UNTAR
Universitas Tarumanagara

2023 ICCIM

Accepted papers will be published in Scopus indexed Proceeding
Scopus

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THE THIRD INTERNATIONAL CONFERENCE of Construction, Infrastructure, and Materials

CIVIL ENGINEERING FOR A LIVEABLE ENVIRONMENT

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

27 JULY 2023

CALL FOR PAPER

Topics:

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

Important Dates

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

Conference Fee

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

Registration Link
https://bit.ly/ConferenceRegistrationICCIM2023

Distinguished Keynote Speaker

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

Keynote Speakers

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

Wikke Novalia, Ph.D.
Monash University, Australia

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

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

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27 JULY 2023

THE THIRD

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

2023 ICCIM

PROGRAM BOOK

Program Studi Teknik Sipil
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Program Book

THE THIRD INTERNATIONAL CONFERENCE of Construction, Infrastructure, and Materials

Civil Engineering
for a Liveable Environment

27 July 2023

Universitas Tarumanagara

Jakarta – Indonesia

The Third
International Conference
of Construction, Infrastructure, and Materials

Contents

Forewords by Rector of Universitas Tarumanagara

Distinguished Guests, Colleagues, Ladies, and Gentlemen

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

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

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

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

Forewords by Rector of Universitas Tarumanagara

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

Rector of Universitas Tarumanagara

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

Forewords by Civil Engineering Program

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

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

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

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

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

Head of Civil Engineering Undergraduate Program

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

Forewords by Conference Chair

Dear Distinguished Speakers, Guests, and Colleagues,

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

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

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

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

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

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

Forewords by Conference Chair

Jakarta, 27 July 2023

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

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7.	Parallel Session	:	Ir. Aniek Prihatiningsih, M.M. Dr. Mega Waty, S.T., M.T.
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General Information & Guidelines

Onsite Registration Counter

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

Registration Hours

27 July 2023, 07:20 – 07:55

Conference Badge

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

Coffee Breaks

27 July 2023

09:40 – 09:55, M Building 8th Floor

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

Lunch

27 July 2023, 11:50 – 13:00

Lunch buffet will be served at M Building 7th Floor

E-Certificate

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

Liability

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

General Information & Guidelines

For Parallel Session Presenters

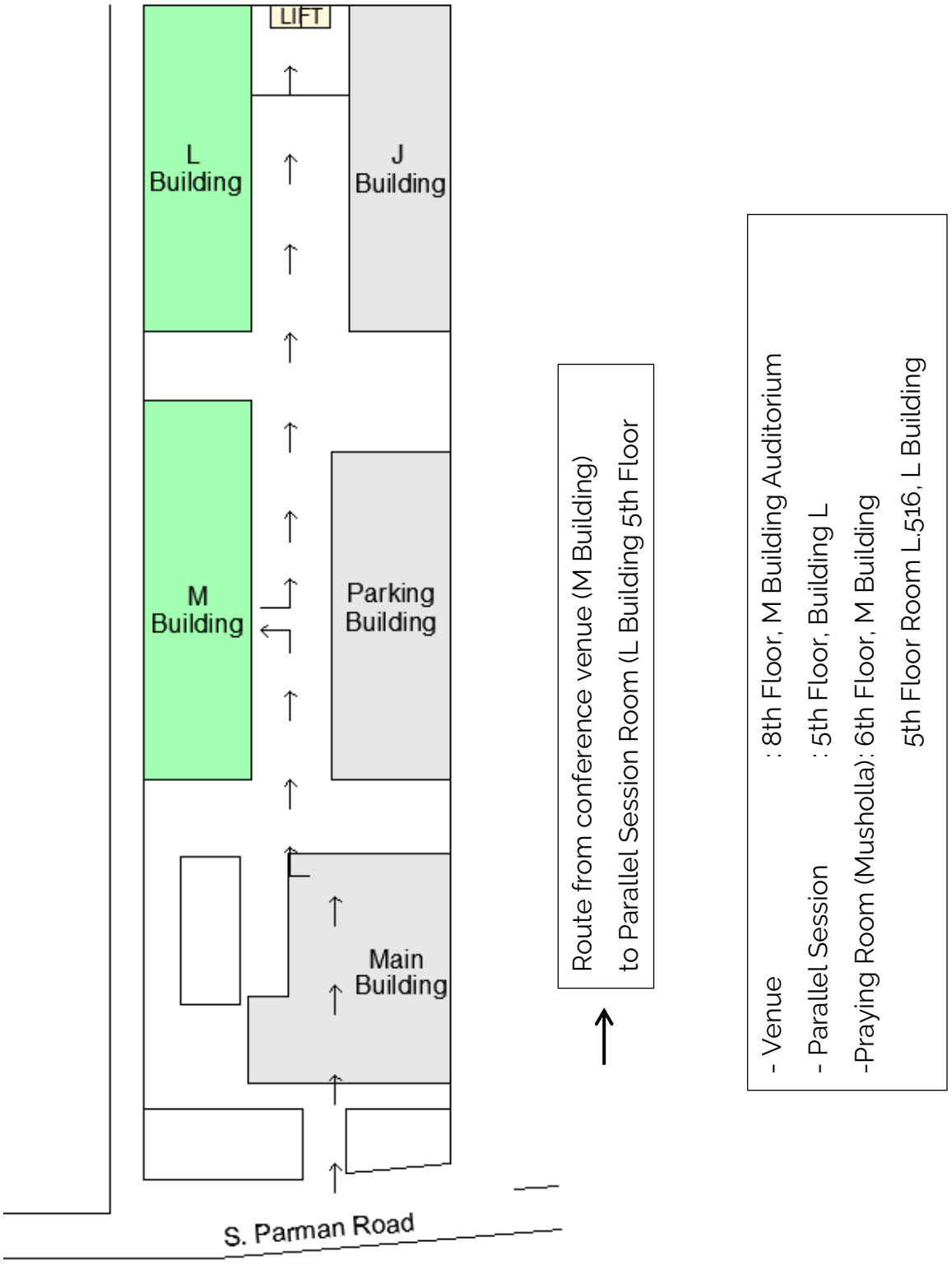
1) You are required to submit your final presentation materials through this online form: https://bit.ly/PresentationICCIM2023 starting from July 26th at 12.00 pm until July 27th at 10.30 pm. Alternatively, you could also share your presentation files at the Parallel Session Room by 12.50 pm on July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

ICCIM 2023 Conference At a Glance

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

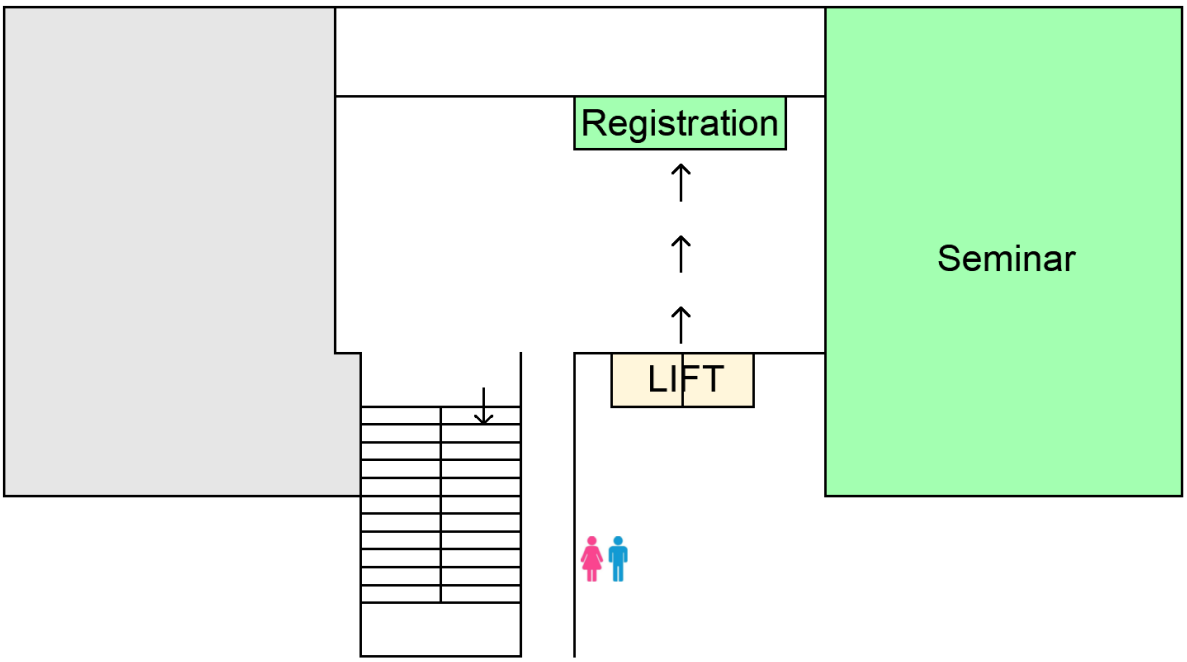
ICCIM Conference Venue

Ground Level Plan View



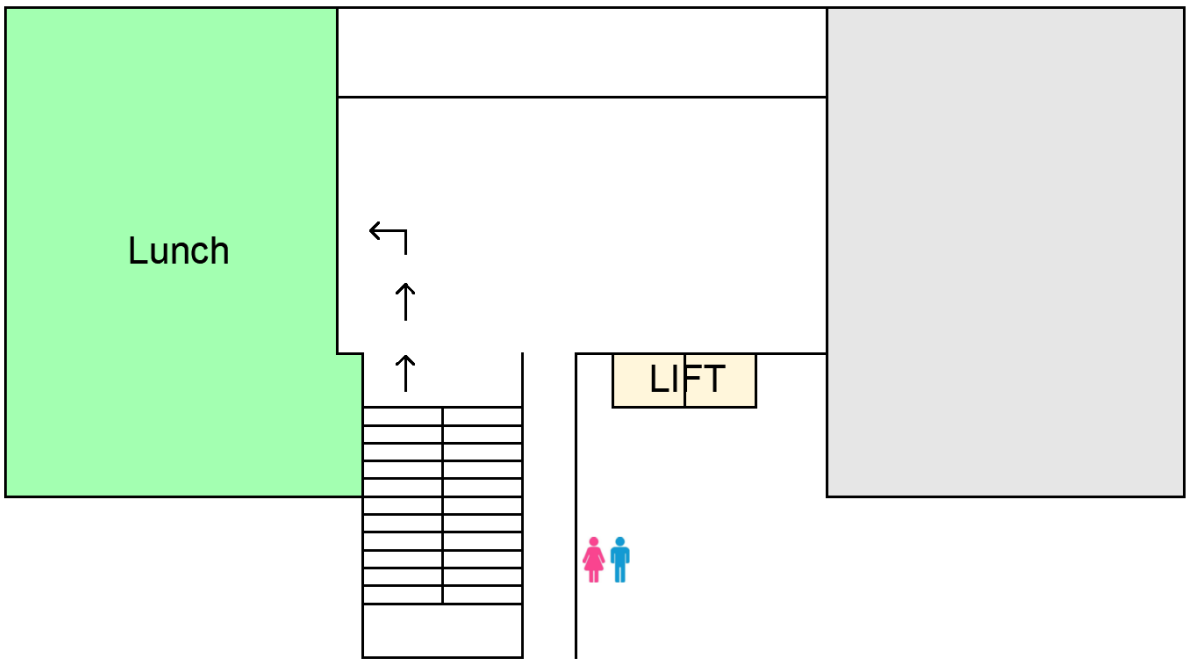
Conference Venue

8th Floor, M Building

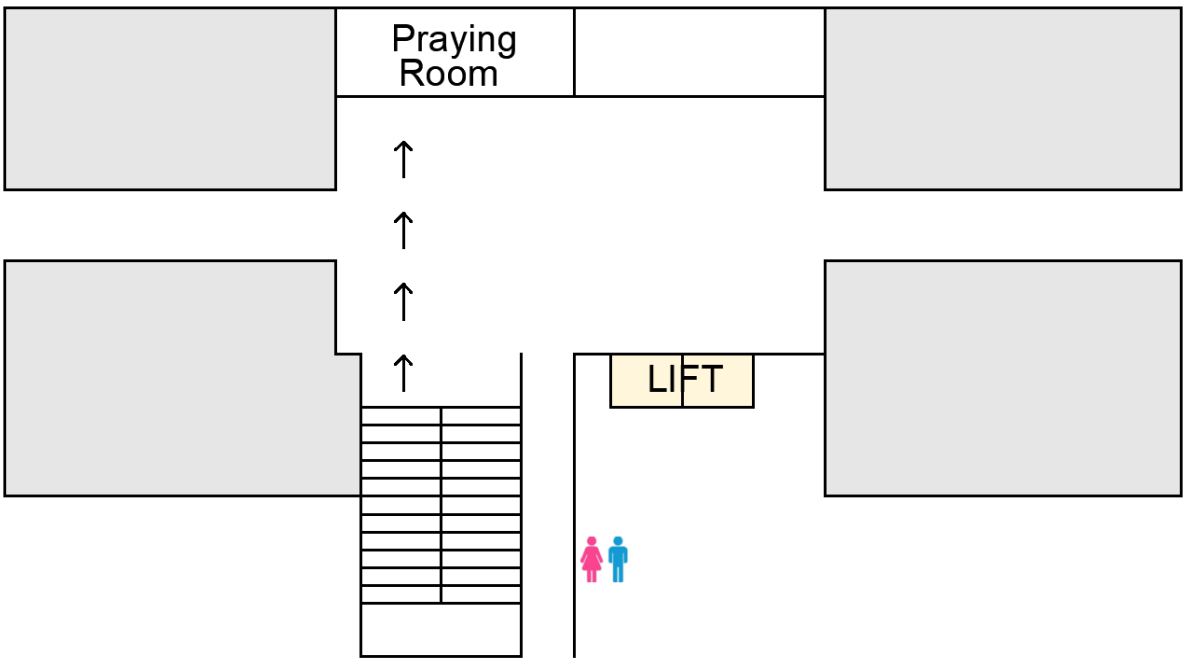


ICCIM Conference Venue

7th Floor, M Building

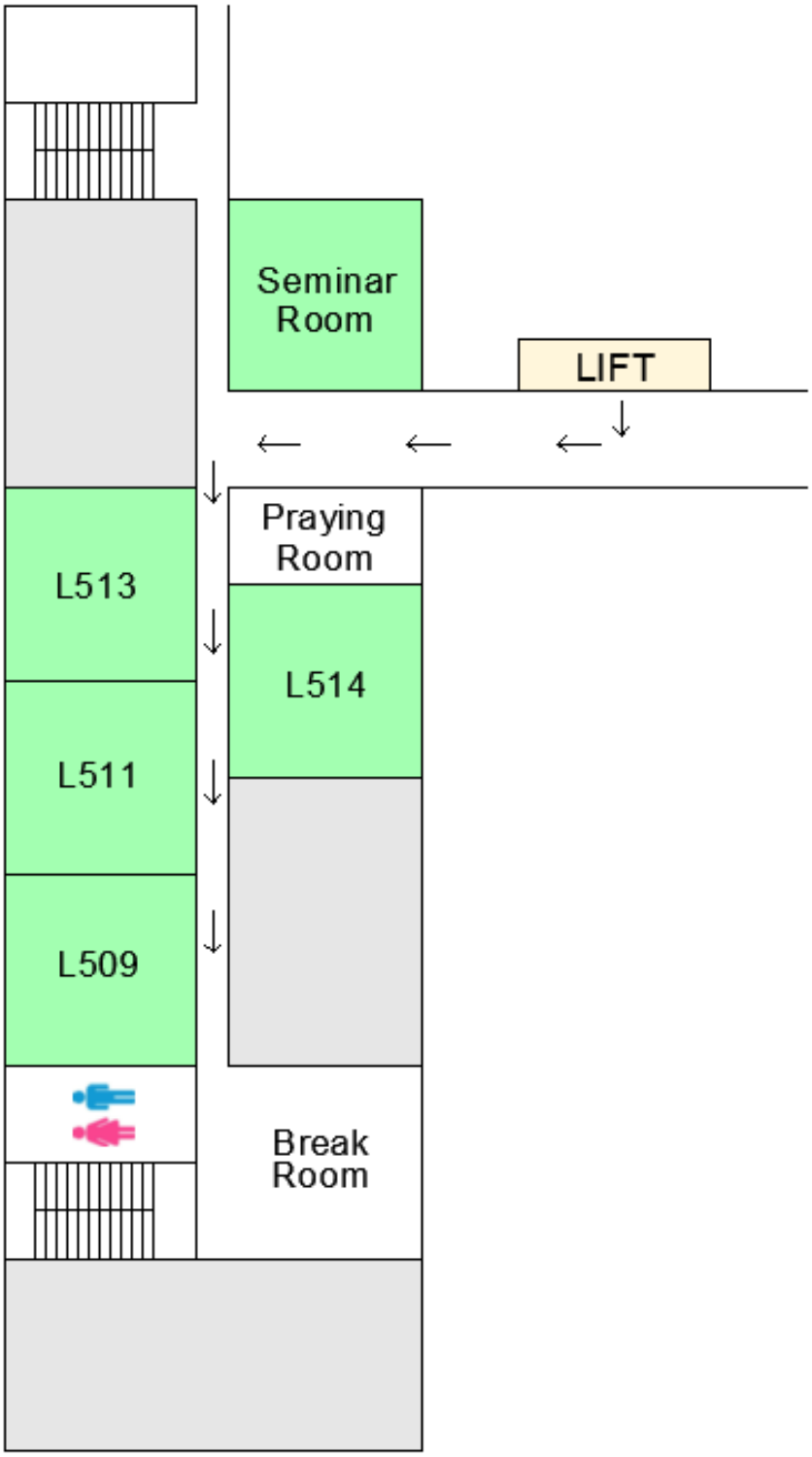


6th Floor, M Building



ICCIM Conference Venue

5th Floor, L Building



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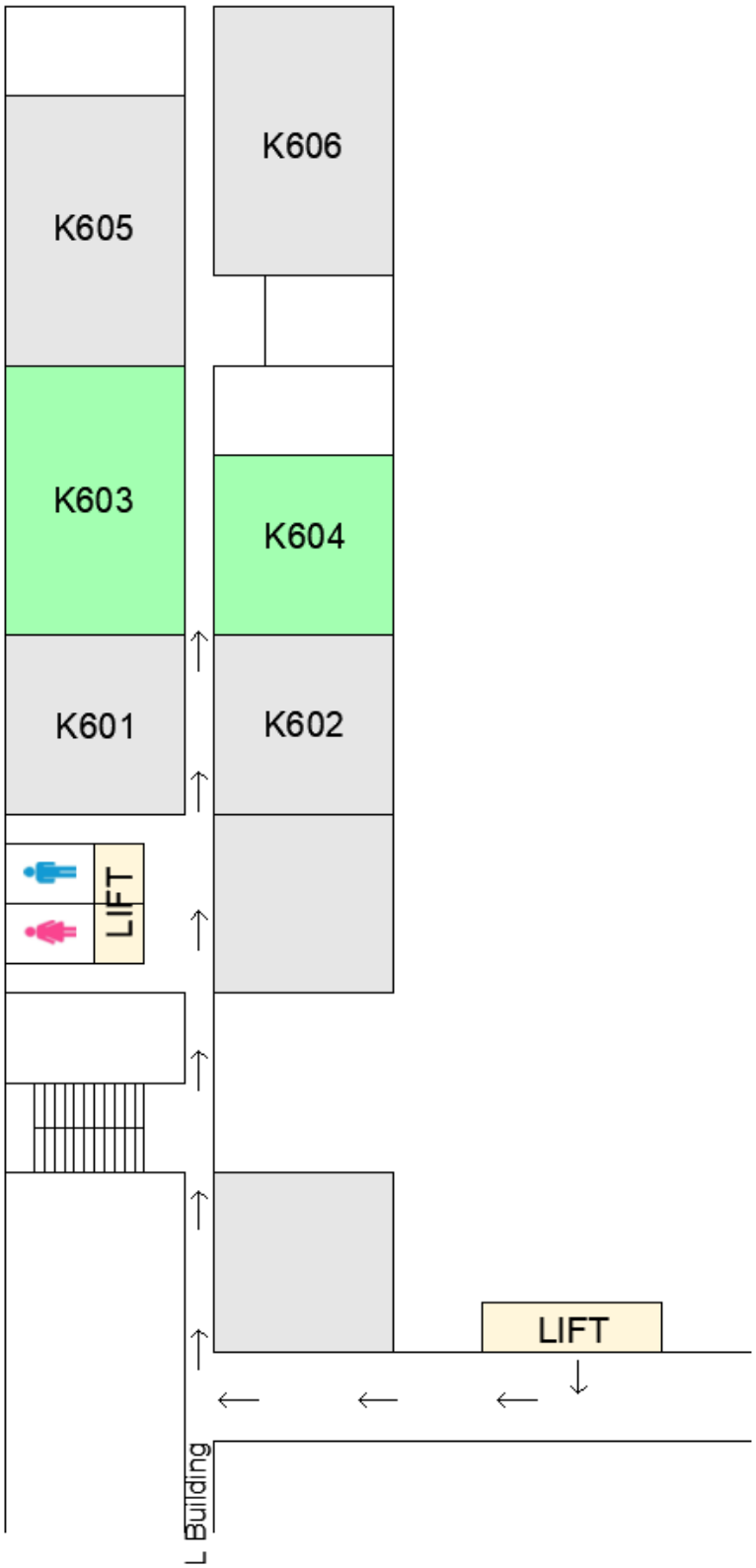
6th Floor, Building K



Parallel Session Schedule: Geotechnical & Earth Sciences (A)

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

Room : L514

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

Parallel Session Schedule: Geotechnical & Earth Sciences (B)

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

Room : L513

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

Parallel Session Schedule: Geotechnical & Earth Sciences (C)

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

Room : **L514**

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

Parallel Session Schedule: Structural Engineering & Materials (A)

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

Room : **L509**

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

Parallel Session Schedule: Structural Engineering & Materials (B)

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

Room : L511

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

Parallel Session Schedule: Structural Engineering & Materials (C)

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

Room : **L509**

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

Parallel Session Schedule: Structural Engineering & Materials (D)

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

Room : **L511**

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

Parallel Session Schedule: Sustainable Transportation Systems (A)

Time : **13.00 - 15.00**

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

Room : **Seminar**

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

Parallel Session Schedule: Sustainable Transportation Systems (B)

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

Room : Seminar

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

Parallel Session Schedule: Hydrological & Environmental Engineering

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

Room : K604

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

Parallel Session Schedule: Green-Construction Management

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

Room : K603

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

Keynote Speakers Profile

Prof. Dawn E. Lehman

University of Washington, USA

Education:

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

Research interest:

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

Li Hai-Ting, Ph.D.

Shanghai Jiao Tong University, China

Education:

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

Research interest:

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

Keynote Speakers Profile

Wikke Novalia, Ph.D.

Monash University, Australia

Education:

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

Research interest:

Environmental governance, urban transformation, infrastructure planning, sustainability transitions

H.R. Pasindu, Ph.D.

University of Moratuwa, Sri Lanka

Education:

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

Research interest:

Pavement management, Low volume roads, Road safety

Keynote Speakers Profile

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

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

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

Examining meandering stream by using geomorphological characteristics with GIS-based analysis

Robby Yussac Tallar[1*], *Olga Catherina* Pattipawaej[1], *Asriwiyanti* Desiani[1], *Yonathan Adi* Saputra[1], *Gerard Christian* Joelin[1] and *Andre Sebastian* Lehman[1]

[1]Civil Engineering Department, Universitas Kristen Maranatha, Jl. Prof.drg.Soeria Soemantri No. 65 Bandung, Indonesia

Abstract. An assessment of the meandering stream type using its classification system to geomorphology characteristics combined with GIS-based analysis is presented in this paper. It describes geomorphology characteristics consisting of 8 parameters with GIS-based analysis that differ in the zone of sediment position, stream width, stream sinuosity, amplitude, wavelength, bend sharpness, meander pattern, and slope. The selected case study in this paper is the Barito Stream, South Kalimantan, Indonesia. Based on the results, the variability varied in all the geomorphology characteristics except bend sharpness and slope. The transport zone is the longest zone with classified as a very wide river with moderate sinuosity and high amplitude (< 1500). It is also categorized as a moderate wavelength and sharp bend with a relatively shallow slope. This approach is a simple, appropriate, and easy-to-use practice in examining meandering stream since there is no data or lack of supporting field data. The implementation of this meandering stream classification method is suitable for stream restoration projects, fish habitat enhancement, and water resource management. Further research is the study of possible geomorphic responses of a channel to natural and anthropogenic disturbances including channel-bed degradation, channel-bed aggradation, channel widening, and channel straightening.

1 Introduction

Meandering streams are one of the most ubiquitous patterns in fluvial morphology [1]. Previous research revealed that the uniqueness and applicative importance of these nearly regular loops in river planimetry have attracted the interest of several researchers in fluid mechanics and morpho-dynamics [2], geomorphology [3-4], river engineering [5], riparian ecology [6-7], and ecological engineering [8-9]. The stream processes itself is directed by fluid velocity and morphodynamical processes, which cause lateral bank erosion and the constant migration of meanders, as well as by intermittent cutoffs that prevent self-intersections of the stream and create sudden reductions in stream length and sinuosity [8]. The variability of large natural streams characteristics is proof that some variables controlled the stream's type or stream's pattern.

Geographic Information System (GIS)-based model and analysis have become quite common for collecting and processing secondary data in many water-subject purposes including watershed and stream management [10-11]. However, few efforts have been dedicated to develop meandering stream classification method regarding water stream management. It is clear that basic stream information is needed to make stakeholder's decisions. However, comprehensive field sampling over many streams in large study areas can be too costly in time and labor. Thus, geographic information system (GIS)-based models and analysis that can synthesize multiple characteristics have become particularly valuable in streams where stream assessments have not been completed or are difficult to perform. Therefore, the main purpose of this study is to examine meandering stream type using its classification system to geomorphological characteristics combined with GIS-based analysis.

2 Methodology

In fact, lack of stream classifications was focused on meandering type. Therefore, previous research [10] tried to develop the conceptual model for classification of meandering streams. This study is the extension research by using geomorphology characteristics with GIS-based analysis in certain study area. The process study was investigated 8 parameters in zone of sediment position: stream width, stream sinuosity, amplitude, wavelength, bend sharpness, meander pattern, and slope.

2.1 Study area

The Barito Stream is one of the most important streams in South Kalimantan, Indonesia, with coordinate location 3°19′11.53″S 114°35′26.7″E and total length 1090 km with a drainage basin of 81,675 km2 also its tributaries flow across various geomorphology characteristics. Barito Stream is also the largest and

*Corresponding author: robbyyussac@yahoo.com, robby.yt@eng.maranatha.edu

second longest stream in South Kalimantan, Indonesia (Fig. 1). It originates in the Muller Mountain Range, from where it flows southward into the Java Sea with the average discharge is 5,497 m^3/s. Its most central affluent is the Martapura Stream, and it passes through Banjarmasin City. The stream flows in the southeast area of Kalimantan with predominantly tropical rainforest climate. The annual average temperature is 24 °C and the average annual rainfall is 2,735 mm.

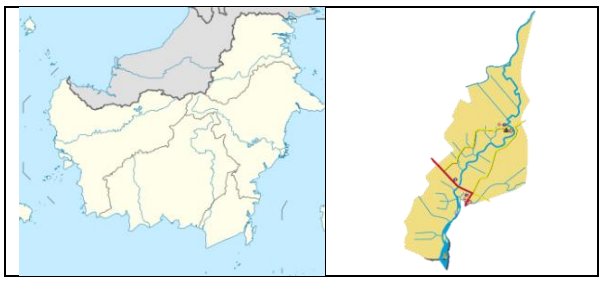


Fig. 1. Location of study area.

2.2 Method and analysis

This study was investigated and analysed 8 parameters:

1. Zone of sediment positions

   At first, Barito Stream was divided by three zone of sediment positions: zone of deposition, zone of transport and zone of production, By using google-earth combined with ArcGIS software, the length of zone of sediment can be measured and defined considering the slope of stream. For the zone of deposition the slope is slightly meanwhile for the zone of production the slope is very steep. The results can be seen on Table 1 and Fig. 2.

Table 1. Zone of deposition.

Zone of Sediment	Length
Zone of deposition	141330 m
Zone of transport	453868 m
Zone of production	144255 m

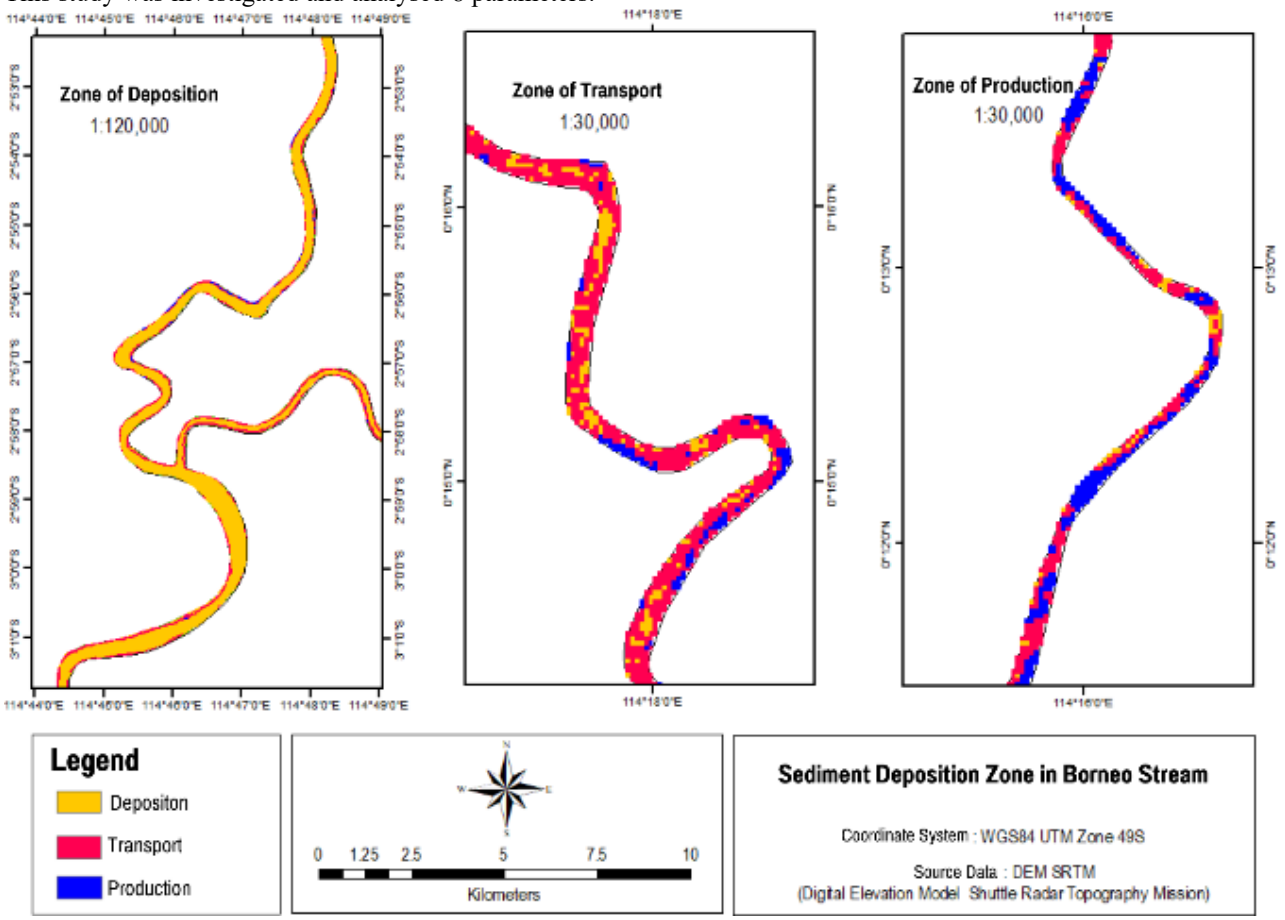


Fig. 2. Classification of sediment deposition.

2. Stream width

   The type of river can be classified by its width. For the large river, the width should be more than 220 m. Moreover, previous research classified the stream's width > 10 m as a large stream. Therefore, the classification is shown in Table 2.

3. Stream sinuosity

   Sinuosity is the result of the stream naturally dissipating its flow forces. According to previous research, meandering streams have a sinuosity larger than 1.25. Therefore, the classification is shown in Table 3.

Table 2. Stream width classification.

Types of Streams	Range of width (m)
Very Large Stream	>300
Large Stream	100 – 300
Middle Stream	50 – 100
Small Stream	<50

Table 3. Stream sinuosity classification.

Types of Streams	Range of sinuosity (m)
Very highly meandering	>2
Highly meandering	1.5 – 2
Moderate meandering	1.25 – 1.5
Low meandering	<1.25

4. Amplitude

   The maximum distance from the down-valley axis to the sinuous axis of a loop is the meander width or amplitude. The developed classification can be seen in Table 4.

Table 4. Stream amplitude classification.

Types of Streams	Range of Amplitude (m)
Very highly amplitude	>2000
Highly amplitude	1500-2000
Moderate amplitude	1000-1500
Low amplitude	<1000

5. Wavelength

   According to previous study, a meander consists of a pair of opposing loops, but in common practice also a single river bend is often called “meander”. In this study a meander is a single river bend. The distance of one meander along the down valley axis is the meander length or wavelength. The classification can be seen on Table 5.

6. Bend sharpness

   The bend sharpness (γ) is represented by the ratio of river width to radius of curvature of the river centerline. The classification can be seen on Table 6.

Table 5. Stream wavelength classification.

Types of Streams	Range of Wavelength (m)
Long meandering	>5000
Moderate meandering	2000 – 5000
Short meandering	<2000

Table 6. Stream bend sharpness classification.

Types of Streams	Range of Bend sharpness (m)
Sharp meandering	>0.5
;.cModerate meandering	0.1 – 0.5
Mild meandering	<0.1

7. Meander pattern

   A variety of river changes are listed under pattern change (Fig. 3). In meander changes, meander enlarges if its amplitude and width increase. Meander shift involves the displacement of the meander in a downstream direction.

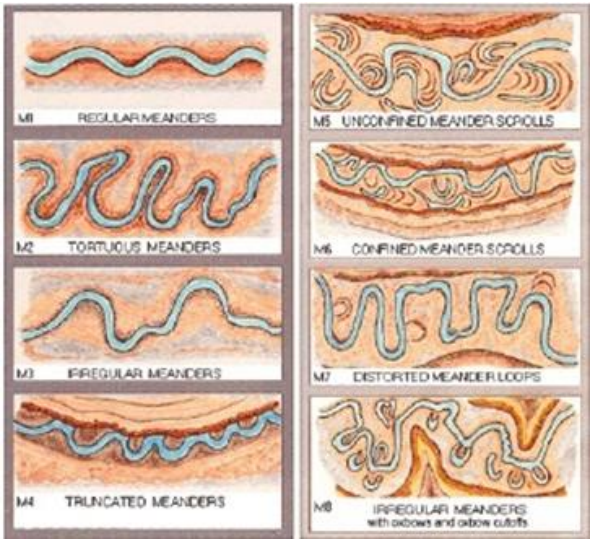


Fig. 3. Classification of meander pattern.

8. Slope

   Slope can be calculated from the elevation and the length of each reach of stream. The classification can be seen on Table 7.

3 Results and discussions

The selected parameters (stream width, stream sinuosity, amplitude, wavelength, bend sharpness, meander pattern, and slope) have been assessed by using

GIS. The comprehensive results can be seen in Tables 8-13 and Fig. 4-10.

Table 7. Stream slope classification.

Types of Streams	Range of Slope
Steep	> 0.05
Moderate	0.01 – 0.05
Shallow	<0.01

Table 8. Results of stream width.

Zone of Sediment	Range of width (m)	Types of Streams
Zone of deposition	481	Very Large Stream
Zone of transport	354	Very Large Stream
Zone of production	203	Large Stream

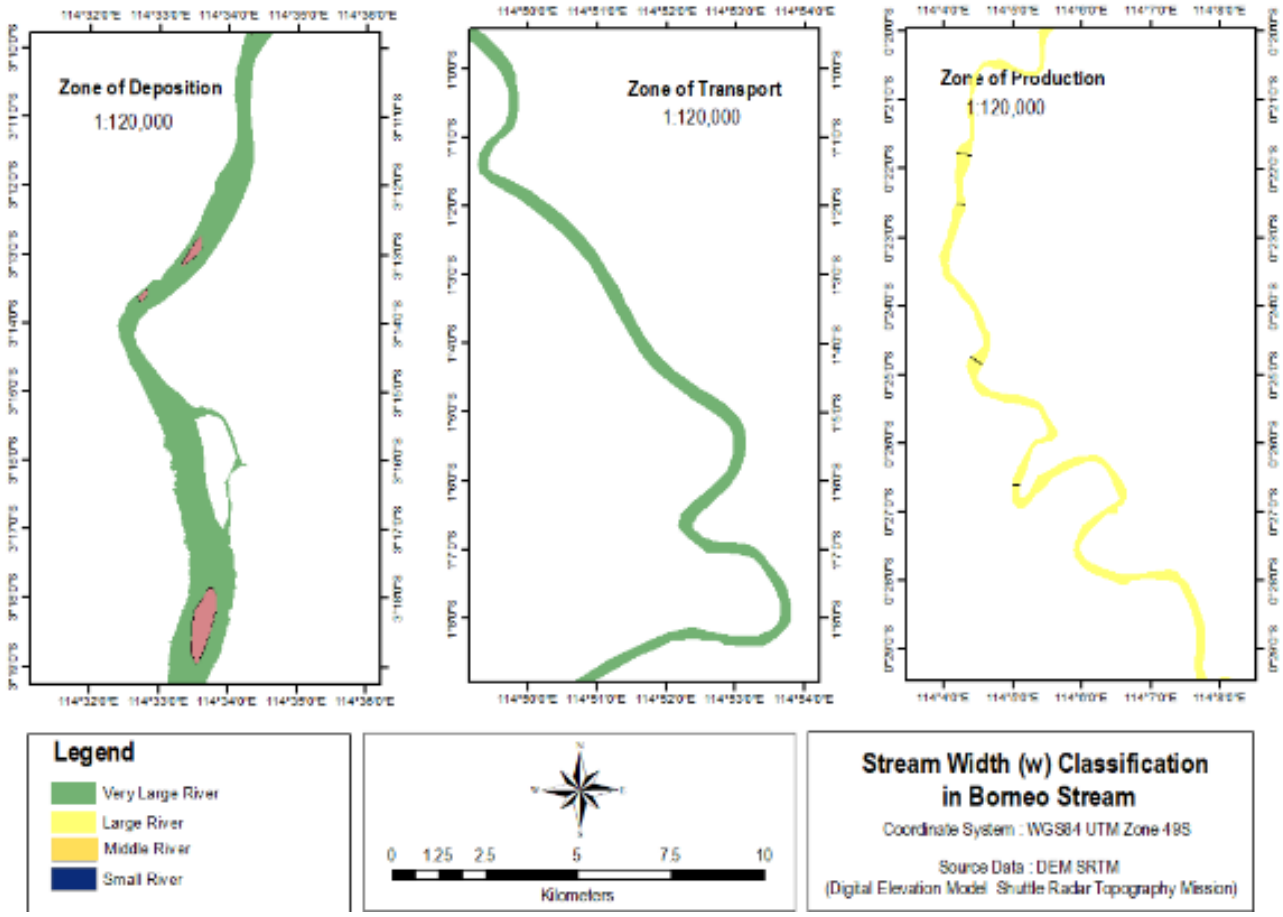


Fig. 4. Classification of stream width

Table 9. Results of stream sinuosity.

Zone of Sediment	Range of sinousity (m)	Types of Streams
Zone of deposition	1.21	Low
Zone of transport	1.46	Moderate
Zone of production	1,54	High

Table 10. Results of stream amplitude.

Zone of Sediment	Range of amplitude (m)	Types of Streams
Zone of deposition	1509	Highly Amplitude
Zone of transport	1632	High Amplitude
Zone of production	1610	High Amplitude

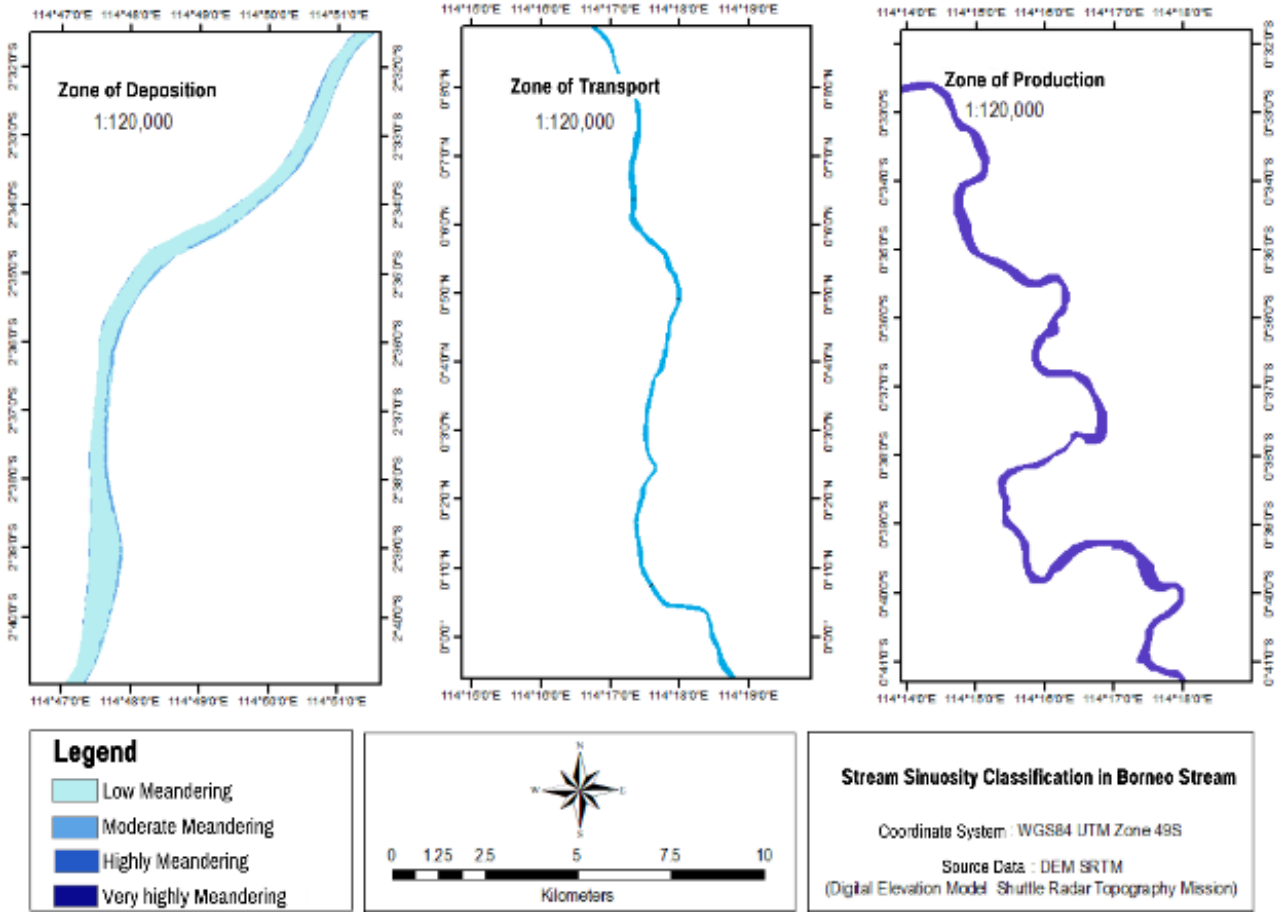


Fig. 5. Classification of stream sinuosity.

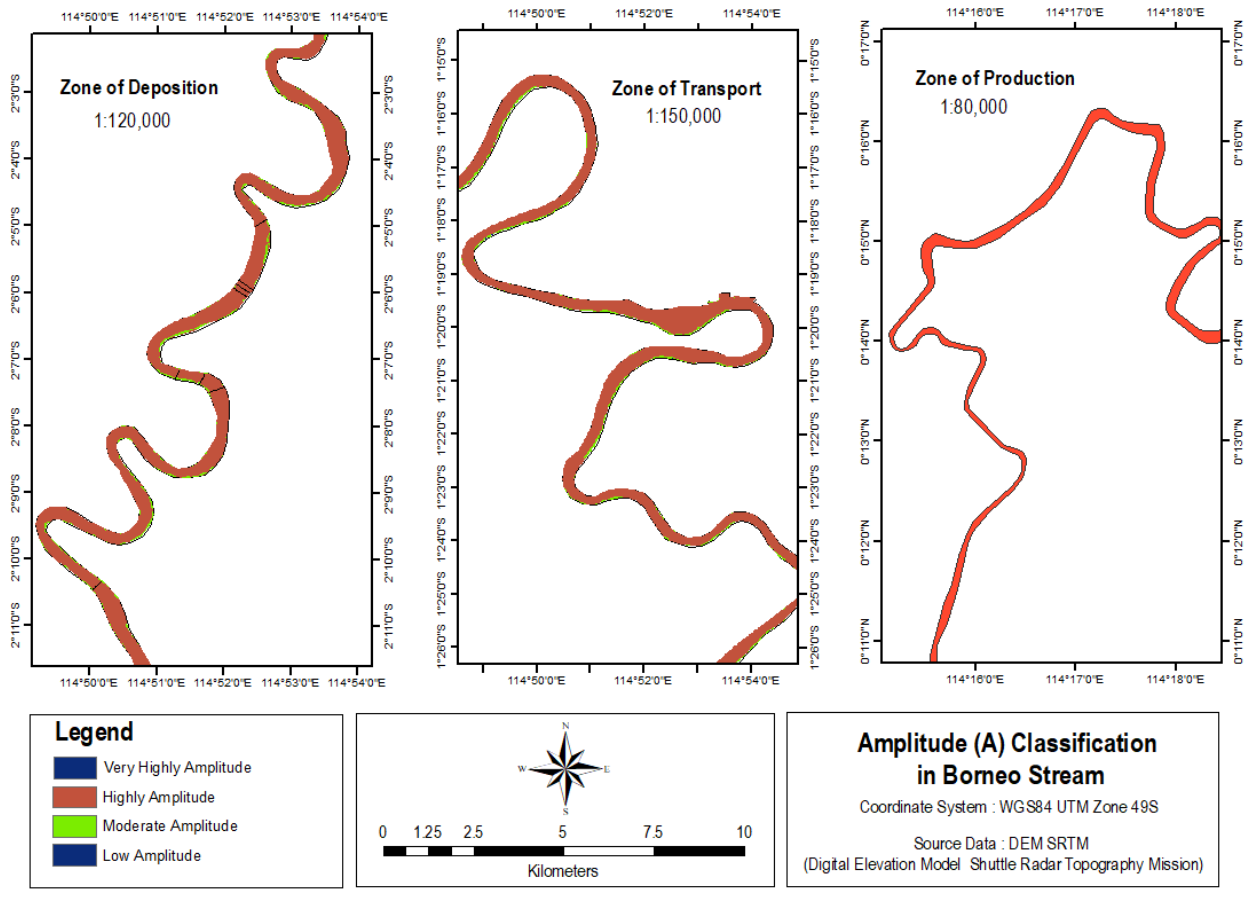


Fig. 6. Classification of stream amplitude.

Table 11. Results of stream wavelength.

Zone of Sediment	Range of wavelength (m)	Types of Streams
Zone of deposition	7144	Long
Zone of transport	4839	Moderate
Zone of production	4558	Moderate

Table 12. Results of stream bend sharpness.

Zone of Sediment	Range of bend sharpness	Types of Streams
Zone of deposition	0,30	Moderate
Zone of transport	0,23	Moderate
Zone of production	0.17	Moderate

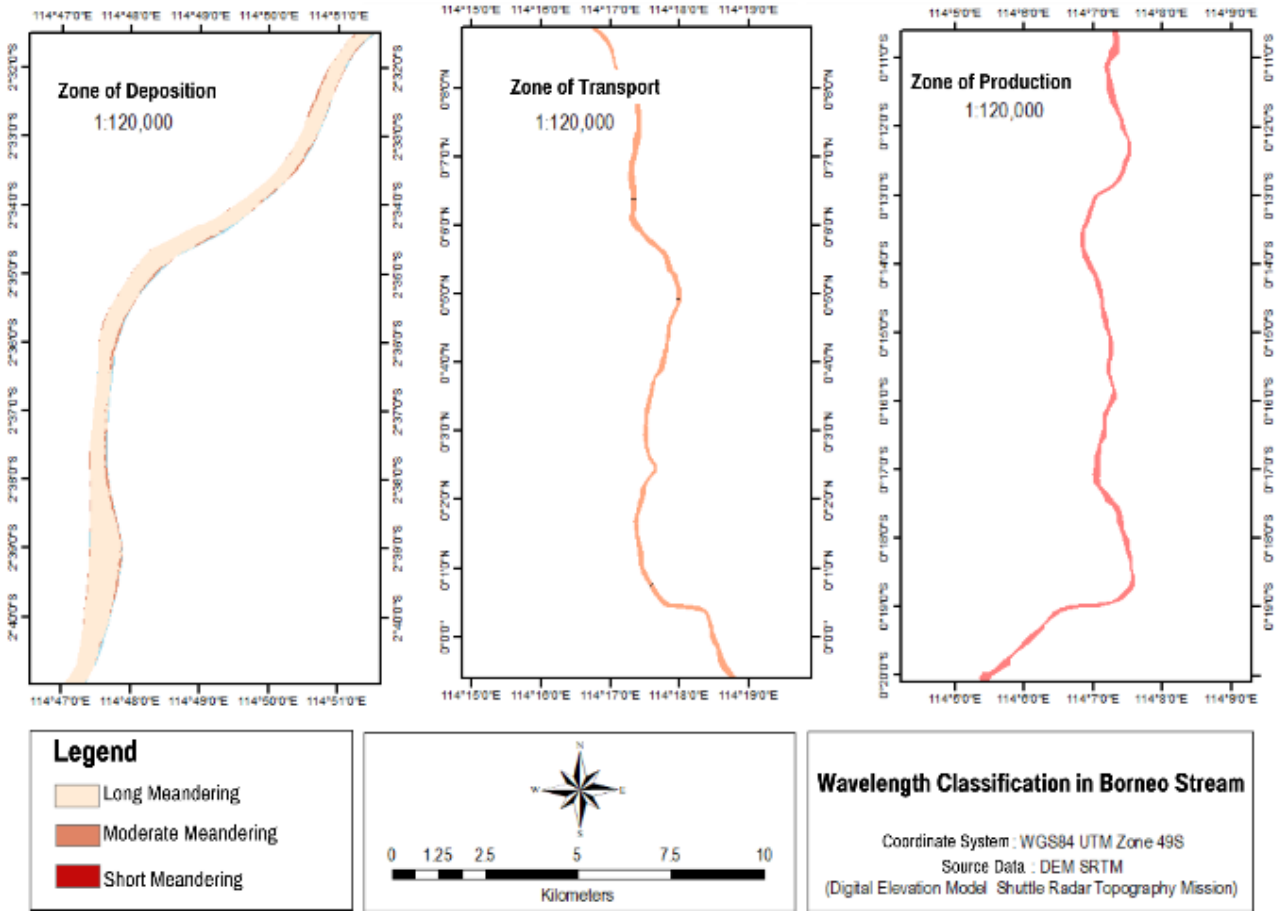


Fig. 7. Classification of stream wavelength.

Table 12. Results of stream meander pattern.

Zone of Sediment	Types of Streams
Zone of deposition	Irregular Meander
Zone of transport	Irregular Meander with oxbow
Zone of production	Distorted Meander Loop

Table 13. Results of stream slope.

Zone of Sediment	Range of slope	Types of Streams
Zone of deposition	0,0006	Shallow
Zone of transport	0,0050	Shallow
Zone of production	0,0189	Moderate

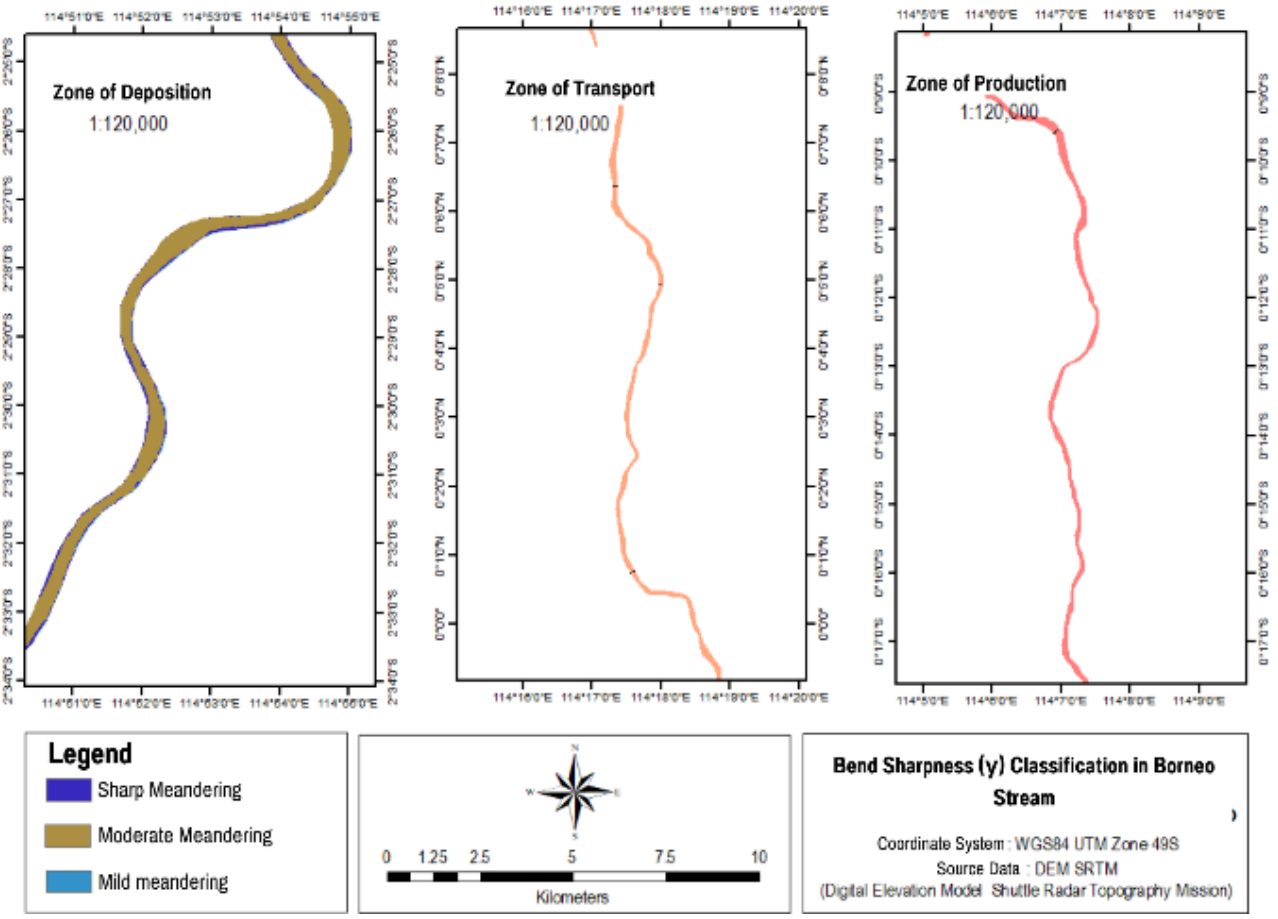


Fig. 8. Classification of stream bend sharpness.

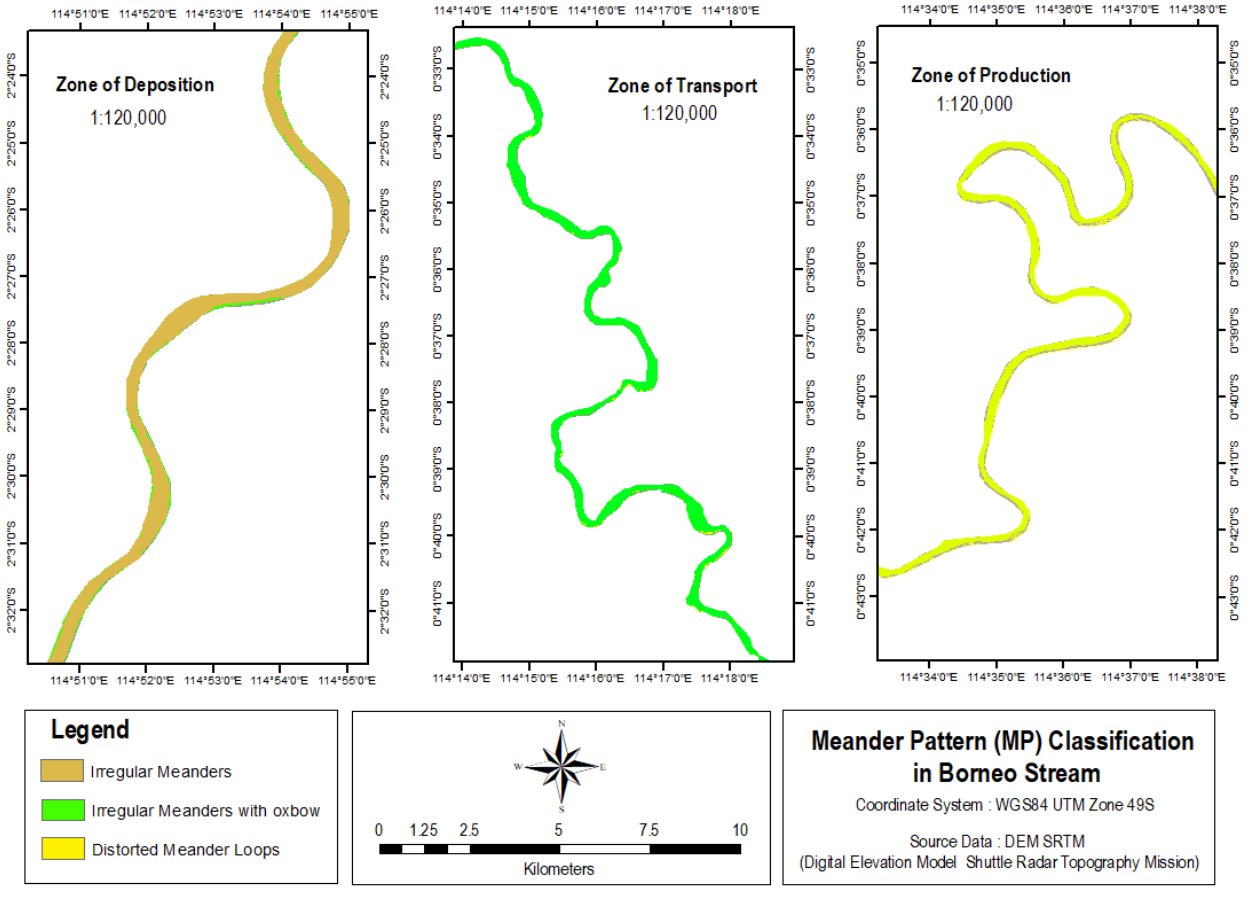


Fig. 9. Classification of stream meander pattern.

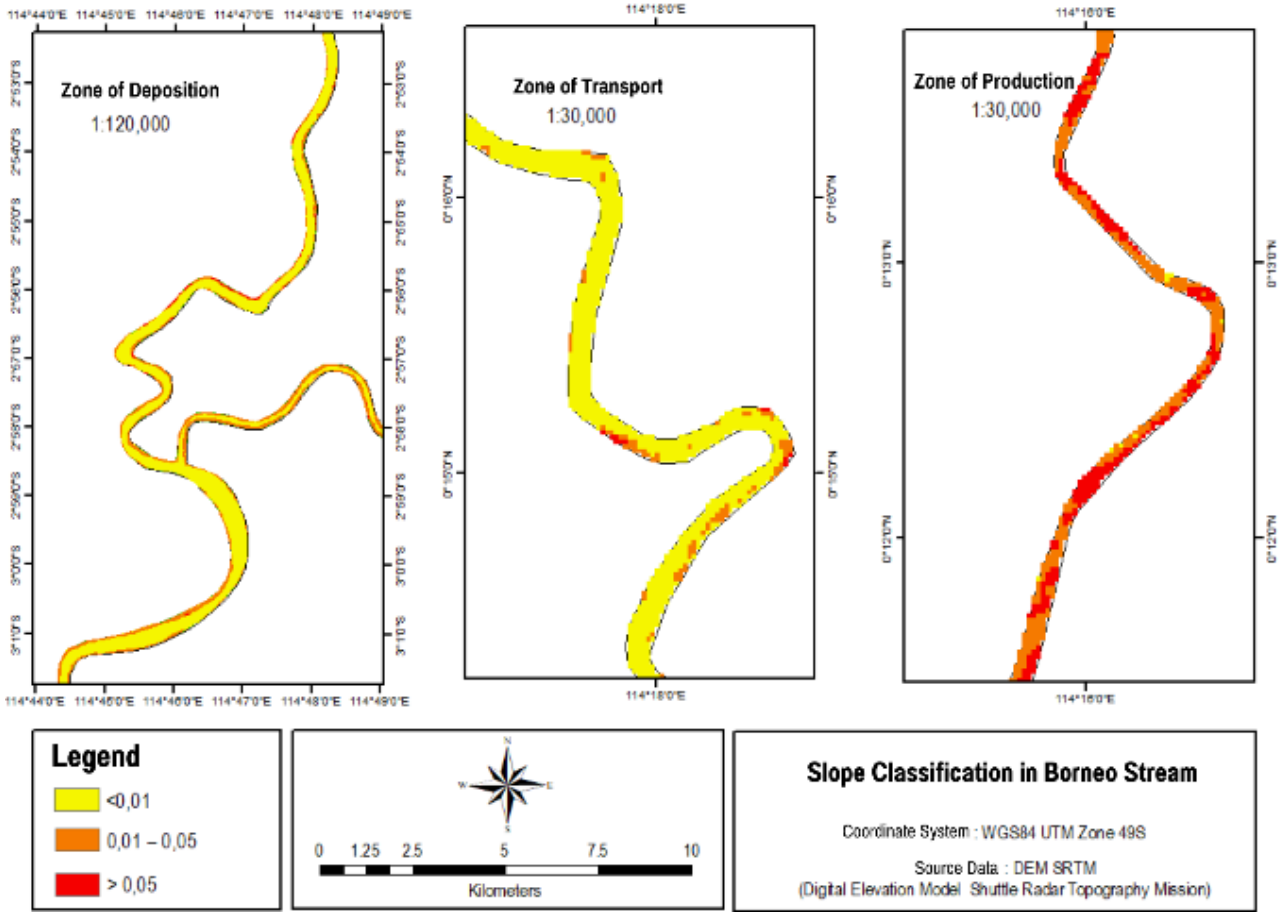


Fig. 10. Classification of stream slope.

The meandering stream classification in study area based on the stream width is categorized as very large stream. Based on its sinuosity is categorized as low meandering stream in zone of deposition, moderate meandering stream in zone of transport and highly meandering stream in zone of production. Based on its amplitude is categorized as highly meandering stream. Based on its wavelength is categorized as low meandering stream in zone of deposition, moderate meandering stream in zone of transport and in zone of production. Based on its bend sharpness is categorized as moderate meandering stream. Based on stream meander pattern is categorized as irregular meandering stream in zone of deposition, irregular meandering with oxbow in zone of transport and distorted meander loop in zone of production. Based on its slope is categorized as shallow meandering stream.

4 Conclusion

In conclusion, meandering streams are a fascinating and important feature that play a critical role in shaping the surrounding environment and supporting a diverse range of streams. Meandering streams form when a combination of factors, including water flow, sediment transport, and channel morphology, work together to create a distinct pattern of channel migration. Based on the results, the variability varied in all the geomorphology characteristics except bend sharpness and slope. The transport zone is the longest zone with classified as a very wide river with moderate sinuosity and high amplitude (< 1500). It is also categorized as a moderate wavelength and sharp bend with a relatively shallow slope. This approach is a simple, appropriate, and easy-to-use practice in examining meandering stream since there is no data or lack of supporting field data. The implementation of this meandering stream classification method is suitable for stream restoration projects, fish habitat enhancement, and water resource management. Further research is the study of possible geomorphic responses of a channel to natural and anthropogenic disturbances including channel-bed degradation, channel-bed aggradation, channel widening, and channel straightening.

The authors are deeply grateful to the Civil Engineering Department, Maranatha Christian University, Indonesia collaborated with Ecological Water Resources Management, Hydraulics and Ocean Engineering Department, National Cheng Kung8 University, Taiwan ROC. This research was financially supported by LPPM Maranatha.

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Examining Meandering Stream by Using Geomorphological Characteristics with GIS-based Analysis

Robby Yussac Tallar[1, a)], Olga Catherina Pattipawaej [1], Asriwiyanti Desiani[1], Andre Sebastian Lehman[1], Yonathan Adi Saputra[1], Gerard Christian Joelin[1]

[1]*Engineering Faculty, Universitas Kristen Maranatha (Maranatha Christian University), Jl. Prof.drg.Soeria Soemantri No. 65, Bandung City, 40164, Indonesia*

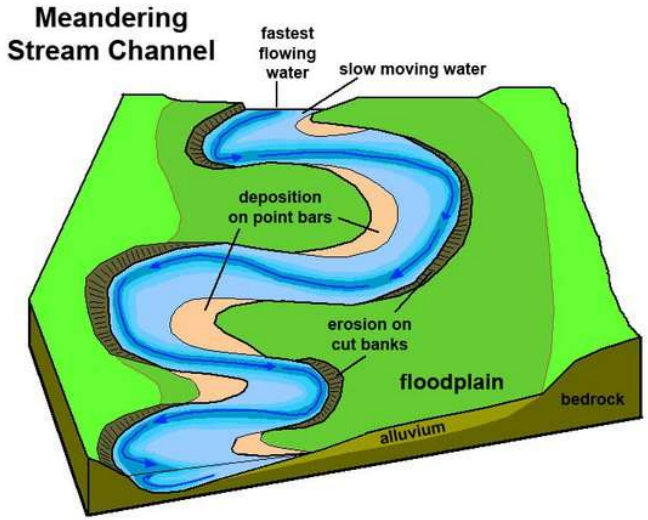
Content

- Introduction
- Methodology (Study Area; Method and Analysis)
- Results and Discussions
- Conclusions

References

Introduction

- Meandering streams are one of the most ubiquitous patterns in fluvial morphology[1].
- Previous research revealed that the uniqueness and applicative importance of these nearly regular loops in river planimetry have attracted the interest of several researchers in fluid mechanics and morpho-dynamics[2], geomorphology [3,4], river engineering [5], riparian ecology [6,7], and ecological engineering [8,9].
- The stream processes itself is directed by fluid velocity and morphodynamical processes, which cause lateral bank erosion and the constant migration of meanders, as well as by intermittent cutoffs that prevent self-intersections of the stream and create sudden reductions in stream length and sinuosity [8].
- The variability of large natural streams characteristics is proof that some variables controlled the stream's type or stream's pattern.



Source:
https://www.quora.com/What-is-a-meandering-river

Introduction

- Geographic Information System (GIS)-based model and analysis have become quite common for collecting and processing secondary data in many water-subject purposes including watershed and stream management [10,11].
- However, few efforts have been dedicated to develop meandering stream classification method regarding water stream management.
- It is clear that basic stream information is needed to make stakeholder's decisions.
- However, comprehensive field sampling over many streams in large study areas can be too costly in time and labor.
- Thus, geographic information system (GIS)-based models and analysis that can synthesize multiple characteristics have become particularly valuable in streams where stream assessments have not been completed or are difficult to perform.

Purpose

- Therefore, the main purpose of this study is to examine meandering stream type using its classification system to geomorphological characteristics combined with GIS-based analysis.

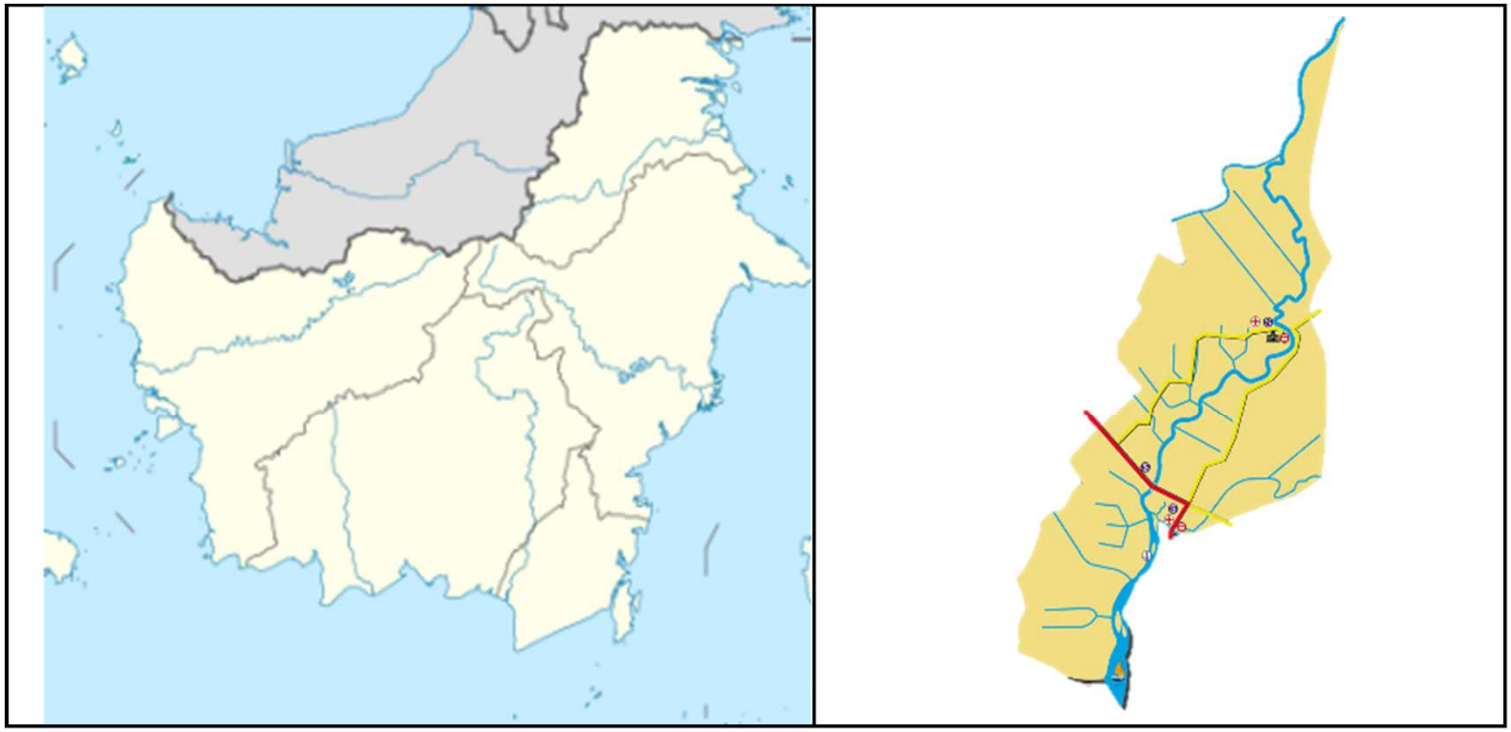
Methodology

- In fact, lack of stream classifications was focused on meandering type. Therefore, previous research [10] tried to develop the conceptual model for classification of meandering streams.
- This study is the extension research by using geomorphology characteristics with GIS-based analysis in certain study area.
- The process study was investigated 8 parameters in zone of sediment position: stream width, stream sinuosity, amplitude, wavelength, bend sharpness, meander pattern, and slope.

Study Area

- The Barito Stream is one of the most important streams in South Kalimantan, Indonesia, with coordinate location 3°19′11.53″S 114°35′26.7″E and total length 1090 km with a drainage basin of 81,675 km2 also its tributaries flow across various geomorphology characteristics.
- Barito Stream is also the largest and second longest stream in South Kalimantan, Indonesia (Figure 1).
- It originates in the Muller Mountain Range, from where it flows southward into the Java Sea with the average discharge is 5,497 m3/s. Its most central affluent is the Martapura Stream, and it passes through Banjarmasin City.
- The stream flows in the southeast area of Kalimantan with predominantly tropical rainforest climate. The annual average temperature is 24 °C and the average annual rainfall is 2,735 mm.

Fig. 1. Location of Study Area



2.2 Method and Analysis

This study was investigated and analysed 8 parameters:

1) zone of sediment positions

At first, Barito Stream was divided by three zone of sediment positions: zone of deposition, zone of transport and zone of production, as can be seen on Table 1 and Figure 2.

Table 1. Zone of Deposition.

Zone of Sediment	Length
Zone of deposition	141330 m
Zone of transport	453868 m
Zone of production	144255 m

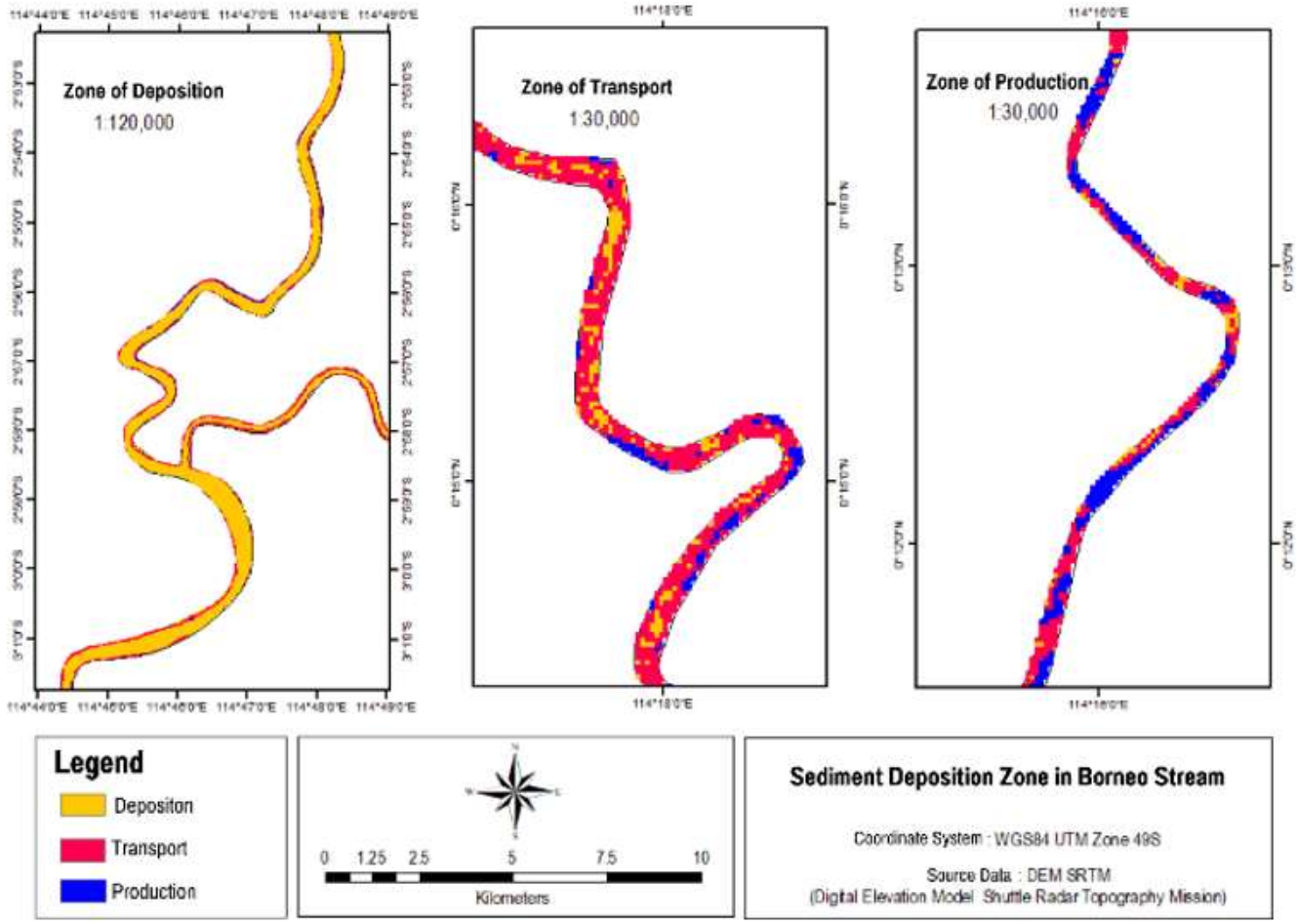


Fig. 2. Classification of Sediment Deposition

2) Stream Width

Based on Kern et. al. (1994), the type of river can be classified by its width. For the large river, the width should be more than 220 m. Moreover, Heirich et. al. (1999) classified the river's width > 10 m as a large river. Therefore, the classification is shown in Table 2.

Table 2. Stream Width Classification.

Types of Streams	Range of width (m)
Very Large River	>300
Large River	100 – 300
Middle River	50 – 100
Small River	<50

3) Stream Sinuosity

- Sinuosity is the result of the stream naturally dissipating its flow forces. According to Brice (1984) meandering rivers have a sinuosity larger than 1.25; according to Leopold et. al. (1964) and Rosgen (1994) the lower limit is 1.5. Therefore, the classification is shown in Table 3.

Table 3. Stream Sinuosity Classification.

Types of Streams	Range of sinuosity (m)
Very highly meandering	>2
Highly meandering	1.5 – 2
Moderate meandering	1.25 – 1.5
Low meandering	<1.25

4) Amplitude

- The maximum distance from the down-valley axis to the sinuous axis of a loop is the meander width or amplitude. The developed classification can be seen in Table 4.

Table 4. Stream Amplitude Classification.

Types of Streams	Range of Amplitude (m)
Very highly amplitude	>2000
Highly amplitude	1500-2000
Moderate amplitude	1000-1500
Low amplitude	<1000

5) Wavelength

- According to Leopold et. al. (1964) a meander consists of a pair of opposing loops, but in common practice also a single river bend is often called "meander".
- In this study a meander is a single river bend. The distance of one meander along the down valley axis is the meander length or wavelength. The classification can be seen on Table 5.

Table 5. Stream Wavelength Classification.

Types of Streams	Range of Wavelength (m)
Long meandering	>5000
Moderate meandering	2000 – 5000
Short meandering	<2000

6) Bend sharpness

- The bend sharpness (γ) is represented by the ratio of river width to radius of curvature of the river centerline. The classification can be seen on Table 6.

Table 6. Stream Bend Sharpness Classification.

Types of Streams	Range of Bend sharpness (m)
Sharp meandering	>0.5
Moderate meandering	0.1 – 0.5
Mild meandering	<0.1

7) Meander pattern

A variety of river changes are listed under pattern change (Figure 3). In meander changes, meander enlarges if its amplitude and width increase. Meander shift involves the displacement of the meander in a downstream direction.

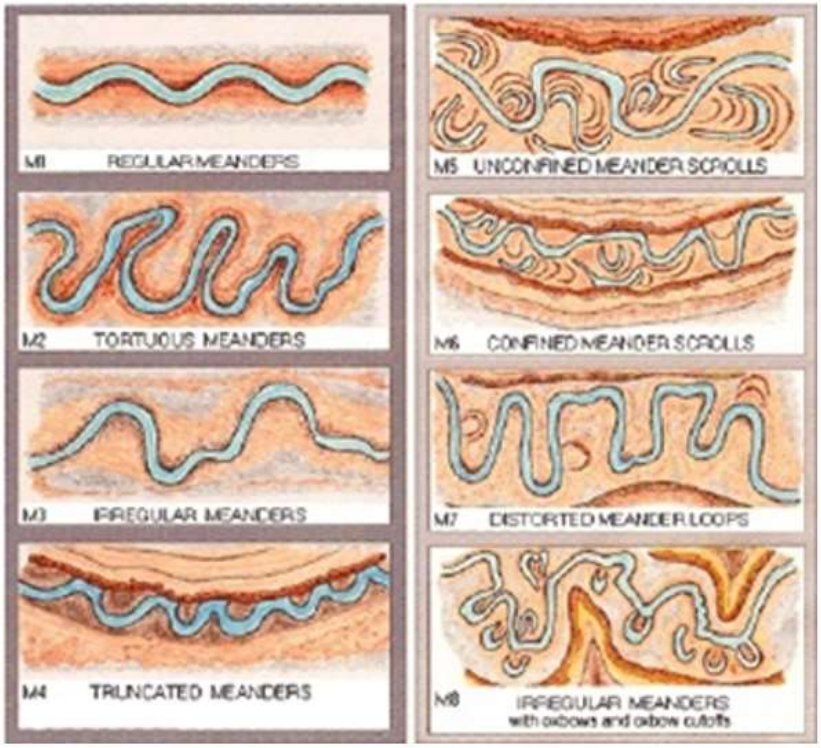


Fig. 3. Classification of Meander Pattern

8) Slope

Slope can be calculated from the elevation and the length of each reach of stream. The classification can be seen on Table 7.

Table 7. Stream Slope Classification.

Types of Streams	Range of Slope
Steep	> 0.05
Moderate	0.01 – 0.05
Shallow	<0.01

Results and Discussions

The selected parameters (stream width, stream sinuosity, amplitude, wavelength, bend sharpness, meander pattern, and slope) have been assessed by using GIS. The comprehensive results can be seen below.

Table 8. Results of Stream Width.

Zone of Sediment	Range of width (m)	Types of Streams
Zone of deposition	481	Very Large Stream
Zone of transport	354	Very Large Stream
Zone of production	203	Large Stream

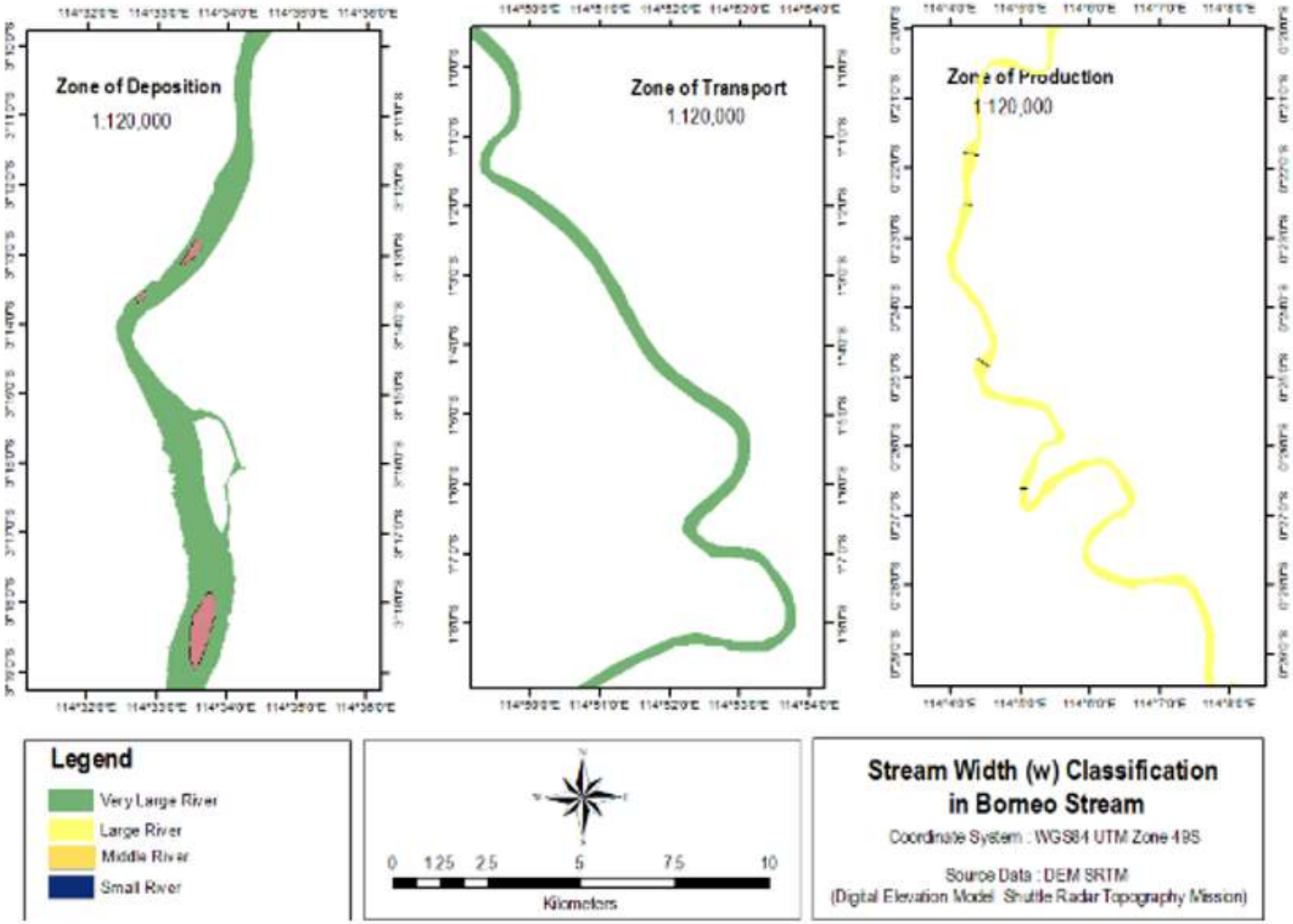


Fig. 4. Classification of Stream Width

Table 9. Results of Stream Sinuosity.

Zone of Sediment	Range of sinousity (m)	Types of Streams
Zone of deposition	1.21	Low
Zone of transport	1.46	Moderate
Zone of production	1,54	High

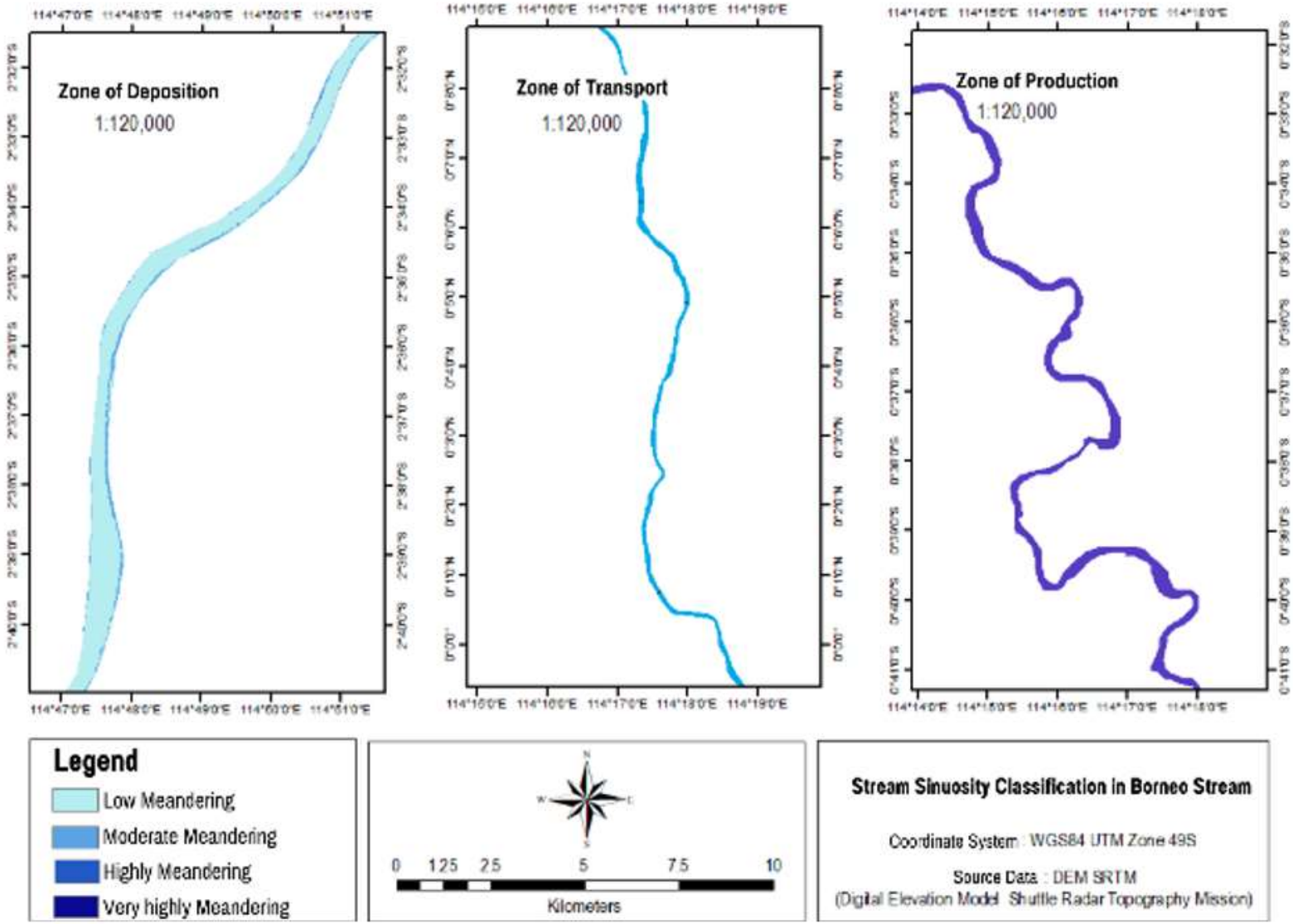


Fig. 5. Classification of Stream Sinuosity

Table 10. Results of Stream Amplitude.

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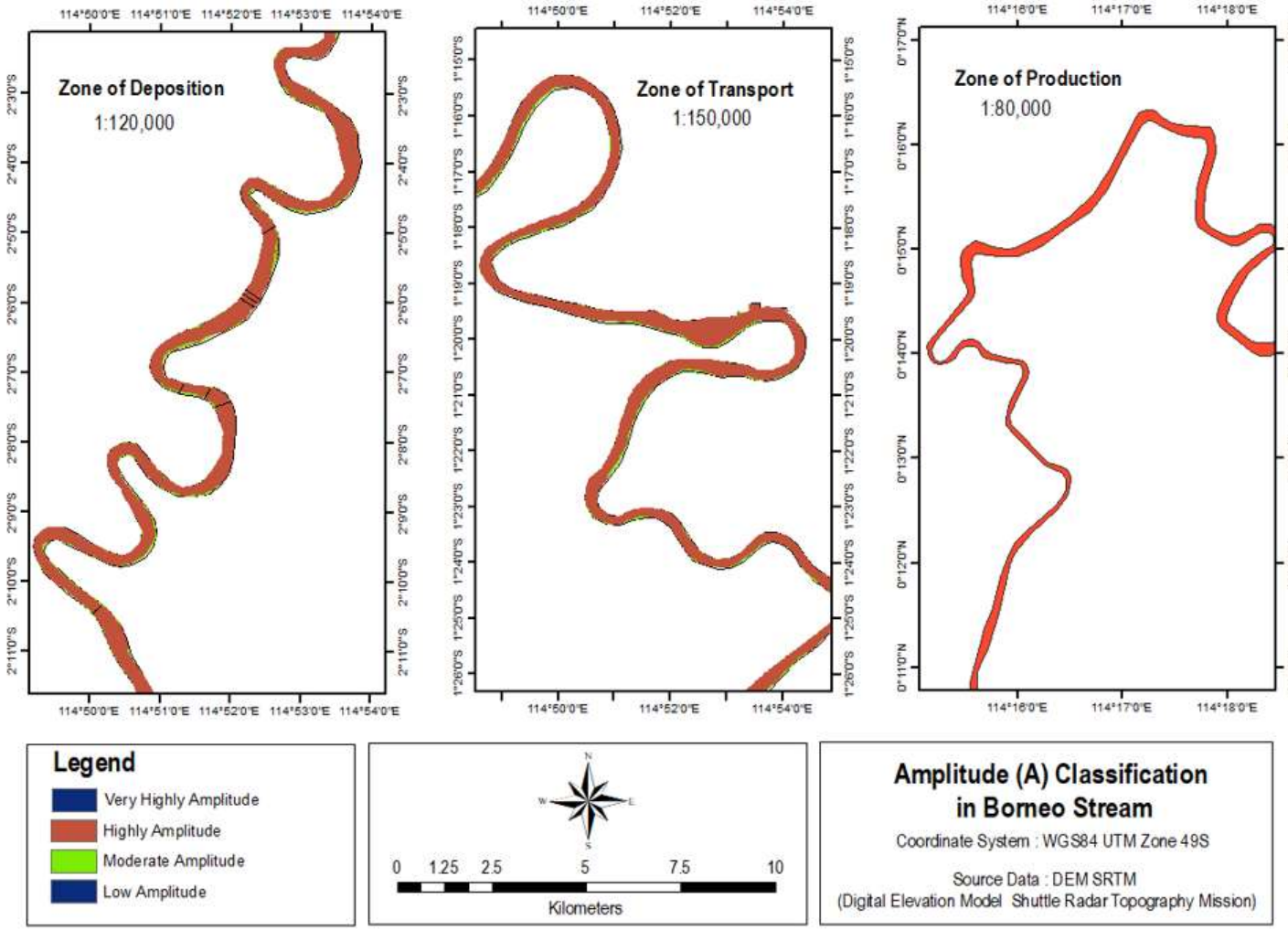

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Zone of Sediment	Range of wavelength (m)	Types of Streams
Zone of deposition	7144	Long
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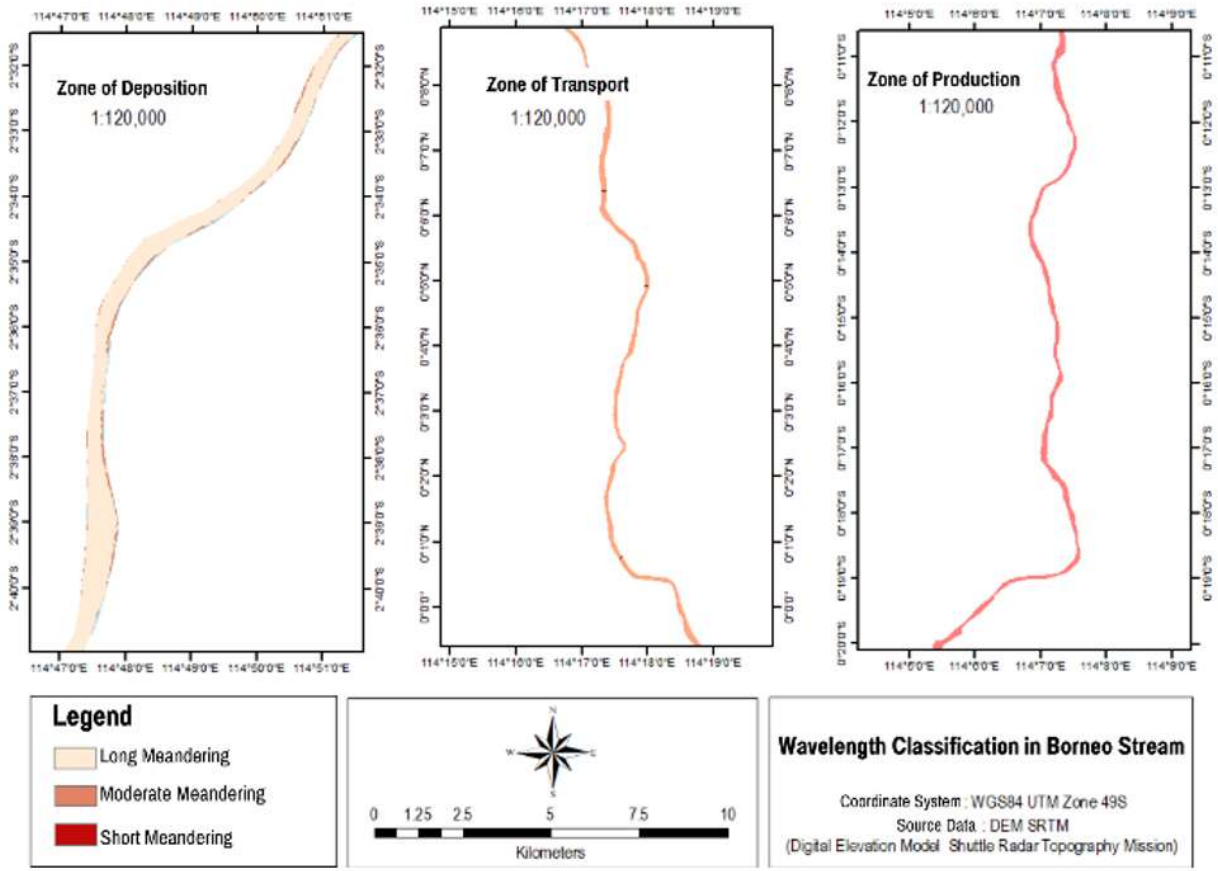
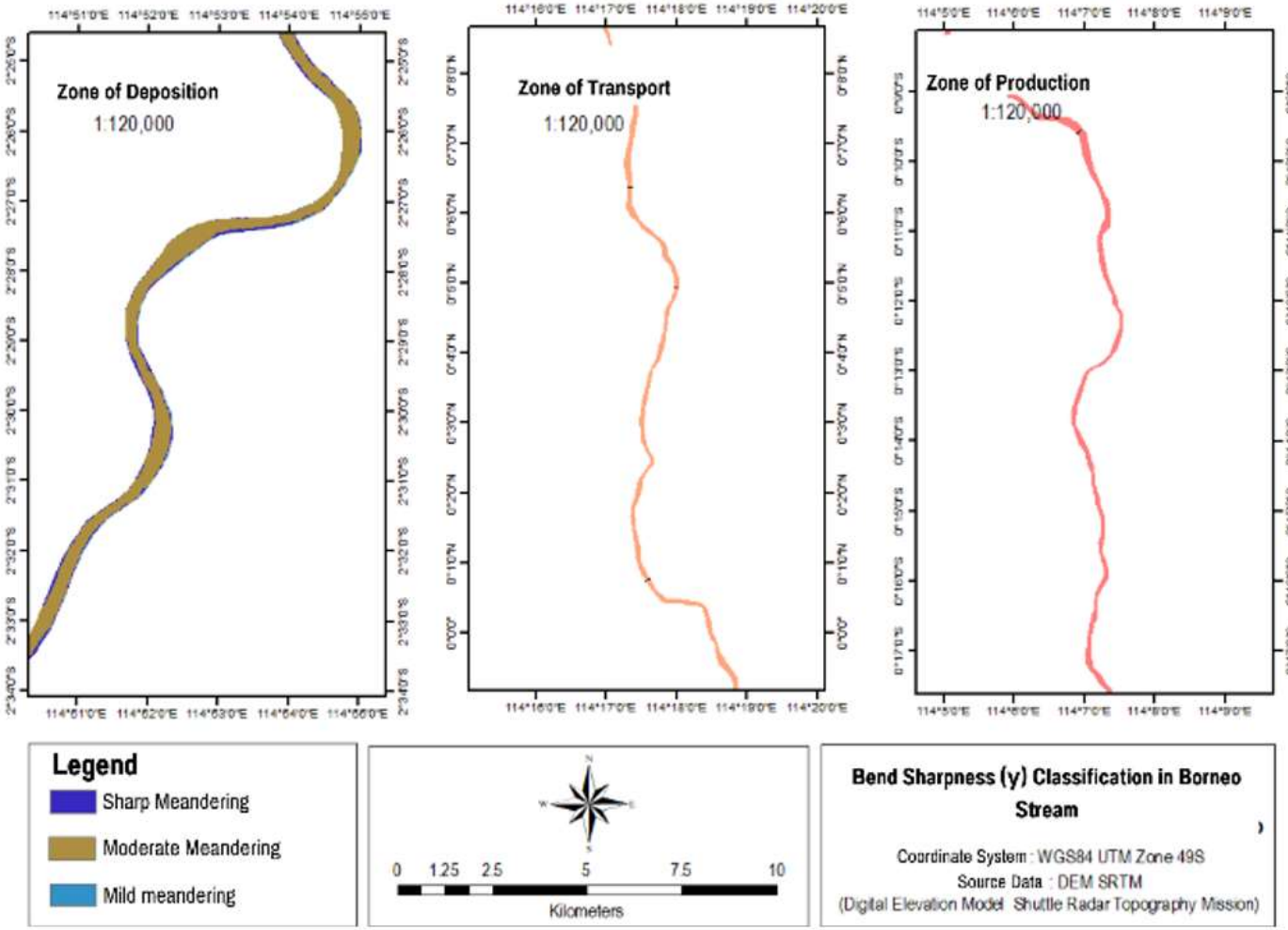


Fig. 7. Classification of Stream Wavelength

Table 12. Results of Stream Bend sharpness.

Zone of Sediment	Range of bend sharpness	Types of Streams
Zone of deposition	0,30	Moderate
Zone of transport	0,23	Moderate
Zone of production	0.17	Moderate



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Zone of Sediment	**Types of Streams**
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Zone of production	Distorted Meander Loop

Fig. 9. Classification of Stream Meander Pattern

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Zone of deposition	0,0006	Shallow
Zone of transport	0,0050	Shallow
Zone of production	0,0189	Moderate

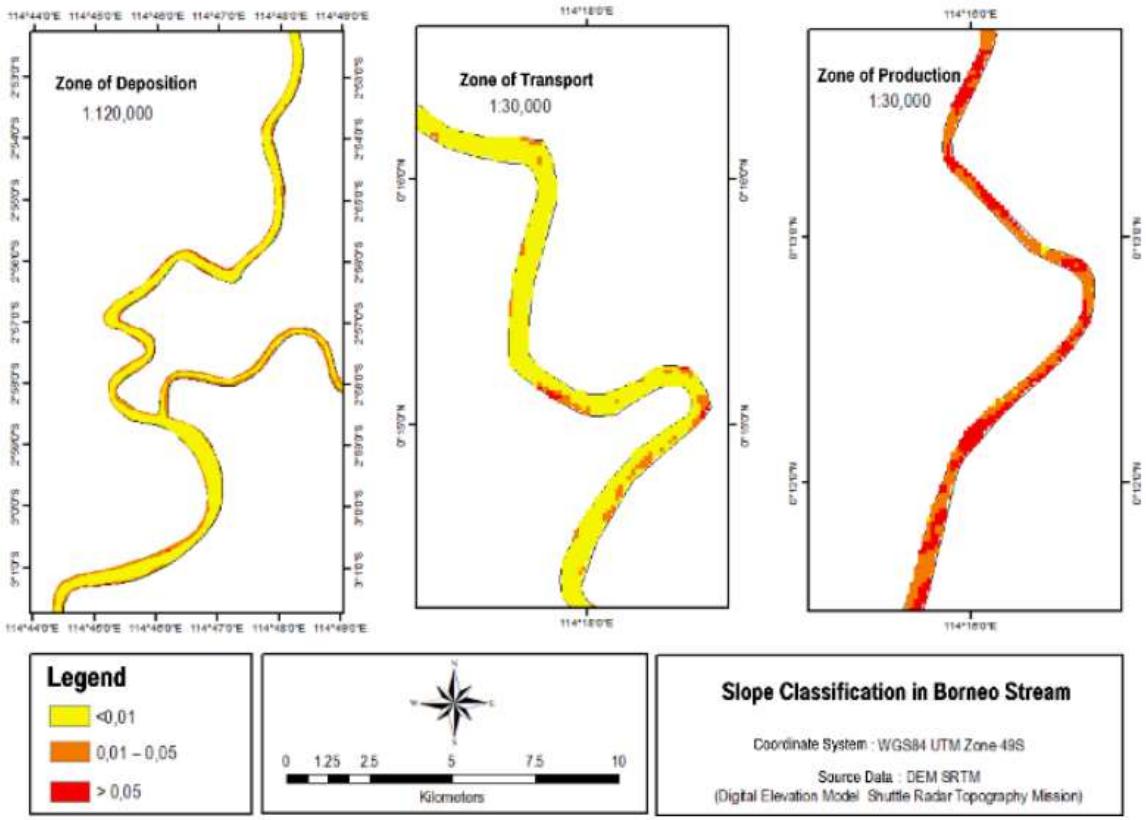

Fig. 10. Classification of Stream Slope

Results and Discussions

- The meandering stream classification in study area based on the stream width is categorized as very large stream.
- Based on its sinuosity is categorized as low meandering stream in zone of deposition, moderate meandering stream in zone of transport and highly meandering stream in zone of production.
- Based on its amplitude is categorized as highly meandering stream. Based on its wavelength is categorized as low meandering stream in zone of deposition, moderate meandering stream in zone of transport and in zone of production.
- Based on its bend sharpness is categorized as moderate meandering stream. Based on stream meander pattern is categorized as irregular meandering stream in zone of deposition, irregular meandering with oxbow in zone of transport and distorted meander loop in zone of production. Based on its slope is categorized as shallow meandering stream.

Conclusion

- In conclusion, meandering streams are a fascinating and important feature that play a critical role in shaping the surrounding environment and supporting a diverse range of streams.
- Meandering streams form when a combination of factors, including water flow, sediment transport, and channel morphology, work together to create a distinct pattern of channel migration.
- Based on the results, the variability varied in all the geomorphology characteristics except bend sharpness and slope.
- The transport zone is the longest zone with classified as a very wide river with moderate sinuosity and high amplitude (< 1500).
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- Further research is the study of possible geomorphic responses of a channel to natural and anthropogenic disturbances including channel-bed degradation, channel-bed aggradation, channel widening, and channel straightening.

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Examining Meandering Stream by Using Geomorphological Characteristics with GIS-based Analysis

Author(s)

Robby Yussac Tallar, Olga Catherina Pattipawaej, Asriwiyanti Desiani, Yonathan Adi Saputra, Gerard Christian Joelin and Andre Sebastian Lehman

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7 August, 2023

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Author(s)

ROBBY YUSSAC TALLAR, OLGA CATHERINA PATTIPAWAEJ, ASRIWIYANTI DESIANI, YONATHAN ADI SAPUTRA, GERARD CHRISTIAN JOELIN ANDREW SEBASTIAN LEHMAN

Author's signature

ROBBY YUSSAC TALLAR

07/08/2023

ICCIM 2023 submission 148 update

Dari: ICCIM 2023 (iccim2023@easychair.org)

Kepada: robbyyussac@yahoo.com

Tanggal: Rabu, 5 Juli 2023 pukul 14.31 WIB

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Number: 148
Authors: Robby Yussac Tallar, Olga Catherina Pattipawaej, Asriwiyanti Desiani, Yonathan Adi Saputra, Gerard Christian Joelin and Andrew Sebastian Lehman
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Kepada: arifs@ft.untar.ac.id

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Dear Prof Arif

Thank you very much for your correction. I already put Figure 9 into the new file (attached). I also will uploaded into the website. Thank you.

Regards,
Robby

> Pada Selasa, 4 Juli 2023 pukul 14.32.51 WIB, Arif Sandjaya <arifs@ft.untar.ac.id> menulis:
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