Institut Teknologi Bandung
Faculty of Civil and
Environmental Engineering

Seratus Satu Tahun
Institut Teknologi Bandung

SIBE2022

Sustainable Infrastructure and Built Environment

PROGRAM & ABSTRACT BOOK

Sustainable Infrastructure and Built Environment -

Challenges on Sustainable and Resilient Infrastructure and Built Environment

Title ■ Program and Abstract Book – The Fourth International Conference on Sustainable Infrastructure and BuiltEnvironment – "*Sustainable Infrastructure and Built Environment - Challenges on Sustainable and Resilient Infrastructure and Built Environment*"

Publisher ■ **Design** ■ Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung, Indonesia

Welcoming Remarks

OPENING REMARKS THE DEAN OF THE FACULTY OF CIVIL AND ENVIRONMENTAL ENGINEERING, INSTITUT TEKNOLOGI BANDUNG

Good Morning,
Distinguished guests, ladies and gentlemen,
It is my great honour to welcome you to **our Fourth International Conference on Sustainable Infrastructure and Built Environment (SIBE-2022) in collaboration with Hokkaido University and the National Taiwan University.** Using the theme of the conference is "**Challenges on Sustainable and Resilient Infrastructure and Built Environment**", the conference cover all aspects of civil, ocean, and environmental engineering practices which include the following:

1. **Disaster and Resilient Infrastructures**
2. **Earthquake Engineering**
3. **Sustainable Construction and Project Management**
4. **Maritime Infrastructure and Coastal Protection**
5. **Transportation System and Engineering**
6. **Water Resources Engineering and Management**
7. **Clean and Renewable Energy**
8. **Water-Food-Environment Nexus**
9. **Climate Change and Air Pollution**
10. **Health, Safety and Environment**
11. **Solid Waste and Hazardous Waste**
12. **Water and Wasterwater Engineering and Management**

In the current rapid rate of urbanization and industrialization, Civil, environmental, and ocean engineers engage the immediate needs in seeking the means and technologies to enhance human life through infrastructure modernization by the provision of settlement, clean water, sanitation, and transport, amongst others. Sustainability and resilience of the built environment have become concerns and studies of the world's academicians and professionals using a multidisciplinary approach in infrastructure development. Relevant researches include not only hard infrastructure but also soft infrastructure aspects such as regulation, institution, and policy development framework

I hope that the SIBE conference will be able to provide a platform for exchanging ideas, information, and experiences among academics, researchers, consultants, engineers, manufacturers, and postgraduate scholars. It is also can be a medium to

discuss and evaluate the latest research, innovative technologies, policies and new directions in infrastructure development, pollution prevention and eco-friendly technologies adapted to developing countries, and to promote cooperation and networking amongst practitioners and researchers involved in addressing sustainable and resilient infrastructure.

Lastly, I would like to thank the sponsors for the support for this conference, the organizing committee, and all students who have been working tenaciously to organize this event.

Enjoy your time at this conference and I hope we have wonderful discussions and potential collaborations in the future.

Bandung, 8 March 2022

Ir. Edwan Kardena, Ph.D.
Dean of the Faculty of Civil and Environmental Engineering
Institut Teknologi Bandung

OPENING REMARKS FROM THE CHAIR OF ORGANIZING COMMITTEE

Welcome to the **4th International Conference of Sustainable Infrastructure and Built Environment (SIBE) 2022**. This conference is organized by the **Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung (ITB)**. This conference is the fourth in the series of the International Conference of SIBE. The first International Conference of SIBE was held at Sasana Budaya Ganesha (SABUGA), on 2nd -3rd November 2009. The second SIBE was held in Aula Barat ITB, on 19th – 20th November 2013, and the Third SIBE was conducted in Aula Barat ITB, on 26th – 27th September 2017. I hope that in the future, SIBE will still become the platform where scientists and practitioners meet and discuss science, innovations, and solutions for sustainable infrastructure and built environment.

It is our great honour to welcome:

- The Minister of Public Works and Housing, the Republic of Indonesia, **Dr. Ir. M. Basuki Hadimuljono, M.Sc**
- The Coordinating Minister of Maritime and Investment, the Republic of Indonesia, **Luhut Binsar Pandjaitan**
- The Rector of Institut Teknologi Bandung, **Prof. Reini Wirahadikusumah, Ph.D.**
- **Prof. Satoshi Okabe**, Hokkaido University
- **Dr. Fouad Bendimerad**, Executive Director of Earthquake Megacity Initiative (EMI)
- **Prof. Louis Ge**, National Taiwan University
- **Prof. Michael Templeton**, Imperial College London
- **Abdul Malik Sadat Idris, ST, M.Eng.**, Ministry of National Development Planning of the Republic of Indonesia
- **Prof. Tadashi Yamada**, Kyoto University

to join this conference as keynote speakers and invited speakers.

This 4th SIBE 2022 has been started last year, when we have a Webinar "**Imagining a Sustainable and Resilient ASEAN City 2040: an Engineering Perspective**" on Saturday, **13th November 2021** with expert speakers in their field:

- **Weni Maulina** - Head of Engineering Division at MRT Jakarta
- **Ventakatachalam Anbumozhi, Ph.D.** - Director of Research Strategy and Innovation Economic Research Institute for ASEAN and East Asia (ERIA)
- **Prof. Koji Ichii** - Kansai University
- **Shalendra Ram** - Technical Director, Transportation (AECOM) & Chair, Transport Australia Society (Engineers Australia)

The main two days seminar will be divided into 10 sub themes with **144 presenters** coming from various institutions in Indonesia and abroad, and covering civil engineering, ocean engineering, and also environmental engineering. After the main seminar, we will also have another side event, a half day webinar on **10 March 2022**, with the title of "**Improving the accessibility of the safe drinking water in Southeast Asia to achieve the SDGs**" As a collaboration between **Faculty of Civil and Environmental Engineering ITB** and **IWA (International Water Association)**.

Therefore, I'd like to convey our gratitude to all authors and attendees for attending this conference in order to share information and initiate future collaborations toward a more sustainable infrastructure and built environment. Although this event will be placed online, I believe that it will provide a forum for discussing and evaluating cutting-edge ideas, innovative technologies, policies, and new perspectives for sustainable infrastructure and the built environment. Additionally, I ask all attendees to consider the possibility of expanding collaboration and networking among us, practitioners and scholars, in solving infrastructure and built environment concerns critical to our sustainability. I hope this event will be repeated in 2026 to foster scientific collaborations and enhance our partnership.

We are very grateful for the supports provided by:

- **PT DSI (Delta Systech Indonesia)**
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- **PT Hutama Karya (Persero)**
- **PT Nur Straits Engineering**
- **Nippon Koei Co., ltd.**
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We would like to thank you all for your active engagement in this conference. So, please enjoy the conference and thank you very much.

Bandung, 8 March 2022

Dr. Ir. Indah Rachmatiah, MSc.
Chairman of SIBE 2022
Institut Teknologi Bandung

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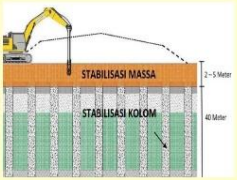

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SIBE 2022 Program Schedule

DAY 1: Tuesday, 08th March 2022

https://bit.ly/PlenarySessionSIBE2022

Meeting ID 968 5612 3853

Password SIBE2022

07.30 – 08.00	Registration
08.00 – 08.30	Opening Ceremony - Report from Organizing Committee (Ir. Indah Rachmatiah Siti Salami, M.Sc., Ph.D) - Speech: Dean of Faculty Civil and Environmental Engineering ITB (Ir. Edwan Kardena, Ph.D) - Opening Speech: Rector of Institut Teknologi Bandung (Prof. Reini Wirahadikusumah, Ph.D) - Song Performance by ITB Students Choir
08.30 – 09.00	*First Keynote Speaker* **Luhut Binsar Pandjaitan, M.P.A.*** Coordinating Minister for Maritime Affairs and Investment Moderator: Prof. Ir. Indra Djati, M.Sc., Ph.D.
09.00 – 09.30	*Second Keynote Speaker* **Prof. Satoshi Okabe** Hokkaido University Title: "Technological Innovations of Human-destroyed Nitrogen Biogeochemical Cycles" Moderator: Dr. Herto Dwi Ariesyady, S.T, M.T.
09.30 – 10.00	*Third Keynote Speaker* **Prof. Louis Ge** NTU (National Taiwan University) Title: "Development of Calcite Precipitation Techniques to Ground Improvement on Liquefiable Soil" Moderator: Ir. Rildova, M.T, Ph.D.
10.00 – 10.30	Coffee break
10.30 – 12.30	Parallel paper presentation
12.30 – 13.30	Lunch break
13.30 – 15.00	Parallel paper presentation
15.00 – 15.30	Coffee break
15.30 – 17.30	Parallel paper presentation

*) to be confirmed

DAY 2: Wednesday, 09th March 2022

https://bit.ly/PlenarySessionSIBE2022
Meeting ID 968 5612 3853
Password SIBE2022

07.30 – 08.00	Registration
08.00 – 08.30	*Fourth Keynote Speaker* **Dr. Ir. M. Basuki Hadimuljono, M.Sc*** Minister of Public Works and Public Housing Moderator: Prof. Ir. Indratmo, M.Sc., Ph.D.
08.30 – 09.00	Song Performance by ITB Students Choir
09.00 – 09.30	*Fifth Keynote Speaker* **Dr. Fouad Bendimerad** Executive Director of Earthquake Megacity Initiative (EMI) Title : "Achieving Sustainable and Resilient Urban Infrastructure" Moderator: Prof. Dr. Ir. Krishna Suryanto Pribadi, M.Sc.
09.30 – 10.00	Coffee break
10.00 – 12.00	Parallel paper presentation
12.00 – 13.00	Lunch break
13.00 – 14.30	Parallel paper presentation
14.30 – 15.00	Closing ceremony

*) to be confirmed

Parallel Session Schedule

DAY 1: Tuesday, 08th March 2022

R1-S1 Disaster and Resilient Infrastructures and Earthquake Engineering

Moderator: Muhammad Riyansyah, S.T., Ph.D.

Time	Link Zoom: https://bit.ly/Room1-SIBE2022
10.30 – 10.45	**ID 421:** Compaction Control Using Degree of Saturation and Plasticity Index on Tropical Soil *Hasbullah Nawir[1], Laras Dipa Pramudita[1], Tita Kartika Dewi[1], Dayu Apoji[2]*
10.45 – 11.00	**ID 318:** Introduction of Unsaturated Soil Mechanics in Indonesia to Improve the Understanding on Geotechnical Engineering- related Infrastructure Problems *Sugeng Krisnanto[1,2], Endra Susila[1], Andhika Sahadewa[1,2], Hasbullah Nawir[1], Erza Rismantojo[1], Dedi Apriadi[1,2]*
11.00 – 11.15	**ID 396:** Vacuum Preloading of Soft Clays on the Sumatra Toll Road in Indonesia – Field Monitoring Records vs. Numerical Modelling Results *Asrinia Desilia[1], Endra Susila[1], Sahadewa Andhika[1]*
11.15 – 11.30	**ID 403:** Analysis of Biodegradation Characteristics Based on Visual Observation and Mass Loss Percentage in Soil Burial Test of Sustainable Geo-bag Materials as Temporary Structures in Natural Coastal Protection System *William Gunawan[4], Rildova Rildova[1], Nita Yuanita[2], Alamsyah Kurniawan[2], Kahfiati Kahdar[3], Vivie Herbenita[4]*
11.30 – 11.45	**ID 341:** Development of seismic map for offshore platform design in Indonesia, case study of the North Coast of Java *- Hendriyawan[1,2], Dega Damara Aditramulyadi[2], Ricky Lukman Tawekal[1,2], - Rildova[1,2]*
11.45 – 12.30	Q & A
12.30 – 13.30	Lunch break

Orange: presenting author

DAY 1: Tuesday, 08th March 2022

R2-S1 Maritime Infrastructure and Coastal Protection

Moderator: Ir. Entin Agustini Karjadi, MCE, Ph.D.

Time	Link Zoom: https://bit.ly/Room2-SIBE2022
10.30 – 11.00	*Invited Speaker* **Abdul Malik Sadat Idris, S.T., M.Eng** Director of Water and Irrigation, Ministry of National Development Planning of Republik Indonesia Title: "Integrated Mitigation of North Coastal Java"
11.00 – 11.10	Q & A
11.10 – 11.25	**ID 330:** Influence of random variable on reliability index of braced monopod platform based on fatigue limit state in Natuna Sea *Paramashanti Paramashanti[1], Rildova Rildova[1], Gary Prayogo[1], Alamsyah Kurniawan[1]*
11.25 – 11.40	**ID 447:** The Effect of Land Subsidence on Hydrodynamic Conditions in Pekalongan Coast *Reinard Joseph Martin[1], Alamsyah Kurniawan[1], Eka Oktariyanto Nugroho[1], Fauzi Septian Wijaya[1], Iqbal Fauzan Muhammad[1], Yola Yola[1], Nurcholish Fauzi[1]*
11.40 – 11.55	**ID 387:** The Effect of Non-linear Wave on Oil Spill Dispersion *Muslim Muin1, Arung Bahari Muslim1, Tirsa Aulia Puspitasari[2]*
11.55 – 12.10	**ID 416:** Study of Temporal and Spatial changes in the Estuarine Area of the Mayangan River, West Java – Indonesia *Hendra Achiari[1], Rajin[1], Gurusu[1]*
12.10 – 12.30	Q & A
12.30 – 13.30	Lunch break

Orange: presenting author

DAY 1: Tuesday, 08th March 2022

R3-S1 Sustainable Construction and Project Management

Moderator: Dr. Iris Mahani, S.T., M.T.

Time	Link Zoom: https://bit.ly/Room3-SIBE2022
10.30 – 10.45	**ID 343:** Systematic Literature Review for Lean Construction Method Current Trends and Issues *Gebriel Huda[1], Mohammed Ali Berawi[1]*
10.45 – 11.00	**ID 374:** The Study of Potential Application of Modular Construction in The Development of Indonesia New Capital City *Oktaviani Turbaningsih[1], Ulfa Mutaharah[2], Pramada Saputra[3]*
11.00 – 11.15	**ID 379:** Assessment of Green Practices in Sentra Timur Apartment, Jakarta Based on Greenship Rating of the Green Building Council of Indonesia *Aqil Azizi[1], Joan Rachel[1], Dicky Setiawan[1]*
11.15 – 11.30	**ID 389:** Application of Value Engineering in Basin (Embung) Construction : A case study in ITB Cirebon *Allan Fitrah[1], Luthfi Yudha Oktano[1], Rani Gayatri K. Pradoto[1]*
11.30 – 11.45	**ID 413:** Development of Concrete Material Technology in the context of supply – demand based on geographical aspects *Rani Gayatri[1], Biemo Soemardi[1], Abdhy Gazali[1], Andira Putri[1], Ignatius Mahardika[1], Rika Permata[1]*
11.45 – 12.30	Q & A
12.30 – 13.30	Lunch break

Orange: presenting author

DAY 1: Tuesday, 08th March 2022

R4-S1 Water and Wastewater Engineering and Management

Moderator: Ir. Ahmad Soleh Setiyawan, S.T., M.T., Ph.D.*

Time	Link Zoom: https://bit.ly/Room4-SIBE2022
10.30 – 10.45	**ID 402:** Performance of Moving Bed Biofilm Reactor Integrated Septic Tank in Treating Office Building Wastewater *Ahmad Soleh Setiyawan[1], Farisah Inarah Rahmat Hasby[1], Arisa Franita Pangaribuan[1], Vandith Va[1], Prayatni Soewondo[1], Dyah Wulandari Putri[1]*
10.45 – 11.00	**ID 364:** Constructed Wetlands with Cyperus Alternifolius as a Sustainable Solution for Household Greywater Treatment *Siti Qomariyah[1], Budi Utomo[1], Agus H. Wahyudi[1]*
11.00 – 11.15	**ID 370:** Application of cellulose of Boehmeria nivea as natural flocculants in direct flocculation *Dinda Fauzani[1], Suprihanto Notodarmojo[2], Marisa Handajani[2], Qomarudin Helmy[2]*
11.15 – 11.30	**ID 323:** The Eco Enzyme Application For Reducing Nitrite in Wastewater as The Sustainability Alternative Solution in Garbage and Wastewater Problems *Temmy Wikaningrum[1], Putri Laila Anggraina[1]*
11.30 – 11.45	**ID 347:** Removal of Phthalocyanine Reactive Dye Using Plasma Corona Discharge *Budy Handoko[1,2], Suprihanto Notodarmojo[1], Rofiq Iqbal[1]*
11.45 – 12.00	**ID 448:** Bioprocess of Oil Contaminated Water At Gathering Station PT "X" in Sumatera Oil Field By Use Of Consortium Endogenous and Exogenous Bacteria *Sandra Madonna[1], Dzalika Nurperbangsari[2], Astrid Sugiana[2], Zulkifliani Zulkifliani[3]*
12.00 – 12.30	Q & A
12.30 – 13.30	Lunch break

Orange: presenting author

DAY 1: Tuesday, 08th March 2022

R5-S1 Transportation System and Engineering

Moderator: Dr. Russ Bona Frazila. S.T., M.T

Time	Link Zoom: https://bit.ly/Room5-SIBE2022
10.30 – 11.00	*Invited Speaker* **Prof. Tadashi Yamada** Graduate School of Engineering, Kyoto University Title: "Optimizing Warehouse Sharing Platform Systems with Vehicle Routing"
11.00 – 11.10	Q & A
11.10 – 11.25	**ID 404:** Commuter Traveler's Perception of Toll Roads During the Ramp-up Period in Indonesia *Weka Indra Dharmawan[1], Ade Sjafruddin[1], Russ Bona Frazila[1], Febri Zukhruf[1]*
11.25 – 11.40	**ID 373:** Evaluation Level of Accessibility on Malioboro Pedestrian Way for People with Disabilities *Kurnia Nindya Nabila[1], Nursyamsu Hidayat[1]*
11.40 – 11.55	**ID 467:** Combination of VRP and Traffic Assignment to Determine The Location of Logistics Distribution Centers *Tas'an Junaedi[1]*
11.55 – 12.10	**ID 419:** Integration of Mass Public Transport Fare in The Jakarta Area *Sofyan Triana[1], Ade Sjafruddin[2], Rudy Hermawan Karsaman[3], Sudarso Kaderi[4]*
12.10 – 12.30	Q & A
12.30 – 13.30	Lunch break

Orange: presenting author

DAY 1: Tuesday, 08th March 2022

R6-S1 Water Resources Engineering and Management

Moderator: Mohammad Bagus Adityawan, S.T, M.T, Ph.D.

Time	Link Zoom: https://bit.ly/Room6-SIBE2022
10.30 – 10.45	**ID 458:** Evaluation of Drainage System of Light Rapid Transport (LRT) Depo at Kelapa Gading, Jakarta City *Joko Nugroho[1]*
10.45 – 11.00	**ID 335:** Study on Numerical Calculation of Flow Structures in A Curved Open Channel with Advanced Depth-Integrated Models *Fikry Purwa Lugina[1], Tatsuhiko Uchida[1], Yoshihisa Kawahara[2]*
11.00 – 11.15	**ID 348:** Study of The Effect of Water Consumption Patterns Changes During The Covid-19 Pandemic on The Rate of Land Subsidence in DKI Jakarta *Diki Surya Irawan[1], Prismita Nursetyowati[1], Maria Cintya Nova[1], Sarah Maulina[1]*
11.15 – 11.30	**ID 436:** Estimation of Extreme Rainfall over Kalimantan Island based on GPM IMERG Daily Data *Arno Adi Kuntoro[1,2], Rana Karinta Hapsari[1,2], Mohammad Bagus Adityawan[1,3], Mohammad Farid[1,3], - Widyaningtias[1,2], - Radhika[4]*
11.30 – 11.45	**ID 465:** The Planned of Behaviour (TPB) Theory Approach to The Participation of Farmers (P3A) and Local Governments in Participating of Agricultural Systems, Case Study: Jatiluhur East Tarum Main Canal, Subang Regency *Agung Wiyono Hadi Soeharno[1], Taufik Andriana[1], Ari Putranto Nugroho[1], Eka Oktariyanto Nugroho[1], Anton Mardiyono[2], Herry Rachmadyanto[2]*
11.45 – 12.00	**ID 376:** Groundwater Salinity and Its Effect on Elevated Concentrations of Other Contaminants in A Coastal Plain: A Perspective for Infrastructure Protection *Anna Fadliah Rusydi[1], Shin-Ichi Onodera[2], Seiichiro Ioka[3], Rizka Maria[1], Fuad Firmansyah[1], Mitsuyo Saito[4], Wahyu Purwoko[1], Dady Sukmayadi[1]*
12.00 – 12.30	Q & A
12.30 – 13.30	Lunch break

Orange: presenting author

DAY 1: Tuesday, 08th March 2022

R1-S2 Health, Safety, and Environment

Moderator: Dr. Herto Dwi Ariesyadi, S.T., M.T.

Time	Link Zoom: https://bit.ly/Room1-SIBE2022
13.30 – 13.45	**ID 378:** How do producers' perceptions and behaviours affect the physical water quality of refill water in urban Bandung, Indonesia? *M Aldiy Akbar[1], Anindrya Nastiti[1,2]*
13.45 – 14.00	**ID 383:** Study of The Effect of Dust Concentration on The Perception of Community Respiratory System Disorders in Bandung District *Farid Wajdi Taradita[1], Indah Rachmatiah Siti Salami[1]*
14.00 – 14.15	**ID 352:** The Analysis of Environment Factor on Covid-19 Indoor Transmission and Preventive Behavior on Covid-19 Cases in Coblong District, Bandung City *Katharina Oginawati[1], Rinaldy Jose Nathanael[1]*
14.15 – 14.30	**ID 397:** The Relationship of Lighting Intensity with Eye Fatigue in Workers at PT Mekar Armada Jaya in 2021 *Eka Fitriani Ahmad[1]*
14.30 – 15.00	Q & A
15.00 – 15.30	Coffee break

Orange: presenting author

DAY 1: Tuesday, 08th March 2022

R2-S2 Maritime Infrastructure and Coastal Protection

Moderator: Irsan Soemantri Brojonegoro, Ph.D.

Time	Link Zoom: https://bit.ly/Room2-SIBE2022
13.30 – 13.45	**ID 385:** Integrated Flood Model in 3D NonOrthogonal Boundary Fitted Hydrodynamics Model for Ciliwung River Jakarta *Arung Bahari Muslim[1], Muslim Muin[1]*
13.45 – 14.00	**ID 460:** Numerical Modeling: The Effect of Land Subsidence on Hydrodynamic Conditions and Coastal Morphology in Pekalongan *Iqbal Fauzan Muhammad[1], Nita Yuanita[1], Alamsyah Kurniawan[1], Eka Oktariyanto Nugroho[1], Fauzi Septian Wijaya[1], Reinard Joseph Martin[1], Yola Yola[1], Nurcholish Fauzi[1]*
14.00 – 14.15	**ID 353:** Sedimentation analysis in front of a submerged rubble-mound breakwater due to daily and extreme waves simulations *Olga Catherina Pattipawaej[1], Tri Octaviani Sihombing, Hanny Juliany Dani, Trianov Harinanta Pelawi, Hendry Suprianto Sihotang*
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14.30 – 15.00	Q & A
15.00 – 15.30	Coffee break

Orange: presenting author

DAY 1: Tuesday, 08th March 2022

R3-S2 Environmental Management

Moderator: Suharyanto, S.T., M.Sc., Ph.D.

Time	Link Zoom: https://bit.ly/Room3-SIBE2022
13.30 – 13.45	**ID 350:** Study of Lerak (Sapindus Rarak) Biochar Application for Andosol Agricultural Soil Remediation *Sekar Arum[1], Temmy Wikaningrum[1]*
13.45 – 14.00	**ID 417:** Assessment of water quality and challenges for vegetable irrigation in Greater Bandung Area, Indonesia *Mayrina Firdayati[1], Rania Anindita[1], Putri Alya Krisnamurti[1], Marisa Handajani[1]*
14.00 – 14.15	**ID 434:** Redefining The Role of Stakeholders in Restoring The Hydrological Function and Conservation of The Biodiversity of Nipa-Nipa Grand Forest Park, Southeast Sulawesi *Ira Ryski Wahyuni[1], Alfian Alfian[2], Mutmainnah Mutmainnah[2], La ode Muhammad Erif[3], Fitria Nur Indah Djafar[2]*
14.15 – 14.30	**ID 386:** Numerical Study of Hydrodynamic and Sedimentation for Sustainable Marine Floating Cage Aquaculture in Indonesia: A Case Study in Situbondo, East Java *Marsha Sabrina Suratman[1], Entin A. Karjadi[1]*
14.30 – 15.00	Q & A
15.00 – 15.30	Coffee break

Orange: presenting author

DAY 1: Tuesday, 08th March 2022

R4-S2 Water and Wasterwater Engineering and Management

Moderator: Teddy Tedjakusuma, S.T., M.T., Ph.D.*

Time	Link Zoom: https://bit.ly/Room4-SIBE2022
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13.45 – 14.00	**ID 336:** Water Saving Planning in Apartment *Tiara Anantika[1]*, Eka *Wardhani[1]*, Nico *Halomoan[1]*
14.00 – 14.15	**ID 415:** Sustainability Analysis of The Upper Citarum Watershed Based on Water quality, Water quantity, and Landuse Indicators *Mariana Marselina[1], Nabila Maharani Putri[1]*
14.15 – 14.30	**ID 440:** Heavy metals in groundwater surrounding industrial areas: a case study in Leuwigajah, Cimahi *Wilda Naily[1,2], Hendarmawan Hendarmawan[1,3], Chay Asdak[1,4], Sunardi Sunardi[1,5]*
14.30 – 14.45	**ID 363:** The Challenge of Assisting Stakeholders in Data-Scarce Settings: Characterising Intermittent Water Systems Using A Citizen Science Approach *Laure Sione[1], Michael Templeton[1], Christian Onof[1]*
14.45 – 15.00	Q & A
15.00 – 15.30	Coffee break

Orange: presenting author

DAY 1: Tuesday, 08th March 2022

R5-S2 Transportation System and Engineering

Moderator: Dr. Eri Susanto Hariyadi, S.T., M.T.

Time	Link Zoom: https://bit.ly/Room5-SIBE2022
13.30 – 13.45	**ID 457:** The use of deflection curve parameters to evaluate the structural condition of the North Coast Corridor of Java Island *Bagus Hario Setiadji[1], Amelia Kusuma Indriastuti[1], Yonikha Rivani[1]*
13.45 – 14.00	**ID 355:** Effects of Dammar as the partial substitution of bitumen in HMA AC-WC containing Buton Asphalt *Edward Ngii[1], La One[1], Nasrul Nasrul[1], Muh. Ikram Udo[1]*
14.00 – 14.15	**ID 333:** Development of Rolled Compacted Concrete as a Preservation Material *Adityo Budi Utomo[1], Gitaning Primaswari[1]*
14.30 – 14.45	**ID 324:** Properties of recycled hot asphalt mixture using RAP added with mastic asphalt component *I Nyoman Arya Thanaya[1], I Made Agus Ariawan[1], I Dewa Gede Rivan Yudistira[1], I Made Widiyarta[1]*
14.45 – 15.00	Q & A
15.00 – 15.30	Coffee break

Orange: presenting author

DAY 1: Tuesday, 08th March 2022

R6-S2 Water Resources Engineering and Management

Moderator: Hadi Kardhana, S.T, M.T, Ph.D.

Time	Link Zoom: https://bit.ly/Room6-SIBE2022
10.30 – 10.45	**ID 466:** Optimizing Rainwater Harvesting Systems for The Dual Purposes of Water Supply and Runoff Capture With Study Case in Bandung Area, West Java *Muhammad Cahyono[1]*
10.45 – 11.00	**ID 463:** Hydrogeochemical Characteristics and The Impact of Anthropogenic Activity on Groundwater quality in the Banjaran Sub Urban Area, West Java Indonesia *Rizka Maria[1,2], Tengku Yan Waliyana Muda Iskandarsyah[2], Bombom Rahmat Suganda[2], Hendarmawan Hendarmawan[2]*
11.00 – 11.15	**ID 456:** Analysis of The Effect of Sediment Transport on River Bed Changes of Cengkareng Floodway *Rezky Dwi Nur Cahyani[1], Muhammad Cahyono[2], Leo Eliasta[3], Arie Setiadi Moerwanto[3], Eka Oktariyanto Nugroho[2]*
11.15 – 11.30	**ID 437:** Assessment of The Potential Land Erosion and Actual Accumulated Sedimentation for Carrying Capacity in Bone River, Gorontalo *Dwiva Anbiya Taruna[1], Budhi Kosasih[2], Irene Jaya[2], Mohammad Bagus Adityawan[3], Arno Adi Kuntoro[4]*
11.30 – 11.45	**ID 420:** The Impact of Upper Citarum Diversion Channels on Sediment Transport and River Morphology *Pravira Rizki Suwarno[1], Sri Legowo Wignyo Darsono[1], Suardi Natasaputra[2]*
11.45 – 12.30	Q & A
12.30 – 13.30	Lunch break

Orange: presenting author

DAY 1: Tuesday, 08th March 2022

R1-S3 Health, Safety and Environment

Moderator: Ir. Yuniati Zevi, M.T., M.Sc., Ph.D.

Time	Link Zoom: https://bit.ly/Room1-SIBE2022
15.30 – 16.00	*Invited Speaker* **Prof. Michael Templeton** Professor of Public Health Engineering, Imperial College London Title: "Sustainable Water and Sanitation Infrastructure for Public Health"
16.00 – 16.10	Q & A
16.10 – 16.25	**ID 367:** Study of Clean Water and Sanitation Access and Its Relationship to Waterborne and Stunting Prevalence in Bandung Regency *Putri Shafa Kamila[1], Indah R S Salami[1]*
16.25 – 16.40	**ID 461:** Health Risk-based Prioritization Approaches of Pharmaceuticals in the Upper Citarum River Basin *Rosetyati Retno Utami[1,2], Indah Rachmatiah Siti Salami[1], Gertjan W Geerling[3,4], Suprihanto Notodarmojo[1], Ad M.J. Ragas[4,5]*
16.40 – 16.55	**ID 358:** Health Risk Assessment and Flood Hazards in The Context of Strategic Environmental Assessment (SEA) in West Java – A Spatial Analysis *Karina Nursyafira Alihta[1], Anindrya Nastiti[1], Barti Setiani Muntalif[1], Arief Dhany Sutadian[2], Eka Jatnika Sundana[2]*
16.55 – 17.10	**ID 474:** Preliminary studies of Bandung City Health System Resilience (case study : Covid-19 pandemic) *Dwina Roosmini[1,2], Tiffenny Resty Kanisha[3], Anindrya Nastiti[1,2], Indah Rachmatiah Siti Salami[1,2], Siska Widya Kusumah[1,3]*
17.10 – 17.30	Q & A

Orange: presenting author

DAY 1: Tuesday, 08th March 2022

R2-S3 Environmental Management

Moderator: Emenda Sembiring, S.T., M.T., M.Eng.Sc., Ph.D

Time	Link Zoom: https://bit.ly/Room2-SIBE2022
15.30 – 15.45	**ID 430:** Comparative Analysis of Municipal Solid Waste to RDF Pre-treatment Methods in Indonesia *I Made Wahyu Widyarsana[1], Dianisti Saraswati[1]*
15.45 – 16.00	**ID 371:** Spatial Analysis of Potential Greenhouse Gas (GHG) Emissions from Household-Scale Energy Consumption in Urban and Sub-Urban Areas of Medan City during the COVID-19 Pandemic *Isra Suryati[1], Novrida Harpah Hasibuan[1], Mifta Hanisah[1], Lusi Nadapdap[1], Milenia Ruadelia[1], Jose Sigalingging[1]*
16.00 – 16.15	**ID 365:** Modular Incinerator with Pre-Treatment Plant for Municipal Solid Waste Treatment in The Super-Priority Tourism Destination of Labuan Bajo Indonesia *Wahyu Purwanta[1], Pandji Prawisudha[2], Firman Bagja Juangsa[2], Ayudia Mutiara Fani[1], Evan Philander[2]*
16.15 – 16.30	**ID 459:** Characterizing Ionic Species of PM2,5 Derived from Agricultural Biomass Burning on Paddy Commodity *Aulia Fauziah Lu'ayi[1], Puji Lestari[1], Kania Dewi[1]*
16.30 – 16.45	**ID 455:** Modelling of Sulfur Dioxide Removal by Seawater In A Flue Gas Desulfurization Absorber *Kania Dewi[1], Addina Shafiyya Ediansjah[1]*
16.45 – 17.30	Q & A

Orange: presenting author

DAY 1: Tuesday, 08th March 2022

R3-S3 Water Resources Engineering and Management

Moderator: Dr. Eng. Eka Oktariyanto Nugroho, S.T, M.T.

Time	Link Zoom: https://bit.ly/Room3-SIBE2022
15.30 – 15.45	**ID 406:** Study of Flood Effect as The Impact of Gelis River Morphological Changes in Kudus Regency *Mahelga Levina Amran[1,2], Dhemi Harlan[2], Agus Suprapto Kusmulyono[1]*
15.45 – 16.00	**ID 356:** Is Rainwater Harvesting The Perfect Solution for Sawagumu Village - West Papua? *Nur Yuni Sujaryanti[1], Iwan Juwana[1]*
16.00 – 16.15	**ID 359:** Estimating Sedimentation Trend of the Wonorejo Reservoir and Dam to sustain the Reservoir's Useful Life *Novi Andriany Teguh[1], Nastasia Festy Margini[1], Mohamad Bagus Ansori[1], Umboro Lasminto[1]*
16.15 – 16.30	**ID 368:** Analysis of The Influence of Reservoirs On Effort Jragung River Flood Reduction *Wahyu Prasetyo[1], Risdiana Cholifatul Afifah[2], Didit Puji Riyanto[1], Pranu Arisanto[1]*
16.30 – 16.45	**ID 372:** Analysis of The Impact of Normalization on Downstream Conditions in The Bringin River Semarang City *Ferdinand Agusta[1,2], Indratmo Soekarno[3], Agus Suprapto Kusmulyono[1]*
16.45 – 17.00	**ID 377:** Study the Impactc of Sediment Rate on River Morphology Changes and Floods in the Sadar River, Mojokerto Regency *Nora Permatasari[1,2], Dhemi Harlan[2], Edy Anto Soentoro[2]*
17.00 – 17.30	Q & A

Orange: presenting author

DAY 1: Tuesday, 08th March 2022

R4-S3 Water Resources Engineering and Management

Moderator: Dhemi Harlan, S.T., M.Sc., Ph.D.

Time	Link Zoom: https://bit.ly/Room4-SIBE2022
15.30 – 15.45	**ID 408:** Potential Sedimentation in the Operation Ciliwung Diversion Tunnel *Ira Fransisca Ria Silalahi[1], Indratmo Soekarno[2], Joko Nugroho[2], Eka Oktariyanto Nugroho[2], Bambang Heri[3]*
15.45 – 16.00	**ID 409:** Study of The Effectiveness of Upgrading and Operations & Maintenance (O & M) Rinjani Checkdam on Flood Early Warning System and Lead Time on The Batu Merah River in Ambon City *Putit Bunai[1], Hadi Kardhana[1], Edy Anto Soentoro[1]*
16.00 – 16.15	**ID 410:** Study of Progo River Morphology and Sedimentation of Intake Kamijoro Weir Bantul Regency, Special District of Yogyakarta *Mukhammad Uzaer[1], Sri Legowo Wignyo Darsono[2], Isdiiyana Isdiiyana[3]*
16.15 – 16.30	**ID 418:** Poi River Sediment Control Post – Earthquake *Elieser Palantik[1,3], Joko Nugroho[2], Arie Setiadi Moerwanto[3], Edy Anto Soentoro[2], Radia Zulfikar[3]*
16.30 – 16.45	**ID 425:** Study of Hydraulic and Sediment of River Sunter in Flood Management *Ajeng Padmasari[1], Indratmo Soekarno[2], Eka Nugroho Oktariyanto[2], Muhammad Farid[2], Bambang Heri[3]*
16.45 – 17.00	**ID 427:** Study of Sedimentation Control on Bangga River, Palu Watershed, Central Sulawesi *Fanny Aliza Savitri[1], Mohammad Bagus Adityawan[1], Widyaningtias Widyaningtias[1]*
17.00 – 17.30	Q & A

Orange: presenting author

DAY 1: Tuesday, 08th March 2022

R5-S3 Transportation System and Engineering

Moderator: Dr. Aine Kusumawati, S.T., M.T.

Time	Link Zoom: https://bit.ly/Room5-SIBE2022
15.30 – 15.45	**ID 469:** Transport Benefit Assessment due to Increasing Capacity Transportation Infrastructure *Andrean Maulana[1,2], Ade Sjafruddin[1], Russ Bona Frazila[1]*
15.45 – 16.00	**ID 351:** Evaluating the use of Google Maps as navigation application by identifying hazards and assessing risks using HIRA matrix *Wildi Kusumasari[1], Friska Miftakhul Ilmi[1], Estiara Ellizar[1], Yos Youssef Rabung[1]*
16.00 – 16.15	**ID 366:** Study of Hybrid Annuity Model on Indonesia Toll Road *Dizka Triarsani Ramadhanti[1], Rudy Hermawan Karsaman[1], Sony Sulaksono Wibowo[1]*
16.15 – 16.30	**ID 338:** Evaluation of Technical Criteria for Construction Technology Implementation of Madiun Train Station Based on Minimum Service Standards, Facilities, and Accessibility *Hana Wardani Puruhita[1], Wahyu Tamtomo Adi[1], Sachiko Mawaddah Lestari[1]*
16.30 – 16.45	**ID 412:** The Impact of Pavement Distress to Vehicle Maneuver in Bandung City *Jongga Jihanny[1], Kardina Nawassa Setyo Ayuningtyas[1], Anju David[1], Firnandia Zahwa Salsabila[1], Murti Kamajaya[1], Difa Salmadhia[1]*
16.45 – 17.00	**ID 405:** Evaluation of Pedestrian Facilities Performance *Nursyamsu Hidayat[1], Haryanto Iman[1], Raihan Pasha Isheka[1]*
17.00 – 17.30	Q & A

Orange: presenting author

DAY 1: Tuesday, 08th March 2022

R6-S3 Water Resources Engineering and Management

Moderator: Mohammad Farid, S.T, M.T, Ph.D.

Time	Link Zoom: https://bit.ly/Room6-SIBE2022
15.30 – 15.45	**ID 392:** Study of Flood Control and Morphology of The Sario River in Manado City *Davidson Rofiano Lombogia[1,2], Dantje Kardana Natakusumah[3], Slamet Lestari[1]*
15.45 – 16.00	**ID 394:** Hydrodynamics Analysis In Bedono Beach Demak Regency, Central Java-Indonesia: Open Resource Processing for Modeling *Rahim Mustaqim[1], Widyaningtias Widyaningtias[1], Ingerawi Sekaring Bumi[2], Yadi Suryadi[3], Eka Oktariyanto Nugroho[3], Hadi Kardhana[3], Muhammad Bagus Adityawan[4]*
16.00 – 16.15	**ID 399:** Analysis of the Five Pillars of Irrigation Modernization with the MASSCOTE Method in the Macan Irrigation Area *Ernawati Ernawati[1], Indratmo Soekarno[1], Joko Siswanto[1], Yadi Suryadi[1]*
16.15 – 16.30	**ID 400:** Effect of Jetty to The Capacity of Bogowonto River Mouth, Kulonprogo, Daerah Istimewa Yogyakarta *Muhammad Dandy Kusuma[1], Mohammad Bagus Adityawan[1], Ana Nurganah Chaidar[1]*
16.30 – 16.45	**ID 401:** Study of Flood Management with Integrated Floodgate Operation Pattern at Pepe River in Solo City *Khoiron Khoiron[1], Dhemi Harlan[2], Edhy Anto Soentoro[2], Widyaningtias Widyaningtias[2]*
16.45 – 17.00	**ID 407:** Sedimentation Impact on Capacity and Morphology Changes on Bendung River of Palembang City *Priseyola Ayunda Prima[1,2], Joko Nugroho[1], Waluyo Hatmoko[2]*
17.00 – 17.30	Q & A

Orange: presenting author

DAY 2: Wednesday, 09th March 2022

R1-S4 Disaster and Resilient Infrastructure and Earthquake

Moderator: Dr.Ing. Ediansjah Zulkifli, S.T., M.T.

Time	Link Zoom: https://bit.ly/Room1-SIBE2022
10.00 – 10.15	**ID 424:** Earthquake Risk Study on Residential Buildings in Urban Areas using the Event-Based Risk Analysis Method *Garup Lambang Goro[1], Masyhur Irsyam[2], M. Asrurifak[3], Irwan Meilano[4]*
10.15 – 10.30	**ID 414:** Numerical Study on Connections of Replaceable Shear Link with Inserted Pins *Muslinang Moestopo[1,2], Dyah Kusumastuti[1,2], Stefan Wibowo[1]*
10.30 – 10.45	**ID 433:** Tsunami Risk Assessment and Business Continuity Planning for Palu Special Economic Zone *Muhammad Rizki Purnama[1], Mohammad Bagus Adityawan[2], Krishna Suryanto Pribadi[3], Mohammad Farid[4], Widyaningtias Widyaningtias[2], Arno Adi Kuntoro[5]*
10.45 – 11.00	**ID 362:** Palu Housing Reconstruction Process: Reviewing and Learning after the 2018 Earthquake *Rani G.K. Pradoto[1], Adrianto Oktavianus[1,2], Krishna Suryanto Pribadi[1], I Made Adhi Bayu Rasmawan[1], Lakshmi Dewi Wulandari[1]*
11.00 – 11.15	**ID 393:** Comparative of Material Properties Between Natural Fibers and Geo-bag Synthetic Fibers as Sustainable Material of Temporary Structure in Natural Coastal Protection Systems *Vivie Herbenita[4], Rildova Rildova[1], Nita Yuanita[2], Alamsyah Kurniawan[2], Kahfiati Kahdar[3], William Gunawan[4]*
11.15 – 11.30	**ID 339:** Disaster and Resilient Infrastructures Musi Riverside Settlement in Palembang *Bambang Wicaksono[1], Ari Siswanto[2], Widya Fransiska FA[2], Susilo Kusdiwanggo[3]*
11.30 – 12.00	Q & A
12.00 – 13.00	Lunch break

Orange: presenting author

DAY 2: Wednesday, 09th March 2022

R2-S4 Maritime Infrastructure and Coastal Protection

Moderator: Ir. Sri Murti Adiyastuti, M.Sc., Ph.D.

Time	Link Zoom: https://bit.ly/Room2-SIBE2022
10.00 – 10.15	**ID 384:** Experimental study of wave transmission in slope crest floating breakwater *Sabaruddin Rahman[1], Daeng Paroka[1], Andi Haris Muhammad[2], Chairul Paotonan[1], Teguh Pairunan Putra[3], Abdy Kurniawan[3]*
10.15 – 10.30	**ID 357:** Vessel Size and Dredging Depth Optimization for Tol Laut Program using Genetic Algorithm: Hub Port Case Study *Rajin Sihombing[1], Muslim Muin[1], Ricky Lukman Tawekal[1]*
10.30 – 10.45	**ID 340:** Quantitative Consideration in Selection of Breakwater Concrete Armor Unit Based on Unit's Internal Tensile Stress Response *Andojo Wurjanto[1], Adi Putra Hardaya[2]*
10.45 – 11.00	**ID 450:** Numerical Modelling of Land Subsidence Effect on Coastal Sediment Transport in Pekalongan *Fauzi Septian Wijaya[1], Alamsyah Kurniawan[2], Nita Yuanita[2], Eka Oktariyanto Nugroho[3], Reinard Joseph Martin[1], Iqbal Fauzan Muhammad[1], Yola Yola[1], Nurcholish Fauzi[1]*
11.00 – 11.30	Q & A
11.30 – 12.00	*Invited Speaker* **Mr. Susumu Onaka & Mr. Koki Miyagawa** Nippon Koei Co., Ltd. Title: "Approaches to Solving Technical Issues in Beach Nourishment Project: A Case of Bali Beach Conservation Project Phase 2"
12.00 – 13.00	Lunch break

Orange: presenting author

DAY 2: Wednesday, 09th March 2022

R3-S4 Sustainable Construction and Project Management

Moderator: Biemo W. Soemardi, Ph.D.

Time	Link Zoom: https://bit.ly/Room3-SIBE2022
10.00 – 10.20	*Invited Speaker* **Ir. Novias Nurendra, M.Sc.** PT Hutama Karya (Persero) Title: "Sustainable Construction Through Digital & Modular Method"
10.20 – 10.30	Q & A
10.30 – 10.45	**ID 468:** Comparative Study in Bill of Quantity Estimates on Reinforcement Works of Pile Cap, Single Pier and Double Pier of Flyover Between Conventional Methods and BIM (Building Information Modelling) *Atanasius Agri Permadi Putra[1], Oei Natanael Indrawan Wiharno[1], Hermawan Tjan[1], Budi Hasiholan[2]*
10.45 – 11.00	**ID 319:** Mechanical Characteristics Of Concrete With The Addition Of Integral Waterproof Using Local Aggregate East Kalimantan *Mardewi Jamal[1], M. Jazir Alkas[1], Budi Haryanto[1], Ahmad Rasyid[1]*
11.00 – 11.15	**ID 321:** Factors Affecting Safety Leadership of Construction Project Owners in Indonesia *Desiderius Viby Indrayana[1], Krishna Suryanto Pribadi[1], Puti Farida Marzuki[1], Hardianto Iridiastadi[1]*
11.15 – 11.30	**ID 332:** Concept Analysis of Earned Value at Construction Implementation Time (Case Study of Package 4 Development Project – APSLC, TILC, DLC, and FRC Buildings Gadjah Mada University Yogyakarta) *Novi Andhi Setyo Purwono[1], Khofifah Adzani Mubarok[1]*
11.30 – 11.45	**ID 380:** Covid-19 Impact Evaluation And Time & Cost Mitigation Strategy For Oil & Gas EPCI Project *M. P. Budi Arisman[1], M. A. Berawi[1], Mustika Sari[1]*
11.45 – 12.00	Q & A
12.00 – 13.00	Lunch break

Orange: presenting author

DAY 2: Wednesday, 09th March 2022

R4-S4 Water and Wasterwater Engineering and Management

Moderator: Dr. Ing. Marisa Handajani, S.T., M.T.

Time	Link Zoom: https://bit.ly/Room4-SIBE2022
10.00 – 10.15	**ID 422:** The Efectiveness Of Grease Trap, Carbon Active and Aerob Biofilter Methods to Clean Canteen's Waste Water *Hari Rudijanto IW[1], Tri Cahyono[1]*
10.15 – 10.30	**ID 375:** Faecal Sludge Treatment Plant Performance Improvement Strategy Through The Implementation of Scheduled Faecal Sludge Services (SFSS) (Case Study: Suwung FSTP, Kuta District) *Angela Deviliana S[1]*
10.30 – 10.45	**ID 349:** The Study of Water Lettuce (Pistia Stratiotes L.) Application in Reducing Cod Levels of Tofu Wastewater Using Batch System Phytoremediation *Nurpita Sinurat[1], Temmy Wikaningrum[1]*
10.45 – 11.00	**ID 342:** Simple Prototype on Fixed Bed Reactor (FBR) Based on Used Plastic with Active Suspension Solution Starter in Domestic Wastewater Treatment *Wayan Budiarsa Suyasa[1], G.A. Sri Kunti Pancadewi[1], Gede Adi Wiguna Sudiartha[1]*
11.00 – 12.00	Q & A
12.00 – 13.00	Lunch break

Orange: presenting author

DAY 2: Wednesday, 09th March 2022

R5-S4 Water Resources Engineering and Management

Moderator: Dr. Eng. Arno Adi Kuntoro, S.T, M.T.

Time	Link Zoom: https://bit.ly/Room5-SIBE2022
10.00 – 10.15	**ID 428:** Study of Capacity Improvement of Plangwot-Sedayu Lawas Floodway *Khoirunisa Ulya Nur Utari[1], Arno Adi Kuntoro[1], Sri Hetty[2]*
10.15 – 10.30	**ID 429:** Mac-cormack Flux Corrected Transport Scheme for Simulation of Dam Break and Super Critical Flow in Curvilinear Coordinate System *Bernardus Sena Pasereng[1], Dantje K. Natakusumah[2], Eka Oktariyanto Nugroho[2], Taufik A.G, Zahir[3]*
10.30 – 10.45	**ID 431:** Evaluation of Structural Mitigation Effort for Flood Control in Rongkong River *Dendy Permana[1], Mohammad Farid[2], Irfan Sudono[3], Joko Nugroho[2], Nana Nasuha Djuhri[4]*
10.45 – 11.00	**ID 441:** The Effect Of Staging Development Structural Flood Design On Sediment Transport Process Along Bringin River *Ricky Pondaag[1], Muhammad Cahyono[2], Hernawan Mahfudz[3], Eka Oktariyanto Nugroho[4]*
11.00 – 11.15	**ID 470:** Hydrological Water Balance Projection in Several Reservoir Catchment *Sartika Rachmawati[1], Hadi Kardhana[2]*
11.15 – 11.30	**ID 388:** Study of The Effectiveness of Bekasi Weir Gate Opening to Control Bekasi River Morphology *Andi Pamungkas[1], Joko Nugroho[2], Agus Santoso[3], Andri Rachmanto Wibowo[3], Eka Oktariyanto Nugroho[2]*
11.30 – 12.00	Q & A
12.00 – 13.00	Lunch break

Orange: presenting author

DAY 2: Wednesday, 09th March 2022

R6-S4 Water Resources Engineering and Management

Moderator: Widyaningtias, S.T., M.T., Ph.D.

Time	Link Zoom: https://bit.ly/Room6-SIBE2022
10.00 – 10.15	**ID 446:** Study of Sedimentation Batu Merah River Ambon City *Bayu Setiawan[1], Agung Wiyono Hadi Soeharno[2], Eka Oktariyanto Nugroho[2], Chandra Hassan[3]*
10.15 – 10.30	**ID 449:** Analysis of Sediment Transport on Ring Ngotok Canal's Morphological Changes *Pipin Surahman[1,2], Sri Legowo Wignyo Darsono[1], Agus Santoso[2], Sri Hardini Suprapti[2], Ima Sholikhati[2]*
10.30 – 10.45	**ID 451:** Effect of Barito River on Drainage Performace in Dadahup Lowland Irrigation Area *Dwi Yunita[1], Mohammad Farid[2], Setio Wasito[2], Yadi Setiadi[2], Parlinggoman Simanungkalit[3]*
10.45 – 11.00	**ID 452:** Study of Barito River Supply System on Dadahup Lowland Irrigation in Central Kalimantan Food Estate Area *Meilani Magdalena[1], Mohammad Farid[2], Winskayati Winskayati[3], Joko Nugroho[2], Parlinggoman Simanungkalit[3], Yadi Suryadi[2]*
11.00 – 11.15	**ID 453:** The Groundsill Effectiveness on The Sediment Distribution Along Cipamingkis River in Bogor Regency, West Java *Tasya Asyantina[1], Hadi Kardhana[1], Eka Nugroho[1], Hernawan Mahfudz[1]*
11.15 – 11.30	**ID 454:** Morphological Study of the Tuntang River on Design Floods Q2 and Q50 in Grobogan and Demak Regencies *Wisnu Hadiwijaya[1], Agung Wiyono Hadi Soeharno[2], Eka Oktariyanto Nugroho[2], Isdiyana Isdiyana[3]*
11.30 – 12.00	Q & A
12.00 – 13.00	Lunch break

Orange: presenting author

DAY 2: Wednesday, 09th March 2022

R1-S5 Disaster and Resilient Infrastructure and Earthquake

Moderator: Ir. Erza Rismantojo, M.SCE., Ph.D.

Time	Link Zoom: https://bit.ly/Room1-SIBE2022
13.00 – 13.15	**ID 411:** The challenges of implementing green factors in urban greening schemes in Indonesia *Mohammad Zaini Dahlan[1], Budi Faisal[1], Sofia Chaeriyah[2], Ina Winiastuti Hutriani[2], Mira Amelia[2]*
13.15 – 13.30	**ID 360:** Utilization of Dredged Mud in Land Reclamation: A Comparison Study of Several Soil Improvement Methods *I Wayan Sengara[1], Jonathan Bratanata[1], Sugeng Krisnanto[1]*
13.30 – 13.45	**ID 327:** Determination of Reflected Temperature in Active Thermography Measurements for Corrosion Quantification of Reinforced Concrete Elements *Suyadi Kartorono[1], Herlien D Setio[2], Adang Surahman[2], Ediansjah Zulkifli[2]*
13.45 – 14.00	**ID 328:** Behavior and Design of Reinforced Concrete Walking Columns *Hermawan Sutejo[1], Yu-Chen Ou[1]*
14.00 – 14.15	**ID 398:** Lateral Movements of An Unstable Slope Before and After Reinforcement by Two Rows of Bored Piles – A Case Study in East Kalimantan Indonesia by Numerical Modeling *Fadlli Ash-Shidiqqy[1], Endra Susila[1], Andhika Sahadewa[1]*
14.15 – 14.30	Q & A
14.30 – 15.00	Closing ceremony

Orange: presenting author

DAY 2: Wednesday, 09th March 2022

R2-S5 Maritime Infrastructure and Coastal Protection

Moderator: Dr. Eng. Hendra Achiari, S.T., M.T.

Time	Link Zoom: https://bit.ly/Room2-SIBE2022
13.00 – 13.15	**ID 435:** Participatory-based Mapping as An Approach for Marine and Coastal Community in Protecting and Strengthening Their Aquatic Culture and Ecosystem *Mutmainnah Adenan[1]*
13.15 – 13.30	**ID 369:** Role of Non-Orthogonal Hydrodynamic and Sedimentation Model for Port Facilities Analysis on Indonesian Hub Port *Muslim Muin[1], Rajin Sihombing[1], Muhammad Weldy Hermawan[1], Arung Bahari Muslim[1], Heru Nur Alam[2]*
13.30 – 13.45	**ID 462:** Coastal Protection System Design at The Indonesian Mangrove Center in Pekalongan, Central Java – Indonesia *Yola Yola[1], Nita Yuanita[1], Eka Oktarianto Nugroho[1], Reinard Joseph Martin[1], Iqbal Fauzan Muhammad[1], Fauzi Septian Wijaya[1]*
13.45 – 14.00	**ID 439:** The Effect of Dadap Port Structure in Indramayu on Coastal Morphology *Muhammad Shodiq Supriyanto[1], Muhammad Cahyono[2], Eka Oktariyanto Nugroho[2], Dede Manarolhuda Sulaiman[3]*
14.00 – 14.15	**ID 331:** Influence of Random Variable on Reliability Index of Braced Monopod Platform Based on Fatigue Analysis in Madura North Java Sea *Paramashanti Paramashanti[1], Rildova Rildova[1], Virty Nobelia Bestin Sucipto[1], Alamsyah Kurniawan[1]*
14.15 – 14.30	Q & A
14.30 – 15.00	Closing ceremony

Orange: presenting author

DAY 2: Wednesday, 09th March 2022

R3-S5 Environmental Management

Moderator: Ir. Indah Rachmatiah Siti Salami, M.Sc., Ph.D.

Time	Link Zoom: https://bit.ly/Room3-SIBE2022
13.00 – 13.15	**ID 361:** Pollutant Index Method in Analyzing the Water Quality of the Cimeta River, West Bandung Regency *Zulfikar Muhajir Falah[1], Eka Wardhani[1]*
13.15 – 13.30	**ID 354:** Economic Valuation and Potential Pollution Load Analysis of Domestic Wastewater in Greater Bandung *Adhitya Rakhmadi[1], Suharyanto Suharyanto[2], Anindrya Nastiti[2]*
13.30 – 13.45	**ID 438:** Impact analysis from visual improvement program of slums to sanitation management: case study Kampung Cibunut, Bandung City, Indonesia *Intan Kusumayanti[1], Larasati Putri Defi[1], Wika Maulany Fatimah[2], Prasanti Widyasih Sarli[3], Prayatni Soewondo[2]*
13.45 – 14.30	Q & A
14.30 – 15.00	Closing ceremony

Orange: presenting author

DAY 2: Wednesday, 09th March 2022

R4-S5 Water and Wasterwater Engineering and Management

Moderator: Ir. Agus Jatnika Effendi, Ph.D.*

Time	Link Zoom: https://bit.ly/Room4-SIBE2022
13.00 – 13.15	**ID 423:** A Mass Balance of Microplastics During the Process of Biofilm Reactor *Ansiha Nur[1], Prayatni Soewondo[1], Ahmad Soleh Setiyawan[1], Katharina Oginawati[1]*
13.15 – 13.30	**ID 337:** Removal of Sulphate and Heavy Metals from Acid Mine Drainage using Permeable Reactive Barrier Technique *Rissa Anungstri[1,3], Himawan Tri Bayu Murti Petrus[1,2], Agus Prasetya[1,2]*
13.30 – 13.45	**ID 391:** Biological Oxygen Demand (BOD) Simulation in Sunter River Using MuQual 3D Non Orthogonal Water Quality Transport Model *Rommy Martdianto[1], Muslim Muin[1], Ricky Lukman Tawekal[1], Arung Bahari Muslim[1], Heru Nur Alam[2]*
13.45 – 14.30	Q & A
14.30 – 15.00	Closing ceremony

Orange: presenting author

DAY 2: Wednesday, 09th March 2022

R5-S5 Water Resources Engineering and Management

Moderator: Faizal Immaddudin Wira Rohmat, Ph.D.

Time	Link Zoom: https://bit.ly/Room5-SIBE2022
13.00 – 13.15	**ID 442:** The Influence of Sedimentation to The Morfology Change of Serang River Estuary at The National Strategic Area Yogyakarta International Airport (KSN YIA) *Dibo Separnu[1,2], M. Syahril Badri Kusuma[3], Dantje Kardana Natakusumah[3]*
13.15 – 13.30	**ID 444:** Study of Cisangkuy River Flood and Sedimentation *Stefan Theophilus Nadapdap[1], Agung Wiyono Hadi Soeharno[1], Yadi Suryadi[1], Eka Oktariyanto Nugroho[1]*
13.30 – 13.45	**ID 445:** The Effect of Coastal Dike and Retention Pond Performance on Flood and Tidal Control in Pekalongan *Adhitya Gilang Irawanto[1,2], Joko Nugroho[1], Adi Prasetyo[2]*
13.45 – 14.00	**ID 464:** Study of Flood Risk Assessment on Banyumas and Cilacap District in Downstream Serayu River Basin, Indonesia *Pratita Hana Kirana[1], Mohammad Farid[2], Mohammad Bagus Adityawan[2], Arno Adi Kuntoro[3], Widyaningtias Widyaningtias[4]*
14.00 – 14.30	Q & A
14.30 – 15.00	Closing ceremony

Orange: presenting author

DAY 2: Wednesday, 09th March 2022

R6-S5 Water Resources Engineering and Management

Moderator: Joko Nugroho, S.T., M.T., Ph.D.*

Time	Link Zoom: https://bit.ly/Room6-SIBE2022
13.00 – 13.15	**ID 471:** Correlation between Rainfall, Flow Rate and Phosphate towards Coliform Bacteria in The Way Sekampung River, Lampung *Tastaptyani Kurnia Nufutomo[1,2], Aulia Annas Mufti[1], Ketut Fitriani[1], Muhammad Fadillah[1]*
13.15 – 13.30	**ID 473:** Study of Loji River Bed Change in Pekalongan City *Prita Lutfitiana[1], Rosalia Putri Ramadhani[1], Muhammad Cahyono[1], Eka Oktariyanto Nugroho[1], Yiniarti Eka Kumala[2], Slamet Lestari[2]*
13.30 – 13.45	**ID 381:** Flood Modelling on The Dadap River and Estuary, Banten Province *Yogi Agus Stiawan[1], Mohammad Bagus Adityawan[1], Adi Prasetyo[2]*
13.45 – 14.00	**ID 382:** River Morphological Study of Downstream Paneki River in Palu Watershed Following The Earthquake and Liquefaction Disaster at Central Sulawesi *James Albert Kaunang[1,3], Dhemi Harlan[2], Arie Setiadi Moerwanto[3], Radia Zulfikar[3]*
14.00 – 14.15	Q & A
14.15 – 15.00	Closing ceremony

Orange: presenting author

BUMN UNTUK INDONESIA

HARITA
NICKEL

Keynote Speakers

Luhut Binsar Pandjaitan, M.P.A., – Coordinating Minister for Maritime Affairs and Investment (*to be confirmed)

Dr. Ir. M. Basuki Hadimuljono, M.Sc – Minister of Public Works and Public Housing (*to be confirmed)

Prof. Satoshi Okabe, Hokkaido University

"*Technological Innovations of Human-Destroyed Nitrogen Biogeochemical Cycles*"

Dr. Fouad Bendimerad – Executive Director of Earthquake Megacity Initiative (EMI)

"*Achieving Sustainable and Resilient Urban Infrastructure*"

Prof. Louis Ge – Vice President for General Affairs, Professor of Civil Engineering, National Taiwan University

"*Development of Calcite Precipitation Techniques to Ground Improvement on Liquefiable Soil*"

Invited Speakers

Prof. Michael Templeton – Professor of Public Health Engineering, Imperial College London

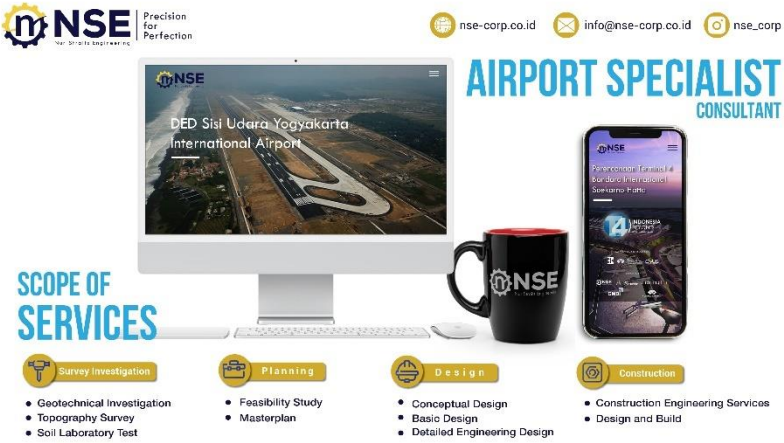
"*Sustainable Water and Sanitation Infrastructure for Public Health*"

Abdul Malik Sadat Idris, ST, M.Eng. – Director of Water and Irrigation, Ministry of National Development Planning of the Republic of Indonesia

"*Integrated Mitigation of North Coastal Java*"

Prof. Tadashi Yamada – Graduate School of Engineering, Kyoto University

"*Optimizing Warehouse Sharing Platform Systems with Vehicle Routing*"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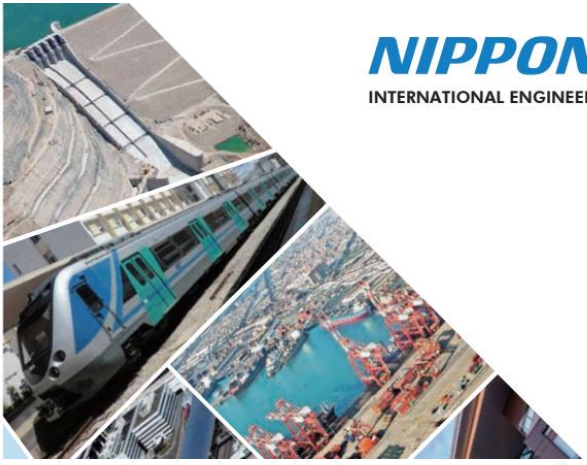
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Abstracts

R1-S1 Disaster and Resilient Infrastructure and Earthquake Engineering

ID 421

COMPACTION CONTROL USING DEGREE OF SATURATION AND PLASTICITY INDEX ON TROPICAL SOIL

Hasbullah Nawir[1], Laras Dipa Pramudita[1], Tita Kartika Dewi[1], Dayu Apoji[2]
[1]Institut Teknologi Bandung, Indonesia; [2]University of California at Berkeley, USA

Soil compaction plays an important role in development of infrastructure sector in Indonesia. Over time, the quality of soil compaction needs to be improved in order to support a better quality of infrastructure. Conventionally, field compaction is controlled by parameter given from laboratory test. Soil compaction test in laboratory is done by giving certain mechanical energy to obtain maximum dry density (ρd)¬max and the optimum moisture content (w)opt which used for controlling field compaction. However, compaction energy level (CEL) and soil type in field are varied which result in difficulty of accurate evaluation. Therefore, a better parameter and method are necessary for developing quality of soil compaction in field.

Optimum degree of saturation (Sr)opt is the degree of saturation when (ρd)¬max obtained during compaction. The value of (Sr)opt is independent of both CEL and soil type thus it is expected to become control parameter that could describe the level of compaction better than conventional way. (Sr)opt value of tropical soil especially in Indonesia is unique. Based on the experiments result, tropical soil has (Sr)opt value around 91.2% which higher than that in subtropical country.

California Bearing Ratio (CBR) in soaked condition, saturated hydraulic conductivity, and Plasticity Index (PI) at various CEL can be correlated with (ρd)¬max and (Sr)opt. Plasticity index value can be used to predict (ρd)max value at certain CEL which can become the reference value to control (ρd)max obtain from laboratory compaction test. CBRsoaked value and saturated hydraulic conductivity as two of physical properties of compacted soil which is frequently used as design requirement has correlation with (ρd) value and Sr value at the end of compaction. These findings may lead to a new compaction control method which include design requirement as consideration to improve quality of infrastructure in Indonesia.

Keywords: *Soil Compaction, Degree of Saturation, Plasticity Index, CBR, Permeability, Tropical Soil*

ID 318

INTRODUCTION OF UNSATURATED SOIL MECHANICS IN INDONESIA TO IMPROVE THE UNDERSTANDING ON GEOTECHNICAL ENGINEERING- RELATED INFRASTRUCTURE PROBLEMS

Sugeng Krisnanto[1,2], Endra Susila[1], Andhika Sahadewa[1,2], Hasbullah Nawir[1], Erza Rismantojo[1], Dedi Apriadi[1,2]

[1]Geotechnical Engineering Research Group, Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung, Indonesia; [2]Soil Mechanics Laboratory, Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung, Indonesia

Several geotechnical engineering-related infrastructure problems cannot be quantified comprehensively using classical soil mechanics for saturated soils. This emphasizes the need of analysis using the framework of unsaturated soil mechanics (USM). The graduate course on soil mechanics for unsaturated soils is provided in Bandung Institute of Technology (ITB) to answer these challenges. The understanding on geotechnical engineering-related infrastructure problems in Indonesia is improved in the course. The understanding on the basic topics in USM is emphasized throughout the course. The balance between the eagerness for innovative design and the carefulness in the design is conveyed using the course. The laboratory testing apparatuses are being developed as a part of the course as well as a part towards the implementation of USM in Indonesia. An option of stages in introduction of USM in Indonesia is proposed.

Keywords: *geotechnical engineering, graduate course, laboratory apparatus, soil mechanics, unsaturated soils*

ID 396

VACUUM PRELOADING OF SOFT CLAYS ON THE SUMATRA TOLL ROAD IN INDONESIA – FIELD MONITORING RECORDS VS. NUMERICAL MODELLING RESULTS

Asrinia Desilia[1], Endra Susila[1], Sahadewa Andhika[1]
[1]Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung, Indonesia

Vacuum preloading method was utilized to improve soft soil Trans Sumatera Toll Road Project. This paper presents a study result of a numerical modelling of the behaviours of vacuum preloading which was verified by a field monitoring result. Numerical modelling of vacuum preloading was performed by three steps based on permeability conversion. PVD's model was carried out by considering smear zone and discharge capacity. Vacuum suction was modelled as a negative pressure along the PVD. The Modified Cam – Clay model was selected to simulate soft clay soils. Effects of vacuum distribution (constant and linearly decreased) along the PVD were investigated. Prediction from this model such as settlement, pore water pressure, and lateral displacement was compared to actual field data. Degree of consolidation was estimated by using empirical calculation based on pore water pressure in the field. This paper shows that the results of the numerical modelling were comparable to the actual field data. This study found that modelling vacuum with a linearly decreased pressure along the PVD resulted the closest to field data. This study also found that a vacuum pressure with a constant along the PVD still resulted in reasonable prediction.

Keywords: *vacuum preloading model, Modified Cam-Clay, field monitoring, Sumatra*

ID 403

ANALYSIS OF BIODEGRADATION CHARACTERISTICS BASED ON VISUAL OBSERVATION AND MASS LOSS PERCENTAGE IN SOIL BURIAL TEST OF SUSTAINABLE GEO-BAG MATERIALS AS TEMPORARY STRUCTURES IN NATURAL COASTAL PROTECTION SYSTEM

William Gunawan[4], Rildova Rildova[1], Nita Yuanita[2], Alamsyah Kurniawan[2], Kahfiati Kahdar[3], Vivie Herbenita[4]

[1]Offshore Engineering Research Group, Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung, Indonesia; [2]Coastal Engineering Research Group, Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung, Indonesia; [3]Craft and Tradition Research Group, Faculty of Art and Design, Institut Teknologi Bandung, Indonesia; [4]Ocean Engineering Master Program, Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung, Indonesia

Coastal erosion is a significant hazard that causes heavy loss of land and damage to structures in coastal areas globally. To mitigate this problem, coastal engineers worldwide are focusing on sustainable coastal development practices. To this end, many countries are using natural protective methods, including vegetation such as mangroves. However, this practice is not without challenges; to ensure that mangroves could grow strongly required at least two years. A natural coastal protection system is the proposed solution, which combines mangrove vegetation as the main structure and geo-bag-dykes as temporary structures to solve this problem. The role of geo-bag-dykes is needed until mangrove plants mature. So, the length of time for geo-bags to degrade naturally is vital to get considered because otherwise, it will become hazardous coastal debris. Today, commonly used geo-bags are made from synthetic fibres that take a long time to degrade. Thus, this study tested alternative materials made from natural fibres, such as lyocell, kenaf, cotton, and rayon. The objective is to determine whether these alternative materials can be used as sustainable geo-bag materials or not in terms of biodegradation. Based on the soil burial test results contained in ISO 11721-1, these alternative materials degrade much faster when compared to commonly used geo-bag materials.

Keywords: *natural coastal protection system, synthetic fibers, alternative materials, biodegradation, soil burial test*

DEVELOPMENT OF SEISMIC MAP FOR OFFSHORE PLATFORM DESIGN IN INDONESIA, CASE STUDY OF THE NORTH COAST OF JAVA

- Hendriyawan[1,2], Dega Damara Aditramulyadi[2], Ricky Lukman Tawekal[1,2], - Rildova[1,2]

[1]Offshore Engineering Research Group, Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung, Indonesia; [2]Ocean Engineering Program, Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung, Indonesia

Indonesia's design of earthquake-resistant offshore platforms does not yet have specific regulations. The commonly used standard in Indonesia, API RP 2A WSD, does not explicitly state the earthquake return period for offshore structures. A more detailed procedure is described in ISO 19901-2:2004. Two methods are introduced in the standard. First, the simplified method allows the use of earthquake maps with a return period of 1000 years. Second, the detailed method requires a site-specific seismic hazard study to determine the return period of earthquakes. This paper presents seismic hazard maps used for simplified method following ISO 19901-2:2004. The maps are prepared using the probabilistic method with a case study on the North Coast of Java. The results show that the study area falls into seismic zones 1 and 2. The seismic hazard maps can be used for earthquake resistance design for structures with L2 and L3 exposure levels based on the seismic risk category following the ISO.

Keywords: *PSHA, simplified method, seismic map, seismic zone*

R2-S1 Maritime Infrastructure and Coastal Protection

ID 330

INFLUENCE OF RANDOM VARIABLE ON RELIABILITY INDEX OF BRACED MONOPOD PLATFORM BASED ON FATIGUE LIMIT STATE IN NATUNA SEA

Paramashanti Paramashanti[1], Rildova Rildova[1], Gary Prayogo[1], Alamsyah Kurniawan[1]
[1]Institut Teknologi Bandung, Indonesia

The uncertainty of load variables affects fatigue reliability of offshore structure. For fatigue failure on offshore platform, cyclic load such as waves is dominant. This study investigates the fatigue performance function that appropriate to annual wave load on Natuna Sea. Reliability analysis on several fatigue performance functions was carried out to analyze the influence of the load variables. Braced monopod structure was designed optimally with API RP2A WSD with environmental condition of Natuna Sea. The reviewed variables are the annual fatigue damage uncertainty from random waves, model uncertainty of S-N curve parameter, and model uncertainty of stress analysis. The relation graph between structure fatigue life and reliability index for each performance function are presented. Annual fatigue damage uncertainty has the most influence on reliability index. Model uncertainty of S-N curve parameter gives the least influence compared to other random variable, with difference of reliability index around 0.1. Reliability indexes of critical joint of this braced monopod are 1.16 (SF=2.0) and 2.70 (SF=5.0), that are less than the index target.

Keywords: *Offshore Platform, Fatigue Analysis, Reliability Analysis, Reliability Index*

ID 447

THE EFFECT OF LAND SUBSIDENCE ON HYDRODYNAMIC CONDITIONS IN PEKALONGAN COAST

Reinard Joseph Martin[1], Alamsyah Kurniawan[1], Eka Oktariyanto Nugroho[1], Fauzi Septian Wijaya[1], Iqbal Fauzan Muhammad[1], Yola Yola[1], Nurcholish Fauzi[1]
[1]Institut Teknologi Bandung, Indonesia

Due to land subsidence at Pekalongan, some areas at Pekalongan coast submerged at a rate up to 10 cm/year. This study was conducted to examine the effect of land subsidence on the hydrodynamic conditions in Pekalongan through a numerical model simulation using Delft3D. There are 2 scenarios for the numerical model, scenario 1 in 2016 and scenario 2 in 2021 after the occurrence of land subsidence at a rate of 10 cm/year. Model calibration was carried out on water level elevation and current velocity by comparing the simulation data and field data based on the variation of the chezy number. The calibrated chezy number parameter was 60 m0.5/s. The sensitivity test is carried out by changing the input parameters such as water level elevation, river discharge, and wave height. The sensitivity test results shows that the most sensitive parameter is wave height. The comparison of the simulation results of the two scenarios shows that the current velocity decreased by about 0.05 m/s to 0.1 m/s and the wave height increased by about 0.05 meters to 0.15 meters after land subsidence occurred. Land subsidence causes the waters in the study area to become deeper, and the results of the study show that current velocity tends to decrease and wave height tends to increase because of the land subsidence.

Keywords: *numerical model, hydrodynamic, land subsidence, Delft3D, Pekalongan*

ID 387

THE EFFECT OF NON-LINEAR WAVE ON OIL SPILL DISPERSION

Muslim Muin1, Arung Bahari Muslim1, Tirsa Aulia Puspitasari[2]
[1]Ocean Engineering Research Group, Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung, Indonesia; [2]Department of Ocean Engineering, Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung, Indonesia

On March 31st, 2018, an oil spill accident polluted Balikpapan Bay. A failure occurred in a pipeline running from Penajam to Balikpapan Oil Refinery, East Kalimantan, Indonesia. Leaking pipeline caused the total estimated volume of leaked oil to approximate 44,000 Barrels of crude oil. MoTuM was used to simulate the dispersion of oil in the area. The modeling results indicate that a strong dynamic tidal current in the Bay controls the oil's movement. The MoTuM software is suitable for spill combating, contingency plans, and backtracking. MoTuM is developed in Windows System, which integrates 3D Non-Orthogonal Boundary Fitted Ocean Hydrodynamics Model, Trajectory, Fates, Stochastic, Backtracking in Geographic Information System. This paper presents a further study of the effect of non-linear waves on the dispersion of oil in the Bay. The simulation results were validated by comparing the model with a satellite image. The agreement between the result of simulation and satellite image is excellent and shows that the non-linear wave is an essential factor for oil spill dispersion.

Keywords: *Boundary Fitted, Hydrodynamic, Non Linear Wave, Oil Spill*

ID 416

STUDY OF TEMPORAL AND SPATIAL CHANGES IN THE ESTUARINE AREA OF THE MAYANGAN RIVER, WEST JAVA – INDONESIA

Hendra Achiari[1], Rajin[1], Gurusu[1]
[1]Institut Teknologi Bandung, Indonesia

The estuarine of the Mayangan River is an area confluence the Mayangan River with the Java Sea. Pondok Bali beach which is about a half kilometer from River mouth of the Mayangan River has undergone a severe abrasion process since 2006. Pondok Bali's coastline changes are expected to affect the estuary area. It caused flooding and changes in water quality on the Mayangan water river area. This research was studied the factors that cause of river level rise and changes in water quality of the Mayangan River whether it due to an impact of coastline geometry change or not. The results of hydrodynamic and water quality model simulations showed river water discharge and increase Sea level is a more influential factor compared to the change in coastline geometry or bathymetry of the river mouth. The increase in salinity at some observation points of the Mayangan River from 2006 to 2014 was only 0.2 ppt, from 2011 to 2014 the salinity increase was only 0.1 ppt, and from 2014 to 2020 only 0.03 ppt.

Keywords: *abrasion, hydrodynamics, water quality, salinity, sensitivity analysis*

R3-S1 Sustainable Construction and Project Management

SYSTEMATIC LITERATURE REVIEW FOR LEAN CONSTRUCTION METHOD CURRENT TRENDS AND ISSUES

Gebriel Huda[1], Mohammed Ali Berawi[1]
[1]Department of Civil Engineering, Faculty of Engineering, Universitas Indonesia, Indonesia

The development of construction management to eliminate waste from construction activities is not effective, in which the total cost of all resources are more than the supposed cost in construction project. The adopted method to solve this problem is using Lean concept. The implementation of Lean construction affects the performance of whole construction project and avoid the repetition of similar objects without any additional value. This research aims to maximize value and minimize waste for optimal utilization of Lean method to increase the efficiency of construction project. The methodology of this research is systematic literature review from Lean construction and Lean method topics. The result of this research are 2 articles published from Indonesia institution. Descriptive statistical analysis is the dominant method. Moreover, the case study about project construction is only 3 case study which are TOLL, High-rise building, and Bridge construction. Finally, the discussion about waste that main point in Lean construction concept limited on physical waste which is material waste in this literature review research, whereas the impact factor from the waste such as cost overrun, delay time for the project is not specific discuss and mention whole in articles reviewed.

Keywords: *Lean Construction, Systematic Literature Review, Waste Management*

THE STUDY OF POTENTIAL APPLICATION OF MODULAR CONSTRUCTION IN THE DEVELOPMENT OF INDONESIA NEW CAPITAL CITY

Oktaviani Turbaningsih[1], Ulfa Mutaharah[2], Pramada Saputra[3]
[1]Institut Teknologi Sepuluh Nopember, Indonesia; [2]Universitas Indonesia, Indonesia; [3]University of Manchester, United Kingdom

The infrastructure industry is one of the crucial sectors that significantly impact economic growth. In the second quarter of 2020, infrastructure was the fourth most significant contributor to Indonesia's economy, contributing 10.56% of the total GDP. Recent research in Asia shows that modular construction outweighs the traditional cost, schedule, and quality methods. This paper investigates the opportunity to apply modular construction to develop Indonesia's New Capital City Project. The authors conducted a SWOT analysis and risk analysis to ensure the benefit of its application. The barrier of modularity application is in the transport cost-efficiency. The study shows that the modularity option provides more advantages in Indonesia's New Capital City development than the traditional cost and time reduction, longevity improvement, standardisation, product quality, minimising construction waste, and meeting high safety requirements. In the large-scale demand, the modularity option with detailing design using BIM and RFID and supported with integrated transport and logistics process as part of the project management will outperform the traditional construction method.

Keywords: *modular construction, BIM, RFID, value engineering, modular transport*

ASSESSMENT OF GREEN PRACTICES IN SENTRA TIMUR APARTMENT, JAKARTA BASED ON GREENSHIP RATING OF THE GREEN BUILDING COUNCIL OF INDONESIA

Aqil Azizi[1], Joan Rachel[1], Dicky Setiawan[1]
[1]Universitas Bakrie, Indonesia

The infrastructure industry is one of the crucial sectors that significantly impact economic growth. In the second quarter of 2020, infrastructure was the fourth most significant contributor to Indonesia's economy, contributing 10.56% of the total GDP. Recent research in Asia shows that modular construction outweighs the traditional cost, schedule, and quality methods. This paper investigates the opportunity to apply modular construction to develop Indonesia's New Capital City Project. The authors conducted a SWOT analysis and risk analysis to ensure the benefit of its application. The barrier of modularity application is in the transport cost-efficiency. The study shows that the modularity option provides more advantages in Indonesia's New Capital City development than the traditional cost and time reduction, longevity improvement, standardisation, product quality, minimising construction waste, and meeting high safety requirements. In the large-scale demand, the modularity option with detailing design using BIM and RFID and supported with integrated transport and logistics process as part of the project management will outperform the traditional construction method.

Keywords: *modular construction, BIM, RFID, value engineering, modular transport*

APPLICATION OF VALUE ENGINEERING IN BASIN (EMBUNG) CONSTRUCTION : A CASE STUDY IN ITB CIREBON

Allan Fitrah[1], Luthfi Yudha Oktano[1], Rani Gayatri K. Pradoto[1]
[1]PT. LAPI GTC, Indonesia

Construction projects in various countries have suffered irreparable losses after completion. It's possible that it's due to construction process complications or another phenomenon. Before moving on with the design or construction stages of a project, the owner must provide a cost estimate. The cost often becomes a problem because amount of the cost is limited to realize a construction project. The present study revealed that Value Engineering can be utilized during the project life cycle as a helpful instrument from the beginning of studies to the end of construction. This method can be delineating alternatives and to suggest choices based on the necessity of the function based on cost-worth relationship.

Value engineering (VE) is a method of examining the function of goods and services in order to acquire the user's desired functionalities at the lowest overall cost while maintaining high performance quality. This study contributes to providing empirical evidence of the advantages of implementation VE in determine construction methods that can be effective to reduce unnecessary costs especially at Retention Basin (Embung) Construction Stage in Construction of ITB Cirebon-Indonesia.

Keywords: *value engineering, project management, construction management*

DEVELOPMENT OF CONCRETE MATERIAL TECHNOLOGY IN THE CONTEXT OF SUPPLY – DEMAND BASED ON GEOGRAPHICAL ASPECTS

Rani Gayatri[1], Biemo Soemardi[1], Abdhy Gazali[1], Andira Putri[1], Ignatius Mahardika[1], Rika Permata[1]

[1]Construction Engineering & Management, Faculty of Civil and Environmental Engineering, Intitut Teknologi Bandung, Indonesia

The Indonesian construction industry is one of the leading sectors with significant contributions to economic growth. A current major issue in the industry is to strive for sustainable development focuses on three aspects, social, environmental, and economical. The use of technology, especially concrete material technology, is one of the supporting factors to achieve the goal. Concrete material usage, with cement as the main component, is quite prominent in the industry, supported by Indonesia's top 12th cement producer globally with a 2,05% contribution of the world's total cement production. However, the industry performance in each part of Indonesia also needs to be observed, considering that Indonesia has numerous islands. This study aims to evaluate the landscape of technological development of construction material regarding the supply-demand from geographical dimensions. This supply-demand analysis can consider policy strategies to support sustainable development programs. The data used in this study are derived from the production and consumption aspects of concrete material with an economic approach. The study shows the relationship between the development of concrete construction technology in terms of supply and market conditions. In addition, this study discusses the sustainable aspect of concrete material technology in the context of the trend of cement usage.

Keywords: *construction technology, sustainable construction, supply-demand, concrete material*

R4-S1 Water and Wastewater Engineering and Management

PERFORMANCE OF MOVING BED BIOFILM REACTOR INTEGRATED SEPTIC TANK IN TREATING OFFICE BUILDING WASTEWATER

Ahmad Soleh Setiyawan[1], Farisah Inarah Rahmat Hasby[1], Arisa Franita Pangaribuan[1], Vandith Va[1], Prayatni Soewondo[1], Dyah Wulandari Putri[1]
[1]Intitut Teknologi Bandung, Indonesia

This research aims to find the effect of initial concentration and Hydraulic Retention Time (HRT) on the performance of the Modified Septic Tank (MST) which treats office building wastewater. The synthetic wastewater that had been characterized based on office wastewater was used with the average COD:TN:TP ratio of 84:28:1. The experiment was executed under steady conditions using three variations of HRT (12, 24 and 36 hours) and different initial concentrations of COD (106, 252 and 432 mg COD/L), TN (35, 85 and 146 mg N/L) and TP (1.26, 3 and 5.14 mg P/L). The result showed that the MST removed 82 to 92% of COD, 41 to 60% of TN, 45 to 61% of NH4, and 39 to 55% of TP. The maximum removal was achieved at 36 h of HRT, COD:TN (3:1) and COD:TP (84:1). A one-way ANOVA showed that initial concentration and HRT have significant effects on the performance of MST ($p < 0.05$). This suggests that appropriate control of initial concentration and HRT in the MST can effectively remove organics and nutrients from office building wastewater.

Keywords: *hydraulic retention time, modified septic tank, initial concentration, office building wastewater*

CONSTRUCTED WETLANDS WITH CYPERUS ALTERNIFOLIUS AS A SUSTAINABLE SOLUTION FOR HOUSEHOLD GREYWATER TREATMENT

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Compared to the conventional wastewater treatment plants, constructed wetlands (CWs) are low-cost and affordable green technologies for treating many types of wastewater. This study aimed to evaluate the sustainability of an old-single CW, after four years of operation, and compare its performance with a new-smaller CW, using Cyperus alternifolius plant and applying Hydraulic Retention Time (HRT) for one day. Two artificial wetlands, namely CW-B and CW-S, were used with dimensions (length x width x height) of 170 x 70 x 70cm and 71 x 42.5 x 52.5cm, respectively. The first operation of the CW-B was in September 2015 and the CW-S was in April 2019. Several concentrations of household greywater influent were loaded into the CWs to analyze their performance. Two aeration pipes were installed in the wetland system to increase the oxygen level in the systems. Water quality parameters namely Biological Oxygen Demand (BOD), Total Suspended Solid (TSS), detergent, and Dissolved Oxygen (DO) were laboratory tested before and after treatment. Research carried out during April to October 2019 resulted in the mean removal efficiencies for CW-B and CW-S being 94.13% and 96.84% for BOD; 95.04% and 95.62% for TSS; 97.11% and 94.61% for detergent; and 99.5% and 79.7% for DO increase, respectively. These findings indicate that the removal efficiencies of those parameters in both wetlands were not significantly different. Hence, the system of the old CW-B wetland still keeps a good working process. Referring to the national standards of water quality, the greywater effluents were safely discharged into water bodies and could be used for irrigation needs. A further study needs to be developed to maximize the detergent removal to meet the existing standard for hygiene sanitation. These results suggest that CWs are becoming a sustainable solution for the treatment of greywater at the household level and finally contributing to minimizing the pollution of water.

Keywords: *constructed wetland, cyperus alternifolius, greywater, sustainable*

APPLICATION OF CELLULOSE OF BOEHMERIA NIVEA AS NATURAL FLOCCULANTS IN DIRECT FLOCCULATION

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The use of cellulose which is a natural polymer as a flocculant has been widely used, however the extraction of cellulose from plants has not been widely studied, particularly extracted from Boehmeria nivea (ramie). In this research, the stem of ramie came from the waste of textile raw material. The isolation of α-cellulose is done through pre-hydrolysis, delignification, and bleaching processes. In this research, there are 6 types of α-cellulose that are isolated from the stem of ramie, depending on the sodium hydroxide concentration in the delignification process. The isolated α-cellulose is characterized using Fourier-transform infrared spectroscopy (FTIR) and tested its flocculation ability through jar-test apparatus with 5 gr/L kaolin suspension as synthetic water samples and turbidity as the test parameter. The coagulation-flocculation experiments were carried without the addition of coagulant, which is called the direct flocculation method. Data analysis was performed by One-Way ANOVA statistical analysis, with Duncan multiple range test as the post-hoc analysis. It is concluded that cellulose is a good candidate biomaterial for natural flocculants in removing turbidity and further modification of α-cellulose with cationic grafts will be carried out for the next stage of research.

Keywords: *cellulose, coagulation, flocculation, natural flocculant, ramie, Boehmeria nivea*

THE ECO ENZYME APPLICATION FOR REDUCING NITRITE IN WASTEWATER AS THE SUSTAINABILITY ALTERNATIVE SOLUTION IN GARBAGE AND WASTEWATER PROBLEMS

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The increasing population growth has an impact on increasing problems in wastewater quality and garbage volume. It is a need to develop a sustainability solution for both problems. In this research, the papaya fruit and spinach vegetable garbage were used as raw organic materials and fermented for six months. This study objective was to determine whether eco enzymes can be used to reduce nitrite concentration in wastewater. The research method was conducted on a laboratory scale with the artificial samples in a batch system. The result showed that eco enzyme made from a mixture of papaya and spinach can reduce the nitrite concentration in the water sample. The t-test showed that the effect of eco enzyme application in reducing nitrite in water samples was significant. The application of eco enzyme 0%, 2%, 4%, and 6% respectively during 10 hours exposure showed the nitrite removal were 0.3 %, 20%, 29%, and 35 %. It can be seen that the reduction of nitrite concentration in samples added by eco enzyme was caused by eco enzyme activity. The application at a higher concentration of 10%, 15%, and 20% showed that nitrite removal efficiencies were 35.7%, 36.7%, 46.7%, 49.4% respectively during 7 hours exposure. It can be concluded that a longer time exposure, and also the more eco enzyme concentration, showed the more result in the effect of nitrite reduction concentration in water. 4. By this study it is proven that application of eco enzyme made from organic garbage can be an alternative solution for garbage and wastewater quality problems.

Keywords: *eco enzyme, nitrite, organic waste wastewater*

REMOVAL OF PHTHALOCYANINE REACTIVE DYE USING PLASMA CORONA DISCHARGE

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Phthalocyanine reactive dye is typically difficult to biodegrade in water because of its big molecular size coming from the complex metal structure of the dye. Corona plasma discharge which can produce active radical species and molecules with high oxidation potentials, shockwaves and ultraviolet light is potential to efficiently degrade the aforementioned compounds. The experiments were carried out in a batch reactor with a capacity of 400 ml. The plasma generator used in this study had a point-plane electrode configuration with a voltage of 40 kV. The concentration of dye used as a target for degradation was 25 ppm. The reactor was operated with the addition of pure oxygen gas flowing into the reactor. The distance between electrodes and the time of exposure were varied and their removal efficiency (color and COD value) were tested. The results showed that the highest removal efficiency of the dye (83.15% and 52.32% for color removal and COD value respectively) was achieved from the experiment with the electrode distance of 4.0 cm and exposure time of 60 minutes.

Keywords: *phthalocyanine, plasma corona discharge*

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BIOPROCESS OF OIL CONTAMINATED WATER AT GATHERING STATION PT "X" IN SUMATERA OIL FIELD BY USE OF CONSORTIUM ENDOGENOUS AND EXOGENOUS BACTERIA

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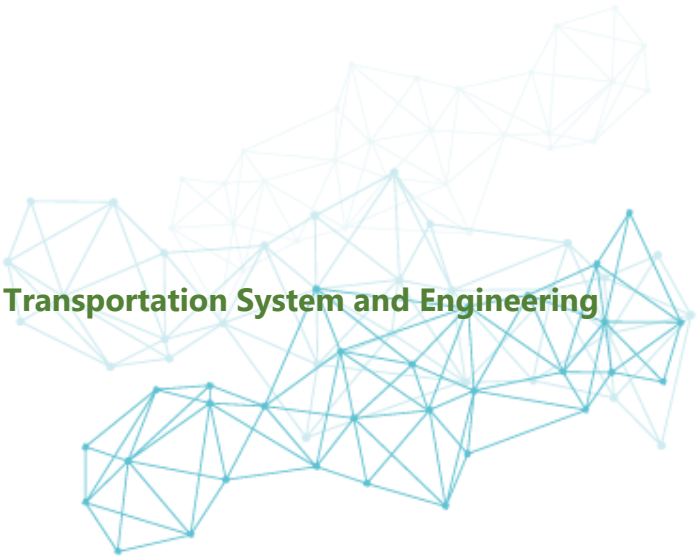
Production activities of petroleum have resulted in extensive environmental pollution, due to accidents, leaks, and oil spills during these activities. Gathering Station is one production facility at the oil field that serves as a gathering place for several liquids produced from production wells to measure the production flow rate. Wastewater at the Gathering Station that still contains oil, so before being discharged into water bodies should be treated to match the existing quality standards. One of the promising methods to remove the oil-polluted at gathering stations is the use of bioprocess technology, which is an eco-friendly, cost-effective, and sustainable approach. A laboratory study was carried out on the Bioprocess of wastewater contaminated oil at the gathering station of PT. "X" in Sumatera oil field by use of consortium endogenous bacteria and Bacillus cereus and Pseudomonas aeruginosa as consortium exogenous bacteria. The major objective of this research is to determine the effectiveness of consortium endogenous bacteria and consortium exogenous bacteria (Bacillus cereus and Pseudomonas aeruginosa) in degrading oil at the gathering station of PT "X" in Sumatera oil field. Bioprocess was done by using 10% (v/v) inoculum consortium of endogenous bacteria and 10% (v/v) inoculum Bacillus cereus and Pseudomonas aeruginosa as exogenous bacteria and using oil spill dispersant (OSD) 0.2% (v/v) in media. Oil concentrations were determined by the gravimetric method (SNI 6989.10-2011). The result showed that the mixture of Bacillus cereus and Pseudomonas aeruginosa as exogenous bacteria and consortium endogenous bacteria in media produced the highest value of effectiveness in degradation oil that up to 64.29% during 21 days (from 1062 mg/l to 379.25 mg/l), with a total population 65 x 106 cfu/ml, this indicated a synergistic relationship between Bacillus cereus and Pseudomonas aeruginosa as exogenous bacteria and consortium endogenous bacteria at room temperature (21±1oC), pH range value 8.34-9.68 and Total Dissolved Solids (TDS) range value from 553-167 mg/l.

Keywords: *Bioprocess, Consortium endogenous and exogenous bacteria, Gathering station, Oil and grease, Sumatera oil field*



R5-S1 Transportation System and Engineering

COMMUTER TRAVELER'S PERCEPTION OF TOLL ROADS DURING THE RAMP-UP PERIOD IN INDONESIA

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Studies on the perceptions of travelers towards toll roads during the ramp-up period are still rare, whereas understanding them is of utmost to assess toll road investment. The paper aims to establish a first approach in modeling the perceptions of individual commuter travelers during the learning process and adaptation to newly operating toll roads. Particularly, efforts to identify the attitudes and behaviors of individual commuter travelers towards interurban toll roads that connect between developing agglomeration areas. Travelers' personal information and travel information were collected through a revealed preference and a stated preference surveys using a snowball sampling technique with social media applications. Then we develop a binary logit model to explore commuter travelers' perceptions to toll road during ramp-up period, and the results indicate that when doing commuter travel activities, travelers in the Greater Bandung area prefer to use the Soroja toll road, with the attributes that most influence on decision making respectively, travel time, travel costs, toll gate distance, travel distance, traveler's age, scenic beauty and the frequency of using toll roads. Furthermore, we found age-related differences in observed road use patterns: older participants tended to choose toll roads, which seems plausible due to the reliability and convenience of the route, as well as established social status. The paper also showed that the positive preference of toll roads during the ramp-up period is not always related to traffic congestion such as in dense urban areas, the presence of sightseeing traffic is very potential.

Keywords: *Ramp-up period, Route choice behaviour, Binary logit model, Toll road investment*

EVALUATION LEVEL OF ACCESSIBILITY ON MALIOBORO PEDESTRIAN WAY FOR PEOPLE WITH DISABILITIES

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One of the way to support equality of rights for people with disabilities can be realized by providing accessibility to pedestrian way. Malioboro as the most popular tourists destination in Yogyakarta have been arrangements to create pedestrian way that is pedestrians friendly, including people with disabilities. The aim of this study is to evaluate the facilities and accessibility of the Malioboro pedestrian way for people with disabilities based on the Indonesian government regulations. The research reveals that some factors influence the level of accessibility on the pedestrian way, namely pedestrian lane, guiding block, parking lot, ramp, zebra cross, bus stop, worship place, toilet, sign and marker. People with disabilities that accept the least to the most conditions in the field from the total requirements of 44 facilities and accessibility, they are blind (29), disabled (34), wheelchair user (35), deaf (37), children and elderly (39). Then, the smallest level of accessibility was obtained the guiding block 50% with sufficient category and the greatest level of accessibility was obtained the pedestrian way (west side), zebra cross and worship place 100% with very good category. Overall, the Malioboro pedestrian way is the good category with accessibility level of 79.7%. It was found that the blind needs a lot of facility improvements, such as changing the guiding block using materials and colors that are according to the standard (yellow), installing signage using braille, and change notification information visually and audio. In addition, improving pedestrian way can also be done by arranging street vendors around Malioboro that are according to standards, providing special toilets for people with disabilities, add of benches at the bus stop, add of trees and canopy seats on the west side.

Keywords: *pedestrian way, accessibility, facility, disabilities*

COMBINATION OF VRP AND TRAFFIC ASSIGNMENT TO DETERMINE THE LOCATION OF LOGISTICS DISTRIBUTION CENTERS

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The choice of location for a distribution center is one of the most critical management decisions in a supply chain system. Both the cost of a distribution system and the level of customer service provided by the system are significantly affected by the number, size, and location of distribution centers. In this paper, taking into account the benefits of the customer and the logistics planning department, a two-level programming model is presented for finding the optimal location for the logistics distribution center. The upper-level model is to determine the optimal location by minimizing planner costs, and the lower one which is a combination of VRP and traffic assignment providing an equilibrium demand distribution with minimized courier costs. with certain limitations, a simple algorithm is proposed.

Keywords: *Vehicle Routing Problem, Traffic Assignment, Logistics Distribution Centers*

INTEGRATION OF MASS PUBLIC TRANSPORT FARE IN THE JAKARTA AREA

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Mass public transportation is one solution of urban community movements growth problems, congestion problems, environmental problems, and waste of fuel. Indonesia, especially in the Jakarta-Bogor-Depok-Tangerang-Bekasi (Jabodetabek) currently has several modes of mass public transportation services, among others TransJakarta BRT, Jabodetabek Commuter Line, and Mass Rapid Transit (MRT), while the Light Rail Transit (LRT) is still in the construction stage.

An alternative to improve the performance of mass public transport such as the application of integration on fares, this study specifically discusses the concept of integrating mass public transport fares with the study location in the city of Jakarta. Based on the identification of problems and also based on several studies of mass transportation in various cities in the world, the integration of fares can increase the number of mass public transportation ridership. This causes a change in the movement pattern of mass public transport users. This study will be used as a hypothesis in the current research.

This research was carried out in 4 (four) main stages of analysis, first, analysis of operator income on the mass public transport transportation network, second, analysis of mode selection, third, analysis of optimizing the determination of integrated fare with the method of backward recursion dynamic program and last, analysis of revenue sharing among mass public transport operators.

An interim analysis has been carried out on a simple public transport network with the number of movements in the origin and destination matrix between stations/stops was 19,611 passengers/hour and variations in the amount of fare between IDR 2,500,-/passenger up to Rp 7,500,-/passenger (Existing average fare is IDR 4,188,-/passenger). In the optimization process, an existing revenue of mass public transport operator as an objective function. The optimization process for determining mass public transport fares is carried out recursively because it is influenced by changes in the integrated fare amount to the number of mass public transport users. The results of the optimization process show that the integrated fare of IDR 3,850/passenger (9% lower than the average existing fare) increases the increase in public transport users by 3% compared to the number of passengers in the existing condition for 1 operating hour.

Keywords: *Integration, Fares, Mass Public Transportation, Optimization, Dynamic Programs, Backward Recursion, Ridership*

R6-S1 Water Resources Engineering and Management

EVALUATION OF DRAINAGE SYSTEM OF LIGHT RAPID TRANSPORT (LRT) DEPO AT KELAPA GADING, JAKARTA CITY

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LRT Depo is a vital infrastructure in the operation of LRT system. The LRT Depo is located at Kelapa Gading Area. Kelapa Gading area is on of inundation prone area in Jakarta. Hence a drainage system should be prepared to manage surface runoff at the area in order to avoid additional runoff to the surrounding drainage system. In order to reduce runoff, Jakarta has a regulation on surface runoff management for every area. The measures, promoted in the regulation, to be applied are in the form of infiltation well and storage pond. The drainage system is modeled in Storm Water Management Modelling software (SWMM). Principle of reducing peak discharge by possible storage system is designed and applied to comply the regional regulation on rainwater control. Reduction of peak discharge is obtanied and proven during heavy rainfall the area is still safe during January 2020 Jakarta flood.

Keywords: *drainage, flood, stormwater management, runoff*

STUDY ON NUMERICAL CALCULATION OF FLOW STRUCTURES IN A CURVED OPEN CHANNEL WITH ADVANCED DEPTH-INTEGRATED MODELS

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A better understanding of flow structures distribution in rivers is crucial to determine the safety degree of rivers. A practical and reliable model is required to overcome the issue of the long computational time of a three-dimensional calculation model and the lack of computation detail of a two-dimensional calculation model for flow structures distribution simulation in rivers. This paper presented an advanced depth-integrated numerical calculation method called the bottom velocity calculation (BVC) to reproduce the flow structures in a curved open channel. BVC method is an integrated multiscale simulation of flows in rivers that can evaluate vertical distributions of velocities and bottom velocity distributions by introducing depth-averaged horizontal vorticity and horizontal momentum equations on a water surface. It has several models, such as simplified bottom velocity calculation (SBVC) with shallow water assumption and general bottom velocity calculation (GBVC) method without the assumptions. The advantages of the BVC method, including SBVC and GBVC models, are validated in this paper using experimental datasets of a curved open channel and compared to two-dimensional and three-dimensional models. The results show that the BVC method has good reproducibility to simulate the flow structures distribution in the channel.

Keywords: *Curved open channel, depth-integrated model, secondary flow, flow structures, numerical model*

STUDY OF THE EFFECT OF WATER CONSUMPTION PATTERNS CHANGES DURING THE COVID-19 PANDEMIC ON THE RATE OF LAND SUBSIDENCE IN DKI JAKARTA

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Excessive groundwater extraction is believed to be one of the main factors for land subsidence which may be caused by tidal flooding due to the position of the surface which is lower than sea level. Covid-19 pandemic that has occurred in Indonesia since March 2020 has caused changes in water consumption patterns which derives from piped water and groundwater. There are many offices and industries that implement work from home (WFH) makes many buildings have a declining occupancy rate. With the decrease in the occupancy rate of the WFH policy, there will be a possibility that groundwater consumption from high-rise buildings that draw groundwater from deep aquifers can be reduced. This research is in the form of modelling and simulation that is used to build a level of understanding on a whole system as well as the interrelationships and interactions between its constituent variables. The purpose of this research was to determine the effect of groundwater consumption during Covid-19 pandemic on land subsidence in DKI Jakarta using the dynamic system simulation method. The results showed that the work from home policy reduces groundwater consumption by 64.7%. In addition, the reduction in groundwater consumption during the Covid-19 pandemic caused land subsidence in DKI Jakarta slows down and the rate of land subsidence in DKI Jakarta decreased from 3.7 cm/year to 1 cm/year.

Keywords: *dynamic system, land subsidence, ground water, covid-19, work from home*

ESTIMATION OF EXTREME RAINFALL OVER KALIMANTAN ISLAND BASED ON GPM IMERG DAILY DATA

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Rainfall is one of the critical data for water resources infrastructure planning. In many cases in developing countries such as Indonesia, rainfall stations are not evenly distributed. In many cases, regional development occurs much faster than the improvement of hydrological measurement instruments. The plan to move the capital city of Indonesia to Kalimantan is one example. Satellites rainfall products can be utilized, especially for areas with a limited number of rainfall stations. This study examines the potential use of Global Precipitation Measurement (GPM) satellite products to estimate the spatial distribution of rainfall in the Kalimantan region. Twenty years data of daily maximum rainfall from GPM satellite rainfall products in 2001-2020 were compared to twenty years data of daily maximum rainfall from 16 rainfall stations under the Meteorology, Climatology, and Geophysical Agency (BMKG), with data time spanning from the 1970s to 2020. The analysis results show a significant difference between extreme rainfall analysis computed by using station data and the satellite. The use of the correction function can increase the accuracy of the GPM rainfall product. It can be used as an alternative data source for a region with limited rainfall stations.

Keywords: *rainfall, GPM IMERG, Kalimantan*

THE PLANNED OF BEHAVIOUR (TPB) THEORY APPROACH TO THE PARTICIPATION OF FARMERS (P3A) AND LOCAL GOVERNMENTS IN PARTICIPATING OF AGRICULTURAL SYSTEMS, CASE STUDY: JATILUHUR EAST TARUM MAIN CANAL, SUBANG REGENCY

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In a previous study in Jatiluhur, the East Tarum Main Canal, Subang Regency, precisely in the Pawuletan SS which was attended by 3 (three) P3A namely Srijaya, Bangkit Jaya and Gondang Jaya with the application of the Planned of Behavior (TPB) theory method, Human Resources (Man Power) and Organizational Behavior with the implementation of Operation and Maintenance of irrigation networks which shows a significant influence on land productivity, in these results many assumptions are formed related to various aspects that affect farmers' welfare. Aspects taken to improve the welfare of farmers are taken from policy designs from countries that are good in terms of rice farming, one of which is Thailand. The purpose of this study is to obtain an overview of the behavior of farmers (P3A) and the local government in carrying out 5 (five) aspects that affect agricultural development in the Jatiluhur DI area, namely land use rights, agricultural credit or agricultural insurance, human resource development, Agricultural Regulations and Mechanisms in terms of the Planned Of Behavior (TPB) theory method which can provide a positive impetus to the behavior of the government and local farmers to carry out these aspects in the Jatiluhur Irrigation Area of the East Tarum Main Canal, Subang Regency. The results of the partial determination test show that Srijaya's P3A intentions have an influence on the intentions of the Binong District UPTD government, which is 92.1%. The results of the partial determination test show that the intentions of Gondang Jaya P3A have an influence on the intentions of the government of UPTD Gondang Jaya District, which is 83.6%. So it can be said that the intention (intention) of farmers in carrying out 5 (five) aspects that can improve the welfare of farmers in government programs influences the government to carry out these aspects in order to improve the welfare of farmers.

Keywords: *Farmer, Government, Irrigation, Theory Planned of Behavior, P3A*

GROUNDWATER SALINITY AND ITS EFFECT ON ELEVATED CONCENTRATIONS OF OTHER CONTAMINANTS IN A COASTAL PLAIN: A PERSPECTIVE FOR INFRASTRUCTURE PROTECTION

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Salinization is a serious threat to coastal groundwater because it degrades water quality and results in trace metal dissolution. Meanwhile, groundwater quality is critical for human and development, as contaminated groundwater cause a negative effect on human`s health and infrastructure. Our investigation of a specific area, Indramayu, on West Java's north coast revealed that most groundwater samples are brackish to saline in existence. TDS concentrations in groundwater samples are predominantly in the thousands to 30,000 mg/L range. Concentration contours are disproportionately high in the north tip area. Numerous factors contribute to the high salinity of this area, including the interaction of saline water and sediment with low-salinity groundwater and evaporation. Additionally, high TDS levels are significantly correlated with Fe2+ and Mn2+ concentrations ($p<0.001$). The area's high salinity is thought to facilitate the dissolution of trace metals from minerals such as siderite and rhodochrosite (SI of the minerals > 1). Concentrations of Fe and Mn are very likely to damage the water piping system. In terms of water quality, less than 30% of samples are fit for human consumption. Finally, the government should take into account the groundwater environment when developing the area in order to protect human health and infrastructure.

Keywords: *salinity, iron, manganese, coastal groundwater, Indramayu*

R1-S2 Health, Safety and Environment

HOW DO PRODUCERS' PERCEPTIONS AND BEHAVIOURS AFFECT THE PHYSICAL WATER QUALITY OF REFILL WATER IN URBAN BANDUNG, INDONESIA?

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In Indonesia, water refill stations expanded as private entrepreneurs sought to provide drinking water while making a profit. Refill stations must guarantee that the drinking water produced meets the quality standards and the sanitation hygiene requirements. This paper attempts to link the perceptions and behaviours of refill water vendors with the physical quality of water that they sell. The study is focused on 66 refill stations in urban Bandung, Indonesia. We measured total dissolved solids (TDS) as a proxy of the physical quality of refill water (Y). We also assess the producers' perceptions (X1) and behaviours (X2) using questionnaires and a sanitary checklist. To determine correlation of X1 and X2 with Y, a Rank Spearman analysis was conducted using SPSS IBM© ver.26. The results show that there is a significant relationship and negative correlation between the respondent's behaviours (X2) and the physical quality of the refill drinking water it produces (Y) (α = 0.010; r = -0.314). Targeted education on refill water stations owners will be beneficial in maintaining and improving their perceptions on the good practices of drinking water production, which will enhance the quality of water produced to safeguard public health.

Keywords: *behaviours, drinking water, perceptions, physical water quality, refill stations*

STUDY OF THE EFFECT OF DUST CONCENTRATION ON THE PERCEPTION OF COMMUNITY RESPIRATORY SYSTEM DISORDERS IN BANDUNG DISTRICT

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Ambient air pollution is one of the problems that have an impact on public health globally. Dust (PM10 and PM2.5) is one that has a major contribution to health. The concentration of dust will affect public health, especially short-term respiratory system disorders. This research aims to measure dust concentration in Bandung Regency and its risks to the public health. This dust concentration measurement was carried out for 3 time periods (morning, afternoon, and evening) in 3 sub-districts based on differences in land use (agricultural, residential, and industrial). Public health data were obtained based on a questionnaire on perception of respiratory system disorders suffered by the community. The results of the measurement of dust concentration showed that the concentrations of dust respectively from the highest were industrial sector, agricultural sector, and residential sector. In the industrial sector, PM2.5 and PM10 obtained were considered exceeding the quality standard, while for the agricultural and residential sector they still met the quality standard. Correlation analysis showed that there was no significant relationship between dust concentrations on perception of respiratory system disorders. Comparative analysis between dust concentration showed a significant difference between dust concentrations in one sector and another. Based on prevalence ratio analysis, it was found that the concentration of dust increased the possibility of respiratory system disorders by 1.091 times. HQ calculation showed 0.0612 that indicates the effects of dust concentration in the area are not likely to occur.

Keywords: *air quality, risk analysis, PM2.5, PM10, land use*

THE ANALYSIS OF ENVIRONMENT FACTOR ON COVID-19 INDOOR TRANSMISSION AND PREVENTIVE BEHAVIOR ON COVID-19 CASES IN COBLONG DISTRICT, BANDUNG CITY

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Infectious diseases such as COVID-19 have risk factors.This research focused on risk factors concerning house environment and preventive behavior, the well-known Indonesian abbreviation '5M'. Here, five house environment parameters for a 'healthy house' set in Indonesian reference (Keputusan Menteri Kesehatan Republik Indonesia No. 829 tahun 1999 and Keputusan Menteri Permukiman & Prasarana Wilayah No. 403 tahun 2002) such as ventilation, humidity, brightness, temperature, and personal space area are investigated. The main objective is to evaluate the importance of 'healthy house' environment parameters set in reference and '5M' that has been constantly promoted in COVID-19 situation. Coblong District in Bandung City was chosen as study area. $\chi 2$ test of independence are used to show the significance between environmental parameter required for healthy house and disease transmission. Two house environment parameters (ventilation and humidity) were found to have significant relation to indoor transmission rate in recovered patients's house. Two preventive behavior (washing hands and reducing mobility). Pearson and Spearman correlation coefficient r were also investigated for each elements of environment factor on indoor transmission rate and preventive behavior on cases. Multiple/single regression with step-wise is used to further investigate and predict the indoor transmission rate and risk with significant parameter/s as predictor/s.

Keywords: *covid-19, environment, behavior, house, risk factor, transmission*

THE RELATIONSHIP OF LIGHTING INTENSITY WITH EYE FATIGUE IN WORKERS AT PT MEKAR ARMADA JAYA IN 2021

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Based on the report on the intensity of lighting in company in 2016-2018, the intensity of lighting in the company exceeds the lighting standard (±100-300 lux), the high intensity of lighting that can cause fatigue in the organs of vision. To determine the relationship between lighting intensity and eye fatigue of workers in the manufacturing industry, this study was conducted by involving 88 research subjects who were selected through random sampling with a different sample calculation of two variables. The research design was cross sectional with Chi-Square statistical analysis between the relationship between lighting intensity, age, working period, driving a vehicle and history of illness with eye fatigue among workers in manufacturing industry. Researchers obtained the results of statistical tests as follows, lighting intensity with (P-value = 0,000), age (P-value = 0,496), years of service (P-value = 0,049), disease history (Eyes Refractive Disorder) (P-value = 0,011) and driving a vehicle (P-value) = 1,000). It can be concluded that, lighting intensity, working period and history of illness (Eye Refractive Disorder) have a relationship with eye fatigue in workers in the company, while age and driving a vehicle do not have a significant relationship with eye fatigue in workers in the company.

Keywords: *eye fatigue, lighting, worker*

R2-S2 Maritime Infrastructure and Coastal Protection

ID 385

INTEGRATED FLOOD MODEL IN 3D NONORTHOGONAL BOUNDARY FITTED HYDRODYNAMICS MODEL FOR CILIWUNG RIVER JAKARTA

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The flood model (MuFlood) had been developed and applied as a flood early warning system in Jakarta, Indonesia. The low land Jakarta faces flood threat because of a significant land-use change in the upstream region, especially in the Katulampa catchment area. Katulampa, Bogor, is located 350 meters above Mean Sea Level (MSL). The distance from Katulampa to Manggarai gate in the Ciliwung River is approximately 91 km. The flood arrival time is about 12 hours. The output of MuFlood is as input for the ocean hydrodynamics model (MuHydro3D) using the 3D Non-Orthogonal Boundary Fitted, which was developed by Muin. The paper presents the integrated model results to simulate flood events from Katulampa and the local catchment area of Jakarta. The comparison between observation and model prediction from the MuFlood hydrodynamic model is excellent for the 21-22 September 2020 case. MuHydro3D predicted that from 21-22 September 2020 case cause the water level increases up to 19 cm on KBB and the closer the bay, the water level will gradually smaller and as same as the tide.

Keywords: *Boundary Fitted, Flood, Hydrodynamic*

NUMERICAL MODELING: THE EFFECT OF LAND SUBSIDENCE ON HYDRODYNAMIC CONDITIONS AND COASTAL MORPHOLOGY IN PEKALONGAN

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This study examines the effect of land subsidence on hydrodynamic conditions and coastal morphology through numerical modeling using MIKE21 with 30-day simulation time. Land subsidence is assumed to be 10 cm/year, which affects bathymetry. There are 2 modeling scenarios, scenario 1 before (2016) and scenario 2 after land subsidence (2021). River discharge is assumed to be constant at 10 m3/s. The model calibration result on water level elevation and current velocity of the model simulation output and field data comparison based on the variation of Chezy Number, the smallest error was obtained at Chezy Number 50 m0.5/s. The sediment transport model sensitivity test was conducted on parameters of model type, sediment grain size, and river discharge. The result of sensitivity test demonstrated that the sediment grain size is the most sensitive parameter. By comparing the two model scenario results show that the current velocity in scenario 1 is greater than scenario 2 by 20%, significant wave height in scenario 1 is smaller than scenario 2 up to 0.1 m, and sedimentation in Mangrove Park increases up to ± 0.01m. Land subsidence reduces the current velocity, increases the significant wave height and sedimentation.

Keywords: *numerical model, hydrodynamics, sediment transport, land subsidence, MIKE 21, Pekalongan*

ID 353

SEDIMENTATION ANALYSIS IN FRONT OF A SUBMERGED RUBBLE-MOUND BREAKWATER DUE TO DAILY AND EXTREME WAVES SIMULATIONS

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Due to the influence of tides, waves and currents, it will be easy to move sediments around the coastline, so that erosion will often occur on the coast. There are several ways that can be done to protect the coastal are, namely strengthening the coast or protecting the coastal area so that it can withstand damage by constructing several coastal structures. The rubble-mound breakwater is a coastal protection structure whose position is parallel to or approximately parallel to the shoreline with the aim of dampening the incoming waves. The purpose of the rubble-mound breakwater is to reduce the wave energy (forces) behind the structure, as well as to protect the harbor pool against wave disturbances. On the other hand, it can also aim to prevent coastal erosion. The function of the rubble-mound breakwater is to protect the harbor water pond located behind it from wave attack, some of the energy of the wave absorber will be reflected, the reduced wave energy in the protected area will reduce the delivery of sediment in the area. The aim of this study was to analyze the sedimentation that occurred in front of the submerged rubble-mound breakwater through laboratory tests. The wave simulation to be analyzed uses daily (regular) wave and extreme (irregular) wave models. The modeling was carried out using a rubble-mound breakwater with a length of 750 m using the main protective layer of dolos with a scale of 1:10 and the core layer using geotube. The sedimentation research area is in front of the rubble-mound breakwater with a length of 750 cm and a width of 200 cm, the observation points are determined by dividing the research area by 50 cm in the length direction and 50 cm in the width direction. All observation points in the sedimentation study area were analyzed and determined points that experienced scouring/deposition due to daily waves and extreme waves. Effect of simulation of daily waves and extreme waves on sedimentation in front of the rubble-mound breakwater was analyzed. The results obtained that the largest sediment scour occurred on the outermost side of the left and right ends of the study area in front of the rubble-mound breakwater building, both due to simulations of daily waves and extreme waves. Further research will review the effect of sedimentation on the stability of the rubble-mound breakwater.

Keywords: *Rubble-mound Breakwater, Extreme Wave, Daily Wave, Sedimentation*

COHESIVE SEDIMENT SIMULATION IN KANAL BANJIR BARAT USING MUSED3D, NONORTHOGONAL BOUNDARY FITTED SEDIMENT TRANSPORT MODEL

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Sedimentation in the lowland area is dominated by fine-grained cohesive sediments. The Density Induced Current process where seawater intrusion occurs, the fine-grained cohesive sediment will be easily flocculated by saltwater and settles rapidly. There are complex problems related to sedimentation in the rivers of Jakarta in the downstream area, which is influenced by tides and the dominance of cohesive sediment. Due to the complex process in the estuary, salinity intrusion will affect the settling velocity. And then the flocculation process, the river's geometry, will also affect sediment deposition. Furthermore, a proper model is needed to simulate the sedimentation in this area. The aim of this study was to investigate the distribution of cohesive sedimentation using 3D hydrodynamic model of Non-Orthogonal Boundary Fitted Sediment transport. This model will be applied to the Kanal Banjir Barat (KBB) river. Model result shown salinity values close to field observations but not for TSS. Salinity model present from 1 till 29,6 ppt and TSS present from 9,8 until 14,2 ppm. Deployment of sediment cohesive on river and estuary depend salinity and TSS value.

Keywords: *Cohesive sediment, salinity, TSS, Density Induced Current, MuSed*

R3-S2 Environmental Management

STUDY OF LERAK (SAPINDUS RARAK) BIOCHAR APPLICATION FOR ANDOSOL AGRICULTURAL SOIL REMEDIATION

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The use of pesticides in farming for increasing and protecting production from physical defects can cause a decrease in soil q uality on agricultural land. Soil quality improvement needs to be done to meet agricultural soil quality standards. The potential soil remediation is through improving contaminated land using biochar. Biochar (Biological Charcoal) is a solid organic material such as carbon that is conserved from solid organic material through incomplete combustion or limited oxygen supply (pyrolysis). This study uses lerak fruit as raw material for biochar because lerak contains saponins that have the potential as natural pesticides and lerak biochar contains C-organic (29.48%) and N-total (0.336%) which is quite high. This study aims to find out wether Lerak (Sapindus Rarak) biochar application can improve the andosol soil quality on pH, C-organic and N-total parameters. The experiments were conducted in Dieng, Banjarnegara, Central Java in Laboratory Scale during 30 days with two repetition. Biochar was manufactured by pyrolysis process uses soil pit method. The experiments were the application of 0.805 g of biochar in 2kg of soil that added by Urea, KCl fertilizer, insecticide and fungicide. The result shows that lerak biochar application has effect on the pH, C-Organic and N-total by improving the value of andosol soil quality based on Soil Quality Standard of the Agricultural Environmental Research Institute Indonesia in 2009. The andosol soil has increase become slightly acid category for pH (6.01), high category for C-Organic (4.85%) and high category for N-total (0.58%). This statement proven by the results of the t-test which shows that there is no difference between the average value of each parameter and their respective standards. This means that the value meets the existing standard category.

Keywords: *Andosol Soil, Lerak Biochar, pH, N-total, C-Organic*

ASSESSMENT OF WATER QUALITY AND CHALLENGES FOR VEGETABLE IRRIGATION IN GREATER BANDUNG AREA, INDONESIA

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The high demand for water used mainly for industry and domestic purposes, put pressure on water for agriculture. In addition, massive land use change, and poor sanitation condition affect the availability of water sources and quality of irrigation water, as well. Consumer needs for good, healthy, and safe food are increasing, especially for raw vegetables. Therefore, water quality is an important factor which, when compared to water quantity, is often neglected. This study identified water sources then examined and assessed quality of water for raw vegetable irrigation in Greater Bandung Area (GBA). This area is one of the main vegetable producers in West Java Province which produced around 2.26-million tons of vegetables in 2019. The harvest is distributed for local and regional consumption. The research was conducted by field surveys in 4 vegetable plantations, which have about 350 farmers, spread over 3 regencies, Bandung City (city boundary), West Bandung Regency and Bandung Regency. Water quality was analysed based on National Water Quality Standard Class II and other parameters such as SAR (Sodium Adsorption Ratio), RSC (Residual Sodium Carbonate) and %Na. Field survey showed farmers depend on different water sources from groundwater, springs, lake and greywater. Assessment of water quality using Pollution Index methods showed that the dominant water source is slightly polluted with pollutant parameters of conductivity, BOD, %Na, ammonia, chloride, and sulphate exceed the standards. It showed possibility of domestic wastewater contamination to irrigation water source. Based on the measured parameters, water used for irrigation, even using groundwater, is polluted and may cause potential health risk for consumer.

Keywords: *water quality, irrigation, agriculture, raw vegetable, water source*

REDEFINING THE ROLE OF STAKEHOLDERS IN RESTORING THE HYDROLOGICAL FUNCTION AND CONSERVATION OF THE BIODIVERSITY OF NIPA-NIPA GRAND FOREST PARK, SOUTHEAST SULAWESI

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The Nipa-nipa grand forest park area is a conservation forest area in the province of Southeast Sulawesi. This area has hydrological potential and serves as the lungs of the city. Its existence is currently used by residents for agriculture, meeting the needs of clean water, settlements, and tourism. The utilization of water sources originating from The Nipa-nipa grand forest park has not been managed wisely. Therefore, it has the potential to cause monopoly and unilateral control of water sources and is prone to potential conflicts. In addition, this area is also used by local people who live around to carry out farming activities on the borderline of the conservation area. The lack of awareness and initiative from the community and stakeholders in maintaining the sustainability of water sources in the Nipa-nipa Forest will cause significant problems. One of them is reduced water discharge, even drought in some river flows during the dry season. This study aims to develop forest and natural resource governance in a fair, sustainable, and accountable manner involving the Governance component (GOV) through the Participatory Action Research (PAR) methodology. The results of this study are developing a strategy for a better governance system, involving stakeholders in decision making, developing equal and harmonious government-community relations, and developing land-use planning that meets the needs of development, environmental conservation, and small sustainable business development.

Keywords: *conservation forest, stakeholder, sustainable, Nipa-nipa grand forest park, water source*

NUMERICAL STUDY OF HYDRODYNAMIC AND SEDIMENTATION FOR SUSTAINABLE MARINE FLOATING CAGE AQUACULTURE IN INDONESIA: A CASE STUDY IN SITUBONDO, EAST JAWA

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We study floating cage aquaculture in Indonesia, specifically the effect on sedimentation in surrounding areas. In addition to waves and currents, we find that sedimentation is a considerable environmental concern. This result could help establish additional criteria for 1) selecting suitable aquaculture locations, 2) assessing the effect of aquaculture on the environment, and 3) developing sustainable marine aquaculture industry in Indonesia. This is important because, as an archipelago, Indonesia is expected to play a significant role in providing food supplies from marine aquaculture. Our results are from a case study in Situbondo, East Java in which we simulate hydrodynamics and sedimentation using the Delft3D model with an energy-loss coefficient included in the model to account for floating cages.

Keywords: *Aquaculture, Numerical model, Hydrodynamic, Sedimentation, Floating Cage*

R4-S2 Water and Wastewater Engineering and Management

ESTIMATING HOUSEHOLD WATER CONSUMPTIONS IN THE BANDUNG METROPOLITAN AREA

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The aim of this study is to determine relevant factors contributing to the water consumption in the Bandung Metropolitan area or Greater Bandung, which covered Bandung City,Cimahi City,Bandung Regency and West Bandung Regency. Towards achieving this aim, questionnaire were developed and served on the households in various communities to collect relevant data on the physical and socio-economic factors. Online questionnaires and direct survey were conducted with the number of samples proportional to the population of the Bandung Metropolitan area which is 1219 samples. Results of the study revealed that the daily average household water consumption in Bandung and Cimahi cities is 163.6 liters per person per day (lpd), Bandung Regency is 168.6 lpd, and West Bandung is 151.7 lpd, in general was 161.26 lpd for Bandung Metropolitan.

These values are higher than the standard commonly used for planning water supply systems which is 120 lcd. The factor affecting water consumptions are the type of water sources (public and private) and socio economic conditions (economic level, education level, gender and age). Comprehensively understanding household water consumption is necessary to design efficient and effective water demand management.

Keywords: *water, consumption, household, Bandung*

WATER SAVING PLANNING IN APARTMENT

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In an effort to save the use of clean water, Apartment X in Cibinong plans several water saving programs in its operational activities. The planned clean water savings consist of recycling gray water and utilizing rainwater. Plumbing tools used are types that require small amounts of water. The research method is carried out by calculating the existing water needs for apartments which have 5 towers of 20 floors each. The population of this apartment is 868. Water saving efficiency is done by determining the difference in water use with and without recycling grey water and harvesting rainwater. Based on the results of calculation of total water needs 209,830 m3/day with the generation of waste water generated total 167.86 m3/day. The composition of the black water of 41.96 m3/day and grey water 126 m3/day. The gray water produced will be recycled using a biological-physic-chemical processing process to produce water of decent quality for flushing and watering plants. Water saving potential of recycling gray water of 126 m3/day. Utilization of rainwater utilizing the catchment area of the roof of the building has the potential to capture rainwater as much as 30 m3.

Keywords: *Apartment, Saving, Recycling, Rain Water Harvesting*

SUSTAINABILITY ANALYSIS OF THE UPPER CITARUM WATERSHED BASED ON WATER QUALITY, WATER QUANTITY, AND LANDUSE INDICATORS

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River is one of the surface water resources used to meet people's need for daily clean water. Along with the population growth, problems related to waste produced are also increasing and causing environmental pollution, including river water pollution. River sustainability is one of the issues that has attracted the attention of various institutions, one of which is the Citarum River which is one of the sources of raw water for people in West Java. In this study, analysis of the sustainability condition from the upstream of the Citarum watershed was carried out in terms of three indicators, namely water quality, water quantity, and land use. The study was conducted using water quality data at four monitoring points, river water discharge, and land use maps around the upstream of the Citarum watershed. The three types of data were processed separately where water quality data were used to determine the status of water quality using the CCME WQI method, river water discharge data were used to calculate the River Regime Coefficient (RRC) value, and land use data were used to calculate the Land Cover Index (LCI). The index values obtained from each calculation were then analyzed and combined into one value for the Upper Citarum Sustainability Index (UCSI) using the composite index method. The results of this study found that the values of UCSI in the period of April – September 2014 are 0.442; 0.419; 0.415; and 0.403. All of these values are categorized in the sub-sustainability class with the interpretation that some of the river functions are slightly damaged. The UCSI value also tends to decrease from time to time towards the un-sustainability class with water quality being the indicator that plays the most role in decreasing the UCSI value in this study.

Keywords: *indicators, landuse, sustainability index, Upper Citarum, water quality, water quantity*

ID 440

HEAVY METALS IN GROUNDWATER SURROUNDING INDUSTRIAL AREAS: A CASE STUDY IN LEUWIGAJAH, CIMAHI

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Living things need groundwater as an alternative source of clean water. Contaminated groundwater will harm living things and the surrounding environment. One of the groundwater contamination is caused by heavy metals with concentrations that exceed the allowable. One source of heavy metals is waste from industrial activities. Leuwigajah is an area in the city of Cimahi with high industrial action, so that groundwater in the region has the potential to be contaminated with heavy metals. This paper describes the potential for heavy metal contamination to groundwater in Leuwigajah. The heavy metals analyzed consisted of Fe, Mn, Zn, Cu. Cr, and Cd, which were analyzed using Atomic Absorption Spectrophotometry. The results showed that Fe, Mn, Zn and Cu were found in groundwater around industrial sites Leuwigajah.

Keywords: *groundwater, industrial area, Leuwigajah, heavy metal, HPI*

THE CHALLENGE OF ASSISTING STAKEHOLDERS IN DATA-SCARCE SETTINGS: CHARACTERISING INTERMITTENT WATER SYSTEMS USING A CITIZEN SCIENCE APPROACH

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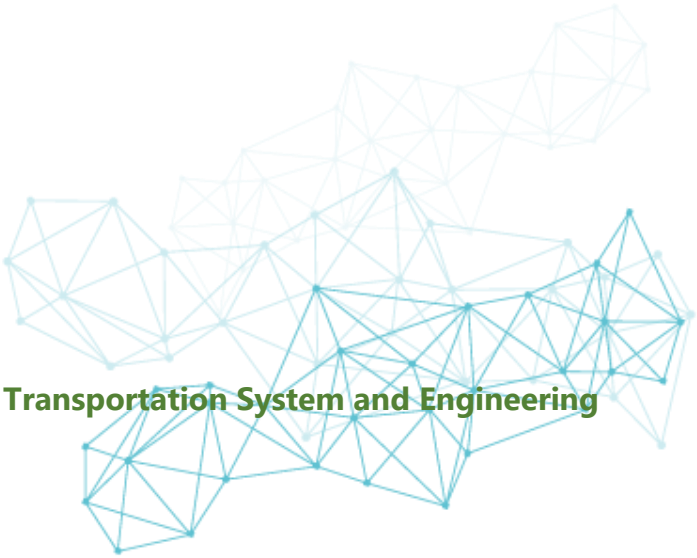
The lack of relevant data on the failures of water supply infrastructure impedes efforts to manage and remediate Intermittent Water Systems (IWS), and, by association, improve public health. This paper discusses implementing a citizen science approach that leverages the personal concern of citizens to gain information on the quantity and quality of services provided by IWS - data which would otherwise be intractable, laborious or costly for officials in low-income settings to gather. In the first instance, this paper discusses the development of the citizen science approach and the supporting data-collection tool – a smartphone application. It then presents: (i) the feasibility and reproducibility of the method, and (ii) the reliability of the collected data by validating the results using internal consistency tests. Finally, the paper reports on the acceptance of the method as a decision-support tool to develop evidence-based solutions to IWS. The research showed for the first time that, in data-scarce and resource-constrained settings, citizen science can be used in conjunction with personal communication technology (i.e. mobile phones) to bridge the information gaps on the supply of municipal water to households. It is a feasible and validated data collection method which requires a minimal time and resource investment.

Keywords: *intermittent, water supply, citizen science, data*



R5-S2 Transportation System and Engineering

THE USE OF DEFLECTION CURVE PARAMETERS TO EVALUATE THE STRUCTURAL CONDITION OF THE NORTH COAST CORRIDOR OF JAVA ISLAND

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Monitoring the structural condition of the pavement is a very important process to be carried out periodically because it can estimate the damage that occurs as early as possible, but this process is currently still constrained to be performed due to the limited non-destructive pavement response measuring instrument available and the lack of expertise in analysing the structural condition of the road from the results of field measurements. Currently, the deflection curve parameter method is one of the methods developed in research in South Africa to provide a more user-friendly method in determining the indication of the bearing capacity of the pavement layers. The use of this method in Indonesia is still limited so that this study aimed to evaluate the suitability of its use on roads in Indonesia. For this purpose, deflection data was collected from several arterial roads on the North Coast of Java Island. The study resulted that the deflection curve parameter method generally can be applied to roads in Indonesia. However, the method has to be used with caution because of the complexity of the pavement structure layers on the North Coast Road of Java Island, especially for the layers that have undergone major repairs. In addition, the benchmarking process for the deflection bowl parameter criteria also only applied to roads with medium traffic load repetitions (up to 50 million ESAL), so that an upgrading of the limit of the traffic load of the parameters was required so that the parameters can be used for roads with very high traffic load repetition as the one at the North Coast corridor.

Keywords: *flexible pavement, structural conditions, deflection bowl parameters*

EFFECTS OF DAMMAR AS THE PARTIAL SUBSTITUTION OF BITUMEN IN HMA AC-WC CONTAINING BUTON ASPHALT

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Petroleum asphalt is the residue of fossil fuel distillation. The flexible pavement material generally uses petroleum asphalt. The world's need for bitumen increases from year to year to pavement materials. Meanwhile, the availability of bitumen as a non-renewable resource is limited. To meet the world's need for bitumen in the future, the utilization of natural polymers, such as a dammar, can be the best solution. This study aims to analyze the influence of dammar on the Marshall stability of HMA AC-WC containing Butan Granular Asphalt (BGA). This study was carried by using Marshall testing on the Asphalt Concrete Wearing Courses (AC-WC) containing Buton asphalt of 10%. Bitumen content is in all specimens amount 6,3%, bitumen content of BGA 50/30 is 22,48%, and the variation of damar content is as the substitution of bitumen of 2.5-10%. Before mixing all material, it was first conducted the mixing of dammar and penetration at the temperature of 90oC to get a modified asphalt. The use of 10% dammar in asphalt mixtures meets the requirements of Bina Marga specifications. Utilization of Dammar content of 10% with BGA content of 10% can substitute petroleum asphalt by 45.68%.

Keywords: *Dammar, Buton Asphalt, Marshall Stability*

DEVELOPMENT OF ROLLED COMPACTED CONCRETE AS A PRESERVATION MATERIAL

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The frequency of road damage's repairing (like pothole, unsmooth, uneven, and crack) is increasing every year and takes precedence when the damage is still early in small size. This is based on the fact that small damage will increase quickly to large if not treated immediately. In areas with high rainfall and violations of vehicle traffic tonnage such as Indonesia, road pavement can be more quickly damaged which is handled by patching road holes or overlays. When rainy condition practically the activity of patching the hole can not be done while usually many holes occur during the rainy season. This research will develop Rolled Compacted Concrete (RCC) material as a road hole repaired material. Research methods are carried out on a laboratory scale and a field application scale. The study was conducted to evaluate the optimal composition of RCC materials and adhesive materials and compare the performance of CMA as a road-repaired material. It was found that by using RCC with cement content minimum 14% and adding 1.6 – 2% of viscocrete to the weight of cement will produce compressive strength 15 MPa in a day. Characteristic of these materials can be used as a material to repair road holes (pothole).It is expected that with increasingly stable road conditions, logistic distribution costs can be compete with other nations.

Keywords: *road preservation, concrete, pothole*

PROPERTIES OF RECYCLED HOT ASPHALT MIXTURE USING RAP ADDED WITH MASTIC ASPHALT COMPONENT

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The use of natural aggregates can be reduced by utilizing Reclaimed Asphalt Pavement (RAP). In field, there have been many simple recycling applications of RAP with addition of new asphalt and stone ash as road pavement on community housing areas. The objective of this experiment is to provide engineering properties of the mixture. Asphalt pen 60/70 was softened or rejuvenated with 11% SAE 10 engine oil, to obtain asphalt pen 180/200. The mixtures were produced by adding the RAP with 10% and 20% rock ash and soften asphalt, in hot mix process. The added asphalt content was varied by 2%, 2.5%, 3%, 3.5% and 4% by weight of the RAP, and compacted at 2x50 Marshall blows. The mixture of RAP with 10% stone ash at 3% added asphalt gave better performances compared to the mixture with 20% stone ash, in which the stability value was 3380.5 kg, flow 3.08 mm, Marshall Quotient of 1097.65 kg/mm, VIM 3.077%, VMA 18.95%, VFB 83.84%, Cantabro 9.02% , ITSM 5422 MPa, creep slope 0.267, and fatigue with load of 700; 900; 1100 KPa failed at 6101; 1471; 831 load repetitions. The mixture well meet the specification for typical mixtures for low to medium trafficked roads.

Keywords: *RAP recycling, stone dust, mastic*

R6-S2 Water Resources Engineering and Management

OPTIMIZING RAINWATER HARVESTING SYSTEMS FOR THE DUAL PURPOSES OF WATER SUPPLY AND RUNOFF CAPTURE WITH STUDY CASE IN BANDUNG AREA, WEST JAVA

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Rainwater harvesting (RWH) systems use runoff to meet water supply demand and may also provide an additional benefit for runoff reduction. We develop the Rainwater Analysis and Simulation Program (RASP) model to simulate an RWH system using storage volume, roof area, irrigated area, and water demand as inputs. A cost-benefit model of RWH was developed with subject to reliability target of water supply and runoff capture in each simulation. Near-optimal solutions were identified for each case using a constrained nonlinear programming algorithm. We apply the model to evaluate the RWH system in Bandung Area, West Java. Various types of buildings, ranging from residential houses, schools, dormitories, offices, apartments, condominiums, mosques, and hospitals are studied to provide several optimal parameters for tank volume and number of users for various land-use scenarios. The resulting parameters are obtained through optimization to obtain minimal RWH's capital costs and water purchase costs and by applying several criteria related to the financial feasibility of the RWH system, and also keeping the runoff coefficient not exceeding the pre-development value. The simulation results can be used as a guide for planners to consider the application of RWH in several types of buildings.

Keywords: *rainwater harvesting, runoff capture, optimization*

HYDROGEOCHEMICAL CHARACTERISTICS AND THE IMPACT OF ANTHROPOGENIC ACTIVITY ON GROUNDWATER QUALITY IN THE BANJARAN SUB URBAN AREA, WEST JAVA INDONESIA

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Banjaran Sub Urban Area in the Southern of Bandung Basin is a volcanic area with variations in lithology and anthropogenic activity that is growing. This study aims to determine the effect of geology and the environment on groundwater hydrochemical conditions in volcanic regions. The method that used are piper diagrams, Gibbs diagrams, correlation and major ion bivariate. Retrieval of 23 groundwater samples consisting of 10 dug wells, 10 drilling wells and 3 springs. The results showed that the groundwater interaction process was influenced by rock weathering. The hydrogeochemical process of major ions in groundwater volcanic regions is characterized by weathering of silica. Groundwater facies are CaMgCl, CaMgHCO3, NaHCO3. Groundwater in the upstream area dominated influence by the groundwater-rock interaction, while groundwater in the downstream area was influenced by anthropogenic factors. Shallow groundwater with land cover agricultural and settlements is more susceptible to contamination by anthropogenic activities.

Keywords: *hydrochemical, rock weathering, groundwater evolution, anthropogenic*

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ANALYSIS OF THE EFFECT OF SEDIMENT TRANSPORT ON RIVER BED CHANGES OF CENGKARENG FLOODWAY

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The city of Jakarta, especially in the northern part, is in a low-lying area and densely populated. This area is prone to flooding, either from rivers or from the sea, which is commonly known as tidal flood. In Jakarta, various flood control structures have been constructed, one of which being the Cengkareng Floodway. Cengkareng Floodway is a 7-kilometer-long artificial river/canal located in the administrative areas of West and North Jakarta. It was created in 1983. The upstream is located at the confluence of Angke River and Pasanggrahan River and the estuary is located at Jakarta Bay. It is part of the flood control system for the western region of DKI Jakarta Province. A comprehensive action from its upstream to its downstream is needed to control the flood. One of the actions is controlling sedimentation in the Cengkareng Floodway. Sedimentation is one of the causes of river capacity reduction, which can affect its performance as a flood control. This study was conducted to analyze the sedimentation rate in Cengkareng Floodway and its effect on river bed changes. In this study, primary data collection was done by collecting bed material and suspended load samples, as well as measuring the discharge along the Cengkareng River and its tributaries (Angke River, Pesanggrahan River, and Mookervart River). Furthermore, the simulation of sediment tranport will be done by using a Quasi-Unsteady Flow model on the HEC-RAS 1D in the existing condition. The result of transport sediment simulation shows that sedimentation occurs along the Cengkareng Floodway with an averaged sedimentation height of 1.157 meters for 5 years (2016-2020).

Keywords: *sediment, Cengkareng Floodway, HEC-RAS.*

ASSESSMENT OF THE POTENTIAL LAND EROSION AND ACTUAL ACCUMULATED SEDIMENTATION FOR CARRYING CAPACITY IN BONE RIVER, GORONTALO

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In 2020, there were 7 floods in Gorontalo City and Bone Bolango Regency due to the overflow of the Bone River which resulted in the breaking of several bridges, damaged embankments, and water-logging in residential areas and community plantations around the river. One of the causes of this flood is a decrease in river capacity due to high sedimentation caused by mechanical sand mining activities in Bone River. Therefore, it is necessary to know the carrying capacity of sedimentation in Bone River so that there is a stable dynamic equilibrium. The use of carrying capacity is a method of measuring sedimentation limits in the river. The carrying capacity is calculated by dividing the net of river capacity using topography in the year of 2007 to 2021 and the potential land erosion using USLE method. The results shows the ratio of sedimentation rate in Bone River caused by erosion is 12.67%. This study resides in its simplicity to provide a solid basis strategy for regional policies to address the real causes of problems and risks. It certainly provides adequate information to improve the management of water regulation or sediment control structures in order to control flooding in the Bone River.

Keywords: *Sedimentation, USLE, River*

THE IMPACT OF UPPER CITARUM DIVERSION CHANNELS ON SEDIMENT TRANSPORT AND RIVER MORPHOLOGY

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Flood control infrastructures such as diversion channels or generally called “sudetan”, levees, retention ponds, and others have been built in South Bandung area to control the flood, especially in affected areas such as Dayeuhkolot, Sapan, and Baleendah. Flood in those areas occurred due to the overflow of water from the Upper Citarum River. The diversion channels have been done on several points along the Upper Citarum River to increase the waterflow velocity, so the water flows as quick as possible to the downstream. The diversion channels give an impact on increasing the river slope, as well as the waterflow velocity. The increasment of the waterflow velocity affects the sediment transport along the river. On the other hand, diversion channels also affect the morphology of Upper Citarum River and causing the reduction of its capacity. The capacity of Upper Citarum after the diversion channels construction have increased by approximately 25%. This capacity is decreasing because of the river morphological changes caused by erosion and sedimentation along the river. The existing river capacity is possible to accommodate design discharge for return period 10 years (Q10). The HEC-RAS simulation model of sediment transport showed that the sediment transport within 1 year was 118,040 tonnes/year. The largest erosion was 1 meter and the largest sedimentation was 1.4 meters. The results of the analysis of meander’ radius growth and stability showed that those radius are not stable and still growing, therefore the diversion channels’ walls need reinforcement, so the riverflow does not moving to its natural form (meandering). There are a lot of oxbows along the Upper Citarum River that potential to be used as retention ponds with total storage capacity of 2,9 million m3.

Keywords: *Upper Citarum, Diversion Channels, Sediment Transport, River Morphology, Oxbow, Retention Ponds*

R1-S3 Health, Safety and Environment

STUDY OF CLEAN WATER AND SANITATION ACCESS AND ITS RELATIONSHIP TO WATERBORNE AND STUNTING PREVALENCE IN BANDUNG REGENCY

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Access to water and proper sanitation in Bandung Regency has not covered all population. Lack availability of water and sanitation is certainly related to public health. This research was conducted to identify clean water access in terms of quality, quantity, and continuity as well as sanitation access in Bandung Regency, then to determine its relationship to waterborne diseases and stunting prevalence. The study was conducted in three locations representing domestic, agricultural, and industrial areas. Study collected 33 water samples for physical and microbial analysis, and questionnaires to 75 household respondents about waterborne disease and stunting prevalence, household income levels, hygiene behaviour, mother's education, and birth weight. The results showed clean water quality differences in those areas for parameters Total Coliform (p=0,051), temperature (p=0,044), and pH (p=0,002) as well as differences of wastewater system types (p=0,002). Factors namely clean water quantity and continuity, personal hygiene, and household income level have association with waterborne diseases prevalence (PR>1). Whereas stunting is associated with sanitation access, personal hygiene, household income level, mother's education, and children birth weight (PR>1). However, only household income level has significant relationship with stunting (p=0,005; PR=4.0; 95% CI=1.33-12). These factors should be improved to prevent waterborne disease and stunting children in the community.

Keywords: *clean water, sanitation, public health, waterborne diseases, stunting, Bandung Regency*

HEALTH RISK-BASED PRIORITIZATION APPROACHES OF PHARMACEUTICALS IN THE UPPER CITARUM RIVER BASIN

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Two methods were developed in prioritizing human health risks of pharmaceuticals based on passive sampling concentrations measured, defined daily dose (DDD), and acute data of pharmaceutical toxicity. An important asset of this method is that it does not require acceptable daily intake (ADI), Tolerable Daily Intake (TDI), or reference dose (RfD) data, which are often unavailable or difficult to obtain in the pharmaceuticals group. The methods were applied to prioritize 16 pharmaceuticals detected in the water source of Ciwalengke Village, a peri-urban area in the Upper Citarum River Basin. The prioritization methods were applied using DDD data from WHO and acute toxicity data from PubChem Database. The ranking of pharmaceuticals showed good agreement between the two approaches. Estrone, Caffeine, and Lidocaine were the top 3 highest human health risks in the study area. The individual pharmaceutical intake through the consumption of river water was predicted to cause negligible human health risks (i.e. RI < 1) but can be further refined by performing additional effect studies for other pharmaceuticals and pharmaceuticals mixtures.

Keywords: *Prioritization, Pharmaceuticals, Risk, DDD, Acute Data, Passive Sampling*

HEALTH RISK ASSESSMENT AND FLOOD HAZARDS IN THE CONTEXT OF STRATEGIC ENVIRONMENTAL ASSESSMENT (SEA) IN WEST JAVA – A SPATIAL ANALYSIS

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One of the main contents of strategic environmental assessment (SEA) is the assessment of environmental and health risks. So far, the risk assessment has not been a big part of the SEA and spatial planning in Indonesia. Further, there is no agreed methods how to assess health risk and flood hazards in the context the SEA. Therefore, this study aims to develop a methodology of health risk assessment and flood hazard in the context of SEA by using meta-analysis, determining of weights indicators, and spatial analysis. The development of this methodology was then applied in West Java Province. The development of the methodology based on Regulation of the National Disaster Management Agency Head Number 2 of 2012, SNI 8197-2015, document review study, and analytical hierarchy process. Spatial analysis using ArcGIS software. Based on the result. The analysis was obtained 3 risk classes and from the total area of West Java Province was found that 57.24% (21,228,362,159 ha), 41.75% (15,484,436,486 ha), and 1% (372,685,808 ha) has a low, medium, and high environmental health risks assessment.

Keywords: *flood hazard; health risk assessment; SEA; spatial analysis: West Java*

PRELIMINARY STUDIES OF BANDUNG CITY HEALTH SYSTEM RESILIENCE (CASE STUDY : COVID-19 PANDEMIC)

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The type of the SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus-2) virus causes the COVID-19 pandemic globally, including in Indonesia and the City of Bandung. The city of Bandung is the city that became the cluster of Covid-19 spread after DKI Jakarta at the beginning of the pandemic. The cases are continuing to increase. The resilient health system's goals are to minimize the impact of outbreaks in communities. In 2019, the Nuclear Threat Initiative developed the Global Health Security Index (GHSI) with the Center for Health Security, John Hopkins Bloomberg School of Public Health. GHSI assesses the readiness of countries in the world facing a pandemic, and the index obtained shows that globally the value of this readiness is still minimal. In improving community health system services, health system resilience has been developed and studied in recent years. This study conducted a preliminary evaluation of the Bandung City health system in dealing with the Covid-19 pandemic using the concept of resilience. This research uses the secondary data on the incidence of Covid-19 on the West Java and Bandung City Health Office website and other secondary data accessed online. Methods used for evaluating the health system, the number of cases of Covid-19 at the sub-district level is correlated with the condition of health facilities, the incidence of infectious diseases in 2019, and the socio-economic conditions of each sub-district. Research shows that the health system in Bandung City has not met the targets in the 2018-2023 Regional Medium-Term Development Plan. Bandung City health systems do not meet some indicators in GHSI. Overall, the initial research on the Bandung City health system still does not meet the criteria for resilience.

Keywords: *Covid-19, Bandung City, Health System, Resilience*

R2-S3 Environmental Management

COMPARATIVE ANALYSIS OF MUNICIPAL SOLID WASTE TO RDF PRE-TREATMENT METHODS IN INDONESIA

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Municipal solid waste in Indonesia has a high potential to be processed and used as an alternative energy source. One of them is by processing the waste into refuse-derived fuel (RDF). The purpose of pre-treatment is to reduce high water content in domestic waste in Indonesia. So that it can produce refuse-derived fuel (RDF) with good quality. This study aims to compare and analyze the optimal pre-treatment method to produce refuse-derived fuel (RDF) from municipal waste solid waste based on waste characteristics in Indonesia. The research was carried out reviewing and analyzing the data of characteristics of municipal solid waste in Indonesia compared with various pre-treatment method that has been applied in Indonesia from kinds of literature and previous research. The methods compared are fermentation method, bio-drying, and conventional solar drying. Each method is analyzed to determine the most feasible and effective to reduce the moisture content of waste. Statistical analysis of differences in waste characteristics (proximal) before and after the pre-treatment method is used to determine the differences in waste moisture content and characteristics before and after the treatment. Multicriteria analysis is used to select the most optimal method. From the research results, it is concluded that there are various methods of pre-treatment to reduce the moisture content of waste. The recommendation from this research is to determine the best methods of pre-treatment based on specific moisture content and characteristics of waste.

Keywords: *municipal solid waste, moisture content, pre-treatment, drying method*

SPATIAL ANALYSIS OF POTENTIAL GREENHOUSE GAS (GHG) EMISSIONS FROM HOUSEHOLD-SCALE ENERGY CONSUMPTION IN URBAN AND SUB-URBAN AREAS OF MEDAN CITY DURING THE COVID-19 PANDEMIC

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Household activities such as electricity, LPG, and fuel for vehicles are sources of greenhouse gas emissions. Energy consumption at the household scale continues to increase, especially during the COVID-19 pandemic due to the policy of working from home. The global COVID-19 pandemic also affects household-scale energy consumption for urban and suburban areas. The increase in energy consumption is in line with the rise in greenhouse gases, so spatial mapping is necessary to reduce greenhouse gas emissions. This mapping aims to determine the potential distribution of greenhouse gas emissions from household-scale energy consumption so that programs, plans, or policies can be determined in strategies for reducing greenhouse gas emissions. This research begins by calculating GHG emissions using the IPPC tier 2 method and making a GHG potential map. The research results from the calculation of greenhouse gas emissions in the household-scale energy sector in the study area ranged from 71120.96 - 168427.84 tons CO2eq/year. GHG emissions in sub-urban regions are more significant than in urban areas because they are influenced by the population and changes in electricity consumption patterns during the COVID-19 pandemic

Keywords: *GHG emission, household, energy, spatial*

MODULAR INCINERATOR WITH PRE-TREATMENT PLANT FOR MUNICIPAL SOLID WASTE TREATMENT IN THE SUPER-PRIORITY TOURISM DESTINATION OF LABUAN BAJO INDONESIA

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One of the competitiveness parameters of tourist destinations is the cleanliness index. Labuan Bajo as a super-priority tourist destination has a very serious municipal solid waste (MSW) problem. Waste generation in Labuan Bajo and Komodo National Park in 2020 reached 14.06 tons/day and is projected to be 15.51 tons/day in 2023. The main sources of MSW come from settlements, hotels, traditional markets, and seaports. The current MSW management system is that waste is collected from the source and then transported to a temporary storage tank to be transported by truck to the Warloka landfill. This system poses a threat in the form of shortening the service life of the landfill. Management through recycling is still a very low percentage because the recycling ecosystem has not yet developed. One alternative for MSW management that is currently being carried out by the central government in Labuan Bajo is to implement a modular incinerator. This paper describes the process of designing and operating a test incinerator with a combustion capacity of 20 tons/day consisting of 2 lines each with a capacity of 10 tons/day. The incinerator is equipped with a pre-treatment plant consisting of a sorting conveyor, thermal dryer, and storage conveyor. The incinerator furnace consists of two chambers and each is equipped with a burner. This furnace is designed to be able to burn waste with a calorific value of 1300 kcal/kg with a maximum moisture content (MC) of 60%. The test results show that the temperature in the primary chamber can reach a minimum of 8000C and a maximum of 10000C in the secondary chamber. The burning rate has obtained a maximum of 527 kg/h which means it has passed the initial design of 417 kg/h. To meet emission-quality standards, exhaust gas is processed through flue gas treatment consisting of a cyclone, quencher scrubber, and chimney. Emissions measured by CEMS include parameters of particulates, CO, SO2, and NOx, all of which are below the national emission-quality standards. The heat generated from partial combustion will be channeled to the thermal dryer to reduce MC so that it can reach 40%. The results of burning waste with this incinerator produce fly ash and bottom ash about 4% of the weight of the input waste.

Keywords: *MSW, pre-treatment, incinerator, performance*

CHARACTERIZING IONIC SPECIES OF PM2,5 DERIVED FROM AGRICULTURAL BIOMASS BURNING ON PADDY COMMODITY

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Indonesia is an agrarian country that a majority of the population are consuming rice as a staple food for daily use. However, farmers tend to do open burning to their agricultural biomass waste. This action proved to be an easy, inexpensive and a trustworthy way that can handle the accumulation of the remaining agricultural biomass waste rapidly. Besides, it could be a way of controlling the wild grass and restoring nutrients to the soil in a short period of time. The agricultural biomass burning practice emitted particulate matter with size less than 2,5 μm (PM2.5) which causes air pollution. Several studies identified the concentration and contribution of PM2.5 and black carbon (BC) from this burning activity. However, characterizing ionic species of PM2.5 derived from agricultural biomass burning on paddy commodity is scarce, especially in Indonesia. In response to this problem, the aim of this research is to characterize the ionic species of PM2.5 derived from agricultural biomass burning on paddy commodity. This research continues the previous reserach by conducting ionic characterization from her samples of research. Sampling was performed on the field and on the chamber after harvesting time at smoldering burning phase. Samples were collected using a Minivol sampler with flowrate 5 lpm. The sample filter analysed in the laboratory using ion chromatography (IC) instrument. The results showed that five dominant ions of PM2.5 are K+, Mg2+, Cl-, NH4+, and SO42-. The t-test were performed between field burning samples and chamber burning samples. It elucidated the p-value above 0,05. Hence, the average ionic species concentration and/or contribution of PM2.5 derived from agricultural biomass burning on paddy commodity at field burning and chamber burning are the same, statistically.

Keywords: *biomass burning, chamber burning, field burning, ionic species, paddy*

MODELLING OF SULFUR DIOXIDE REMOVAL BY SEAWATER IN A FLUE GAS DESULFURIZATION ABSORBER

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Although Indonesia has set a target for increasing the use of renewable energy for electricity generation, the use of coal as source of energy will still dominate at least until 2040. Sulphur dioxide (SO2) along with other gases and particulates released from the use of coal in a coal fired power plants (CFPPs) which may cause air pollution. The use of seawater flue gas desulphurization (SWFGD) absorber, the abundant source of absorbent in a maritime country such as Indonesia, is an economical option for treating SO2 in an absorption tower compared to other alkaline chemicals, e.g., limestone (CaCO3) or magnesium hydroxide (MgOH2). A model which corelates the equilibrium of the reaction with the salinity of the absorbent was developed to predict the process of sulphur dioxide scrubbing process inside a WFGD absorber. Simulation also took into account the mass and energy balance during scrubbing processes. Calibration using field WFDG data showed a good confirmation between field data and modelling results.

Keywords: *flue gas desulfurization, modelling, seawater, sulfur dioxide*

R3-S3 Water Resources Engineering and Management

STUDY OF FLOOD EFFECT AS THE IMPACT OF GELIS RIVER MORPHOLOGICAL CHANGES IN KUDUS REGENCY

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Gelis River is located in the middle of Kudus Regency. In January 2014, there was a flood which caused major losses. The flooding was caused by high rainfall and sedimentation in the downstream of the river, so that the storage capacity of the river is reduced. In addition, backwater occurs from the Wulan River which is the confluence of the Gelis River. During the flood incident in early 2021, 25 m long embankment broke and caused inundation in 4 (four) villages to a height of 1 m. Due to this, the Ministry of Public Works and Housing carried out the Construction of the Gelis River Flood Control in 2020-2021. However, in the planning study, an analysis of sedimentation has not been carried out. Therefore, this study analyzes related to this.The purpose of this study was to analyze changes in the bottom of the Gelis River channel on the existing profile and normalization, as well as analyze the rate of sedimentation that occurred and its comparison with the rate of erosion in the Gelis watershed. Hydrological analysis was carried out with the help of software and obtained a calibrated HSS SCS, then continued with an analysis of changes in river morphology using the Toffaletti model and 2 scenarios, namely the existing profile and the normalized profile. The bottom of the river channel resulting from the two simulations is modeled hydraulically with a design flood discharge (equivalent to Q25) to obtain the maximum water level at the time of flooding. The results of the modeling show that the sedimentation rate downstream of the Gelis River is 8,914.59 tons/year. Changes in the bottom of the channel that occur in the form of average degradation is 0.31 m and average aggradation value of 0.2 m for the existing profile, while the normalized profile undergoes the average degradation of 0.39 m and a degradation of 0.15 m. An alternative solution that can be done in maintaining river capacity is to periodically dredge with at least 2.809,25 tons/year along the modelled river.

Keywords: *flood, river morphology, sediment*

IS RAINWATER HARVESTING THE PERFECT SOLUTION FOR SAWAGUMU VILLAGE - WEST PAPUA?

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Sawagumu urban village is one of the flood-prone areas in North Sorong sub-district based on the regional plan 2014-2034 of Sorong City. This region has 3 RW (hamlet) that are severely flooded based on the determination of the priority scales from the Minister of Public Works Regulation number 12 Year-2014 on urban drainage. The Hamlets 03, 04, and 06 were at the top of priority based on the calculation. During the evalution of the drainage channel, there are 27 overflowing channels and 4 not-flowing channels in the affected area. The main causes of overflowing channels based on observation is high discharge, as found is 49% of the total channels, sedimentation of 29%, the presence of waste of 13% and narrowing channels of 9%. To overcome the problems, a rainwater harvesting system is planned as environmentally friendly control to reduce runoff discharge. The principle of the rainwater harvesting is to collect rainwater from the roof, and store in a reservoir using a piping system. In this research, the harvested rainwater is compared with the total runoff to determine the effectiveness of the rainwater harvesting system. Results showed that 53.10-78.81% of the runoff can be reduced using simple rainwater harvesting system.

Keywords: *Runoff Discharge, Priority Scale, Overflow Channel, Piping System, Drainage Channel*

ESTIMATING SEDIMENTATION TREND OF THE WONOREJO RESERVOIR AND DAM TO SUSTAIN THE RESERVOIR'S USEFUL LIFE

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Sedimentation is a natural problem in water-related structures, especially dams and reservoirs. Wonorejo Reservoir, as a multipurpose reservoir, also experienced this. Sedimentation can affect the performance of reservoirs and dams. With the accumulation of sediment, the reservoir volume will change from time to time, so it is necessary to estimate the volume of sediment during the useful life of the reservoir and dam so that they can function optimally. This study was conducted to estimate the volume of sediment deposition during the useful life of reservoirs and dams, which is 50 years. Using the sediment data from the year 2016-2019 with the implementation of methods from other studies that have been carried out in other reservoirs and dams in Indonesia, the volume of the sediment deposition in the year 2050 is estimated at 16.37% of the total storage capacity. The most sediment deposition is located close to the dam. However, based on calculations, it is estimated that up to the service life of the reservoir, the reservoir can still function properly with a sediment content of not more than 20% of the total reservoir volume. Theoretically, the Wonorejo Reservoir can still work normally until 50 years. However, with the continuous increase in the percentage of sediment to the volume of reservoir capacity, efforts are needed to overcome this so that the useful life of the reservoir is not affected and the reservoir can still work optimally.

Keywords: *reservoir, dam, sediment, wonorejo*

ANALYSIS OF THE INFLUENCE OF RESERVOIRS ON EFFORT JRAGUNG RIVER FLOOD REDUCTION

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The Jragung Basin is located in Demak and Grobogan districts where this study was conducted. The aim of this study is to analyze the reduction of flood costs by the arrangement of the river basin in the upper part in the form of dams and reservoirs. The hydrological method used to calculate precipitation and runoff is to use HEC-HMS software and for hydraulic analysis to use 2D-HEC-RAS to create a floodplain map. Based on the hydraulic analysis, the existing flood discharge (before the reservoir appeared) was determined to be 500.9 m3/s along the Wonokerto River as the lower basin. After refilling the storage area in the catchment area of the river basin, the flood discharge can be reduced to 422.9 m3/s or the flood discharge to 78.0 m3/s. As a result of the HEC-RAS flood mapping analysis under existing conditions, the floodplain area was 3,738.00 ha and was reduced to 3,026.21 ha after reservoir replenishment, reducing the floodplain by 711.79 ha or about 19.04%.

Keywords: *watershed, flood, reservoirs, reduction, HEC HMS, 2D-HEC-RAS*

ANALYSIS OF THE IMPACT OF NORMALIZATION ON DOWNSTREAM CONDITIONS IN THE BRINGIN RIVER SEMARANG CITY

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An increase in flood discharge is largely influenced by the change of land use in the watershed (DAS). The increase occurred in the Bringin especially in the upstream of which is located in Kecamatan Mijen and the downstream is located in Tugu District of the Northern part of the town and empties into the Java Sea. The purpose of this study was to determine the magnitude of the flood discharge of the River Bringin and identify locations prone to flooding and provide handling solutions. The data required in the form of rainfall data, the data of land use, and the cross-section of the river. Furthermore, the data daily precipitation is distributed into the rain for 12 hours using the distribution of rainfall cumulative PSA 007.The determination of Flood Discharge using the SCS method. Scenario modeling using flood discharge return periods 2, 5, 10, 25, and 50 years. Modeling hydraulics performed using the unsteady flow in the software HEC RAS 6.1.The results showed that the change of land use in the watershed Bringin changes is very significant especially in the upstream area that has been transformed into the residential and industrial, while the downstream region is dominated by housing and the area of the pond.

Keywords: *Flood Discharge, Hec-ras*

STUDY OF THE EFFECT OF SEDIMENT RATE ON RIVER MORPHOLOGY CHANGES AND FLOODS IN THE SADAR RIVER, MOJOKERTO REGENCY

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Kali Sadar is a collector canal of several river tributaries, and is a flood plain that protects a 1.930-hectare of agricultural land areas in Mojokerto Regency, East Java Province. Flooding occurs frequently in the Sadar River's basin at Mojokerto Regency East Java Province every year causes a lot of material losses. The flood incident was caused by the narrowing and silting of the Kali Sadar channel by sediment. Sediment and erosion can affect changes in river morphology which can cause a reduction in the capacity of the Kali Sadar river because it experiences scouring (degradation) and sedimentation (aggradation) every year. The methodologies used in this study are analyzing the potential for bedload sediment transport using the Engelund Hansen Methode. The hydraulics analysis used the unsteady flow equation 1D and 2D models by including the planned flood discharge for 25th year return periods and cross-sectional data from upstream to downstream of Kali Sadar. the 1D model analysis resulted in changes in the long sections and cross-sections profile of the river and eroded and sedimented river sections. The results obtained in this study of changes in riverbeds experienced an average elevation as high as 1.45 m downstream of the river and degradation of an average of 1.5 m upstream. This needs to be handled by dredging the total sediment volume of 2,911 m3 which is done periodically.

Keywords: *sediment transport, river morphology, and flood control engineering*

R4-S3 Water Resources Engineering and Management

POTENTIAL SEDIMENTATION IN THE OPERATION CILIWUNG DIVERSION TUNNEL

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The construction of the Ciliwung–East Flood Canal is carried out in order to maximize the capacity of the main drainage channels such as the East Flood Canal and reduce the flood water level in the Ciliwung River. This diversion is planned to be able to divert some of the flood discharge from the Ciliwung River to the East Flood Canal through the Cipinang River at 60 m3/second. One of the problems in this construction is sedimentation which can reduce the effectiveness of the diversion system. Sedimentation that occurs can be in the form of sedimentation on the river section where the inlet is located or sedimentation that occurs in the tunnel outlet pond. Therefore, this study will try to analyze the potential for sedimentation that occurs at the tunnel outlet after the flood has passed and the floodgates at the inlet and outlet drains are closed. Sedimentation potential in the Ciliwung Diversion System was analyzed using a calibrated HEC-RAS model. The calibrations carried out are manning calibration and sediment model calibration. The sediment calibration model was carried out by comparing the modeling results of the Ciliwung River with the data from the geometry measurement of the Ciliwung River at the inlet of the diversion in 2021. From the results of the analysis, it is known that the bankful discharge of the Ciliwung River before normalization is equivalent to the flood design discharge of Q10 and after normalization is equivalent to the flood design discharge of Q50. For the calibration of the sediment model, the base elevation of the Ciliwung River 4 years after normalization was completed in 2017 was + 7.4057 or a difference of 0.079 m from the 2021 measurement results. The amount of sediment carried into the tunnel before normalization was greater than after normalization in the small return period flood discharge like Q2 and Q5. After normalization, the amount of sediment that enters is approximately 48 tons at the flood design discharge Q2, smaller than the sediment that enters the condition before normalization which is 104 tons. To prevent sedimentation in the tunnel, it is necessary to pump immediately after the flood flow in diversion channel is being stopped.

Keywords: *Sedimentation, Diversion Tunnel, Ciliwung, Cipinang, East Flood Canal*

STUDY OF THE EFFECTIVENESS OF UPGRADING AND OPERATIONS & MAINTENANCE (O & M) RINJANI CHECKDAM ON FLOOD EARLY WARNING SYSTEM AND LEAD TIME ON THE BATU MERAH RIVER IN AMBON CITY

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Ambon City floods in 2012 and 2013 caused great losses to the community. Batu Merah River is one of the rivers that flows in Ambon City with a watershed area of 6,891 km2 and a length of ± 7 km. The research was conducted with the aim of knowing how effective the construction of check dams is in increasing the lead time for flooding. The method used is to perform hydrological and hydraulic analysis as well as sedimentation analysis at the review location. The modelling uses Hec-HMS software with 3 scenarios, first in initial, second with check dam empty and third check dam full of sediment. By using the Q25 discharge using the SCS method, an additional lead time of 19 minutes was obtained and a reduction of the flood peak of 13 m3/s. When the check dam is full of sediment, the resulting lead time is 13 minutes with a flood reduction of 7.93 m3/s. The check dam can reduce the flood water level by 1.12 m. Changes in river morphology tend to be degraded with erosion that occurs at 6397.18 tons/year or equivalent to a degradation as high as 47cm/year.

Keywords: *Rinjani Check dam, Batu Merah River, Flood Early Warning*

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STUDY OF PROGO RIVER MORPHOLOGY AND SEDIMENTATION OF INTAKE KAMIJORO WEIR BANTUL REGENCY, SPECIAL DISTRICT OF YOGYAKARTA

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Irrigation Intake in Pijenan (2370 hectares) at Kamijoro weir Sungai Progo, Bantul Regency, is experiencing problems with sedimentation and blockages due to trash (stone and wood), so that the intake does not function optimally.

BBWS Serayu Opak, Ministry of ublic Works and Housing has made efforts by periodically dredging and constructing a Trashrack aimed at controlling sedimentation and waste in front of the intake.

A comprehensive analysis through the morphological and hydraulic changes approach shows that the intake position has a tendency to change the river channel pattern (meander). Besides that, the sediment transport rate of the Progo River is very large because it originates at Mount Merapi, which is still actively releasing eruptions and cold lava, besides that the rate is triggered by erosion of critical river watershed lands (land erosion > 3mm/yr).

For this reason, an alternative solution is needed to overcome sedimentation hydraulically, namely using the KRIB building on the side of the channel around the intake. In this study, analysis was carried out using HEC-RAS 6.1 software, both sedimentation and flow velocity.

The simulation results of HE-CRAS 6.1 water level 2D and Sediment 1D software conditions before and after installing KRIB on the right side of the river, showed that after installing KRIB there was a reduction of 66.67% (bankfull condition) and 79.31% (100yr flood condition). Based on the Hjulstorm graph, the condition after the KRIB is installed, shows that it is in the Transport in Suspension area, meaning the area where the sediment grains in front of the intake can be carried away by water velocity in bankful conditions.

The simulation shows that there is a change in the morphology of the bottom and riverbanks around the intake which has a tendency for reduced sedimentation due to the deflection of the current towards the intake position, so that the construction of KRIB can complete sedimentation at the intake in the long term.

Keywords: *Kamijoro Weir, Progo River, Morphology, Intake, Sedimentation, KRIB Simulation*

POI RIVER SEDIMENT CONTROL POST – EARTHQUAKE

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The earthquake of magnitude 7.4 that occurred on September 28, 2018 caused a landslide in Poi Village. Post the earthquake, there were two flood events accompanied by debris flows, on June 29, 2019 and December 8, 2019. In order to anticipate the recurrence of debris flow, the Ministry of Public Works and Housing (PUPR) in 2020 has built a sabo dam and five consolidation dam. This research is aimed to study the impact of the sabo dam built to control debris flows in Poi River. Numerical Simulation of 1-D debris flow (Kanako software) is used to simulate river conditions without and with sabo dam built. simulation of debris flow refers to the flood incident on December 8, 2019 with a flow rate of 2.34 m3s-1 obtained sediment at the bridge location reaching 1.5 meters. Sabo dam with a height of 14.5 meters is simulated using Q2 (6,24 m3s-1) able to withstand the overall sediment deposition of 28,058 m3, there is no deposition on the bridge. Simulation using Q100 (13.9 m3s-1), the sabo dam building retains 53,570 m3 of sediment, but other than that, there is 7,756 m3 sediment that still runs off downstream.

Keywords: *debris flow, Poi River, land slide, earthquake*

STUDY OF HYDRAULIC AND SEDIMENT OF RIVER SUNTER IN FLOOD MANAGEMENT

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Sunter River flows through East Jakarta City with its upstream in Cimpaeun District, Depok City and downstream of the Sunter River cut by the KBT (Kanal Banjir Timur) and flows directly into the sea. Cipinang Melayu Village, East Jakarta City is one of the villages in the lower reaches of the Sunter River which often floods. This study aims to obtain a proposed cross-section of the Sunter River with a planned flood discharge of 25 years and the morphological changes that occur in the Sunter River with respect to daily discharge and daily discharge without high rainfall. Analysis of planned flood discharge using Hec-HMS software. Meanwhile, the daily flood discharge used is from PDA Pondok Gede in 2013. For flood discharge without high rainfall, discharge is used from PDA Pondok Gede with a maximum value of 10% probability percentage. River morphology analysis using Hec-Ras 1D software. The conclusion of this study is that a cross section of the proposed management of the Sunter River is obtained with a width of 20 meters and a height of 4.5 meters. As well as the existing sedimentation trend as well as the proposed normalization of daily discharge and daily discharge without high rainfall which are relatively the same. And the amount of existing sediment of the Sunter River at daily discharge without high rainfall is 95% greater than the amount of sediment that enters the daily discharge.

Keywords: *Sunter River, Flood Management, Sedimentation, HecRas*

STUDY OF SEDIMENTATION CONTROL ON BANGGA RIVER, PALU WATERSHED, CENTRAL SULAWESI

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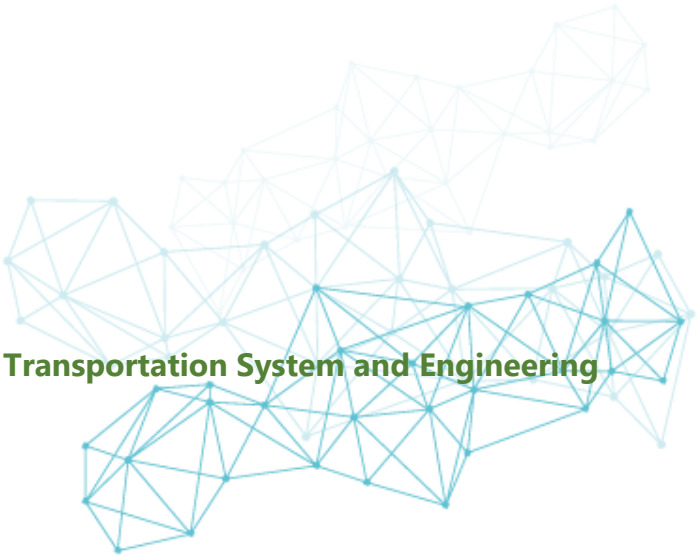
Bangga River is one of Palu's tributaries, located in a mountainous area in Palu River Basin (DAS) with an area of 74.82 km2 and has a river length of 16.97 km. Bangga River is a source to meet daily needs, including agricultural land and plantations. However, floods occur frequently which is mainlyexerted by the silting of sediment. The silting of sediment itself is contributed by the landslide on the upstream of the Bangga River. This proofs that the cliffs upstream of Bangga River are quite unstable, which can be collapsed easily due to the disaster. This statement was proven in 2018 that the earthquake and rainfall with a duration of 6 hours on the downstream area of the Bangga River, with the approximated water depth of 3 m, and was generating enormous losses. The losses is regarding the settlements, offices, and infrastructure.

Considering the similar condition that would be happening in the future, the Ministry of Public Works and Housing developed the sediment control through the construction of the Sabo dam inline the Bangga River. Hence, this study aims to analyze the performance of sabo dam in reducing the yields of sediment. Analysis and modeling will be carried out into two scenarios, before and after the sabo dam structure. The design is based on 100 years of return flood discharge and a flow rate of 4 years. Modeling uses HEC-RAS software with purposeful 1D modeling to simulate flow patterns, total sediment before and after the sabo dam structure's sediment control building.

According to the HEC-RAS simulation, shows that the water surface is stood at 2.1 m depth in existing condition. However, the simulation indicates low discharge (run-off) subsequent to the constructed after sabo dam's building. It is also denoted by the reduction of sediment transport, which was computed according to Engelund (81% reduction), Mayer Peter Muller (MPM) with 92% reduction and Yang (91% sediment yields reduction).This confirms that Bangga sabo dam is not merely utilized to retain the sediment,but it can be reducing the potential flooding in the future.

Keywords: *sedimentation, Sediment Control Building, HEC-RAS, sabo dam, flood*



R5-S3 Transportation System and Engineering

TRANSPORT BENEFIT ASSESSMENT DUE TO INCREASING CAPACITY TRANSPORTATION INFRASTRUCTURE

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The West Java Provincial Government plans to improve the transportation infrastructure capacity with road widening program in the southern part area. Current situation is travel time for trip in southern part Java is long, below the target of road functional as a collector road (40 km/h). The traffic volume is low (no congested), since it was a rural area. The transportation infrastructure feasibility can be assessed from cost-benefit analysis. Increasing the capacity of transportation infrastructure has an impact on the travel time, travel cost and gas emission, which will save the value of time, vehicle operational costs and gas emission cost. The transportation network model tool was used to assess benefits. The percentage of vehicle operating cost savings contributed the most in terms of benefits (78%). Economic feasibility measurement is carried out using the IRR indicator. with a value of 8.68%, which requires additional benefits so that it can be feasible based on the size of the Asian Development Bank study.

Keywords: *transport benefit, firm actor, vehicle operation cost, travel time saving, gas emission saving*

EVALUATING THE USE OF GOOGLE MAPS AS NAVIGATION APPLICATION BY IDENTIFYING HAZARDS AND ASSESSING RISKS USING HIRA MATRIX

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Google Maps as a navigation application provides route information with the shortest route or fastest travel time, but this technology has a weakness as it does not consider the suitability of road condition with the type of vehicles, therefore the choice of the routes does not accommodate traffic safety aspects. This research aims to evaluate the use of Google Maps as a navigation application by identifying hazards and assessing risks. The method used is based on an analysis using HIRA (Hazard Identification and Risk Assessment) matrix to determine the level of risk thus the step of mitigation can be executed. The data source obtained was from the results of questionnaires distributed to 1,114 respondents. As the results of analysis, it was found that 11 hazards from the usage of Google Maps came from the driver's aspect, Google Maps feature's aspect, and road conditions aspect. Evaluation of risks came from the three sources of hazard classified into 7 (seven) risks in the intolerable risk category and 4 (four) risks in the tolerable risk category. After the mitigation efforts were arranged to control the risk, there were still 13 risks but in the acceptable risk category. To anticipate the road traffic accident due to the usage of Google Maps, the recommendation for this navigation application is to add more features to warn the users about the road characteristics in the form of voice notification or pop up if not disturb the driver while driving and providing a specific route for truck/heavy vehicle as now the Google Maps is only available for light vehicle.

Keywords: *Google Maps, hazard, risk, HIRA, safety*

STUDY OF HYBRID ANNUITY MODEL ON INDONESIA TOLL ROAD

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Indonesia strives for toll road connectivity to push the high logistics costs and lead to economic growth. However, the expansion of toll road construction on a large scale has cost much money. So, an innovative funding scheme must be developed to attract the private to invest in those projects. The hybrid Annuity Model is a new public-private partnership developed by the Government of India in 2016 to reduce concessionaires' risk on toll road project funding. This study aimed to examine the compatibility of the Hybrid Annuity Model implementation on Indonesia toll road. The analysis was carried out through financial feasibility and sensitivity analysis on Serang – Panimbang toll road as the object study. Moreover, a survey was conducted to know the stakeholders' perception of this funding scheme implemented in Indonesia. The results showed that Hybrid Annuity Model could give financial feasibility on Serang – Panimbang toll road under any changes of traffic volumes, toll fares, discount rates, investment costs, investment return period, and the investment proportion between the Government and the concessionaires. From stakeholders' perspective, Hybrid Annuity Model could be implemented on Indonesia toll roads, especially those which were not financially feasible and located in rural areas. Furthermore, it needed some improvements and supporting regulations to be more suitable applied on Indonesia toll road.

Keywords: *toll road, Hybrid Annuity Model, feasibility analysis, sensitivity analysis, stakeholders' perception*

EVALUATION OF TECHNICAL CRITERIA FOR CONSTRUCTION TECHNOLOGY IMPLEMENTATION OF MADIUN TRAIN STATION BASED ON MINIMUM SERVICE STANDARDS, FACILITIES, AND ACCESSIBILITY

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Types, classes, and activities at the train station are used as a reference for evaluating building criteria components. In addition, the minimum service standards for train stations in Regulation of the Minister of Transportation of Indonesia Number 63 of 2019 must also be adjusted, must be met by service providers in providing services also be equipped with benchmarks used as guidelines for service providers and service quality assessments as obligations and quality, fast, easy, affordable and quality assessments. Guidelines regarding the facilities and accessibility of buildings, especially train stations, are also required by the regulation of the Minister of Public Works, so that the existing facilities in the stations must also be adjusted for comfort, convenience, usability, and independence. The purpose of this study is to evaluate the value of the component weights of the Madiun Train Station building facilities, evaluate the minimum service standards, facilities, and accessibility of Madiun Train Station in terms of the Regulation of the Minister of Transportation with the Regulation of the Minister of Public Works, and provide solutions regarding the improvement of station facilities to support technical criteria and minimum service standards on the building. The method used in this study is the Responsive Evaluation method and statute approach in Indonesia. The results of the evaluation of the weight value of the Madiun Train Station building facilities component are appropriate, namely Large Class Stations. The evaluation of the minimum service standards for transportation of people by train and station building in terms of the Regulation of the Minister of Transportation there are differences in assessment between PT. KAI with a survey in the field, but the results of interviews conducted with Madiun Train Station are in accordance with the results of field surveys; Meanwhile, according to the Regulation of the Minister of Public Works, there are exactly 50% of the requirements for facilities and accessibility of the railway station building that have not been met, on average, are facilities for people with disabilities and the visually impaired. Solutions to improve Madiun Train Station facilities and accessibility to support minimum service standards in buildings are availability of: pedestrian path; Guideline; Parking Route; Door and Handrail; Ram Detail; Stair Detail; Details of Closet, Toilet, and Position of the Shower Booth; public telephones; Equipment for Persons with Disabilities; Counter Table, sitting room furniture, and beds for the Disabled; Deaf Emergency Light Alarm, Teletext and TV text for the Deaf.

Keywords: *Responsive Evaluation method, evaluating building criteria components, Train Station's facilities and Accessibility, Regulation of the Minister of Transportation and Public Works, Minimum Service Standards, statute approach*

THE IMPACT OF PAVEMENT DISTRESS TO VEHICLE MANEUVER IN BANDUNG CITY

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Pavement distress can interfere with the vehicle's maneuver, causing the vehicle to reduce its speed and change lanes or do an evasive maneuver to avoid it. These behaviors could impact traffic conflict significantly. This study aims to identify the impact of pavement distress on vehicle maneuver, specifically the speed and evasive maneuver of the vehicle when approaching poor pavement conditions. The results show differences in responding to pavement distress for each type of vehicle. Motorcycles tend to maneuver or change lanes to avoid the poor pavement condition and it may be because of its dimension, while heavy vehicles tend to reduce the speed while confronting the pavement distress. Besides, light vehicles tend to maneuver, reduce their speed, and do a combination of those responses. From this study, we can investigate that it could be dangerous if the vehicle takes an opposite lane while there is a vehicle on the opposite lane. Some vehicles reduce their speed while confronting poor pavement thus they could be more careful on roads, nevertheless, in the rainy season, it could be dangerous, especially when the pothole is covered with rainwater. The improvement of road conditions is vital to enhance travel time and reduce obstacles on road.

Keywords: *Pavement distress, Potholes, Vehicle Maneuver, Speed*

EVALUATION OF PEDESTRIAN FACILITIES PERFORMANCE

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Most of sidewalks, especially in developing countries, are roled as public area with many social activities besides as the main function for serving pedestrian movement. Therefore, sidewalks may need some facilities to support users activities, namely benches, planting, including stalls for street vendors. The aims of this research is to evaluate pedestrian facilities in two different characteristic area y.i. residential and business area in Yogyakarta city using Pedestrian Index (P-Index) method. The data are collected in KHA Dahlan street-H Agus Salim street-Kauman street coridors, and Sudirman street-Suroto street coridors, that both coridors are considered residential and business area in downtown of Yogyakarta. Some variables are taken in to account, namely mobility, safety, facility, and accessibility. The results reveal that the pedestrian facilities are supportive towards pedestrians. The sidewalk in Sudirman-Suroto corridors are better in safety aspect, but must be improved.

Keywords: *sidewalk, public area, mobility, safety, facility, accessibility*

R6-S3 Water Resources Engineering and Management

STUDY OF FLOOD CONTROL AND MORPHOLOGY OF THE SARIO RIVER IN MANADO CITY

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Sario River is one of the rivers that contributes to flooding in Manado City. The floods that occurred caused a lot of loss and damage to facilities and infrastructure, as well as paralyzing the activities of residents. The causes are high rainfall, land conversion in the upstream part, silting occurring due to sedimentation and garbage, as well as river narrowing due to occupation. The condition of the downstream Sario Riverbank is very densely populated, so in this study, the solution for flood control is the construction of a floodway under the road that leads to the sea. The construction of this floodway aims to drain some of the water discharge in the Sario River during the Q25 flood discharge. The methodology used is hydrological analysis, hydraulic analysis, and sedimentation analysis. Hydrological analysis was carried out to calculate the design flood discharge, and hydraulic analysis was carried out using the HEC-RAS 6.1 1D software. This study simulates the water level and discharge after the construction of the floodway under the road, as well as the degradation and degradation that occurs. Based on hydraulic analysis, the presence of a floodway can reduce flood discharge downstream of the river by around 65.35%. From the results of the study, it was also found that the Sario River had sedimentation in several sections, indicating that normalization or dredging of the riverbed was needed.

Keywords: *sario river, floodway, flood control, Hec-ras*

HYDRODYNAMICS ANALYSIS IN BEDONO BEACH DEMAK REGENCY, CENTRAL JAVA-INDONESIA: OPEN RESOURCE PROCESSING FOR MODELING

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Input data derived from open resources is used as variables in numerical model calculation. Hydrodynamic analysis at Bedono Beach is modeled using a combination of open software models Delft3D-Flow and Delft3D-Wave. The model domain uses a combination of national bathymetry from BATNAS and national topography from DEMNAS. The driving force on this model are the tide of TPXO 7.2 and the wave results of hindcasting from NOAA wind data. The important water level elevation of HHWL = 1,156 m, MHWL = 1.060 m, MSL = 0.600 m, MLWL = 0.140 m, LLWL = 0,044 m were obtained from observation point on grid model. In addition, the significant wave height and significant peak period for each nautical direction are calculated and being input for open boundary in wave model. The result of one month hydrodynamic visualization after simulation complete can be seen using a quickplot menu from Delft3D.

Keywords: *Bedono Beach, Open Resource, Delft3D, Hydrodynamic, Visualization*

ANALYSIS OF THE FIVE PILLARS OF IRRIGATION MODERNIZATION WITH THE MASSCOTE METHOD IN THE MACAN IRRIGATION AREA

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Macan Irrigation Area is part of Jatiluhur Irrigation Area which is included in the scope of irrigation modernization in Indonesia. Irrigation modernization consists of five pillars, the first pillar of water availability, the second pillar of irrigation infrastructure, the third pillar of irrigation management system, the fourth pillar of irrigation management institutions, the fifth pillar of human resources. To find out the readiness of irrigation modernization in Indonesia, one way to measure it is with the Irrigation Modernization Readiness Index (IKMI). The readiness of irrigation areas can be categorized into 4 (four) categories, > score 80: predicate is sufficient and modernization can be applied, score 50-80: predicate is sufficient, modernization is delayed, improvements are made according to the results of IKMI 1 - 2 years, < value 50: predicate less, modernization is delayed, irrigation system improvements are carried out for 2-4 years, < value 30: predicate is very bad. This paper is about analyzing the five pillars of irrigation modernization with the MASSCOTE (Mapping System and Service for Cannal Operation Technique) method in the Macan Irrigation Area which is part of the Jatiluhur Irrigation Area. The MASSCOTE and RAP (Rapid Appraisal Process) methods are correlated with the five pillars of irrigation modernization with the results of pillars one 10.4, pillar two 29.2, pillar three 50.3, pillar four 6.7, and pillar five 3.4. Based on this, what must be improved is the fifth pillar, human resources.

Keywords: *Irrigation Modernization, MASSCOTE, Five Pillar of Irrigation Modernization*

EFFECT OF JETTY TO THE CAPACITY OF BOGOWONTO RIVER MOUTH, KULONPROGO, DAERAH ISTIMEWA YOGYAKARTA

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Bogowonto River is the main river in the Bogowonto watershed which is included in the Serayu Bogowonto River Area. In the dry season, the mouth of the Bogowonto river closes because sediment deposits accumulate at the river mouth, disrupting the river flow to the sea. At high tide, sediment holds the Bogowonto river flow because it impacts the backwater downstream of the Bogowonto river, causing flooding in several locations, especially around Yogyakarta International Airport. The flow capacity of the Bogowonto river is decreasing, causing flooding problems, so this study needs to do an analysis. Backwater analysis at the Bogowonto River estuary simulates the existing jetty in the HEC-RAS program. In contrast, simulated morphology change river was with two jetty scenarios using the DELFT3D program. The simulation results of flood modeling in the Bogowonto Hilir River when the estuary is closed have a backwater impact up to a distance of about 3 km with a water level rise of about 1 m. When the estuary is open and there is a jetty, the change in water level rises due to backwater becoming 0.2 m. If it normalizes constructing a jetty in the estuary, it can reduce the water level rise by about 0.8 m. Simulation using DELFT3D software was carried out in 2 scenarios, where the results for Scenario 1 still have the potential to have an impact on sedimentation at the end of the jetty so that it can close the flow of river discharge, and while Scenario 2 can overcome the effect of sedimentation so that Bogowonto river can be flowing into the sea. However, sedimentation on the west side of the jetty has the potential to down drift, and the east side of the jetty has the potential to up drift.

Keywords: *estuary, discharge, sedimentation, waves, jetty*

ID 401

STUDY OF FLOOD MANAGEMENT WITH INTEGRATED FLOODGATE OPERATION PATTERN AT PEPE RIVER IN SOLO CITY

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Floods that occurred in Solo City were caused by increased flood discharge, reduced capacity in Kali Pepe, and backwater from Bengawan Solo which is the estuary of Kali Pepe. This was triggered by land use, erosion in the upstream watershed, and sedimentation downstream as a result of the function of Kali Pepe as the main drainage of Solo City. One of the measures taken by the government to control flooding in the Kali Pepe catchment area is to build the Tirtonadi Rubber Weir and the Demangan Baru Sluice Gate which is located near the confluence with the Bengawan Solo River. When a flood occurs in the upper reaches of the Kali Pepe, the floodgates are closed and water flows through Kalianyar to empties into the Bengawan Solo River. While at times Pepe downstream in case of flooding in the Bengawan Solo river, then the floodgate Demangan are closed then water is pumped with a capacity of 12.5 m3/sec to be forwarded to Bengawan Solo.

This study aims to examine the integration of the Sluice Gate Operation Pattern at the Tirtonadi Weir with the gate and Pump Operation Pattern at the Demangan Baru Sluice Gate in Flood Management of Solo City and to control sediment flow in Kali Pepe. Simulations were carried out on an unsteady flow model with various scenarios of sluice gate settings. The simulation model is carried out on the existing condition and after the Demangan Baru Sluice Gate is built and operated. Results of the analysis show that the operation of the rubber weir begins when the discharge is more than 20 m3/sec. The operation pattern starts from gate 1 followed by gate 3 and gate 2 until the water level remains at +93.35 m. Meanwhile, at the Kali Pepe Downstream with a Q25 condition of 70.7 m3/sec and the Bengawan Solo River discharge Reaching Q50 at an elevation of +89.90 m, the floodgates in Demangan Lama are opened and the pump is operated, while the floodgates in Demangan Baru are closed and the pump is operated. By setting up an integrated floodgate and increasing long storage at Pepe Downstream of 300,000 m3 occur potential flood reduction of 40.71% with a decrease in water level of 1.8 m.

Keywords: *flood, Sluice Gate Operation Pattern, and Pepe River*

SEDIMENTATION IMPACT ON CAPACITY AND MORPHOLOGY CHANGES ON BENDUNG RIVER OF PALEMBANG CITY

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Bendung River is one of the rivers in Palembang city that experiences overflowing when the rainy season occurs. This river length is 5.47 km, and its watershed area is 18.38 km2. The flood that occurred in the area around the Bendung river has caused material and non-material losses. The flood that occurred was due to the capacity of the Bendung river not being able to accommodate the flood discharge. In addition, backwater from the Musi River which is the estuary of the Bendung river is also one of the causes of flooding. The reduced capacity of the Bendung River is caused by sedimentation that occurs almost along with the river flow.

The research method in this study is sedimentation modeling using HEC-RAS 6.1 1D using cross-sectional data from upstream to downstream of the Bendung river. In this study, primary data was collected, namely floating sediment samples and base sediments. This study aims to determine the amount of sediment in the Bendung river at the time of flooding for a definite return period, analyze the influence of remaining sediment on changes in river morphology and capacity of the Bendung river in Palembang city and provide recommendations for normalization locations on the Bendung river.

From the results of this study, it was found that sediment affects the capacity of the Bendung River and causes vertical morphological changes, both in aggradation and degradation. The location that must be normalized on the Bendung river every year is upstream to the middle part of the Bendung river.

Keywords: *sediment transport, river morphology, HEC RAS*

R1-S4 Disaster and Resilient Infrastructure and Earthquake

EARTHQUAKE RISK STUDY ON RESIDENTIAL BUILDINGS IN URBAN AREAS USING THE EVENT-BASED RISK ANALYSIS METHOD

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Based on data compiled by UNISDR (United Nations Office for Disaster Reduction) states that Indonesia is in the third-highest rank after Japan and the United States for the average economic loss due to earthquakes. Previous earthquake risk studies conducted by the National Agency for Disaster Management (BNPB) in 2011 and developed in 2016 are in the form of a risk index and have not taken into account the vulnerability function of buildings so that the loss value has not been presented quantitatively. This research aims to analyze earthquake risk in urban areas (West Jakarta Municipality) using the Event-Based Risk Analysis method, which considers several factors, including: earthquake source updates, GMPE, site-specific, exposure, and building vulnerability functions. Hazard and risk analysis were conducted for the probability of exceedance (PoEs) 10% and 2% in50 years. Risk analysis was conducted for residential buildings exposure. The lowest total building loss due to the earthquake per district is around 8.1 million USD and the highest loss is 15.5 million USD at a PoEs 10% in 50 years. Whereas for the PoEs 2% in 50 years, the lowest total loss was 14.86 million USD and the highest total loss was 25 million USD.

Keywords: *Hazard Analysis, Risk Analysis, Event Based, Urban Area*

NUMERICAL STUDY ON CONNECTIONS OF REPLACEABLE SHEAR LINK WITH INSERTED PINS

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The link end plate of replaceable shear link in eccentrically braced frames has been modified with the 'inserted-pins' to ensure the high seismic performance and to reduce the number of bolts in its slip-critical connections. The maximum shear force in the connection is resisted by the pins, while the bolts resist the bending moment at the link-ends. Numerical work has been conducted using a non-linear ABAQUS program to study the deformation as well as the stress distribution of the shear-link and its connection elements: end plates, bolts, pins, and beam-outside the link. The results showed an adequate performance of the proposed modified shear link connections, where the end plate of the beam outside the link remained elastic as the shear-link reached 0.08 rad plastic rotation due cyclic loading.

Keywords: *shear link, replaceable, connection, pin*

TSUNAMI RISK ASSESSMENT AND BUSINESS CONTINUITY PLANNING FOR PALU SPECIAL ECONOMIC ZONE

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On September 28, 2018, an earthquake with a magnitude of 7.4 Mw struck Central Sulawesi, Indonesia and triggered a major tsunami. At least 3475 people lost their lives as reported by the Indonesian National Board for Disaster Management (BNPB), while a large unknown number is still buried under the rubble and presumed dead. This event also damaged the facilities and infrastructure of the Palu City coastal area. Currently, The Goverment of Palu is developing the Palu Special Economic Zone (PSEZ) in Tawaeli District, Palu, Central Sulawesi to attract investors and spur economic growth in neighbouring areas. Thus, mitigation plans are urgently needed to reduce damage and losses due to the impact of future tsunamis on PSEZ. This study assesses the impact of tsunamis around the Palu Special Economic Zone and its supporting infrastructure. Hypothetical earthquake-induced tsunamis were simulated using Delft3D and Delft Dashboard. The fault scenario is developed based on data from PUSGEN. Further parameters were developed with the empirical earthquake source-scaling laws. The model simulates the tsunami generation, propagation, and inundation from the source to the coastal area. A tsunami impact scenario is then developed as a basis for analysing the business impact to the transportation infrastructure and critical utilities serving the PSEZ, as well as to the operation of the industries and businesses within the PSEZ. The lessons learned from this study can assist stakeholders in developing an areawide business continuity plan as a commitment of the stakeholders for implementing areawide business continuity management for the PSEZ, which will improve the economic resilience of the Palu City as well as South Sulawesi region.

Keywords: *tsunami, mitigation, business continuity plan, Palu*

ID 362

PALU HOUSING RECONSTRUCTION PROCESS: REVIEWING AND LEARNING AFTER THE 2018 EARTHQUAKE

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The strong earthquake that hit the province of Central Sulawesi on 28 September 2018 (M7.4), followed by tsunami and liquefaction has caused many casualties, injuries as well as damages in the housing sector. In the rehabilitation and reconstruction (R&R) program, the Government policy was to provide the affected community with aid to rebuild their houses (for houses outside the red zone), the Government also will build new settlements for relocation (for houses inside the red zone), which both are expected to be more earthquake-resistant. In order to understand what happens in the field related to various issues, an investigation to study the whole processes and to document the lessons learnt from the reconstruction process is conducted in Central Sulawesi. One of the highlights of this study is the impact of the three types of disasters that occurred in Palu (earthquake, tsunami, and liquefaction) on the housing reconstruction process after the disaster occurred. The primary field survey and Focus Group Discussion were conducted through interviews with various parties in the earthquake-affected areas to reveal the findings of problems and obstacles in the field during its two years of implementation, from 2018 to 2020. This study focuses on reviewing and learning from the post-disaster housing sector reconstruction process. The result of this study is expected to provide future lessons for the post-disaster housing reconstruction process in Indonesia and other countries.

Keywords: *housing reconstruction, post disaster, earthquake, Palu*

COMPARATIVE OF MATERIAL PROPERTIES BETWEEN NATURAL FIBERS AND GEO-BAG SYNTHETIC FIBERS AS SUSTAINABLE MATERIAL OF TEMPORARY STRUCTURE IN NATURAL COASTAL PROTECTION SYSTEMS

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The natural coastal protection system is a proposed solution to the coastal erosion problem, including in Indonesia coastal areas, which combines the primary natural protection (vegetation such as mangroves) and temporary artificial structures as sustainable coastal development practices. The geo-bag-dike was chosen as a possible temporary structure to protect the growth of mangrove seedlings from sea waves, about two to five years before they are strong enough to prevent erosion. In today's practice, the geo-bag-dike is made of polymeric synthetic fibers (nonwoven geo-bag), which take a relatively long time to degrade naturally. Thus, this study focused on finding sustainable alternative materials from natural fibers, such as lyocell (Tencel), kenaf, cotton, and rayon, that can be applied as the primary material of geo-bag-dike by comparing their material properties to nonwoven geo-bag. The results of the laboratory testing method show that kenaf textile has a higher value of tensile and tearing strength, but not higher than nonwoven geo-bags (768 N, 1.080 N, and 2.140 N for tensile strength of kenaf, local and imported nonwoven geo-bag, respectively). Therefore, kenaf textile has the potential as a sustainable alternative material. By extrapolating, it is necessary to increase the layer number of kenaf textile, at least three layers of fabric to resemble the tensile strength of nonwoven geo-bags.

Keywords: *Natural coastal protection system, material properties, sustainable alternative materials, natural fibers, nonwoven geo-bag*

ID 339

DISASTER AND RESILIENT INFRASTRUCTURES MUSI RIVERSIDE SETTLEMENT IN PALEMBANG

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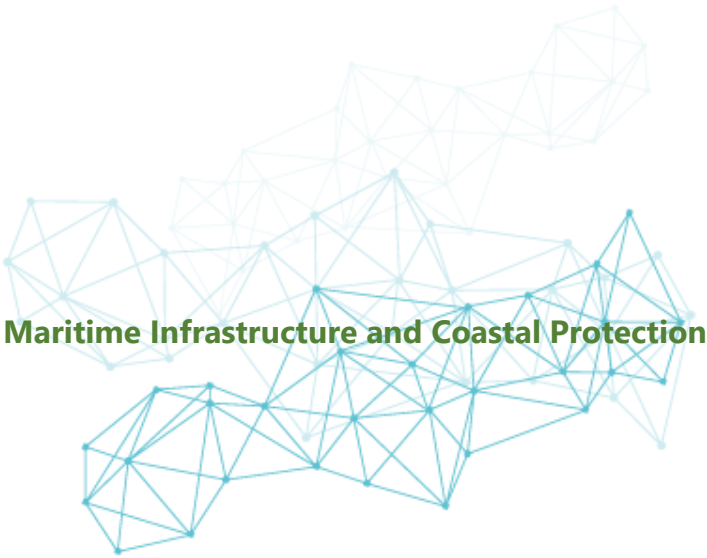
The settlements of Musi Riverside in the city of Palembang are the strongest attraction for the community to build settlements. This settlement of the Musi Riverside, which has been inhabited for generations, has architectural and cultural aspects that reflect traditions that still survive. However, the community's need for housing and riverside infrastructure that extends to cover river water catchment areas actually causes changes in land topography, changes in water management, and even river widths that cause urban flooding. The purpose of this study is to reconstruct the resilience system of residential infrastructure on the banks of the Musi River, Palembang in the face of urban flooding. This study uses quantitative methods with the analysis used is descriptive analysis, cross tabulation analysis and analysis based on geographic information systems (GIS). The results showed the resilience of riverbank infrastructure in the 5 Ulu and 7 Ulu settlements. Infrastructure resilience in dry land is in the form of road expansion, while in wet land it is in the form of expansion of concrete walkway. Changes in the patterned settlement infrastructure to form rivers that are not in accordance with the character of the river. This study provides a concept in reconstructing the resilience of riverside infrastructure based on exogenous and endogenous aspects, by making shelter and networks with stilt construction.

Keywords: *Disaster, Resilience, Infrastructure, Musi Palembang, Settlements*



R2-S4 Maritime Infrastructure and Coastal Protection

ID 384

EXPERIMENTAL STUDY OF WAVE TRANSMISSION IN SLOPE CREST FLOATING BREAKWATER

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Studies on floating breakwater become increased in the past two decades. Researchers proposed some type of floating breakwater which is among them the Pi-type model. The performance of this model is still under development. In this study, a new model is made by modifying the PI-type breakwater by two slopes in the crest from the centreline down to both sides of the model, named slope crest floating breakwater (SCFB). A series of regular waves in intermediate water depth was generated to evaluate the performance of the model reducing transmission waves to shoreward. An empirical formula has been proposed to calculate the transmission coefficient for practical purposes. Further study is required to simulate wave transmission through various model dimensions.

Keywords: *floating breakwater, intermediate water depth, transmission coefficient*

VESSEL SIZE AND DREDGING DEPTH OPTIMIZATION FOR TOL LAUT PROGRAM USING GENETIC ALGORITHM: HUB PORT CASE STUDY

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Tol Laut is an Indonesian government containerized sea freight program which is aimed at reducing the price disparity, as well as extending logistic distribution from developing regions. The program can be enhanced by determining the optimum dredging depth of port navigation channel and the optimum size of vessel. The required channel depth is affected by the size of vessel, which is represented by its draft, on the respected hub port. The significance of vessel size and dredging depth in accommodating the container demand will be evaluated by considering the physical environmental conditions such as surface water elevation which affected by tidal conditions. Genetic Algorithm is utilized in this study since it showed robust results on optimizing port performances problems that have many dependent variables and solutions. As a hub port within Tol Laut Program, Port of Belawan is selected as a case study due to its strategic location. Several demand scenarios were run using the algorithm, resulting several channel depth-vessel size pairs as the solution. In conclusion, the feasibility of the dredging activity relies significantly on the growth of the demand.

Keywords: *Genetic Algorithm, Optimization, Tol Laut, Vessel Size, Dredging Depth*

QUANTITATIVE CONSIDERATION IN SELECTION OF BREAKWATER CONCRETE ARMOR UNIT BASED ON UNIT'S INTERNAL TENSILE STRESS RESPONSE

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Concrete armor units are essential for the protection of rubble mound breakwaters, yet their selection is generally not based on structural integrity considerations. In this study, the authors used static finite element simulations, as implemented by Ansys software, to compare the structural integrity of five armor units: Accropode, A-Jack, BPPT-Lock, tetrapod, and dolos. All armor units have a mass of around 11,500 kg and have the same quality of concrete at f'c of 30 MPa. The study involves two different loading cases: Armor units were (1) arranged on a breakwater slope subjected to their own weight and (2) placed on a horizontal ground subjected to idealized wave attacks. In Case #1, the armor units were modelled fixed to the ground and bonded to each other. In Case #2, the wave attack was modelled as a unidirectional and uniform pressure. From the simulation results, the authors compare the highest tensile stresses which could be found on the corner regions of the armor units—their most vulnerable region. In both cases, armor units with stocky shapes experience lower tensile stresses compared to those with slender shapes. These results confirm that Accropode, BPPT-Lock, and tetrapod are structurally safer than dolos and A-Jack.

Keywords: *breakwater, concrete armor units, structural integrity, Accropode, BPPT-Lock*

NUMERICAL MODELLING OF LAND SUBSIDENCE EFFECT ON COASTAL SEDIMENT TRANSPORT IN PEKALONGAN

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This study examines the condition of sediment transport on the Pekalongan coast by a numerical model computation using the Delft3D Flow module. The research was started by collecting and analysing field data both primary and secondary. Thus, the hydrodynamic and sediment transport model are then calculated in two scenarios which are representing the conditions before (2016) and after (2021) land subsidence by assuming a land subsidence of 10 cm/year. The numerical model is then calibrated and verified on the data of tidal water level elevation and current velocity, the best results are obtained at a chezy number of 60 m 0.5 /s, and sensitivity tests are carried out on changes in sediment grain size, wave height and wave direction in order to determine the characteristics of the numerical model. The sensitive analysis of sediment grain size is the most sensitive effect to sediment transport characteristic. The results of the numerical model are then compared based on the scenarios before (2016) and after the occurrence of land subsidence (2021). The results indicate that after land subsidence, the sedimentation rate is increasing by 56.34%, whereas the erosion rate is decreasing by 3.98% after one neap-spring tidal cycle (around 15 days) in the study area.

Keywords: *Land Subsidence, Erosion, Sedimentation, Numerical Modeling, Sediment Transport*

R3-S4 Sustainable Construction and Project Management

ID 468

COMPARATIVE STUDY IN BILL OF QUANTITY ESTIMATES ON REINFORCEMENT WORKS OF PILE CAP, SINGLE PIER AND DOUBLE PIER OF FLYOVER BETWEEN CONVENTIONAL METHODS AND BIM (BUILDING INFORMATION MODELLING)

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One of the construction materials with a high level of demand is reinforcing steel. Globally, the demand for reinforcing steel has quadrupled from 1960 to 2005 and this increase is predicted to double by 2050. In one project, reinforcing steel accounts for 16% to 60% of the total project budget. Therefore, if the volume of reinforcing steel is not estimated correctly it will have an impact on project budget wastage and swelling. The project budget wastage is indicated by the large volume of material remaining, while the budget swelling is indicated by the procurement of additional reinforcing steel because the material requirement is greater than the initial estimate. To minimize this, a comprehensive understanding of volume estimation is required. Currently, the method of estimating the reinforcement volume that is widely used is the conventional estimation method and the BIM -based estimation method. The conventional method is done manually based on the BBS (Bar Bending Schedule) as a reference. Meanwhile, the BIM-based method is a more modern estimation alternative because it is considered more practical efficient. Although these two methods are widely used, there are limitations and advantages that are taken into consideration when choosing the most appropriate method. Therefore, a study is needed to prove and compare the accuracy of the estimation of reinforcement volume between the conventional method and the BIM-based method. This study also highlights the advantages and limitations of the two methods for comparison. The conventional method is more transparent in terms of the estimation formula used because it is done manually. This can help the estimator track the estimation process to ensure the accuracy of the results. Whereas, the BIM-based estimation method is superior in terms of work automation. Furthermore, the limitations of the conventional method are that it does not have a 3D visual model and become more complex if there is a revision of the plan drawing. On the other hand, the BIM-based estimation method offers convenience in the form of data input using 3D drawings. However, the main limitation of the BIM-based method, especially for the software used in this study, is that the estimation formula cannot be traced because it relies more on three-dimensional modeling. This causes the estimator to be unable to ensure the accuracy of the estimation results. However, this limitation may differ from other BIM software products outside of this study.

Keywords: *reinforcing steel, volume estimation, quantity take off, conventional method, building information modeling, allplan engineering*

MECHANICAL CHARACTERISTICS OF CONCRETE WITH THE ADDITION OF INTEGRAL WATERPROOF USING LOCAL AGGREGATE EAST KALIMANTAN

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Nowadays, there are various ways to deal with leaks in concrete. One way that is often used to deal with leaks is to provide a waterproofing or waterproofing layer on the surface of the floor or wall. Along with technological developments, research on the quality of concrete waterproofing continues to be improved. One of them is the use of Concrete Integral waterproofing, which is a mixture of concrete that is added with integral waterproofing to minimize water penetration into the concrete, thereby increasing the concrete's impermeability and protecting the concrete against leakage. The purpose of this study was to determine the effect of adding Integral waterproofing to the compressive and tensile strength of concrete and to determine the optimum level of addition of Integral waterproofing. The aggregates used are Palu coarse aggregate and Kalimantan local fine aggregate to utilize the natural resources in East Kalimantan. Addition of Integral Waterproofing into the concrete mixture with a percentage of 0%, 0.5%, 1% and 2% of the cement weight. Concrete testing was carried out at the age of 28 days by testing its mechanical properties, namely compressive strength and tensile strength. Based on research results, for concrete that uses Mahakam fine aggregate, the highest compressive strength value at 2% addition is 34.73 MPa, and the highest tensile strength value at 2% addition is 2.38 MPa. And for concrete that uses Sambera fine aggregate, the highest compressive strength value at 2% addition is 30.91 MPa, and the highest tensile strength value at 1.5% addition is 2.34 Mpa.

Keywords: *integral waterproof, mechanical characteristics, concrete*

FACTORS AFFECTING SAFETY LEADERSHIP OF CONSTRUCTION PROJECT OWNERS IN INDONESIA

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Construction is an industry with high possibility of risk. The construction industry accounts for the highest number of work accidents globally, with more than 60,000 fatal accidents per year. In order to improve safety performance, a construction safety culture through mature safety leadership can be the fundamental factor. Safety leadership is the process of interaction between leaders and followers to achieve organizational safety goals. In many cases of work accidents in construction projects in Indonesia, the leadership of the project owner is rarely discussed. It is more often determined that the responsible stakeholder is the contractor. Leadership by the project owner is the main factor for generating new and effective safety management measures. This study aims to determine the factors that influence the Safety Leadership of construction project owners in Indonesia. This study uses the delphi round technique to analyse experts' judgements to avoid biases. This study results in obtaining several factors and indicators that are considered to have an influence on the safety leadership of construction project owners in Indonesia.

Keywords: *Safety, leadership, construction, industry, owner*

CONCEPT ANALYSIS OF EARNED VALUE AT CONSTRUCTION IMPLEMENTATION TIME (CASE STUDY OF PACKAGE 4 DEVELOPMENT PROJECT – APSLC, TILC, DLC, AND FRC BUILDINGS GADJAH MADA UNIVERSITY YOGYAKARTA)

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The implementation of a project is said to be successful in its management if the project can be completed with a predetermined quality or quality, so it is necessary for the existence of planning and scheduling techniques or methods that can help the management of project implementation. This research was conducted on Building Package 4 Gadjah Mada University Yogyakarta. In this study using time control methods with the concept of value results or Earned Value Concept. This method generates BCWP values, BCWS values, SV values, SPI values, and can predict project end time completion (ETC and EAC).

This research requires data such as Time Schedule and Cost Budget Plan, This study produces information that there are time deviations in the 4th and 5th weeks of etc and EAC calculation results can be predicted that the project is delayed in week 4 which is completed in week 65 and in the 5th week completed in week 59. This shows that the implementation of the project experiences slight deviations at the time of implementation of project activities.

Keywords: *Earned Value Concept, BCWS, BCWP, SV, SPI, ETC, EAC*

COVID-19 IMPACT EVALUATION AND TIME & COST MITIGATION STRATEGY FOR OIL & GAS EPCI PROJECT

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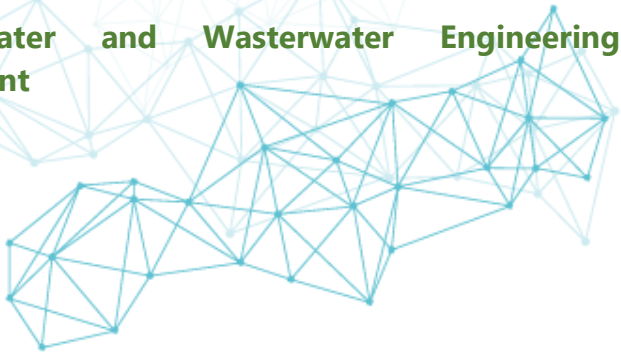
The outbreak of COVID-19 pandemic at the end of 2019 has impacted all social, cultural and economic sectors. As part of the outbreak, oil and gas industry in Indonesia is also experiencing the impact of COVID-19, especially in the upstream sector. The study will discuss the implications of COVID-19 as a case study of the development project in the upstream oil and gas sector by identifying specific impacts in each project phase and their relationship to time & cost overrun. Through the research questions, specific impacts of each phase of the project (Engineering, Procurement, Construction & Installation) are obtained, including overrunning in labor cost, cancellation cost due to early termination of the chartered vessel, extension cost for material storage, and remobilization for the marine spreads on next offshore campaign. Based on the research, there is 8-14 months impact on the project schedule and 25%-27.5% overrun on cost impact.

Keywords: *Covid-19, Oil and Gas, Risk Mitigation*

R4-S4 Water and Wasterwater Engineering and Management



ID 422

THE EFECTIVENESS OF GREASE TRAP, CARBON ACTIVE AND AEROB BIOFILTER METHODS TO CLEAN CANTEEN'S WASTE WATER

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Background. In developing countries, domestic household and industry wastewaters are still occurring and putting the community in severe health problems. The waste from industrial, hotel, health facilities, slaughter house, and domestic activities are mostly contains of oil, grease, detergent and soap, and other organic waste substances. This study purpose is to examine the effectiveness of grease trap, carbon active and aerob biofilter (bioball) methods in cleaning canteens's wastewater. Methods. A Quacy Experiment with Non Equivalent Control Group Design approach was implemented to examine the grease, oil, BOD, and TSS levels of the canteen's waste water samples of Health Polytechnic Kemenkes Semarang Campus 7th. Pre-and post tests applied to the samples from dish washing-process. HATRI (researchers' name) was performed for the analysis and the number were calculated using efficiency formula and paired t-test. The examination was applied on the sample before and after three day-treatment. The anticipated result was that the oil, grease, TSS, and BOD level in the waste was reduced and the equipment used was efficient. Activated carbon is used in wastewater treatment. With large coverage and effect, activated carbon functions as color, flavor, and smell remover as well as purification agent. Results. The data revealed the decreased on BOD level (83,7%), TSS level (24,6%), and oil level (98,7%) while for the grease showed - 0,03%. That means the wastewater treatment in Campus 7 canteen is more effective in reducing oil and BOD level. Bioball is the development of aerobic bio filter process with source of bacteria from TACHEM Concorcium TCM – 4143 WE. The presence of oil an grease will disturb the performance of the aerobic bio filter (bio ball) and activated carbon layer, besides that it will float on the surface of the water because the density is smaller than the density of water (0.8 gr / cm3 <1 gr / cm3). The condition was obtained because there were early food residual sedimentation and filtration that occurred in the first basin by micro screen. Furthermore, the smaller substances were trapped in grease trap making them stop flowing. To improve the waste-waste treatment efficiency, implementing more pre-treatments and/or more treatments is needed. Thus it can maximize the decrease of BOD, TSS, oil and grease level. Conclusion. HATRI was able to reduce the level of BOD, TSS, and oil. Yet it was not for reducing grease level. Therefore, it is needed to maximize the treatment on the grease trap.

Keywords: *Hatri, BOD, TSS, oil, grease, bioball*

ID 375

FAECAL SLUDGE TREATMENT PLANT PERFORMANCE IMPROVEMENT STRATEGY THROUGH THE IMPLEMENTATION OF SCHEDULED FAECAL SLUDGE SERVICES (SFSS) (CASE STUDY: SUWUNG FSTP, KUTA DISTRICT)

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Indonesia have achieved 79,53% access to improved and safely managed sanitation in 2020. The government has mandated an improvement in sanitation access to 90% through National Mid-Term Development Plan (RPJMN) in order to fulfill 100% access to water and sanitation as stated in Sustainable Development Goals (SDGs). The province of Bali was able to achieve improved sanitation access up to 89%, but it is not yet safely managed. One of the government's efforts to achieve safely managed sanitation is through the implementation of septic tank regular desludging program named the Scheduled Faecal Sludge Service (SFSS) system. This research aims to formulate SFSS implementation strategy by assessing user aspect (Willingness to Pay/WTP and Ability to Pay/ATP), financial aspect, and technology aspect. The research methodology used are interview using questionnaires for user aspect; Interactive Septage Management toolkit for financial aspect; and technology audit method combined with pairwise comparison method for technology aspect. Strength-Weakness-opportunity-Threat (SWOT) analysis was used to provide recommendation for implementation strategy. Questionnaires were given to 100 respondents who live in Kuta District and it was found that 87.13% strongly agree with SFSS program, WTP is Rp. 9.110,- and ATP is Rp. 30.050,-. Financial aspect analysis result shows service rate of Rp. 9.722,- per month and 37 desludging trucks are needed to serve Badung Regency and Denpasar City. Technology audit consist of technoware, humanware, infoware and orgaware (THIO) variables and involved 13 key informants. The overall performance of Suwung FSTP was 81.46%, which indicates good performance with the performance of the THIO variables is 72.22%, 86.67%, 90.28%, and 76.67% consecutively. Scenario analysis shows that should SFSS has been implemented in the study area, the FSTP performance can be increased to 89.79%. SWOT analysis result shows that implementation strategy include establishing partnerships with the private sector, combining data management with a centralized system, improving services and making regulations that support the SFSS program.

Keywords: *Technology Audit, Kuta District, SFSS, Pairwise comparisons, SWOT*

ID 349

THE STUDY OF WATER LETTUCE (PISTIA STRATIOTES L.) APPLICATION IN REDUCING COD LEVELS OF TOFU WASTEWATER USING BATCH SYSTEM PHYTOREMEDIATION

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Tofu industry wastewater contains high complex organic materials such as BOD, COD, and an acidic pH. High concentration of tofu wastewater can cause damage to aquatic ecosystems, so it requires treatment before finally being discharged. Phytoremediation is one of wastewater treatment methods that can be applied. The objective of this research was to determine the effect of Water Lettuce application and its COD removal efficiency. The research method used was the experimental method with laboratory-scale batch reactor, used Water Lettuce with amount 200 and 400 grams which already acclimatized for 7 days, sample 5L of tofu wastewater within and without pH controlled, and was done with 3 replications. The results showed there is an effect of Water Lettuce in reducing COD with removal efficiency of 24%, 57%, 82% for experiment 1 (200 gr, pH acid), 2 (400 gr, pH acid), and 3 (200 gr, pH neutral), respectively. The condition of Water Lettuce in every experiments was differ because pH and weight affected it, but at the end of experiment the Water Lettuce died because it had saturation point of growth, it showed the roots and the body was separated and became black, the leaves colour became yellow to brown.

Keywords: *COD, Tofu Wastewater, Water Lettuce*

ID 342

SIMPLE PROTOTYPE ON FIXED BED REACTOR (FBR) BASED ON USED PLASTIC WITH ACTIVE SUSPENSION SOLUTION STARTER IN DOMESTIC WASTEWATER TREATMENT

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Biofiltration was commonly performed in a complex bioreactor. Yet by adjusting the biofiltration according to the field conditions and application purposes, the efficiency factor need to be considered. This study aims to determine the treatment performance of biobags on the fixed bed reactor (FBR) in domestic wastewater treatment to meet the specified quality standards. Biobag in FBR was supported by used plastic of Low Density Polyethylene (LDPE). The plastic waste was cleaned and arranged in such a way into a bag. The bag unit was activated by immersing it in media containing nutrients and active suspension. The growth of biofilm in biobags was carried out at various active suspension content (10%, 20% and 30%) and variations in the treatment time of 12, 24, 36 hours. The results showed that the best Active Suspension was obtained in soil samples from ditches exposed to domestic waste in the Southern Region of Denpasar City, Bali Province. The colony were found at 3.66 x 104 CFU/mL in 42 hours of breeding. Meanwhile, the best biofilm growth period on the plastic (biobag) surface was obtained at 54 hours with an active suspension content of 20%. The results of FBR treatment with biobags and the implementation of active suspension obtained that the best wastewater treatment retention time (HRT) was obtained within 24 hours of treatment. With 24 hours HRT on 2 mg/L plastic treatment with anionic surfactant efficiency was achieved for COD, BOD and Ammonia parameters and the effectiveness of quality standards was achieved for COD, BOD, Ammonia and TSS parameters.

Keywords: *active suspention Biobag, domestic wastewater, used plastics*

R5-S4 Water Resources Engineering and Management

STUDY OF CAPACITY IMPROVEMENT OF PLANGWOT-SEDAYU LAWAS FLOODWAY

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One of the problems that occur in the Bengawan Solo watershed is the high flood discharge from upstream, causing flooding downstream, especially in Lamongan Regency and Gresik Regency. In order to anticipate this, BBWS Bengawan Solo has built the Plangwot-Sedayu Lawas Floodway with an initial capacity of 640 m3/s. However, due to flooding still occurring in Lamongan and Gresik regencies, BBWS Bengawan Solo is working on increasing the capacity of the Plangwot-Sedayu Lawas Floodway to 1000 m3/s. This research was conducted to examine the effect of adding the inlet gate of the Plangwot-Sedayu Lawas Flood Canal to the reduction of flood discharge in the Bengawan Solo River.

The analysis was carried out by modeling the existing operating manual with 3 (three) inlet gates (capacity 640 m3/s) and 5 (five) inlet gates (capacity 1000 m3/s). The modeling uses flood discharge at the 50-year return period. The modeling is done using HEC-RAS 5.0.7 software.

Based on the results of hydrological analysis, it was found that the peak flood discharge at the 50-year return period of Bengawan Solo Hilir River was 4191.70 m3/s. Simulation using 3 (three) inlet gates shows that the peak flood discharge can be reduced to 3628.94 m3/s (reduced by 13.43%). For the simulation using 5 (five) inlet gates, it shows that the peak flood discharge can be reduced to 3298.6 m3/s (reduced by 21.31%). The highest discharge that can enter the floodway during modeling using 3 (three) inlet gates is 562.8 m3/s so that there is deviation of 12.1% from the design capacity of 640 m3/s. The highest discharge that can enter the floodway during modeling using 5 (five) inlet gates is 893.1 m3/s so that there is deviation of 10.7% from the design capacity of 1000 m3/s.

Keywords: *flood discharge, floodway, inlet gates, reduction*

ID 429

MAC-CORMACK FLUX CORRECTED TRANSPORT SCHEME FOR SIMULATION OF DAM BREAK AND SUPER CRITICAL FLOW IN CURVILINEAR COORDINATE SYSTEM

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Dam break is one of a hydraulic phenomenon can cause material and life losses to the downstream. Dam break generally caused by geotechnical failures such as earthquakes, excessive pore water pressure, and materials used in dam construction. The use of mathematical models in the simulation of diverse hydraulic phenomena has become essential as a predictive tool in the evaluation of proposed engineering works to analyze the risk of disaster caused by dam failure or other hydraulic phenomena such as supercritical flow that has high impact and velocity, so the damage and losses caused by dam failure can be reduced. All hydraulic phenomena are naturally three-dimensional and unsteady, but computation involving assumptions of one-dimensionality or quasi-two dimensionality and/or steadiness have been successfully applied. A major disadvantage of Finite difference Method is that, when using a rectangular grid network, irregular physical boundaries must be treated using a "stair stepped" representation. A better representation of the physical boundary can be generation of a curvilinear coordinate system with coordinate lines coincident with the generally irregular physical boundaries. This paper present application of the Mac-Cormack scheme to solve the St Venant equations in generalized coordinates describing the depth-averaged, unsteady, sub and super-critical free-surface flows and hydraulic jumps. The calculated results are compared to experimental or analytical data. Comparisons with analytics as well as with other numerical solutions show that the proposed method is relatively accurate, fast, and reliable.

Keywords: *Dam Break, Supercritical flow, Mac-Cormack FCT Scheme, Saint-Venant Equation, Finite Difference Method*

EVALUATION OF STRUCTURAL MITIGATION EFFORT FOR FLOOD CONTROL IN RONGKONG RIVER

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One of the alternative flood structural mitigation planned for Rongkong River is the construction of embankments and river normalization. However, river normalization has a weakness where the widening of the cross section of the river can cause an increase in sedimentation. The purpose of this study is to examine the effectiveness of the planned flood control in reducing flood runoff using the flood overflow hydraulic model. Rongkong watershed was divided into 14 subwatershed to create a distributive model. Design rainfall was analyzed using frequency distribution analysis with GEV method at various return period. Flood discharge was analyzed using HEC-HMS software with the SCS and Snyder methods on the 20-year return period. Hydraulic modelling was analyzed using HEC-RAS 1D with unsteady flow condition under existing and design cross section. Based on the results of flood modeling with a flood discharge Q20 of 1,046.78 m3/s resulted in a flood reduction of 100% and an increase in the average flow velocity of 18% from 1.82 m/s to 2.14 m/s.

Keywords: *Flood Control, Normalization, Embankment, HEC-RAS, HEC-HMS*

THE EFFECT OF STAGING DEVELOPMENT STRUCTURAL FLOOD DESIGN ON SEDIMENT TRANSPORT PROCESS ALONG BRINGIN RIVER

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Floods that often occur make the government build a flood prevention embankment on the Bringin river, it is hoped that the embankment can prevent flooding to the maximum, in addition to the embankment, normalization of the Bringin river is also carried out by widening the river from 25-45 m, but it is important to note that widening the river has a positive impact. for the community but has a negative impact on the Bringin river itself, river widening can damage or disrupt the flow speed and slope of the riverbed. The slowing speed causes the fall velocity of sediment grains to reach the riverbed first before they can flow into the estuary, the HEC-RAS simulation results show that for 5 years the riverbed changes with sediment heights ranging from 0.12 to 1.10 m, besides that sedimentation can reduce effectiveness Bringin river embankment, simulation results show that for 5 years the capacity of the flood control embankment has decreased to 24%. while the simulation results for 10 years of sediment height ranged from 0.44 to 1.39 m with a reduced capacity of the flood control embankment by 31.83%.

Keywords: *Sedimentation, Bringin River, flood discharge, HEC-RAS, Downstream*

HYDROLOGICAL WATER BALANCE PROJECTION IN SEVERAL RESERVOIR CATCHMENT

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According to data from Badan Meteorologi, Klimatologi dan Geofisika (BMKG), Indonesia experienced changes in annual rainfall. Some areas of Indonesia experienced an increase in rainfall reaching 120 mm and other areas experienced decreasing. This condition certainly indicates a climate change will affect the availability of water around the location. The selection of the study location is the catchment area of the reservoir which has a large change in annual rainfall and the size of the reservoir and the benefits to the community. The analysis was carried out only by considering hydrometeorological parameters, rainfall and evapotranspiration. The projection data uses the CORDEX RCP 8.5 (2020-2045) and BMKG data (1999-2005). The results of the analysis show that the evapotranspiration value of the four catchment areas of the reservoir have a positive trend, with the highest increase in the Bili-bili catchment area in Maros reaching 4% in the rainy season and 3% in the dry season. This is influenced by the amount of sunshine duration above 10 hours. In contrast to evapotranspiration, the value of effective rainfall that occurs in the four catchment has a negative trend although it is not very significant. During the dry season, all location predicted there will be no runoff and no infiltration.

Keywords: *Evapotranspiration, CORDEX, projection*

STUDY OF THE EFFECTIVENESS OF BEKASI WEIR GATE OPENING TO CONTROL BEKASI RIVER MORPHOLOGY

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Bekasi River is located in urban areas with a significant flood problem at the downstream sections. The flood occurred because of the channel depth reducing the river's capacity as a result of sediment transport from the collapse of the embankment erosion. In the Bekasi River, Flood Control works, it is planned to build a parapet with a bored pile foundation. However, some parameters are not considered in the design, especially in the changes of channel depth by sediment transport. These parameters can affect changes in river morphology and the stability of the flood control structure, mainly at the outer bend of the river. Thus, this research examines the effect of sediment transport on changes in the morphology of the Bekasi River. The methods used include hydrological analysis, sediment sampling, hydraulics analysis, and sediment transport analysis. Several scenarios as a basis for interpreting existing conditions with several buildings across the river (e.g., Bridges and weir) and predicting changes in river morphology are conducted, and the validating data is used by comparing river cross-section data at the time of planning in 2015 with the results of the measurement of the implementation of the work in 2021. From the hydrological analysis, it was found that a discharge of 25-year return period was the basis for planning the embankment, daily discharge from rainfall-runoff analysis, and a 2-year return period as full bank capacity and the basis for calculating sediment transport. The results of the hydraulics analysis and sediment transport show a relation graph of the flow discharge and sediment discharge which estimate the amount of sediment accumulation in a certain segment as the basis for river maintenance. The distribution of potential erosion and sedimentation also can be represented how to handle sediment transport based on the production of the sediment transport processes.

Keywords: *Bekasi River, River Morphology, Sedimentation, River Maintainance*

R6-S4 Water Resources Engineering and Management

STUDY OF SEDIMENTATION BATU MERAH RIVER AMBON CITY

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The Batu Merah River is located in Ambon City, Maluku Province, where floods can occur almost every year and have the greatest flood impact compared to other areas in Ambon City. Sediment deposition on the riverbed causes river channel instability, cliff erosion and reduces river channel capacity which at any time can trigger flooding. Analysis and modeling were carried out in two conditions, namely before and after the sabo dam building with a design flood discharge of 25 years return period and daily field discharge for 5 years using HEC-RAS software with 1D modeling which aims to simulate flow patterns, sediment transport before and after after the existence of a sediment control building/sabo dam building. The simulation results obtained using HEC-RAS, in the existing conditions the highest degradation/erosion is 1.99 m with an average of 0.71 m and the highest sedimentation is 0.68 m with an average depth of 2: 0.31 m. In the condition of the building, the highest degradation/erosion is 1.99 m with an average of 0.91 m and the highest sedimentation is 0.90 m with an average depth of 0.21 m. In soil erosion analysis using USLE (Universal Soil Loss Equation) Batu Merah watershed, the erosion rate was 1,197 tons/ha/year with sediment production of 46,186 tons/year.

Keywords: *erosion, sedimentation, USLE, chekdam*

ANALYSIS OF SEDIMENT TRANSPORT ON RING NGOTOK CANAL'S MORPHOLOGICAL CHANGES

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Ring Ngotok Kanal (RNK) is long storage in the Brantas River Basin which is managed under the authority of the Brantas River Basin Organization. It is estimated built-in 1925, with a length of ± 27.2 km and an average width of 30 m, to catch and divert the flow of 8 (eight) tributary of the Brantas River, as well as protect the ± 10.000 ha floodplain of Brantas River which is dominated by agricultural areas and at the same time supplying irrigation water for the irrigation area. The canal in recent years has decreased in capacity, so that it overflows, and causes flooding in settlements around the canal. Identification of the main cause of the capacity degradation is caused by local morphological changes, mainly due to sedimentation along the canal. By using the USLE equation, the erosion rate value is 177.16 tons/ha/year (based on Suripin (2001) this erosion value was in the moderate category erosion hazard class) atau 17.715,8 ton/km2/year = 35.043,48 ton/day = 11,07 mm/year, watershed is classified as critical (the limit value tolerance of land erosion rate in the watershed is 3 mm/year). With a Sediment Delivery Ratio (SDR) of 0.32, the amount of sediment transport from land erosion in RNK is 10,513 tons/day. Based on the sediment inflow outflow contability analysis, the net sediment at the bottom of the canal is 20 cm/year which changes the morphology of the Ring Ngotok Kanal vertically. There is a horizontal morphological change (bend/meander) that needs to be handled. The results of the simulation of the HECRAS software for sediment transport obtained a net in the form of sediment qualitatively along the canal similar to the results of the calculation of sediment stability.

Keywords: *Sediment transport, River Morphology, Sediment Delivery Ratio*

EFFECT OF BARITO RIVER ON DRAINAGE PERFORMACE IN DADAHUP LOWLAND IRRIGATION AREA

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Food Estate is a presidential directive signaled by FAO to anticipate the potential threat of scarcity and world food crisis as a result of the global Covid-19 pandemic and strengthen national food reserves. The land area of 165,000 Hectares divided into 4 Blocks (Block A, Block B, Block C and Block D) will be used for the development of agricultural areas and food security as well as increasing agricultural productivity with technological and management advantages. The current condition of the infrastructure in the Food Estate area is not all in good condition and can serve all existing irrigation areas. Some of the problems that occur include the not yet optimal drainage performance at Dadahup Lowland Irrigation Area, Block A area. This area is influenced by the tides of the Barito River, when the tide occurs in the rainy season this area floods as high as 0.5 - 1.0 m for ± 2-3 months. The purpose of this study is to minimize flooding in the Dadahup Lowland Irrigation Area in high tides condition on the Barito River and during the rainy season by optimizing the existing drainage performance. Irrigation activities at Dadahup Lowland Irrigation Area are closely related to the condition and morphology of the Barito River. Dadahup Lowland Irrigation Area agricultural potential area is 21,226 Hectares and dominated by peatland. This study uses several data, including rainfall, river discharge, climatology, topography and digital elevation model (DEM), Barito River cross section, tides, land cover, cropping, and other supporting data. Drainage performance in Dadahup Lowland Irrigation Area is assessed through analysis and modeling. Hydrological analysis is conducted to obtain flood discharge which will be an input in hydraulic model by using Hec-RAS software. The output of this model is evaluated and further can be used to get recommendations whether the drainage can operate by gravity or requires a pump due to the influence of the Barito River water level.

Keywords: *Food Estate, Drainage Performance, Lowland Irrigation Area*

STUDY OF BARITO RIVER SUPPLY SYSTEM ON DADAHUP LOWLAND IRRIGATION IN CENTRAL KALIMANTAN FOOD ESTATE AREA

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The Dadahup Swamp Irrigation Area (DIR Dadahup) is a part of The Ex-Mega Rice Project Area (MRP) Block A which is one of the locations for the Food Estate Area in Kapuas Regency, Central Kalimantan. DIR Dadahup has a potential area of 21,226 hectares with the condition of the irrigation system in moderate to severe damage. The need for irrigation water to irrigate rice fields in tidal swamp land is supplied from the Barito River. The problem is that the tidal water level on agricultural land cannot be controlled so that most of the rice fields cannot be planted. The purpose of this study was to examine the pattern of river flow at the point of view and to determine the water level of the irrigation canal. Tidal analysis of the canal is carried out by making a model using software HEC-RAS 6.0 under main canal and secondary canal existing cross section. The canal water level data used are in the dry season and the wet season as a boundary. Based on the modeling results, 53% or 11,223 hectares of agricultural land cannot be irrigated by gravity, because the canal elevation is lower than the land elevation, namely in Block A1, A2, A4, A5, A6, A7, A8, and A9. To overcome these problems, a pump and a sluice gate are needed that are able to regulate the water supply of the Barito River that enters from the inlet point of the DIR Dadahup.

Keywords: *Lowland Irrigation, Food Estate, Barito River*

THE GROUNDSILL EFFECTIVENESS ON THE SEDIMENT DISTRIBUTION ALONG CIPAMINGKIS RIVER IN BOGOR REGENCY, WEST JAWA

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The degradation of Cipamingkis River in Bogor Regency that occurs in the downstream of New Cipamingkis Weir is a main problem that potentially cause damage to the infrastructure built on it. In addition, the excavated materials like sand is used for the construction of physical infrastructure. River sand mining can cause a decrease in the riverbed which results in damage to public infrastructure. One of the preventive ways to control decreasing elevation of the riverbed is the construction of groundsills. This study analyzes the distribution of sediment along Cipamingkis river before and after the groundsill construction and the effect of sand mining on riverbed changes, using MIKE 11 software with discharge data, river topography and river bed grain gradation as the inputs. The simulation shows that without groundsill, the length of the degraded river, aggradation, and the transition area are about 5 km, 3.5 km, and 1.5 km, respectively. After the simulation with two groundsills built downstream of the Cipamingkis Weir, it can be seen that all are changed; the degradation, aggradation, as well as transition area becoming 1.5 km, 3 km, and 1 km. Therefore, It is recommended that the sand mining site is done in the Jonggol Cariu Bridge along 4 km downstream. Sediment transport simulations based on recommended location and capacity of new sand mining site show that the average of riverbed degradation is 0.8 m and 0.6 m.

Keywords: *sediment, degradation, aggradation, river sand mining*

MORPHOLOGICAL STUDY OF THE TUNTANG RIVER ON DESIGN FLOODS Q2 AND Q50 IN GROBOGAN AND DEMAK REGENCIES

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The Tuntang River is located in the Jratunseluna River Region in Central Java Province. At this time the morphological conditions of the river have been experiencing degradation and degradation. Aggradation is caused by the large amount of soil granular material carried by the river flow due to the landslide of the existing embankment. The degradation is caused by the erosion of the riverbed in the upstream. The purpose of this study is to examine the parameters of river morphology changes in conditions before and after normalization for the 2-year return period (Q2) and 50-year return period (Q50) design flood discharge with models using the analysis method HEC-RAS 1D software for quasi unsteady flow. In the HEC-RAS 1D quasi unsteady modeling Q2 and Q50 the geometry is used from terrestrial measurements with boundary condition types in the upstream form of flow hydrograph with actual unit hydrograph and boundary sediment with rating curve, boundary condition types downstream in the form of stage hydrograph of tides, and bed gradation grain size as many as 15 points spread from upstream to downstream. On the results of the simulation analysis of river morphology during Q2 of 259.50 m3/s after normalization there was a decrease in the average flow velocity (V) from 0.97 m/s to 0.86 m/s by 11.57%, an increase the average channel bed slope (S) from 0.000385 m/m to 0.000427 m/m by 10.91%, the increase in the average channel bed shear stress (τ) from 2.02 pa to 2.36 pa by 16.65%, the maximum decrease in the height of the aggradation from 2.04 m to 0.68 m by 66.78%, and the maximum depth of degradation by 2.00 m. On the results of the simulation analysis of river morphology at the time of Q50 of 259.50 m3/s after normalization there was a decrease in the average flow velocity (V) from 1.28 m/s to 1.17 m/s of 8.46%, an increase in the average channel bed slope (S) from 0.000346 m/m to 0.000491 m/m by 12.48%, the increase in the average channel bed shear stress (τ) from 3.25 pa to 4.33 pa by 33.27%, the maximum decrease in the height of the degradation from 4.37 m to 3.95 m by 9.50%, and the maximum depth of degradation of 2.00 m.

Keywords: *River Morphology, Tuntang River, Design Flood, Normalization, HEC-RAS*

R1-S5 Disaster and Resilient Infrastructure and Earthquake

THE CHALLENGES OF IMPLEMENTING GREEN FACTORS IN URBAN GREENING SCHEMES IN INDONESIA

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Recently, new planning tools have emerged to support urban landscape planners in achieving sustainability through optimizing the urban greening scheme. Some cities have approved the green factor tool to increase the quantity and quality of urban green spaces. This greening scheme is considered suitable for a relatively dense city where challenging to provide adequate urban green spaces. This short communication challenges the usefulness of the green factor tool and how it relates to the existing urban green space planning procedures through a qualitative case study in Jakarta, Indonesia. The result shows that while the green factor tool performs well, improvements could be made primarily in convincing stakeholders regarding the new paradigm in calculating green areas in relatively dense urban areas. Furthermore, trials in actual cases need to be carried out to examine the effectiveness of the formula. Regarding the usefulness of this tool, we conclude that while increasing the number of green areas, improving its quality is more necessary to build resilient infrastructures.

Keywords: *Green space, Green factor, Urban landscape, Greening scheme*

UTILIZATION OF DREDGED MUD IN LAND RECLAMATION: A COMPARISON STUDY OF SEVERAL SOIL IMPROVEMENT METHODS

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Utilization of dredged mud in land reclamation will become more applicable in the future due to the increase of the need for space and the rising cost of granular fill materials. Dredged mud mainly consists of soft clay and has very low bearing capacity and high compressibility. Therefore, soil improvement is urgently required. In this paper, the effectiveness of using dredged mud as the fill material in land reclamation was analyzed for a case study of land reclamation. The performance of several soil improvement methods in using such reclamation material was calculated and compared. The soil improvement methods considered in this study were prefabricated vertical drain (PVD) with vacuum preloading, cement mixed dredged mud, and rigid inclusion. The load transfer mechanism in each method was analyzed using analytical and numerical methods. In addition, an elementary cost analysis was performed to compare the cost of the methods based on Indonesian prices. It was found that for the considered case study, cement mixing achieved the highest bearing capacity with the shortest time but with the highest cost. For the same increase in bearing capacity, PVD with vacuum preloading provided the lowest cost. This study provides a preliminary step towards the implementation of effective soil improvement for land reclamation in Indonesia.

Keywords: *dredged mud, prefabricated vertical drain (PVD), rigid inclusion, soil-cement mixed, soil improvement, vacuum preloading*

DETERMINATION OF REFLECTED TEMPERATURE IN ACTIVE THERMOGRAPHY MEASUREMENTS FOR CORROSION QUANTIFICATION OF REINFORCED CONCRETE ELEMENTS

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This paper summarises the results of an analysis of the thermocouples mounting at warming phase on reinforced concrete so the temperature can be applied as a Trefl value. The results of the study will be used as a reference for testing reinforced concrete corrosion by thermography method. Laboratory temperature distribution testing methods, value analysis and location Trefl are explained in this paper. The value and position of Trefl are affected by the distance between the heat source and the test objects. To study the effects of heat source magnitude variations on concrete surface temperature, the heat source is used as two halogen lamps of 500 watts each fitted at a distance of 30-50 cm. Noises appearing during testing of thermography are corrected with the point of measuring Trefl and are explained in this paper. The concrete surface temperature results of quantitative image processing method are compared to the experimental test results. The results showed good accuracy, which was seen from most errors <3% and the maximum error is <5%.

Keywords: *reflected temperature, room temperature distribution, quantitative analysis*

BEHAVIOR AND DESIGN OF REINFORCED CONCRETE WALKING COLUMNS

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This research is focused on finite element analysis on reinforced concrete walking columns structure. Walking columns with three span-to-depth ratios (aspect ratios) are tested. The aspect ratio of 1:9 is taken to represent the slender walking columns. For medium aspect ratio of 1:4 is used. Meanwhile aspect ratio of 1:1 is adopted for squat walking columns. All walking columns models are designed in accordance with ACI 318-19 strut-and-tie method. This method is taken into consideration since it is widely used for deep beam design and walking column serves a similar function as deep beam as a shear transfer element. The finite element analysis shows that strut-and-tie method provides conservative design result for all aspect ratios.

Keywords: *walking column, strut-and-tie, aspect ratio, axial capacity, finite element analysis*

LATERAL MOVEMENTS OF AN UNSTABLE SLOPE BEFORE AND AFTER REINFORCEMENT BY TWO ROWS OF BORED PILES – A CASE STUDY IN EAST KALIMANTAN INDONESIA BY NUMERICAL MODELING

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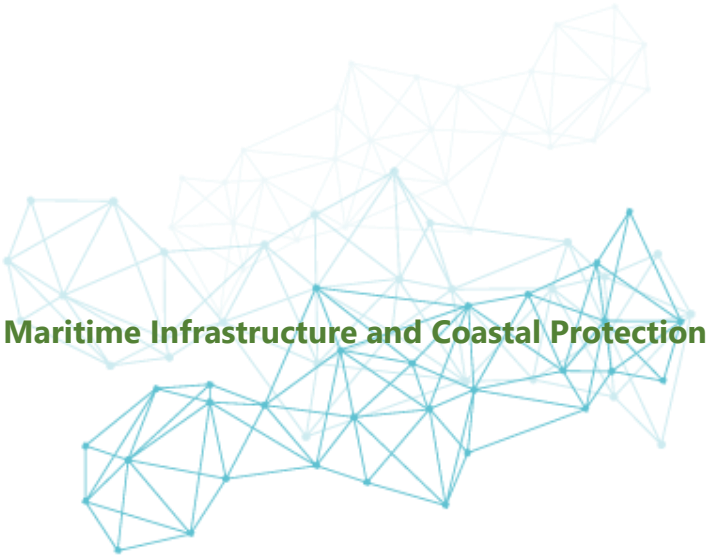
This paper discusses the behaviors of an unstable slope in Kalimantan Indonesia, before and after installation of reinforcement by two rows of bored piles. Horizontal movements were noticed several months after completion of construction on a pile slab structure built on clays with fairly steep slope conditions. An instrumentation system of an inclinometer was installed following the noticed movement, the to monitor lateral movements of the embankment. Data from the installed inclinometer shows that slow movement had occurred continuously and had caused the pile slab structure to move. For a quick mitigation, a group of bored piles were selected to reinforce the slopes. To study the behaviors, a finite element modeling was performed. A Professional software called PLAXIS was utilized. To model the field conditions, the back analysis method was performed to study the condition and to refine parameters obtained from field soil investigation. The modeling's were carried out using peak and residual soil parameters. The results were next compared with the movement behavior of the movement monitored by the installed inclinometer. The selected soil parameters were the ones that matched the most the behavior of the inclinometer monitoring results. Next, an analysis of the deformation behavior that occurs due to the reinforcement of the soil and its slab structure was carried out. Furthermore, the results will be compared with the results of monitoring using an inclinometer, so that the treatment carried out was verified. This study found that the selected reinforcement system can effectively stabilize the unstable slope. This study also found, the selected numerical model could capture the behaviors of the unstable slopes (deformation and failure plane) and could predict the behaviors of reinforced slopes.

Keywords: *Slope Stability, Reinforcement, inclinometer, mitigation, residual, bored pile, PLAXIS, prediction lateral movement by modelling*



R2-S5 Maritime Infrastructure and Coastal Protection

PARTICIPATORY-BASED MAPPING AS AN APPROACH FOR MARINE AND COASTAL COMMUNITY IN PROTECTING AND STRENGTHENING THEIR AQUATIC CULTURE AND ECOSYSTEM

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The Indonesian government in 2014 stated that coastal and small island natural resources are protected, conserved, and managed together by local government and local communities to take an active role toward, to support the livelihood of its communities. This is such an outstanding step that will benefit the local community towards its local wisdom and culture in protecting their marine and coastal area. This paper elaborates the methodology in conducting the participatory mapping in the coastal area and its importance for the local communities. Regarding the local community-based management, one of the obstacles that occur in its local community is the way to identifying its managed potential area. To overcome the problem, the local community needs to be able to map their potential resources and local wisdom in managing it. This is program-based action research aims to prove that the participatory mapping conducted by the local communities in the small island such as Binongko is one of the effective approaches to support and strengthen the marine and coastal area, as well as their local wisdom.

Keywords: *Participatory Mapping, Small Island, Marine Ecosystem*

ROLE OF NON-ORTHOGONAL HYDRODYNAMIC AND SEDIMENTATION MODEL FOR PORT FACILITIES ANALYSIS ON INDONESIAN HUB PORT

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The port-channel and the availability of piers are strongly influenced by physical environmental conditions such as sea current, sea tide, sediment transport, and wave. The best size of vessel and pier length depend on the demand and sea environment in the location. The uncertainty of these environmental factors results in the low efficiency of port infrastructure, the load factor for back cargo, and the reliability level of port users. This paper presents the role of MuHydro3D and MuSed3D software, which are 3-dimensional hydrodynamic and sedimentation models to determine the best size of vessel. Using a non-orthogonal curvilinear coordinate technique, also known as the boundary-fitted technique, MuHydro3D and MuSed3D can accurately and quickly simulate the environmental conditions at port. Knowledge of environmental conditions is expected to be an accurate basis in determining the depth and dredging duration, pier length, ship size, or the need of breakwater. Port of Kuala Tanjung is one of Indonesia designated international hub port and was chosen as the case study in this paper. The result shown that the sedimentation rate of dredging for a vessel which has up to 3,000 TEUs capacity is not too sensitive. Moreover, a vessel design with an approximate capacity of 3,000 TEUs is the optimum size from the pier length aspect.

Keywords: *MuHydro, MuSed, Port Facilities, Hub Port, Tol Laut*

COASTAL PROTECTION SYSTEM DESIGN AT THE INDONESIAN MANGROVE CENTER IN PEKALONGAN, CENTRAL JAVA – INDONESIA

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The Pekalongan area suffered from coastal flooding and heavy coastal erosion due to land subsidence and increasing wave condition in the last decade. Pekalongan government built a land dike in 2018 to protect Pekalongan city from coastal flooding. The purpose of this study is to determine a suitable coastal protection system, consists of hard structure and mangroves, to solve erosion problem at Pekalongan coast, specifically at the location of the Pekalongan Mangrove Information Centre (PIM). Environmental data, i.e., wind, wave, current, tidal, sediment, and soil data, were obtained by field survey and secondary data collection from open-source data. The selection of coastal protection design concepts was performed by comparing several alternatives of structure materials. Coastal protection layout was obtained based on a numerical sediment transport model result using Delft3D software. From environmental data processing and analysis with various design aspects, the top elevation of coastal protection structure is +4.5 m MSL. The form of the mangrove planting media consists of 'guludan' with dimension 10 m x 5 m x 4 m.

Keywords: *PIM Pekalongan, Coastal Protection, Numerical Modeling, Groin, Guludan*

THE EFFECT OF DADAP PORT STRUCTURE IN INDRAMAYU ON COASTAL MORPHOLOGY

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Human activities in this coastal area will generally lead to a greater rate of erosion and tidal flooding due to the loss of natural protection in the form of mangrove forests or inappropriate construction of structures in coastal areas. Dadap Beach, located in Juntinyuat District, Indramayu Regency, West Java Province is one of the locations experiencing problems above. In 2003, a Fishing Port (PPI) was built on Dadap Beach, with a structure that jutted 200 m from the shoreline, connected to the mainland by trestles supported by piles structure with a 1.5 m spacing to prevent sedimentation. However, currently there has been a massive sediment deposition in the port pool and the trestle structure area behind the port. In addition, in recent years after the existence of the port structure, the rate of coastal erosion around the port area is increasing and threatens the rice fields and settlements in the coastal area. This study aims to determine the sedimentation pattern that occurs in PPI Dadap, Juntinyuat District, Indramayu Regency, and the influence of the port structure on changes in the coast morphology of the surrounding area, using a numerical model simulation. The results of this study indicate that the presence of the port structure has caused wave diffraction that forms a circulation flow behind the port structure and around the entrance area to the port pool. The current circulation in the area behind the harbor structure causes sediment to settle which in the long term will lead to the formation of a button. In the port pool the sedimentation that occurs comes from the circulation flow around the port entrance area so that the sediment carried from the longshore currents and local scour around the port breakwater enters the port pool area. Furthermore, the existence of Dadap port structure causes the obstruction of longshore currents so that the supply of sediment to the area around the port is reduced and the erosion rate is increasing.

Keywords: *coastal erosion, sedimentation, numerical model, delft3d*

INFLUENCE OF RANDOM VARIABLE ON RELIABILITY INDEX OF BRACED MONOPOD PLATFORM BASED ON FATIGUE ANALYSIS IN MADURA NORTH JAVA SEA

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This paper carried out fatigue reliability analysis on braced monopod structure located in Madura North Java Sea to find the most suitable fatigue performance function so better service life prediction of each structure's components can be done by testing the influence of some load random variable. Fatigue reliability analysis is a local analysis therefore analysis will be conducted only on four critical joints. Reliability analysis is done on several performance function using First Order Reliability Method (FORM). The load random variables which will be tested are yearly fatigue damage, local and global stress analysis, and S-N curve parameter. Randomness of fatigue damage is obtained by running fatigue analysis using only one year wave data for 59-year SEAFINE wave data. Fatigue damage from analysis will be divided by safety factor and service life to obtain yearly fatigue damage. Reliability index from several performance functions show S-N curve parameter hardly influence the result of reliability analysis. Therefore, fatigue reliability analysis will only include yearly fatigue damage and local and global stress analysis as load random variable. Reliability index of four critical joint which are 301L, 303L, 203L, and 201L respectively are 1.24, 1.30, 1.30, and 1.30.

Keywords: *braced monopod, fatigue analysis, reliability analysis, reliability index*

R3-S5 Environmental Management

POLLUTANT INDEX METHOD IN ANALYZING THE WATER QUALITY OF THE CIMETA RIVER, WEST BANDUNG REGENCY

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The Cimeta River is a tributary of the Citarum River in West Bandung Regency, where at the outlet the river directly enters the Citarum River. The pollution of the Citarum River has harmed the health of the people living around the water body. Various diseases are suffered by people living in watersheds (DAS) such as nervous system disorders due to heavy metals, skin diseases, and infections. The Cimeta River Basin covers 29 villages, based on the number of villages that are passed will affect the increase in domestic land use along with the increase in population which can lead to an increase in domestic waste generated, to reduce the quality of the Cimeta River, thus water pollution caused in the Cimeta River will accumulate in the Citarum River. The purpose of this study was to analyze the water quality of the Cimeta River and determine its water quality using the Pollutant Index method. The results of the study are initial data to determine efforts to control pollution of the Cimeta and Citarum rivers. Based on the results of research, the quality of the Cimeta River is categorized as heavily polluted in the upstream, middle, and downstream parts. Of the 18 parameters measured are pH, Temperature, TDS, TSS, BOD, COD, DO, Nitrite, Nitrate, Cyanide, Sulfide, Phosphate, Free Chlorine, Oil and Fat, Phenol, Detergent as MBAS, Total Coliform, and Fecal Coliform, 8 parameters do not meet quality standards based on Government Regulation Number 22 of 2021 concerning the implementation of environmental protection and management. Parameters that do not meet quality standards are TSS, BOD5, COD, Nitrite, Free Chlorine, Detergents such as MBAS, and Sulfide. The highest Cimeta River Pollutant Index is in the middle part, which is 14,097, the two downstream parts are 13,266, and the last part is 12,834 upstream. Based on the results of the study, it is necessary to control water pollution by determining the sector that contributes the most dominantly to the pollution that occurs in this river.

Keywords: *Cimeta, Pollutant Index, West Bandung Regency*

ECONOMIC VALUATION AND POTENTIAL POLLUTION LOAD ANALYSIS OF DOMESTIC WASTEWATER IN GREATER BANDUNG

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Sanitation is still a major problem in most developing countries. The lack of awareness and low education level are the main factors causing 30% of people to still practice open defecation. The problems are getting worse because of the population growth. They are not followed by the availability of sanitation infrastructure and services, leading to people mostly still discharging their domestic wastewater into the river. According to the Ministry of Environment and Forestry (2017), domestic waste water contributes significantly to Citarum River's pollution by 68. From the calculation of domestic waste pollution estimation potential and analysis using SFD tools, the people in Greater Bandung produced 292 tons of BOD/day (106.580,25 ton/year), 401,5 tons of COD/day (131.101 ton/year), and 277,4 tons of TSS/day (101.251 ton/year). Ironically only 10,54% of the waste generated are safely managed, and 89,46% of the rest are unsafely managed. Pollution can cause several problems, including health and some more economic loss. The financial loss of the people of MBR is IDR 4.234.059.114.465/year or IDR 461.543/person/year. The economic loss from the health sector is responsible for about 29% of the total cost, it cost IDR 1.217.720.640.356/year or Rp 148.016/person/year. This is followed by clean water access cost for IDR 3.054.566.638.642/year or IDR 371.289/person/year (71%). This cost is equivalence to 1,3% of the Gross Domestic Product (GDP) of the people in the Metropolitan Bandung Area.

Keywords: *Greater Bandung Area, domestic wastewater, economic loss*

IMPACT ANALYSIS FROM VISUAL IMPROVEMENT PROGRAM OF SLUMS TO SANITATION MANAGEMENT: CASE STUDY KAMPUNG CIBUNUT, BANDUNG CITY, INDONESIA

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Visual improvement of slum settlements in urban areas is a new breakthrough to increase public awareness of sanitation management; a capital to foster community participation and ensure the sustainability of implemented sanitation program. This study aims to identify the factors and relationships between visual improvement with behaviors related to domestic wastewater management. The sampling technique used in this research is cluster random sampling. A sample size of 86 households was obtained using the Yamane formula with a confidence interval of 10%, a population of 369 households, and a cluster technique proportional to size. Based on the correlation test of the Spearman method, it was found that visual improvement is the main path to form perceived behavioral control in domestic wastewater treatment (ρ 0.842, p-value <0.05). However, perceived behavioral control has a negative correlation to the community's intention (ρ -0.297, p-value <0.05) and behavior (ρ -0.243, p-value <0.05) in treating domestic wastewater. Visual improvement is the main path for forming perceived behavior control in financing domestic wastewater management (ρ 0.912, p-value <0.05). However, perceived behavior control has no correlation with the public's intention (p-value <0.05) and behavior (p-value <0.05) in paying the cost of domestic wastewater management.

Keywords: *domestic wastewater management, sanitation, slum settlement, theory of planned behavior, visual improvement*

R4-S5 Water and Wasterwater Engineering and Management

A MASS BALANCE OF MICROPLASTICS DURING THE PROCESS OF BIOFILM REACTOR

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A microplastics mass balance was established on a continuous biofilm reactor during the process over a period of 53 days. The aim of this study seeks to expand the knowledge of the dynamic of microplastics inside biofilm reactors by applying a mass balance approach to investigate their occurrence and fate. A 91,5 L continuous laboratory-scaled reactor consists of four compartments, anoxic-1, anoxic-2, aerob, and sedimentation. It was fed with raw domestic wastewater from a residential scale of wastewater treatment plant in Bandung, Indonesia. In order to established a mass balance of microplastics at biofilm reactor, it is crucial to considered into account at all treatment step. The results showed that the abundance of microplastics inside the reactor was generated by sludge, bio-carrier and effluent. The microplastics was retained 15,56 – 59,01% in the sludge. The remaining was found in the biofilm 13,83 – 15,06 % and the effluent 1,23%. Microplastics less than 500 µm in size, fiber and fragment were detected most frequently in the samples. The results of this study comprise useful tools to obtain in-depth knowledge of microplastics in different kinds of wastewater treatment process

Keywords: *aerob, anoxic, biofilm, microplastics, wastewater treatment*

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REMOVAL OF SULPHATE AND HEAVY METALS FROM ACID MINE DRAINAGE USING PERMEABLE REACTIVE BARRIER TECHNIQUE

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Containing sulphates and heavy metals, acid mine drainage (AMD) should be managed strategically to mitigate and control the migration of the contaminants to the downstream area. Conventional treatment techniques such as using lime to increase pH levels and metal precipitation or using imported material are usually inefficient and unsustainable. The AMD treatment investigated in this study uses the permeable reactive barrier (PRB) technique to enhance bacterial sulphate reduction and metal sulphide precipitation. The AMD treated is seepage water from industrial mining waste rock dump. This study aims to calculate the removal efficiency percentage of reactive materials to reduce contaminants in a batch test. Reactive materials used were organic waste generated locally i.e. domestic sewage sludge (SE), municipal compost (CO), cocopeat (CP), and the inorganic waste material is fly ash (FA) from a coal-firing power plant. A batch test was conducted in 56 days in an anaerobic chamber using nitrogen gas to support an anaerobic environment during subsampling. Mine water used in this test has a low pH level of 3.2; no alkalinity (as CaCO3), high sulphate 3280 mg/L, and heavy metal concentrations of Fe 46 mg/l; Al 54 mg/L; Cu 2.3 mg/L; dan Zn 3.4 mg/L. The test result at day 56 from using individual reactive material shows increased pH levels to 6.9; 5.6; 3.7; and 11.6 for sewage (SE), compost (CO), cocopeat (CP), and fly ash (FA), respectively. Alkalinity was increased to 1450 mg/L (SE), 323 mg/L (FA), 15 mg/L (CO), 1 mg/L for CP. The highest sulphate removal was measured in 85% from the addition of FA. Sulphate removed from organics material reactor was 52% by (SE), 17% by (CO), 20% by (CP). The removal efficiency of dissolved metals (Cu, Zn, Al, Cd, Co, Mn, Ni, Fe) from each reactor was: 81-100% for SE, 13-100% for CO, 0-100% for CP, 99-100% for FA. Oxidation-Reduction Potential (ORP) was measured to determine reducing conditions. ORP's were measured at -551 mv, 255 mv, 156 mv, and -113 mv for SE, CO, CP and FA respectively. SE has the potential to remove metals and favour reducing conditions for sulphide precipitation at medium pH levels. Meanwhile, metal precipitation from the addition of FA is mainly due to hydroxide precipitation at high pH levels. FA was able to decrease the most sulphate due to ion adsorption.

Keywords: *Acid Mine Drainage, Permeable Reactive Barrier, Organic Materials Waste, Flyash*

BIOLOGICAL OXYGEN DEMAND (BOD) SIMULATION IN SUNTER RIVER USING MUQUAL 3D NON ORTHOGONAL WATER QUALITY TRANSPORT MODEL

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Water pollution problem in Jakarta has been going on for long time. The existence of some rivers which are not directly connected to upstream, in tidal area able to speed up the occurrence of water pollution, and slowing circulation of polluted waste that affects water quality in river-estuary. Since 2010 after Kanal Banjir Timur (KBT) operated, Sunter river streamflow was devided by KBT, changes flowrate and water quality pattern. Main channel at study area of Sunter river segment around 17 km covers Duren Sawit, Pulo Gadung, Kelapa Gading, Plumpang, Rawa Badak, and Tanjung Priok, has average waste load 624 mg/L, and simulated in 2 scenarios to compare correlation of BOD with flowrate configuration 5 m3/dt, and 100 m3/dt (for 1 hours as influence of raining condition).

MuQual3D possible to obtain an accurate water pollution load modelling with surface layer and bottom layer water quality parameters, including contour profile describe water pollution effect will be effective and efficient guidence to solve the complexity water quality problems along Sunter river-estuary. According modelling result the effect of salinity will gradually reduce BOD concentration, and existence permanent construction around estuary like breakwater, and port will also replace radius range of pollutant distribution concentrations to west and east side and also increase time of decomposition in waters, especially in low flowrate condition from Sunter river.

Keywords: *water quality, BOD, MuQual3D*

R5-S5 Water Resources Engineering and Management

THE INFLUENCE OF SEDIMENTATION TO THE MORFOLOGY CHANGE OF SERANG RIVER ESTUARY AT THE NATIONAL STRATEGIC AREA YOGYAKARTA INTERNATIONAL AIRPORT (KSN YIA)

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The New Yogyakarta International Airport is located in the National Strategic Area of Temon District, Kulon Progo Regency, Yogyakarta Special Region Province. This area is geologically a lowlands area flanked by Bogowonto River and Serang River that cause annual floods during rainy season. That's why a flood control system is developed to ensure the performance of that new airport. Meanwhile, the establishment of the Nasional Strategic Area has generated land use change of its surrounding area that may also has an influence on the morphology change of both rivers that would influence the performance of that flood control system. The morphological changes of both rivers have been identified based on visual field observations, interviews with local residents and sediment sampling at several points from the river channel to the river mouth. Based on this observation It is obviously seen that increasing sedimentation rate is the most important parameter that may cause not only the morphology changes of both rivers but also backwater generation from the river mouth to the flood control outlet of the new airpot. The effect of that morphological changes at Serang river estuary has been studied base matematical models using DELFT3D Software, the sedimentation in Serang river estuary has been simulated with some scenarios including the west monsoon and east monsoon. The modeling results show that the thickness of sedimentation in the Serang estuary under existing conditions is 3.5 m in the west monsoon with an area of 0.063 Ha and 4.0 m in the east monsoon with an area of 0.437 Ha.

Keywords: *Sedimentation, Morphology, River Estuary*

STUDY OF CISANGKUY RIVER FLOOD AND SEDIMENTATION

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In 2020, the Cisangkuy Floodway has operated with the main function of parsing flood discharge from the Cisangkuy River. With the distribution of the discharge, the old Cisangkuy river has changed from its natural condition. Therefore, it is necessary to study the analysis of the river's carrying capacity and changes in the riverbed that occurred with the construction of the Cisangkuy Floodway. The results of the flood model, with a 5-year return flood discharge, in the lower reaches of the Cisangkuy River, there is still flooding in the downstream for a length of 3.55 km. The simulation results of the sedimentation model, after the existence of the Cisangkuy FW using daily discharge data for 2020 for 1 year, show that the sedimentation of the riverbed in the upstream has decreased due to some sediment entering the Cisangkuy Floodway. In the middle, the degradation that occurs is reduced and in the downstream part, the degradation occurs first and then is degraded. The simulation results with the flood discharge compared to the average discharge in a year, it can be seen that the flood discharge erodes more due to the higher shear stress. Simulation results in the presence of embankments downstream of the Cisangkuy River, resulted in one section of the Cisangkuy river being more degraded.

Keywords: *agradation, degradation, river bed*

THE EFFECT OF COASTAL DIKE AND RETENTION POND PERFORMANCE ON FLOOD AND TIDAL CONTROL IN PEKALONGAN

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Pekalongan is one of the areas located in the north of Java Island. The main problem in Pekalongan is tidal flooding, where seawater enters the mainland at high tide. Tidal flooding in Pekalongan has occurred for years and has inundated residential areas, public facilities, and economic areas. This tidal flood worsens when there is a high discharge in the river. For this reason, the government built a coastal dike and a retention pond to overcome these problems. The concept of this system is to create a coastal dike that crosses the river to eliminate tidal effects. The retention pond is located along the coastal dike to accommodate the discharge from the river, then the water will be pumped downstream of the river and will flow into the sea. This study simulates flooding in the coastal area of Pekalongan to see the effect of the construction of coastal dike and retention ponds. This study aims to obtain pump operating time for each pump built in this system to reduce the flood elevation of Q25 to an elevation of – 0.5 m in the retention pond. This study also saw the pump's operating time after adding the Mrican pump and the valve door on the Mrican. The methodology used in this study is flood modeling with the HEC-RAS 6.0 model. This research shows that the pump operating time for the Silempeng and Sengkarang pumps is 150 hours. After the addition of the Mrican pump, the operational time of the Silempeng pump, the Sengkarang pump, and the Mrican pump was 49 hours. After adding the Mrican valve door, the operating time for each pump became 36 hours.

Keywords: *Tidal flood, coastal dike, retention pond*

STUDY OF FLOOD RISK ASSESSMENT ON BANYUMAS AND CILACAP DISTRICT IN DOWNSTREAM SERAYU RIVER BASIN, INDONESIA

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Floods due to the Downstream Serayu River overflow inundate agricultural land and houses in parts of Banyumas and Cilacap district every year. Based on the classification of flood hazard level referring to MLIT (Ministry of Land, Infrastructure, and Transport) Japan, the level of flood hazard is high. The objective of this study is to develop a flood risk map by using GIS to overlay flood hazard map and vulnerability map. Flood hazard assessment uses HEC-RAS 5.0.6 two-dimensional model which is verified with field observation data. The river discharge is obtained from hydrological calculations while the tidal component is obtained from the calculation using MATLAB-LP Tides BIG. River geometry uses river cross-section from field measurement data for hydraulic modeling combined with MERIT DEM as its banks. Vulnerability assessment uses the parameters of population density, land use, drainage density, slope, and landform, refer to a 2014 study from the Ministry of Public Work and Housing (PUPR) Indonesia. The result for a 50-year return period of flood shows that the sum of the area with high flood risk in the Downstream Serayu River Basin is 23.79 km2. The highest flood risk is located in the Maos sub-district.

Keywords: *flood risk, downstream serayu river, HEC-RAS 2D, GIS, MERIT DEM, MATLAB-LP Tides BIG*

R6-S5 Water Resources Engineering and Management

CORRELATION BETWEEN RAINFALL, FLOW RATE AND PHOSPHATE TOWARDS COLIFORM BACTERIA IN THE WAY SEKAMPUNG RIVER, LAMPUNG

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The Way Sekampung River is a source of drinking water for the people of Lampung. However, the activities of residents around the Way Sekampung River include agricultural land and houses that produce sewage, for example, feces and phosphate. Disposal of feces in surface water presents risks if the community consumes the water. The amount of phosphate in water bodies usually comes from fertilizer runoff from agriculture, human and animal waste, but when the amount of phosphate is high, it leads to very large algae growth and leads to lack of light and when the algae die, the bacteria break them down with the help of dissolved oxygen in the water. River flow can affect the presence of coliform bacteria in the water and the phosphate, then river flow influence by rainfall. Today rainfall can change because of climate change. This study aims to conduct research on whether there is a correlation between in rainfall changes, flow rate, phosphate towards coliform bacteria that affect the water quality in the Way Sekampung river, Lampung. Purposive sampling technique is used to select the location of the sampling points based on the uses of the surrounding land. The number of coliform bacteria is estimated by the most probable number method. Rainfall data is obtained by month from the Meteorology and Geophysics Agency. Data analysis using statistics to determine the correlation between these variables. The conclusion of this study is at the first location to the last location there is a relationship between rainfall, water flow velocity and coliform bacteria. however, for phosphate, it does not show the relationship between Coliform bacteria.

Keywords: *Rainfall, Flow rate, Phosphate, Coliform Bacteria, River*

STUDY OF LOJI RIVER BED CHANGE IN PEKALONGAN CITY

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Uncontrolled changes in river due to erosion and sedimentation will eventually reduce the capacity of the river and the sustainability of infrastructures along the river. Therefore, it is essential to understand the bed change pattern to unravel the mechanism of sediment transport in the river. Previous studies on Loji River in Pekalongan City are mainly related to flood control and have not elaborated on the river morphology. This study is aimed to analyze the riverbed change based on riverbed comparison and long-term prediction to provide insight into the river morphological problem, in order to reduce the impact of erosion and sedimentation. The riverbed data used for comparison is of 2018 and 2021, within 5 km from downstream. The long-term sediment transport simulation is conducted using HEC-RAS for eight years period. The results revealed that within 2018 to 2021 the erosion and sedimentation occur in the river, consisting of a maximum of 1.43 m thick deposition and -1.22 m of erosion from the initial bed. Long-term simulation results indicated that there is significant reduction of river capacity. Thus, future research direction is proposed to reduce the impacts of aggradation and degradation for the more resilient river infrastructures.

Keywords: *river morphology, erosion, sedimentation*

FLOOD MODELLING ON THE DADAP RIVER AND ESTUARY, BANTEN PROVINCE

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Dadap River is located in Kosambi, Tanggerang, which often experiences flooding in the estuary. The problem of flooding is caused by the lack of rivers capacity and estuaries caused by sedimentation and tidal conditions. The flooding caused damage to city infrastructure and paralyzed the activities of the affected residents. The Dadap River was normalized in 2012 to overcome the flooding problems. This study aims to determine the capacity of rivers and estuaries and as an alternative solution for flood management. Simulations were carried out in conditions before and after normalization and with alternative embankment elevations. Flood modeling using the HEC-RAS 1D unsteady flow. Boundary conditions in the upstream using flood discharge with a 50 and 100 yr return period and downstream using HHWL elevation and wave height. The analysis results show that the capacity of the Dadap River before normalization was not able to accommodate flood discharge at the 50 and 100 yr return period. After normalization, the water surface elevation may decrease by 24-29%. However, there is still flooding downstream due to the tides, so raising the embankment elevation of +3.5 m.

Keywords: *Dadap River, Estuary, Flood, Normalization, HEC-RAS*

RIVER MORPHOLOGICAL STUDY OF DOWNSTREAM PANEKI RIVER IN PALU WATERSHED FOLLOWING THE EARTHQUAKE AND LIQUEFACTION DISASTER AT CENTRAL SULAWESI

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An earthquake that struck Central Sulawesi Province in 2018 triggered liquefaction in several locations such as Jono Oge village where the middle stream of Paneki River flows. Liquefaction caused the Paneki River wash in the densely populated settlement became narrower and shallower due to "flowing" material. In response, the Ministry of Public Works and Housing initiates River Improvement and Sediment Control in Paneki River project. The implementation of this project will affect the river's behaviour, especially its morphological aspects. Therefore, a study of the discharge capacity and morphological analysis due to said project is needed. The study is conducted using numerical model simulation to obtain the river discharge capacity and river morphological changes in form of bed changes. The model simulation result shows the maximum discharge capacity of Paneki river is 259.81m3/s, also the bed upstream and downstream of the river degrade, with consolidation dam - 1 (CD-1) stabilized the river bed upstream of the dam to 2740 m relative to the river outlet. Stabilization due to the position of CD - 2 could be described using the following equation of y = -1018 ln(x)+7208.1, the average degradation of the downstream area could be described with y = 0.017(x^0.6701).

Keywords: *Aggradation, degradation, river morphology*

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