloping Ground | Daud Rahmat Wiyono, Asriwiyanti Desiani, Robby Yussac Tallar, Yosafat Aji Pranata, Deni Setiawan and Roi Milyardi |
| 8 | 16:45 | 110 | Effect of Micro-Pile, Stone Column, and Encased Stone Column Mitigation on Seismic Performance of Liquefiable Ground in the Coal-Fired Power Station in Central Java | Fajrina Citra Asokawati, Laura Elvirandra and Muhammad Hamzah Fansuri |
| 9 | 17:00 | 107 | Road Settlement Analysis on Improved Peat Soil in Pekanbaru | Aniek Prihatiningsih and Jonathan Wansons Khohara |

# Parallel Session Schedule: Structural Engineering & Materials (A)

**Time** : **13.00 - 15.00** **Moderator** : **Dr. Herry Suryadi**

**Room** : **L509**

| No | Time (UTC +7) | Paper ID | Paper Title | Authors |
|---|---|---|---|---|
| 1 | 13:00 | 168 | Corrosion Potential of Coated Steel Bar Embedded in Sea-Water Mixed Mortar | Pinta Astuti, Laode Abdul Zakri Radio, Farah Salsabila, Afdhal Kresna Aulia, Rahmita Sari Rafdinal and Adhitya Yoga Purnama |
| 2 | 13:15 | 48 | Effect of Polypropylene Fiber on Workability and Strength of Fly Ash-Based Geopolymer Mortar | Rahmad Afriansya, Evelyn Anabela Anisa, Pinta Astuti and Martyana Dwi Cahyati |
| 3 | 13:30 | 151 | Physical and Mechanical Properties of Synthetic Beams from High Density Polyethylene Waste | Restu Faizah, Yoga Aprianto Harsoyo, Wahyu Arif Pratama, Raihan Nur Fathiya and Cahyo Budiyantoro |
| 4 | 13:45 | 84 | Effect of Acrylic Copolymer Addition and Interface Treatment on the Bond Strength of Polymer Modified Mortar and Concrete | Rachmad Aditya Caesar, Stefanus Adi Kristiawan and Sholihin As'Ad |
| 5 | 14:00 | 55 | The Effect of Using Steel Slag Waste on Stability in Porous Asphalt Mixture | Anita Rahmawati, Bagus Soebandono, Wahyu Widodo and Indri Rahmandhani |
| 6 | 14:15 | 187 | The Impact of Calcium Hydroxide Addition on HVFA Mortar and Concrete Properties | Adrian Joener Pratomo Ringu, Evan Andreas, Antoni Antoni and Djwantoro Hardjito |
| 7 | 14:30 | 177 | Evaluation of Fly Ash Concrete in Salt Environment | Ahmad Zaki and Husnah Husnah |
| 8 | 14:45 | 193 | State of the Art: Correlation Self-Healing Agent and Corrosion on Concrete | Kharisma Wira Nindhita and Ahmad Zaki |
| 9 | 15:00 | 26 | Axial Compressive Behavior of Green Sustainable Water Hyacinth & Bio-Resin (WHBR) FRP Composites-Confined Circular Concrete | Aoron Honestyo, Tavio Tavio, Hosta Ardhyananta, and Daniel Christianto |

# Parallel Session Schedule: Structural Engineering & Materials (B)

**Time** : 13.00 - 15.00 **Moderator** : Dr. Wong Foek Tjong

**Room** : L511

| No | Time (UTC +7) | Paper ID | Paper Title | Authors |
|---|---|---|---|---|
| 1 | 13:00 | 171 | Optimum Buckling-Restrained Braces Application to Enhance Seismic Performance of RC Frame with Curtailed Walls | Taufiq Ilham Maulana, Muhammad Ibnu Syamsi and Ryo Majima |
| 2 | 13:15 | 77 | Numerical Static-Load Test and Earthquake Simulation of a Cable Stayed Bridge | Muhammad Ibnu Syamsi, Taufiq Ilham Maulana and Chung-Yue Wang |
| 3 | 13:30 | 86 | Readiness Level of Muhammadiyah School in Bangun Jiwo Village Against Earthquake Disaster | Fanny Monika, Hakas Prayuda, Kundari Rahmawati, Muhamad Evan Firjana and Andri Ari Wibowo |
| 4 | 13:45 | 166 | Strength of Brick Paver by Replacing Up to 40% of Fine Aggregate by Weight with Plastic Waste | Arif Sandjaya, Ovy Sabrina and Tan Novita |
| 5 | 14:00 | 111 | Capacity Analysis of Advanced Bolt Shear Connectors in Composite Beams with Finite Element Method Using MIDAS FEA Software | Nichole Kurniawan and Sunarjo Leman |
| 6 | 14:15 | 93 | Validation of Nonlinear Finite Element Model of Reinforced Concrete Beams Subjected to Monotonic Loading | Jimmy Chandra, Yonathan Billy Christian, Felix Go Ardenlie and Hartanto Wibowo |
| 7 | 14:30 | 155 | Performance Evaluation of High-Rise Apartment Building Using Pushover Analysis | Masrilayanti Masrilayanti, Ruddy Kurniawan, Yuni Aulia Hasibuan, Jati Sunaryati and Ridho Aidil Fitrah |
| 8 | 14:45 | 28 | Adaptive Mesh Refinements for Analysis of 2D Linear Elasticity Problems Using the Kriging-Based Finite Element Method | Johanna Handoko and Foek Tjong Wong |

# Parallel Session Schedule: Structural Engineering & Materials (C)

**Time** : **15.00 - 17.00** **Moderator** : **Arif Sandjaya, S.T., M.T.**

**Room** : **L509**

| No | Time (UTC +7) | Paper ID | Paper Title | Authors |
|---|---|---|---|---|
| 1 | 15:00 | 165 | Enhancing the Seismic Performance of Building Using Damage-Avoidance Shearwall Hold-Downs | Luhur Budi |
| 2 | 15:15 | 164 | Analysis of Ductility Parameters and Building Performance Level on Dual System Structure Retrofitted with Steel Bracing | Yenny Untari Liucius and Albert Jovan |
| 3 | 15:30 | 141 | Evaluation of Earthquake Design Variables on Middle-Low Rise Building with Varied Concrete-Steel Strength | Masykur Kimsan, Vallentin Papalangi and Wisena Perceka |
| 4 | 15:45 | 178 | Capacity Analysis of Exterior Beam-Column Reinforced Concrete Joints Using Midas FEA Software | William Hartantio and Sunarjo Leman |
| 5 | 16:00 | 62 | Evaluation of Functional and Structural Conditions on Flexible Pavements Using Pavement Condition Index (PCI) and International Roughness Index (IRI) Methods | Muji Rifai, Ary Setyawan, Fajar Sri Handayani and Antonius Dipta Arun |
| 6 | 16:15 | 49 | Mechanical Strengths and Ultrasonic Pulse Velocity Evaluation of Supersulfated Cement Mortar Containing Sodium Sulfate | Herry Suryadi Djayaprabha, Jean Jessica Aliusius, Jerrica Pangestu and Tiffany Candra |
| 7 | 16:30 | 87 | Proposed Stress Block for No Coarse-Aggregate Concrete | Daniel Christianto, Metta Yoana, Tiara Amira Utami and Helga Lenita |
| 8 | 16:45 | 34 | Performance of Asphalt Wearing Course Against the Immersion Effect of Tidal Flood (Rob) with Added Materials Polyethylene and Fine Aggregate Slag | Juny Andry Sulistyo, Pratikso and Rachmat Mudiyono |

# Parallel Session Schedule: Structural Engineering & Materials (D)

**Time** : **15.00 - 17.00** **Moderator** : **Dr. Andy Prabowo**

**Room** : **L511**

| No | Time (UTC +7) | Paper ID | Paper Title | Authors |
|---|---|---|---|---|
| 1 | 15:00 | 82 | Mechanical Properties of Cellulose-Fibre Reinforced Bituminous Mix Under Various Loading Rates | Christian Gerald Daniel and Christian Felix |
| 2 | 15:15 | 123 | Remaining Service Life Prediction Using Road Structure Performance Data with Pavement Condition Index (PCI) and Benkelman Beam (BB) Methods | Fajar S Handayani, Ary Setyawan, Florentina Pungky Pramesti and Nugraheni Widhiarti |
| 3 | 15:30 | 54 | Experimental and Numerical Study on the Withdrawal Behaviour of Lag Screws on Wood Side-Grain | Bryan Yehezkiel Firmansyah, Helmy Hermawan Tjahjanto and Wivia Octarena Nugroho. |
| 4 | 15:45 | 56 | Experimental and Numerical Evaluation on the Behavior of Single-Shear Timber Connections Using Lag Screw | Hansen Marchel Hartono, Helmy Hermawan Tjahjanto and Wivia Octarena Nugroho |
| 5 | 16:00 | 27 | Effects of Few Layers Graphene Addition, Aggregate Size, and Water Acidity on the Compressive Strength and Morphology of Cellular Lightweight Concrete | Revika Wulandari, M Novrianda, Desi Heltina, Harnedi Maizir and Amun Amri |
| 6 | 16:15 | 10 | Seismic Evaluation of Structure Existing Building Using United States (ASCE 41-17) and Japanese (JBDPA) Standard: Case Study Office Building in Indonesia | Faiz Sulthan, Angga Arief Gumilang S, Muhammad Rusli and Matsutaro Seki |
| 7 | 16:30 | 74 | Seismic Performance of Post - Fire Building (Case Study: Pasar Wage, Banyumas) | Via Azizul Saputri Khalifah, Halwan Alfisa Saifullah and Stefanus Adi Kritiawan |
| 8 | 16:45 | 79 | Experimental Study on Compressive Strength and Infiltration Rate of Pervious Concrete Containing Recycled Coarse Aggregate and Seawater | Lusman Sulaiman, Tandi Uji and Asbil A |
| 9 | 17:00 | 192 | Mortar with Fly Ash as a Partial Cement Replacement: Analysing the Compressive Strength and Heat of Hydration | Andi Prasetiyo Wibowo, Messaoud Saidani |

# Parallel Session Schedule: Sustainable Transportation Systems (A)

**Time** : **13.00 - 15.00**

**Moderator** : **Prof. Leksmono S. Putranto**

**Room** : **Seminar**

| No | Time (UTC +7) | Paper ID | Paper Title | Authors |
|---|---|---|---|---|
| 1 | 13:00 | 30 | Estimation of the Origin-Destination Matrix from National Road Traffic Data in Central Java Province Using the Least Squares Method | Wahyuningsih Tri Hermani, Ary Setyawan and Syafi'I |
| 2 | 13:15 | 185 | Model Development of Road Performance Indicator-Related Travel Time Using International Roughness Index: a Case Study National Road Network of Sulawesi | Thomas Setiabudi Aden, Hera Widyastuti and Anak Agung Gde Kartika |
| 3 | 13:30 | 183 | How Airline Service Post COVID-19 Pandemic? Domestic LCC Passenger Perception in Indonesia | Andri Irfan Rifai, Agusman Manao and Susanty Handayani |
| 4 | 13:45 | 184 | The Conceptual of Barrier-Free Access for Passengers Based on Transit-Oriented Development in Greater Jakarta - Indonesia | Jumardi Jumardi, Andri Irfan Rifai, Susanty Handayani and Joewono Prasetijo |
| 5 | 14:00 | 129 | The Impact of Service Quality and Passenger Satisfaction on Passenger Loyalty of Petra Shuttle Bus | Rudy Setiawan, Edwin Japarianto, Katherina Stefani Santoso and Yohanes Malvin Samsudin |
| 6 | 14:15 | 22 | Did the Covid -19 Pandemic Influence Mode Choice and Activity Satisfaction? | Tri Hardiyanti Asmaningrum, Dimas Bayu Endrayana Dharmowijoyo, Arif Budiarto and Amirotul Musthofiah Hidayah Mahmudah |
| 7 | 14:30 | 21 | Prediction Model for the Maintenance of Rail Infrastructure in Java | Hadi Yudariansyah, Ismiyati Ismiyati and Alfa Narendra |
| 8 | 14:45 | 194 | Transportation Mode Choice Model Between Private Car and Railway for Responding the Operation of Makassar - Parepare Railway for Makassar - Pangkep Route | Savitri Prasandi Mullyani, Muhammad Isran Ramli, Sakti Adji Adisasmita, Muhammad Asad Abdurrahman and Hajriyanti Yatmar |

# Parallel Session Schedule: Sustainable Transportation Systems (B)

**Time : 15.00 - 17.00** **Moderator : Prof. Leksmono S. Putranto**

**Room : Seminar**

| No | Time (UTC +7) | Paper ID | Paper Title | Authors |
|---|---|---|---|---|
| 1 | 15:00 | 16 | Assessment of Airport Conditions in Resilience Efforts: a Review | Eko Prihartanto, M Arif Rohman and I Putu Artama Wiguna |
| 2 | 15:15 | 46 | Systematic Literature Review: Financing System in Railway Transportation | Delli Noviarti Rachman, Joni Arliansyah and Edi Kadarsah |
| 3 | 15:30 | 20 | Green Transportation: Development Opportunities in Support of Sustainable Transportation | Sri Sarjana |
| 4 | 15:45 | 124 | The Impact of Charging Time of Electric Vehicle Battery to Costumer Willingness to Purchase | Brata Pratama Putra Ridwan and Leksmono Suryo Putranto |
| 5 | 16:00 | 19 | Influencing Factors of Sustainable Highway Construction | Nelda Maelissa, M. Arif Rohman and I Putu Artama Wiguna |
| 6 | 16:15 | 149 | Overlay Thickness Evaluation Based on Indonesian Manual Road Design and Shell Pavement Design Method | Ary Setyawan and Nicolas Sulistyojati |
| 7 | 16:30 | 35 | Science Mapping of Transit-Oriented Development, Typology and Travel Demand Research | Christina Sari, Ismiyati Ismiyati, Mudjiastuti Handajani and Yudi Basuki |
| 8 | 16:45 | 182 | Relationship of Present Serviceability Index for Flexible and Rigid Pavement in Urban Road Damage Assessment Using Pavement Condition Index and International Roughness Index | Muhammad Isradi, Joewono Prasetijo, Thomas Setiabudi Aden and Andri Irfan Rifai |

# Parallel Session Schedule: Hydrological & Environmental Engineering

**Time : 13.00 - 15.30** **Moderator : Vittorio Kurniawan, M.Sc.**

**Room : K604**

| No | Time (UTC +7) | Paper ID | Paper Title | Authors |
|---|---|---|---|---|
| 1 | 13:00 | 36 | The Effect of Sediment Density Parameter Values on the Debris Flow Velocity Parameters | Jazaul Ikhsan, Jahfal Jundi and Ani Hairani |
| 2 | 13:15 | 159 | Bedload Transport Analysis Using Various Methods | Puji Harsanto, Muhammad Huda Adicandra and Surya Budi Lesmana |
| 3 | 13:30 | 69 | Analysis of Hydrodynamics and Thermal Dispersion by Numerical Modelling in Sele Strait, West Papua | Alvin Yesaya, Anasya Arsita Laksmi and Mikhael Mangopo |
| 4 | 13:45 | 3 | Wave Distribution and Proposed Seawall Design Around Tanjung Emas Port, Semarang | Estu Wijayanti, Wakhidatik Nurfaida, Adhy Kurniawan and Muhammad Sulaiman |
| 5 | 14:00 | 23 | The Prospect of Utilizing Recycled Wastewater in Conserving Freshwater Usage in an Industrial Park | Vittorio Kurniawan, Wati Asriningsih Pranoto and Bryan Tan |
| 6 | 14:15 | 44 | Alternatives of Drainage Engineering in Tidal Flood Prone Areas Using Eco-Infrastructure Approach in North Pekalongan | Laily Fadhilah Sabilal Haque and Wakhidatik Nurfaida |
| 7 | 14:30 | 52 | Effects of Sluice Gate Operation on Sediment Flushing in Bekasi Weir Using a 1D Numerical Model | James Zulfan, Bobby Minola Ginting and Marta Nugraha Hidayat |
| 8 | 14:45 | 148 | Examining Meandering Stream by Using Geomorphological Characteristics with GIS-Based Analysis | Robby Yussac Tallar, Olga Catherina Pattipawaej, Asriwiyanti Desiani, Yonathan Adi Saputra, Gerard Christian Joelin and Andrew Sebastian Lehman |
| 9 | 15:00 | 51 | Artificial Viscosity Technique for Direct Runoff Calculation | Bobby Minola Ginting |
| 10 | 15:15 | 126 | Wave Transmission at Low-Crested Structures | Oki Setyandito, M H Aslami, Martin Anda and Risky Ayu Kristanti |
| 11 | 15:30 | 132 | Study of Inundation and Eco Drainage System Approach in Cicayur Kampong Area | Alivia Aurice Pradiesha, Yureana Wijayanti and Riana Ayu Kusumadewi |

# Parallel Session Schedule: Green-Construction Management

**Time** : 13.00 - 15.30 **Moderator** : Dr. Hermawan

**Room** : K603

| No | Time (UTC +7) | Paper ID | Paper Title | Authors |
|---|---|---|---|---|
| 1 | 13:00 | 41 | A Theoretical Mapping of Green Roofs on Building for Sustainable Constructions | Milania M Dule and Peter Kaming |
| 2 | 13:15 | 57 | Development of Business Processes on Sustainable Procurement Based on Identification of Policy and Institutional Factors in the LRT TOD Apartment Project | Danurwendho Fikri Hekmatsyar and Rossy Armyn Machfudiyanto |
| 3 | 13:30 | 68 | A Review on Safety Knowledge and Skills for Reducing Human Error and Accidents in Construction | Misbahul Sidiq and Moh. Rohman |
| 4 | 13:45 | 179 | Evaluation of a Construction Management Software: "Progresi" | Muhammad Aziz and Toriq Ghuzdewan |
| 5 | 14:00 | 24 | The Influence of Schematic Design Document on Outcome of Design and Build Project of Public Buildings | Rialita Dwi Lestari, Ika Bali and Jack Widjajakusuma |
| 6 | 14:15 | 94 | A Review on the Success Factors of Crowdfunding-Based to Finance Small-Scale Infrastructure Projects | Mohammed Ali Berawi, Mustika Sari, Sultan Akbar Rianto and Suci Indah Susilowati |
| 7 | 14:30 | 128 | Study of Factors Affecting Construction Quality, Cost, and Time in Building Project Using Analytical Hierarchy Process (AHP) | Nurlia Ramadhanty, Yureana Wijayanti and Putri Arumsari |
| 8 | 14:45 | 40 | A Review and Bibliometric Analysis of Utilizing Building Information Modeling (BIM) on Effective Operation and Maintenance (O&M) | Hannah A Goretti and Peter Kaming |
| 9 | 15:00 | 186 | Evaluation of Readiness for Implementation of Domestic Component Levels of Architectural Work to Support the Implementation of Green Building in Government Bogor Regency | Mardi Aman and Doddy Setiawan |
| 10 | 15:15 | 157 | Comparison of Change Order Risk Identification in Road Construction Project | Hendrik Sulistio and Mega Waty |
| 11 | 15:30 | 63 | Case Study of Waste Material 2 Development Projects | Mega Waty and Hendrik Sulistio |

# Keynote Speakers Profile

## Prof. Dawn E. Lehman

University of Washington, USA

Education:

- Ph.D., UC Berkeley, Dec. 1998
- M.S.E., UC Berkeley, Dec. 1992
- B.S.C.E., Tufts University, June 1989

Research interest:

Testing and Design Large Scale Structures, Earthquake Resistant Design of Steel Structures, Sustainable Construction Materials

## Li Hai-Ting, Ph.D.

Shanghai Jiao Tong University, China

Education:

- B.Eng. – Chang'an University, China
- M.Eng. – Chang'an University, China
- Ph.D. – The University of Hong Kong

Research interest:

Cold-formed steel structures, High performance steel structures, Thin-walled structures, Composite structures; Fire resistance of metal structures

# Keynote Speakers Profile

## Wikke Novalia, Ph.D.

Monash University, Australia

Education:

- Bachelor Environmental Engineering
- Master of Science Civil Engineering
- PhD Environmental Sociology

Research interest:

Environmental governance, urban transformation, infrastructure planning, sustainability transitions

## H.R. Pasindu, Ph.D.

University of Moratuwa, Sri Lanka

Education:

- B.Sc. Eng., University of Moratuwa
- PhD, National University of Singapore
- C.Eng., CMILT

Research interest:

Pavement management, Low volume roads, Road safety

# Keynote Speakers Profile

**Alfred J. Susilo, Ph.D.**
Universitas Tarumanagara, Indonesia

Education:
- Tarumanagara University, Jakarta
- McNeese State University, Louisiana
- University of Kentucky, Kentucky

Research interest:
Geotechnical Earthquake Engineering, Construction Engineering, Structural Engineering

# Static and Dynamic Story Shear in Split-Level Building on Sloping Ground

Daud Rahmat Wiyono[1*], Asriwiyanti Desiani[1], Robby Yussac Tallar[1], Yosafat Aji Pranata[1], Deni Setiawan[1]

[1]Department of Civil Engineering, Universitas Kristen Maranatha, Jl. Surya Sumantri No.65, Bandung City 40164, Indonesia

**Abstract.** Building structures located on slopes behave differently than structures located on flat ground because of the different levels of stepped floors made to overcome the slope of the land, resulting in several layers of basements. Also, due to the existence of these steps and the difference in soil level, a retaining wall is often made to hold the soil. The forces acting on the structure consist of those acting on the structure and those acting on the retaining walls, both against gravity loads and against earthquake loads. Often, there is an avalanche force due to the stability of the slopes. The main objective of this research is to: 1) Perform building modelling according to certain assumptions, 2) evaluate the distribution of story-shear forces based on a static and dynamic analysis of building structures, and 3) determine the scale factor based on the distribution of shear forces at the levels of static and dynamic analysis. This paper discusses the structure of a seven-story building with stepped floors, which is then used to calculate a similar structure with 14 levels. The dual system is used to overcome the effect of a smaller floor area on the lower part of the terraces due to the slope of the ground. In this case study, the load due to lateral earth pressure is calculated separately from the building structure with the assumption that the retaining wall, namely the soldier-pile type, can carry the lateral earth pressure as well as overcome sliding due to slope stability. Therefore, the building structure can be designed separately without considering the presence of lateral forces due to differences in soil levels. In the dynamic analysis of the response spectrum, it is advised to obtain a scale factor to compare the basic shear force with the basic shears force of the static analysis. In conclusion, the results of the static and dynamic analysis showed the distribution of the story-shear forces from the first to seventh floors as smaller than those of the eighth floor. Static analysis with ETABS software provides a more rational shear-force solution by level compared to manual static analysis, which assumes cumulative sum. Since the first through seventh floors are semi-basements, a scale factor was taken for the dynamic shear force to the static shear force at the eighth floor.

## 1 Introduction

Buildings are often built on slopes or sloping land because they have beautiful views. They are generally made of terraces following the slope of the land by providing a retaining wall to withstand the difference in soil between the floors. Structural modelling to calculate building loads and earthquake forces as well as earth pressure needs to be undertaken, whether modelled as a whole or separately [1–3]. Modelled as a whole, the structure of the building and its retaining wall are represented as a single unit that receives gravity loads as well as earthquakes and soil pressure. In this research, modelling of the structure is carried out separately. The soil pressure is resisted by a retaining wall in the form of a soldier pile that also keeps the soil from sliding due to slope stability. Thus, the building structure is calculated independent of earth pressure. In relation to the soil conditions, the building has pedestals with different levels where the floor mass at the bottom is less than the floor mass at the top, which will exhibit different structural behavior than when the pedestal is placed on a flat plane. The building against the sloping ground is due to the placement of the columns that are not on one flat plane but are located at different levels due to the sloping ground.

The uniqueness of a building structure on a slope lies in the shape of the floor area at the bottom attached to the ground that is smaller than the floor area at the top that is also attached to the ground. So, the part that is attached to the ground has several floors because of the slope of the land made into terraces. This results in unusual structural behavior. When a dynamic analysis is carried out and the dynamic-base shear force is compared with the static-base shear force, it is difficult to determine the scale factor. Buildings that are on flat ground generally take the scale factor at level one to compare the dynamic-base shear force with the static-base shear force because at level one the building is no longer attached to the ground. Buildings located on sloping ground made of terraces may still be attached to the ground above the first level, resulting in a small dynamic-base shear force, causing a large-scale impact. Here, floors that are not attached to the ground are still used so that a rigid diaphragm is not made for floors that are attached to the ground, therefore the results are similar to those of the static-base shear force [4, 5]. The

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goal is to use a rigid-diaphragm floor for a floor that is no longer attached to the ground for the dynamic analysis [6, 7]. This can be achieved by providing a separate support for the lateral force caused by the soil pressing against the retaining wall, allowing the structure to vibrate freely without additional soil pressure. In this case, the details of the structure need to be adjusted so that the structure can act without the influence of soil pressure that is retained by the retaining wall, which also functions to resist landslides due to slope stability. Separate modelling allows soldier piles to be designed as cantilever beams that resist soil pressure and earthquakes. Soldier piles also prevent the soil from sliding due to the slope of the ground. In front of the soldier pile, a concrete wall holds back the soil and water from the soldier-pile gap, which blends in with the columns and slabs of the basement above the soldier pile [8, 9].

## 2 Analytical Model

The building model in this study was assembled using a 3D structural model for a 13-story reinforced-concrete building with a frame structure and shear walls using the ETABS computer program [10, 11]. The building was designed for use as a school. The original model structure is situated in Bandung City ($S_{DS}$=0.67g, $S_{D1}$=0.63g) and has an E site class. The material property of the concrete is $f'_c$ = 28 MPa, and the steel reinforcement is $f_y$ = 420 MPa for all element types in the building. The 3D-analytical model is shown in Figure 1, and the building and floor plans are shown in Table 1.

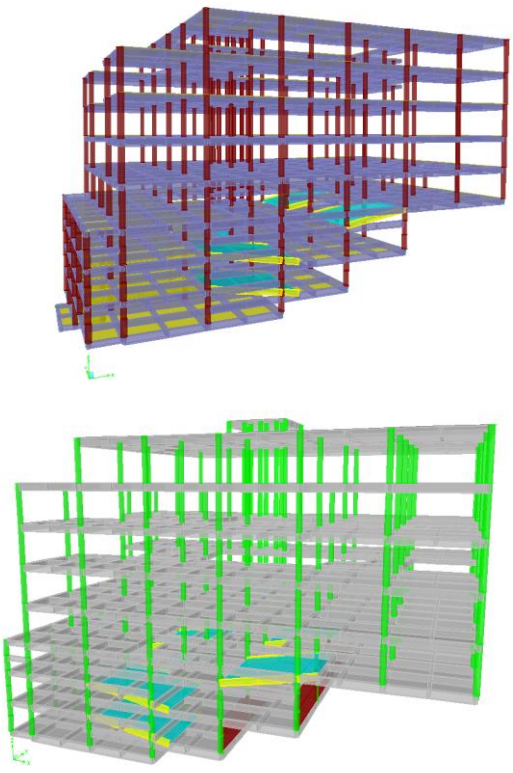
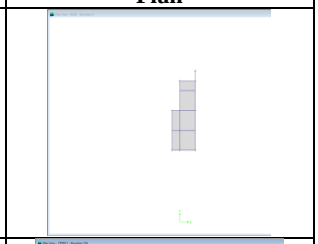
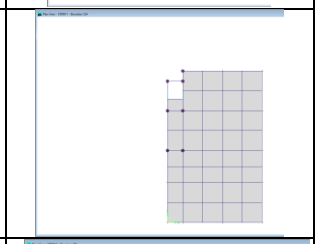
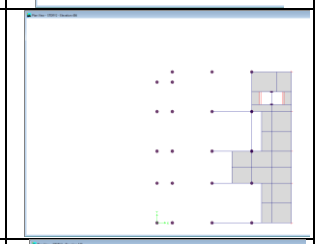
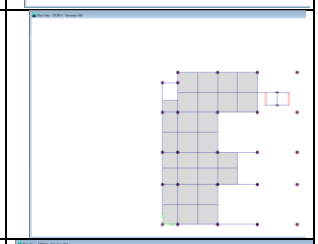
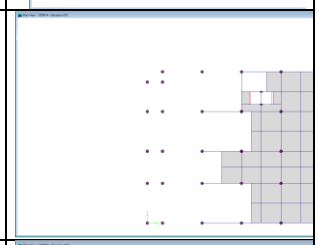
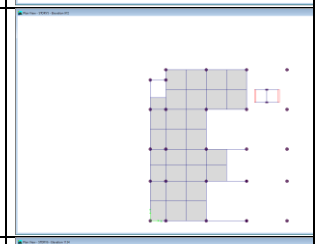
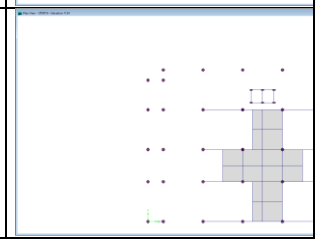
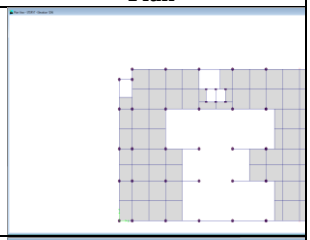
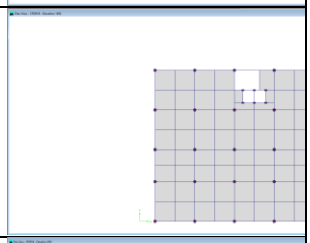
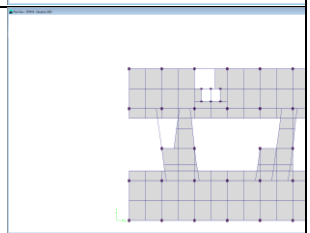
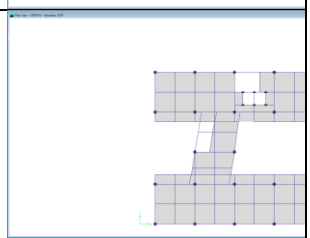
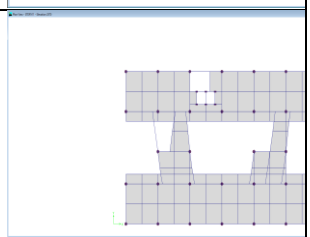
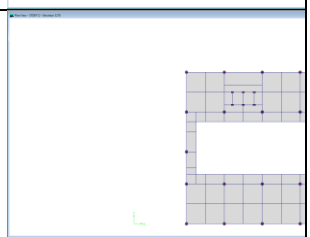
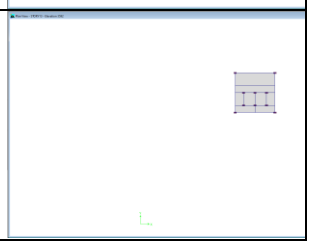


**Fig. 1.** 3D-analytical model for building with and without basement wall

The ground behind the split level is held up by soldier piles, while in front of the soldier pile, there is a basement wall that can be modelled based on the structure. Here, the distribution of static and dynamic story shear will be calculated for the two models.

**Table 1.** Building Floor Plan.

| Floor | Plan |
|---|---|
| GF |  |
| 1st FL |  |
| 2nd FL |  |
| 3rd FL |  |
| 4th FL |  |
| 5th FL |  |
| 6th FL |  |

| Floor | Plan |
|---|---|
| 7th FL |  |
| 8th FL |  |
| 9th FL |  |
| 10th FL |  |
| 11th FL |  |
| 12th FL |  |
| 13th FL |  |

In the diagram of the structural modelling, the mass of the floor at the lower level is smaller than the mass of the floor at the level above. Based on the inspection results for horizontal and vertical irregularities, the structure still meets the requirements. Building-structure modelling is carried out separately with soil retention through soldier piles that are calculated separately and modelled as cantilever beams that resist the lateral force from the soil. It is assumed that the ground floor is floating such that the floor in front of the soldier pile merges with the floor behind the soldier pile that is attached to the ground.

## 3 Result and Discussion

The analysis of the dual-system structure gave the results shown in Fig. 2. The blue $V_{sx}$ and $V_{sy}$ graphs are the results of manual static analysis with ETABS software, while the red $V_{sx}$ and $V_{sy}$ are the results of manual static analysis with a value of 85% $V_{sx}$ and $V_{sy}$. The purple $V_{sx}$ and $V_{sy}$ graphs are the results of static analysis with ETABS software. The distribution and values of the story-shear forces calculated manually are different than those calculated by ETABS software. The value of the static analysis level-shear force calculated manually is greater than the static analysis level-shear force from the software on the floor below. This is because mode one is dominant, but because it is still on the basement layer, what is calculated is the story-shear force on floor eight, which is no longer connected to land. The scale factor is taken from the sixth floor.

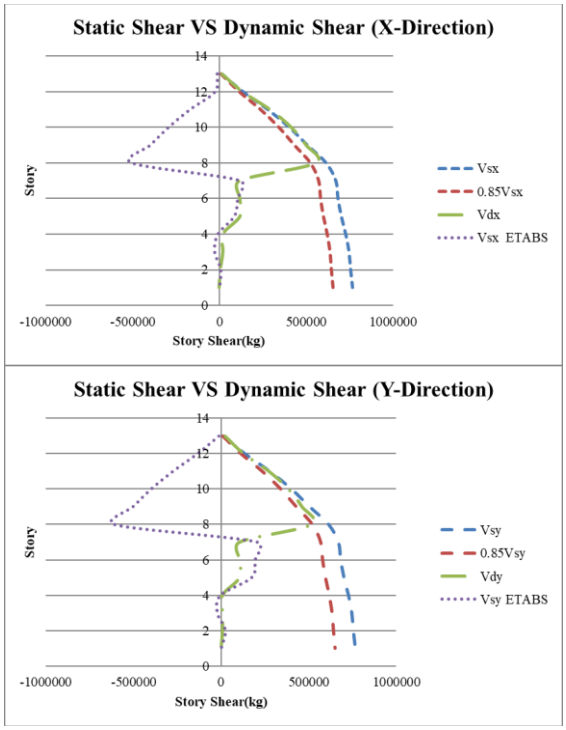



**Fig. 2.** Initial analysis of static and dynamic story shear in X-direction and Y-direction

The difference in signs/directions in ETABS software analysis and static analysis using the manual method is not a problem because the directions are the same. The manual method uses a cumulative-distribution story-shear, but dynamic analysis does not, which accounts for their value differences. The distribution of the shear force in static analysis and dynamic analysis gives a small value at levels one to seven and then grows to a value that is almost the same as the static-shear force at level eight in both the X and Y directions. When using the scale factor on the first through seventh floors, which is based on manual static

analysis, the dynamic shear force will be much greater on the eighth floor. This is not necessary because by looking at the distribution of shear forces for static analysis with ETABS software and the distribution of shear forces for dynamic analysis, it can be seen that the models are similar. In conclusion, the distribution of static- and dynamic-level shear forces given by the software is more precise than that given by the manual method for static-level shear forces.

**Table. 2.** Story shear comparison on building without basement wall model in X-Direction

| Story | $V_{dx}$(kg) | $0.85V_{sx}$ | $0.85V_{sx} \geq V_{dx}$ |
|---|---|---|---|
| 13 | 16820 | 11389 | OK |
| 12 | 134426 | 21763 | OK |
| 11 | 292188 | 143524 | OK |
| 10 | 414349 | 248747 | OK |
| 9 | 499868 | 336988 | OK |
| 8 | 558011 | 428761 | OK |
| 7 | 119169 | 99135 | OK |
| 6 | 119634 | 88338 | OK |
| 5 | 120041 | 72065 | OK |
| 4 | 21769 | 7678 | OK |
| 3 | 21830 | 23944 | CHECK |
| 2 | 6880 | 6005 | OK |
| 1 | 283 | 99 | OK |

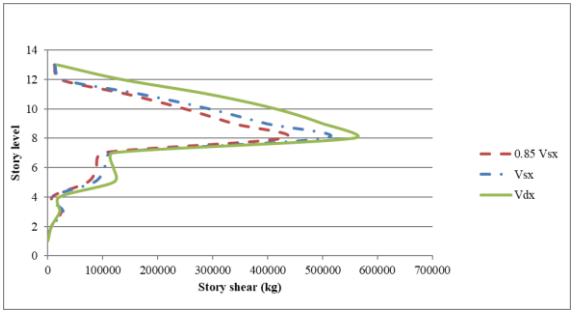



**Fig. 3.** Final analysis of static and dynamic story shear in X-direction without basement wall

**Table. 3.** Story shear comparison on building without basement wall model in Y-Direction

| Story | $V_{dy}$(kg) | $0.85V_{sy}$ | $0.85V_{sy} \geq V_{dy}$ |
|---|---|---|---|
| 13 | 23135.08 | 11389.15 | OK |
| 12 | 129962.44 | 115262.55 | OK |
| 11 | 274717.45 | 234675.574 | OK |
| 10 | 385145.09 | 339956.565 | OK |
| 9 | 463129.78 | 427791.774 | OK |
| 8 | 519548.77 | 519565.424 | CHECK |
| 7 | 106364.16 | 175221.168 | CHECK |
| 6 | 106289.5 | 164423.618 | CHECK |
| 5 | 106407.7 | 148150.368 | CHECK |
| 4 | 8640.71 | 2304.197 | OK |
| 3 | 8681.79 | 18569.797 | CHECK |
| 2 | 8961.5 | 20183.8195 | CHECK |
| 1 | 270.59 | 343.264 | CHECK |

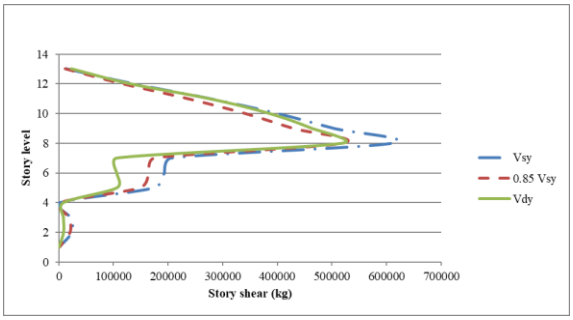



**Fig. 4.** Final analysis of static and dynamic story shear in Y-direction without basement wall

**Table. 4.** Story shear comparison on building with basement wall model in X-Direction

| Story | $V_{dx}$(kg) | $0.85V_{sx}$ | $0.85V_{sx} \geq V_{dx}$ |
|---|---|---|---|
| 13 | 15745.84 | 11389.15 | OK |
| 12 | 125462.74 | 21762.55 | OK |
| 11 | 272734.42 | 143524.2 | OK |
| 10 | 386746.62 | 248746.55 | OK |
| 9 | 466569 | 336987.6 | OK |
| 8 | 520785.1 | 428761.25 | OK |
| 7 | 113911.9 | 99135.3725 | OK |
| 6 | 114358.63 | 88337.8225 | OK |
| 5 | 114738.75 | 72064.5725 | OK |
| 4 | 21186.76 | 7677.931 | OK |
| 3 | 21239.87 | 23943.531 | CHECK |
| 2 | 4453.12 | 6004.689 | CHECK |
| 1 | 227.74 | 99.3395 | OK |

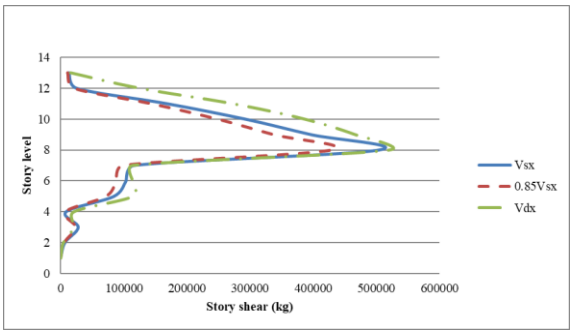



**Fig. 5.** Final analysis of static and dynamic story shear in X-direction with basement wall

**Table. 5.** Story shear comparison on building with basement wall model in Y-Direction

| Story | $V_{dy}$(kg) | $0.85V_{sy}$ | $0.85V_{sy} \geq V_{dy}$ |
|---|---|---|---|
| 13 | 23336.59 | 11389.15 | OK |
| 12 | 130958.14 | 115262.55 | OK |
| 11 | 276810.15 | 234675.574 | OK |

| Story | $V_{dy}$(kg) | $0.85V_{sy}$ | $0.85V_{sy} \geq V_{dy}$ |
|---|---|---|---|
| 10 | 388154.37 | 339956.565 | OK |
| 9 | 466243.04 | 427791.774 | OK |
| 8 | 522381.09 | 519565.424 | OK |
| 7 | 35536.01 | 175221.168 | CHECK |
| 6 | 35519.2 | 164423.618 | CHECK |
| 5 | 35565.39 | 148150.368 | CHECK |
| 4 | 10396.13 | 2304.197 | OK |
| 3 | 10406.73 | 18569.797 | CHECK |
| 2 | 16487.63 | 20183.8195 | CHECK |
| 1 | 261.39 | 343.264 | CHECK |

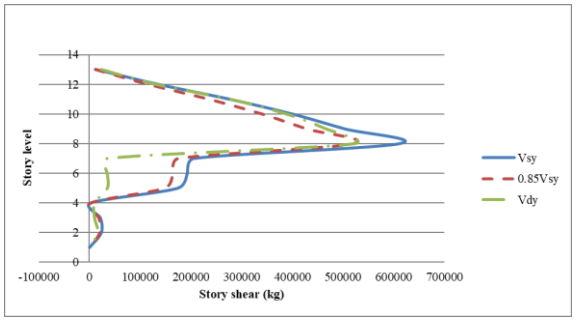



**Fig. 6.** Final analysis of static and dynamic story shear in Y-direction with basement wall

**Table. 6.** Story shear comparison on building with basement wall and Soldier Pile model in X-Direction

| Story | $V_{dx}$(kg) | $0.85V_{sx}$ | $0.85V_{sx} \geq V_{dx}$ |
|---|---|---|---|
| 13 | 13399 | 11389 | OK |
| 12 | 25603 | 21763 | OK |
| 11 | 168852 | 143524 | OK |
| 10 | 292643 | 248747 | OK |
| 9 | 396456 | 336988 | OK |
| 8 | 504425 | 428761 | OK |
| 7 | 116630 | 99135 | OK |
| 6 | 103927 | 88338 | CHECK |
| 5 | 84782 | 72065 | CHECK |
| 4 | 9033 | 7678 | OK |
| 3 | 28169 | 23944 | CHECK |
| 2 | 7064 | 6005 | CHECK |
| 1 | 117 | 99 | CHECK |

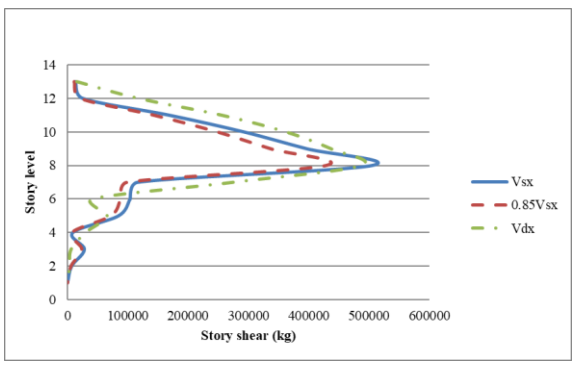



**Fig. 7.** Final analysis of static and dynamic story shear in X-direction with basement wall and soldier pile

**Table. 7.** Story shear comparison on building with basement wall and soldier pile model in Y-Direction

| Story | $V_{dy}$(kg) | $0.85V_{sy}$ | $0.85V_{sy} \geq V_{dy}$ |
|---|---|---|---|
| 13 | 13399 | 11389 | OK |
| 12 | 135603 | 115263 | OK |
| 11 | 276089 | 234676 | OK |
| 10 | 399949 | 339957 | OK |
| 9 | 503284 | 427792 | OK |
| 8 | 611253 | 519565 | OK |
| 7 | 206143 | 175221 | OK |
| 6 | 193440 | 164424 | CHECK |
| 5 | 174295 | 148150 | CHECK |
| 4 | 2711 | 2304 | OK |
| 3 | 21847 | 18570 | CHECK |
| 2 | 23746 | 20184 | CHECK |
| 1 | 404 | 343 | OK |

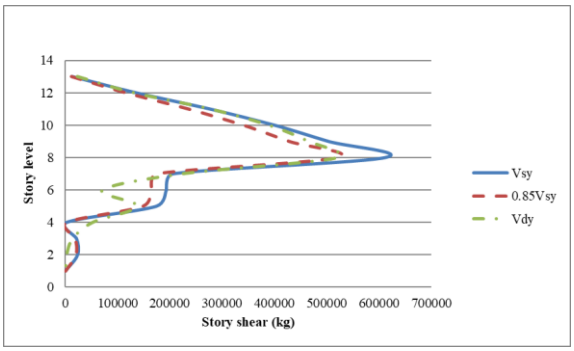



**Fig. 8.** Final analysis of static and dynamic story shear in Y-direction with basement wall and soldier pile

Fig. 3 compares the story-shear values for the static analysis using the ETABS software with the story-shear values for the dynamic analysis. The scale factor taken gives a satisfactory value on the eighth floor, while on the first through seventh floors, there is something that is slightly less, this is not a problem because these floors are semi-basement floors.

## 4 Conclusion

In conclusion:

1. Buildings built on sloping land with terraced structures / split levels have smaller floor areas on the terraced lower floors, namely floors one through seven, which function as semi-basement parking.
2. In the manual calculation, the static-equivalent analysis gave greater values on the floors below the terraces, namely floors one through seven because of the cumulative-sum assumption.
3. The software calculation of the equivalent static analysis gave more realistic values for the floors below the terraces, namely the first through seventh floors, according to the floor area, which had an impact on the floor mass.
4. The static equivalent analysis software calculation gave a negative value, while in manual calculations

it gave a positive value, which is not a problem because it is a sign agreement.

5. The basic shear force in static analysis was based on mode one, which has the largest mass and therefore was used as a reference for the scale factor in dynamic analysis.
6. The results of the basic shear-force dynamic analysis in the X direction on the first run provided a greater value than the results of the static analysis in the X direction on the first run, so for the dynamic shear force values in the X direction, this value can be taken.
7. When designing the lower structure, soldier piles for slope stability and retaining walls should be considered to manage gravity and earthquake loads.

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