STRENGTHS 2024

THE ENGINEERS' QUILL
INSIGHTS.
INNOVATIONS.
INDUSTRY.

KEY HIGHLIGHTS

- Faculty Views on Students In GEN-Z ERA
- Professor Interviews
- Sankalan 2024: Inaugural Edition
- Placements 2023-24
- Awards and Recognitions
- SoCE:Events and Team
- Summer Camp: Chitrakoot

DEPARTMENT OF CIVIL ENGINEERING
INDIAN INSTITUTE OF TECHNOLOGY KANPUR

STRENGTHS

A MAGAZINE FROM THE SOCIETY OF CIVIL ENGINEERS

THE ENGINEERS' QUILL
INSIGHTS. INNOVATIONS. INDUSTRY.

DEPARTMENT OF CIVIL ENGINEERING
INDIAN INSTITUTE OF TECHNOLOGY KANPUR

ABOUT THE SOCIETY OF CIVIL ENGINEERS

The Society of Civil Engineers at IIT Kanpur is a non-profit student organization that fosters strong connections among civil engineering students, esteemed alumni, and esteemed professors. Recognizing the profound impact of student-alumni-faculty interaction on various aspects of student success, such as academic performance, graduation persistence, personal and intellectual growth, educational aspirations, faculty and department satisfaction, career prospects, and curriculum development, our society serves as a vital link within the civil engineering community at IIT Kanpur. We firmly believe that enhancing the interaction between students and faculty is paramount for the comprehensive development of any educational institution. Our society consistently organizes various events and activities to cultivate a thriving learning environment where students and faculty can engage in meaningful exchanges and forge lasting connections. By prioritizing this essential interaction, we strive to contribute to the holistic growth and success of civil engineering students at IIT Kanpur.

ABOUT STRENGTHS

STRENGTHS, the annual magazine published by the Society of Civil Engineers, stands as a commendable publication wholeheartedly supported and acknowledged by the Department of Civil Engineering. With a primary objective of offering a comprehensive glimpse into the diverse domains and fields within civil engineering, STRENGTHS also serves as a platform to recognize and showcase the remarkable activities and initiatives undertaken by the SoCE and department. Moreover, it proudly features the commendable works and contributions of the Society of Civil Engineers, effectively catering to the wider civil engineering community. By meticulously curating its content, STRENGTHS aims to provide readers with a rich assortment of articles, Interviews, and insights that encapsulate the dynamic nature of civil engineering. This magazine, born out of a strong commitment to excellence, serves as an invaluable resource for professionals and enthusiasts in the field, ensuring that the Society of Civil Engineers continues fostering knowledge-sharing and appreciation within the civil engineering community.

MESSAGE FROM HOD , CIVIL ENGINEERING

The world is experiencing financial limitations, and their impacts are felt everywhere. Nevertheless, with several large infrastructure projects,
India's civil engineering sector is growing steadily and on a steep trajectory. Thus, students of civil engineering must therefore possess both perseverance and hope. Civil engineering is rapidly evolving. The requirement for higher-quality technical staff, increased available funding, and the usage of higher technology are just a few of the critical elements that civil engineering programmes must recognise and help students prepare for. However, a civil engineering graduate with a
balanced personality will be able to realise all of the aforementioned goals. The "STRENGTHS" magazine is a modest step towards helping graduates create well-rounded personalities. Now is the perfect time to reflect and put your emotional fortitude and self-belief to the test. These are also opportunities for faculty members to acquire better insight into today's students' ideas and sentiments to prepare them for life in the real world. On behalf of the civil engineering faculty, I applaud the "STRENGTHS" team for their latest creation and for letting in some fresh air.

PROF. PRIYANKA GHOSH

With warm regards,
P. Ghosh

MESSAGE FROM FACULTY COORDINATOR

The Society of Civil Engineers (SoCE) has been an integral part of the department since a very long time. It has actively taken care of organising academic and social events in the department. The society has contributed significantly towards professional development activities including guest talks and mock interviews. Particularly the last year, we took several major initiatives that helped SoCE emerge as one of the most vibrant student societies on campus. The events such as Sankalan and DS Lecture were organized so successfully that they helped in enhancing positive vibes in the department, which was essential to overcome the saddish environment that had overtaken due to covid lockdown a few years ago.

However, in a few areas such as alumni engagement and industry collaborations, we still need to make more progress. Civil Engineering being an old department, the alumni base is large and spread. Through SoCE, we shall aim to reach out to our alumni and get connected. Alumni engagement shall benefit both the current and future students and the department. By bringing together the past, present and future of the department, we shall be able to demonstrate our true STRENGTH!

Looking forward, I am very positive and encouraged with the events that are lined up for the upcoming year. I am also very hopeful that we will see more engagements within and outside the department through SoCE.

I wish the SoCE coordinators and secretaries all the best and look forward to working together.

PROF. CHUNENDRA KUMAR SAHU

With warm regards,
C.K. Sahu

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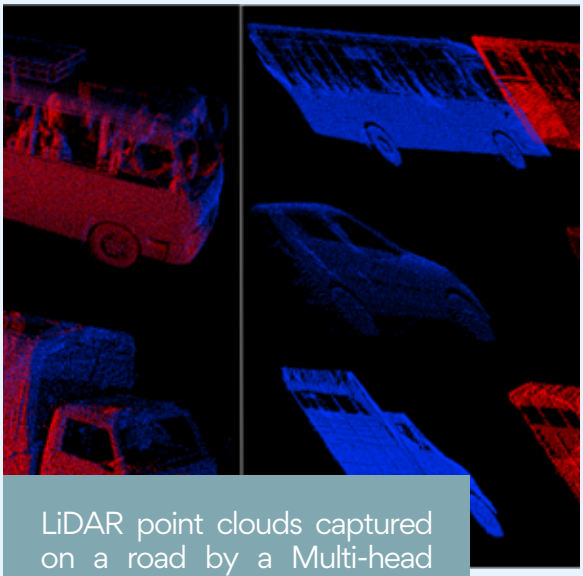

LiDAR point clouds captured on a road by a Multi-head Mobile Laser Scanner system (StreetMapperV).

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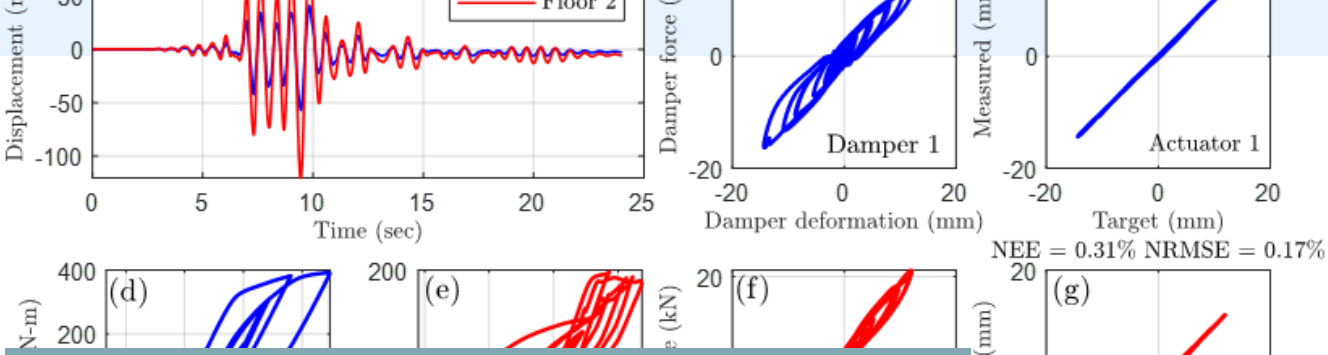
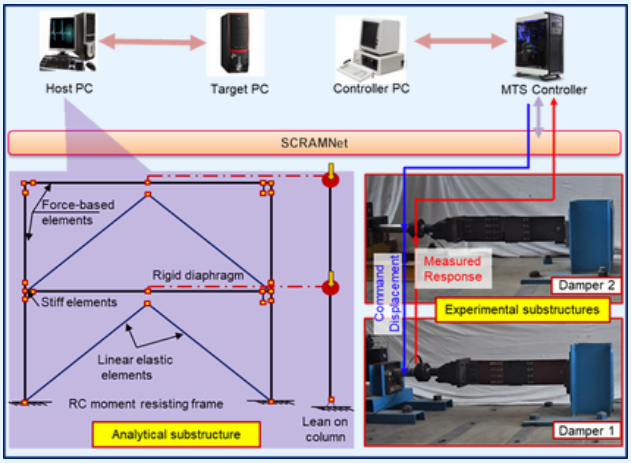
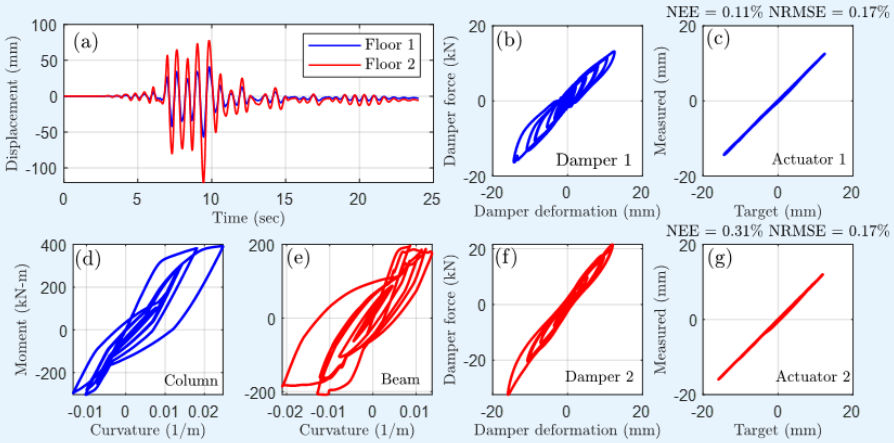


Implementation of Real Time Hybrid Simulation at IITK

Hironmoy Kakoty, Chinmoy Kolay, Shubham Raj, and Kamal K. Kar

Real-time hybrid simulation (RTHS) is a state-of-the-art, accurate, affordable method for simulating seismic effects on structures with loading rate-dependent behaviour. In RTHS, a part of the system that cannot be accurately modelled numerically is simulated experimentally in the laboratory, and the rest numerically.





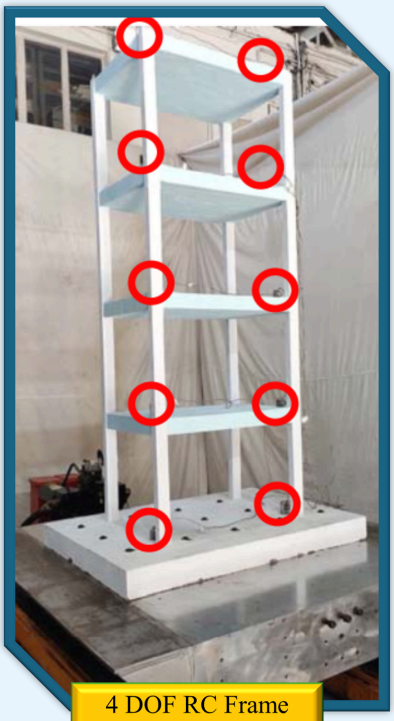
The response of the hybrid system is obtained in real-time by solving the governing equations of motion. This communication demonstrates an implementation of RTHS in the Pseudo Dynamic Testing Facility at IIT Kanpur and its application to seismic response simulation of a two-storey reinforced concrete special moment-resisting frame building with in-house-built nonlinear viscoelastic dampers.

The information presented here will be useful for implementing the RTHS technique in other laboratories and promoting experimental earthquake engineering research at the national level.

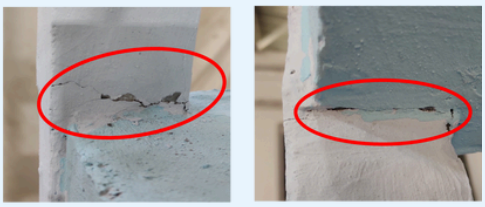
State-parameter estimation and damage assessment of RC frame subjected to ground motions

Adrita Kundu and Suparno Mukhopadhyay

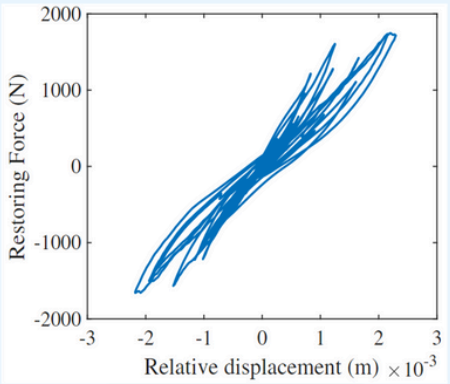
Algorithms based on vibration data measurements have been proven to be reliable and cost-effective for system identification and structural health monitoring. When measurements from the system are obtained, dynamic identification of the system parameters as well as tracking of its states (such as dynamic displacements and/or velocities of the system), can be performed by casting it as a Bayesian state-parameter estimation problem. One such well-known framework is that of the Unscented Kalman Filter (UKF). In this work, model informed constraint bounds such as the stiffness and damping coefficients being positive, are incorporated within the UKF algorithm to improve its robustness. The enforcement of the constraints is performed by truncating the conditional probability distribution of the states and parameters at the constraint bounds. Referring to this algorithm as the Truncated UKF (TUKF), it is further modified to decrease computational efficiency, and is proven to be suitable for state-parameter estimation of complex hysteretic systems involving degrading and pinching characteristics. Acceleration measurements from a lab-scale four-storied RC frame tested at IIT Kanpur, is also used for validation. The obtained results are also corroborated by visual observations of damage, and damage assessment of the frame stories are analyzed through Park-Ang damage indices.



4 DOF RC Frame with accelerometers



Observed damages at joints



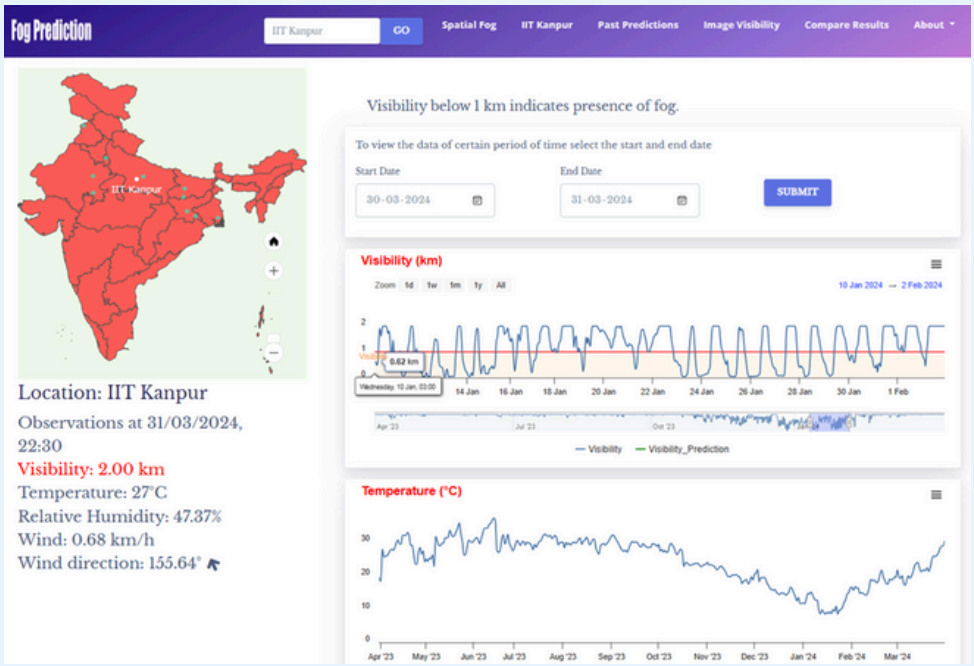
Tracked hysteretic Force-Deformation

Fog Prediction in Northen India using Artificial Intelligence

Prasad Deshpande

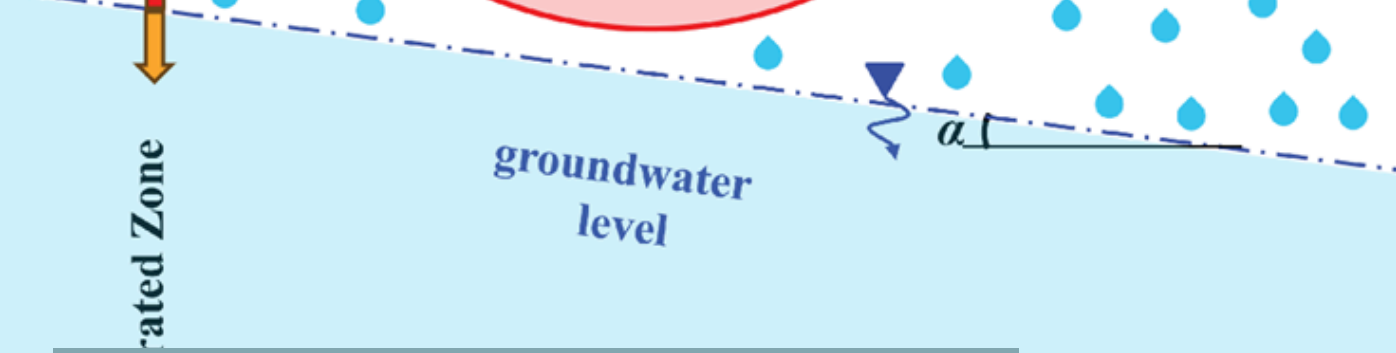
Northern India, the home to one-seventh of the world's population, experiences thick blankets of fog every winter. It delays transportation services (air, train, and road) and increases the chances of accidents. For example, a loss of approximately 30000 Cr Rupees in Delhi airport was caused by fog from 2011 to 2016, proving that fog is a serious problem. Fog affects agriculture also. Moreover, the gloomy weather on foggy days creates general achiness and joint pains due to Vitamin D deficiency.

The lowered levels of Serotonin on such days trigger depressive mood, also known as Winter Blues. In such a way, fog creates a loss to the economy as well as health.Timely and accurate fog prediction will help us to mitigate the hazards caused by fog, e.g., proper flight scheduling. The IITK Fog Prediction project started in 2020, aims to predict short- and long-term fog for different cities in North India. Modern Artificial Intelligence techniques are used for prediction. Currently, the short-term visibility (fog) prediction (up to 6 hours) is generated with an error of less than 70 m, which is better than other weather forecasts. The real-time weather variables (viz., temperature, humidity, and air quality information) and visibility predictions are



Snapshot of Fog Prediction IITK website showing real-time visibility (proxy for fog) and temperature values.

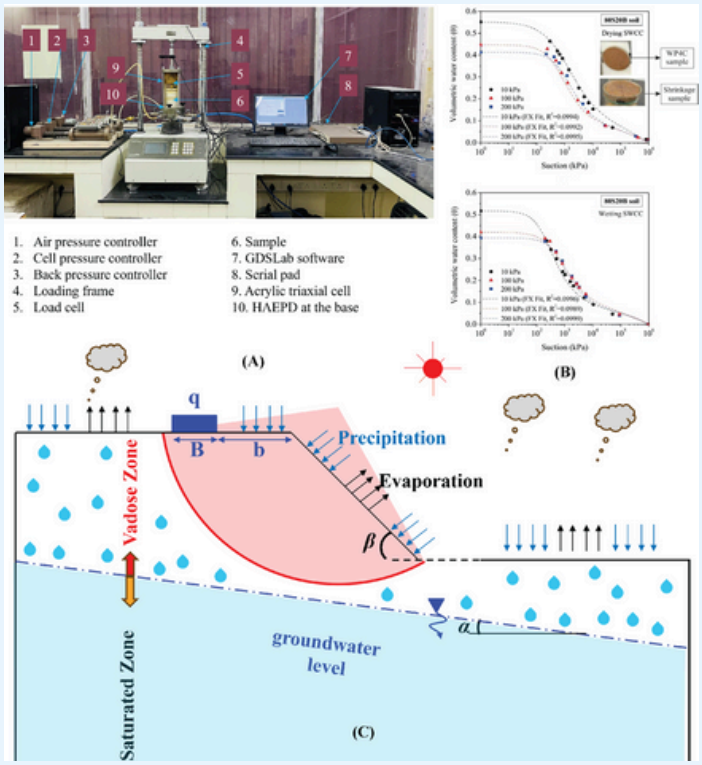
disseminated to the public at https://fog.iitk.ac.in/fog-prediction/. The outcome of this project will improve the decision-making of the traveler community and policymakers. The project team includes students and professors from CSE and CE dept. of IIT Kanpur.



Transferring experimental outcomes to the field applications in the domain of unsaturated soil mechanics

Chidanand M Jadar and Sathiyamoorthy Rajesh

In the field of geotechnical engineering, the analysis of Geostructures often hinges on theories rooted in saturated soil mechanics. Nonetheless, reality often presents a different scenario where soil remains partially saturated due to the dynamic flow of fluxes. Incorporating appropriate hydromechanical properties into the design process is pivotal for achieving optimal outcomes. Laboratory procedures for obtaining hydromechanical properties, particularly using axis translation techniques (ATT) (Fig.1, a),



can be intricate and may lack efficiency in establishing soil properties across a wider range of suction levels. Therefore, a combination of the ATT and the dewpoint potentiometer method emerges as a viable alternative. The GDS triaxial automated system, equipped with a high air entry porous disk at the base, plays a crucial role in elevating the reference of suction measurement. The soil water retention curve (SWRC) stands out as a critical property (Fig.1, b) correlating soil water content to soil suction.

Unveiling unsaturated shear strength parameters through tests like CD/CW, based on SWRC, becomes imperative.These established soil properties of unsaturated soil serve as the bedrock for Geostructure design. Illustratively, a schematic application depicting a footing resting on a slope underscores the practical implications (Fig. 1, c). Commercially available numerical tools such as SvOffice, Plaxis, and COMSOL come equipped with built-in constitutive models tailored for analyzing unsaturated soil behavior. A comprehensive numerical analysis, encompassing full-scale transient state and flux-strength coupling, offers insights into structural stability. The precision of the design endeavor hinges on the meticulous application of pertinent parameters and the judicious adoption of crucial considerations.

Distortions in LiDAR Scanning of Moving Objects

Aman Kumar Singh and Bharat Lohani

In today's ever-evolving technological landscape, LiDAR emerges as a crucial tool in remote sensing, fundamentally altering how we gather spatial data. With LiDAR we can scan our surroundings and capture 3D point cloud data of the world around us. When we are dealing with the static objects i.e. objects that are not moving such as buildings, static vehicles, poles, roads, etc then the point cloud that we get accurately represent the true dimensions and geometry of the object in real world. However, things get a bit dicey when the object starts moving, such as cars, vehicles, pedestrians, etc. The point cloud of the moving objects that we get are often distorted in shape and size and do not accurately represent the true spatial dimensions of the object in real world. Mobile Lidar Systems such as Streep Mapper have two 2D rotating lidar sensors and when these sensors observe the moving objects multiple times, they result in different positions of the point cloud of the same object.

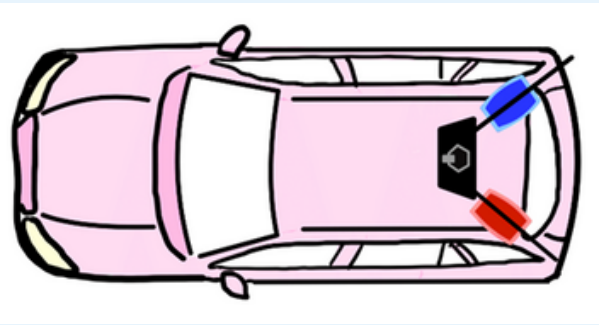


Figure 1: A schematic illustration of a Multi-head Mobile Mapper, designed for mobile mapping. This system integrates two 2D rotating LiDAR scanners mounted on a mobile vehicle platform. This setup is also called Mobile Laser Scanner or MLS. The two sensors are mounted at a certain angle to capture the front and back of environment as well since they are 2D rotating sensors.

That creates double point clouds of the same object present in the surrounding. And the individual point clouds of object are distorted in themselves here as well. Despite the challenge, there is not any comprehensive work on these distortions and their causes so far to the best of our knowledge. We have modelled the types and causes of these distortions. Categorised the different kinds of distorted point clouds that are possible. We're also exploring the possibility of extracting object velocity from these distortions which is an essential information to accommodate driver behaviour in autonomous vehicles accordingly. Ultimately, the objective is to recover the 'true' geometry of the object for which a correction needs to be applied to the collected data, which should consider the object motion. Thus, this research work aims to advance our understanding of LiDAR data distortions, paving the way for future work and enhanced precision in spatial representation.

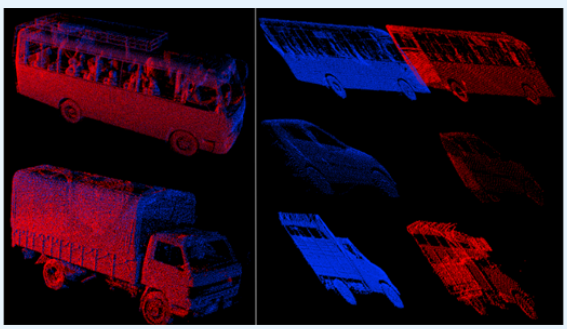
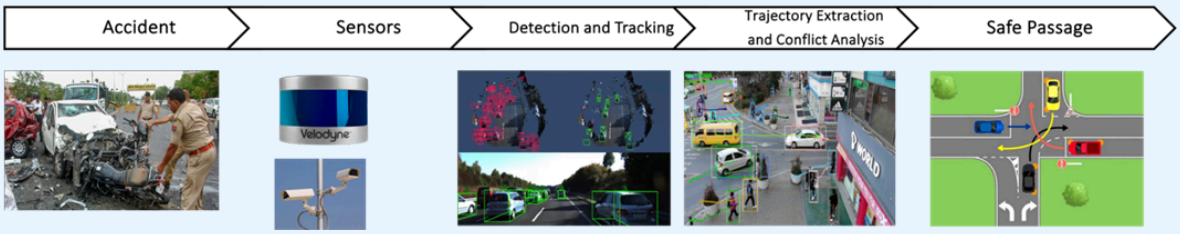


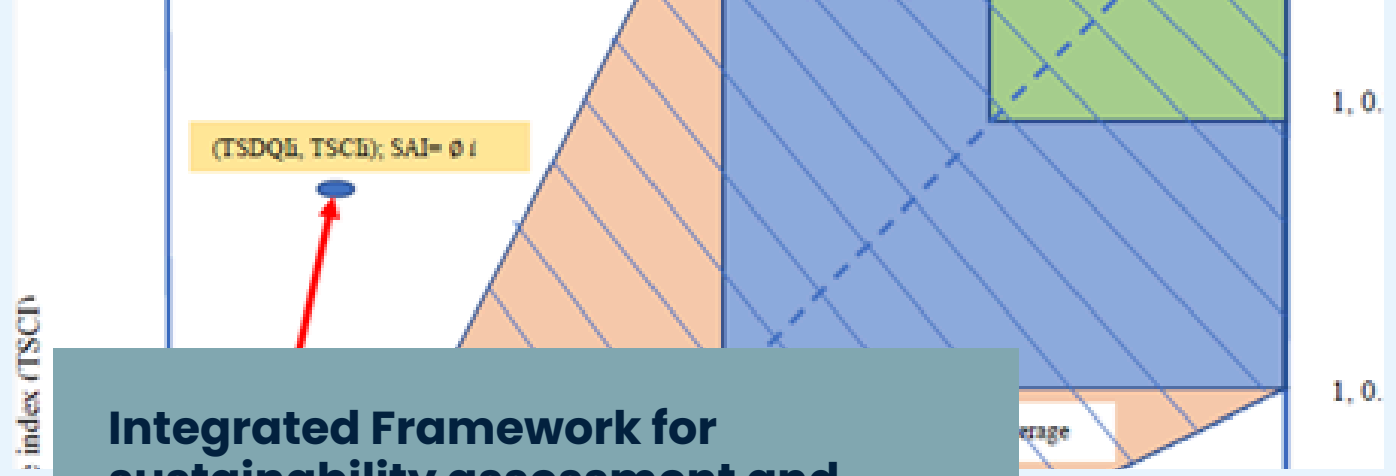
Figure 2 : LiDAR point clouds captured on a road by a Multi-head Mobile Laser Scanner system (StreetMapperV). The left images illustrate the point cloud of static objects, showcasing true data with no distortions and coinciding overlapping point clouds. In contrast, the right images display the point cloud of moving object which appears to be distorted and double point clouds exist due to the relative motion between scanned object and the mobile mapper.

Surrogate Safety Assessment

Rohit Rajput, Salil Goel, and Aditya Medury



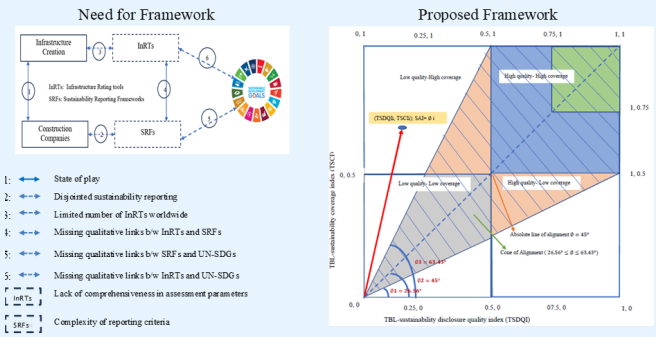
Road traffic accidents are a serious issue, a public health concern, and a leading cause of death and injury worldwide. Intersections are risky locations in a road transport network. The number of road users continuously increases because of which the vulnerability of road users to collision increases as the same space is being used by a variety of motorized, non-motorized vehicles and pedestrians. Traditionally intersection safety has relied on historical crash data, and the drawback of this is that we must wait for sufficient crashes to occur to prevent them, making crash-based safety assessment slow. Crashes are rare and underreported events, making crash data incomplete and unreliable. Surrogate safety assessment is a proactive approach, do not rely on crash data to analyse the intersection safety. Surrogate safety assessment aims to enhance road users' safety by reducing crashes at intersections by utilizing the traffic conflict as a surrogate event. Trajectory information is required to measure traffic conflict. Computer vision is the most advanced technology used to detect and track road users more accurately in real-time. CCTV cameras are primarily used to collect data at the intersection and perform detection and tracking tasks. The camera provides high-resolution image data but does not work correctly in low-light and bad weather conditions. Spatial information is lost while projecting 3D space into a 2D view. Nowadays, LiDAR is used for performing 3D detection and tracking in autonomous vehicles. LiDAR gives the 3D point cloud, which includes accurate depth information, but its resolution is limited. To overcome the limitations of each sensor type, the multi-sensor fusion methodology is used in combination with a deep learning framework to achieve better detection and tracking accuracy. Various conflict indicators are used to distinguish traffic conflict from other traffic events. The most commonly used indicators are proximity-based (Time-to-collision, Post Encroachment Time, Modified TTC), distance-based (Proportion sight distance, Margin to collision), and deceleration-based (Deceleration rate to avoid crash). Single conflict indicators represent a partial image of traffic events and cannot measure traffic conflict accurately. Multiple indicators are combined to get more detailed and accurate information on traffic conflict. Safety assessment is performed based on traffic conflict frequency and severity to reduce the crash risk at intersections.



Integrated Framework for sustainability assessment and reporting for civil infrastructures projects: delivering the UN SDGs

Shivam Srivastava, Usha Iyer Raniga, and Sudhir Misra

Large-scale infrastructure endeavors, encompassing airports, highways, railways, urban developments, and analogous projects, hold pivotal significance in advancing the societal, economic, and environmental dimensions of sustainability, in concurrence with the United Nations Sustainable Development Goals (UN-SDGs). Yet, merely assessing their impacts falls short; entities and vested stakeholders engaged in the inception, operation, and maintenance of such undertakings must furnish comprehensive reports thereof.



Recent publications from the United Nations Environment Programme (UNEP) underscore a sluggish uptake of sustainability evaluation and reporting principles within the civil infrastructure sector. This research endeavors to forge a systematic methodology for appraising the sustainability of civil infrastructure projects and delineating sustainability reports to harmonize with the UN-SDGs. The methodology unfolds in two principal phases. Initially, a cross-referencing is established among sustainability assessment criteria delineated in various infrastructure rating tools (InRTs), the standards set forth by the Global Reporting Initiative (GRI), and the targets delineated in UN-SDGs. Subsequently, a composite metric christened the Sustainability Alignment Index (SAI) is formulated, comprising the Triple Bottom Line (TBL) Sustainability Coverage Index (TSCI) and the TBL Sustainability Disclosure Quality Index (TSDQI). These components are subsequently deployed to scrutinize both the quantitative and qualitative facets of sustainability reporting by select civil infrastructure entities in Asia and Europe. The outcomes of the study signal apprehensions regarding the comprehensiveness of evaluation criteria deployed in InRTs and unveil disparities amidst the sustainability assessment criteria of projects, GRI standards, and UN-SDGs targets. Moreover, the findings spotlight a paucity in the emphasis accorded to environmental sustainability assessment and reporting parameters within companies' disclosures. The delineated cross-referencing, indices, and sub-indices can furnish assistance to organizations in benchmarking their sustainability performance and apprising their relative standing vis-à-vis peers. Additionally, this framework will facilitate more cogent juxtapositions of diverse sustainability dimensions, to the advantage of the general populace, policymakers, and other pertinent stakeholders.

Faculty Views on Students In GEN-Z ERA

Feedback of Students by Faculty

Prof. Chirag Kothari

What do you expect from students of IITK in terms of education, particularly in the discipline of civil engineering?

Frankly speaking, I have spent more time as a student than as a teacher. I became a faculty very recently. Therefore, I can relate with students more than I can relate with faculty members at this point. But I will try to answer your question.

I believe that both students and faculty members should strive to understand and communicate how the contents covered in the curriculum fit into the bigger picture. I've noticed that we study a lot of topics, but sometimes we fail to appreciate how they will be applicable in the real world. For example, you might have studied foundational subjects such as soil dynamics, foundation design, reinforced concrete structures, and many more. However, if, at the end of four years, I ask you to design a simple house, can you do it? We should strive to understand how these subjects relate to real-world applications. From a student's point of view, there should be curiosity—asking questions like, "If I have learned about reinforced concrete designs, can I apply what I've learned to a small project?" This curiosity would push faculty members to create courses that align with industry needs and offer a practical perspective.

How can students apply what they learn in civil engineering to real-world scenarios?

Civil engineering has a vast curriculum that needs to be covered. It used to be a five-year program, but now it has been reduced to four years, with additional courses in humanities and arts included. Thus, it becomes challenging. Despite this, students should always explore how concepts learned can be implemented in the real world.

If you don't understand how the topic that is being taught is applicable in the real world, you should stop the professor and ask, "Why are you teaching us this?" “Where is it applicable”. Unless we can link concepts learned to a real-world application, the knowledge loses its value.

For example, in project management course, we often talk about the critical path method for scheduling. I might teach this in class using a small example with 5 or 10 activities and show how a network is drawn and a critical path is determined. However, in real-world projects, even something as small as building a home could involve around 100 to 150 activities. As a faculty member, it is my duty to provide assignments or tools that allow students to scale up what they've learned. If you know how to handle 5 to 6 activities by hand, are you also aware of the relevant software to implement bigger problems or can you program it in Excel to manage projects with around 100 activities?

Therefore, both students and faculty should aim to tailor assignments in a way that reflects real-world examples. This will require more effort from both students as you need to learn a few additional skills.

How do you ensure academic integrity to prevent plagiarism in assignments?

This is a big challenge. For example, for one of my classes, I have created an assignment to create a schedule and plan for a real-world residential building project. It’s a two-storey house and I have asked students to calculate quantities, prepare schedules, and determine the project costs. By completing this assignment, students would gain some idea of how much it costs to construct a house and how to plan it, which could be useful in their personal lives as well.

However, if students end up copying the assignment, it loses its value because they don't learn the skills. From my side, I cannot create 30 or 40 different assignments and customize them for everyone. So, maintaining academic integrity is a shared responsibility. Faculty members should create realistic and engaging assignments, and students should put in the effort to complete them honestly. This also ties into the broader aspect of integrity and ethics in engineering.

Do you think the courses being offered, particularly ethics courses, impart ethical values in students, or are these values learned from other sources? Are these courses beneficial in the long run?

Are you referring to the engineering ethics courses that were introduced for the Y22 batch? To address your question, I’m not aware of how that course was developed, its goals, or how it is taught. But here's what I think:

As humans, generally, we don’t want to do bad things. I believe in humanity, and this applies to engineers as

well—we don't want to do unethical things. However, our circumstances, the system we live in, societal pressures, and personal ambitions often push us toward unethical decision-making. If an ethics course can effectively communicate the impacts of non-ethical decisions, it could be very beneficial.
For example, if I provided you with 10 case studies where civil engineers took unethical paths and explained the cascading consequences of those decisions, it might resonate with you throughout your life. It could even prevent you from making similar decisions in the future. If we can understand the consequences of unethical decisions through case studies, then yes, an ethics course can add value. Alternatively, instead of having a separate course on ethics, these topics could be integrated into all our courses. This way, ethical considerations are taught across the board.

Should courses like Building Information Modeling (BIM) be integrated into the B.Tech. curriculum for civil engineering students or remain electives?

The challenge is that there are already so many courses that need to be covered in the B.Tech. curriculum. However, I do believe that courses like BIM should at least be offered as electives for B.Tech. students. If you're inclined to pursue a career in civil engineering, especially in project management or construction, then these courses will be beneficial. BIM has the potential to revolutionize our industry.
BIM as a concept should be taught. We don't necessarily need to teach all the software in detail—you can learn that through YouTube or other learning platforms. But as faculty, we should at least introduce you to software, explain its relevance, and create assignments where you can apply it. This way, you learn both the concept and the practical application.

Do you think the lack of software training in the curriculum affects civil engineering students' job prospects compared to their peers in other branches?

Yes, to some extent, it does. Not just software, we need to have some industry-aligned courses in our curriculum, and that includes offering electives that meet the diverse career paths students may choose as civil engineers — whether it's design engineer, project management consultant, or involvement in government initiatives like smart cities.

For example, during my PhD in the U.S., I noticed that their curriculum often included one or two industry-driven courses. These courses were designed to ensure that students would be job-ready, particularly in fields of construction management.

If a student completed these courses with good grades, they were almost guaranteed a job because the industry recognized the value of those specific skills. This created a positive feedback loop: companies valued graduates from certain universities, which increased the university's reputation and led to more opportunities for students.
Similarly, for example, now some government organizations have made use of BIM mandatory for their projects. In this case, if the engineers in the industry are not aware of BIM, they cannot effectively meet these requirements, regardless of the mandate. This is where IITs can play a role in capacity building. Our graduates with such a knowledge set will be invaluable to the industry. We need to understand industry needs and create courses that align with them.

Will these industry-aligned courses be offered as Departmental Electives (DEs) soon?

Yes, I believe they will. In fact, some of these courses, like Project Management and Controls, are offered in the next semester. We are also planning to introduce a course on BIM in a couple of years once we have enough faculty strength in Infrastructure Engineering and Management specialization. Other courses such as Construction economics and finance, and construction contract management, will be available as electives for UG students who are interested in these. So, your batch will have the opportunity to take these courses in the upcoming semesters.

PROFESSOR INTERVIEWS

PROF. SAUMYEN GUHA

Hydrological Engineering

Can you describe the experiences you had since the beginning of your journey?

Over my 26 years here, starting in 1997, I was initially in environmental engineering until 2015, and then I moved to water resources. I was involved in both fields as my original Ph.D. area focused on the intersection of these two disciplines. This integration is common in universities worldwide, as environmental engineering and water resources are closely related. While water resources cover a broad spectrum of hydrological systems, my specific expertise lies in subsurface hydrology. This encompasses groundwater pollution, contaminant transport, and environmental flow dynamics. Essentially, my focus is on the subsurface realm.

With emerging technologies like AI and machine learning, how do you see them influencing your research?

As of now, the application of AI in our field hasn't been successful. AI models require extensive training data, and in hydrology, where systems can be highly complex and varied, this has proven challenging. Currently, we're experimenting with some latest models, but their effectiveness remains limited. However, there's potential for AI to aid in data analysis and prediction in the future, especially with the accumulation of vast datasets from various sources.

You have bioremediation as a research focus. How does this contribute to sustainable groundwater management?

Sustainability has a broad sense and is a buzzword. If you ask someone, what is sustainability, the answer will be subjective depending on their area of interest. I generally avoid such buzzwords. If you talk about my research contribution towards sustainability, I do work on rainwater harvesting and wastewater recycling which are a small part of sustainability. There has been a project going on in Gujarat since 2008 in one of the biggest industry clusters, where we have managed to save almost 50 percent of groundwater and freshwater by recycling the industrial wastewater and sewage back to the industry, through technological intervention.

Can you share any memorable experiences from your time as a mentor at IIT Kanpur?

Over the years, I've had the pleasure of mentoring numerous students, some of whom still maintain contact with me since their time here in 1997-98. It's incredibly rewarding to see their successful lives and careers. Additionally, associating with the students through extracurricular activities like dramatics club and sports has provided unique and enjoyable experiences.

How has the campus evolved during your tenure?

One notable change I've observed is the increase in class sizes, which has affected the dynamics of teaching and teacher-student interaction. Previously, till 2006, the class sizes (in CE core courses) were around 40-45 but now it is 150. So at that time, I used to know every student and all the students also talked to each other and had discussions. Each student could approach me anytime but this is not humanely possible anymore to pay attention to 150 students individually. This part I don't enjoy. Taking classes has become more like performing in a drama with no connection with the students.

What challenges do you foresee in implementing sustainable water management in India?

The primary challenge lies in policy-making. Many policies lack a solid foundation in data and are often influenced by subjective factors rather than empirical evidence. Moving forward, adopting a data-driven approach to policy-making is crucial for the effective implementation of sustainable water management practices. Instead of bureaucrats making the policies, technocrats should do it based on the data.

Could you elaborate on the concept of river interlinking and its feasibility?

River interlinking proposes to transfer water between different river basins, but this approach faces numerous practical and ecological challenges. From hydraulic feasibility to potential ecological impacts, the complexities involved make it an impractical solution. Localized, context-specific strategies are more viable for addressing water scarcity issues. The idea is catchy for the crowd, but if there is no water in Kaveri in the dry season, there will not be excess water in other basins either. To bring water from, say, Narmada to Kaveri will require lifting water across the water divide, which is hydrologically cost-intensive but may not be effective.

What do you see as the emerging field in your area of research?

The integration of various disciplines within the broader realm of water resources management is gaining traction. Large-scale initiatives like the GRACE mission in 2010-11, which is the two satellites NASA sent to study hydrology, is an example. Dr. Balaji Devaraju works on the GRACE data. So these kinds of global missions are going on and these include collaborations of geoinformatics, physics, mathematics, hydrology, everything together. On a smaller scale, you have the challenge of how to close the water cycle. For example, in places like India, you get freshwater input for 2-3 months from monsoon but you have to survive for 12 months. If you can't solve that problem, India will become like Kalahari desert. The main challenge is how to provide water to billions of people.

How do you approach addressing water scarcity as a researcher?

We can't come up with any global solution. It has to be local because the problems have many local aspects. If there is a water shortage in Africa, you cannot transfer it from India. If there is a water shortage in Kaveri Basin, you cannot transfer it from the Brahmaputra Basin. The moment you talk about local, there are local environmental criteria. For example, rainwater harvesting that might work in Odisha will not work in Rajasthan. Global solutions are catchy as a concept but not scientifically tenable at the local scale.

What challenges have you encountered as a researcher in India?

Accessing necessary resources and materials for research can be cumbersome due to bureaucratic processes. Unlike in some other countries where researchers have easier access to resources, navigating bureaucratic hurdles in India can delay research progress and innovation. In the US, if you need a consumable, you pick up the phone and tell the company the university account number and within 24 – 48 hours, the material will be on the table. It was like that in the 90s and even better now. Here, I have to get quotations, fill up several forms, get permissions, and make a big file.

By the time I get the material delivered, someone with the same idea in the US has already done the experiment and figured out the solutions.

Is there any message you'd like to share through SoCE?

I don't know, personally, I don't like to give messages. I don't think I have a lot of wisdom or something. The only thing I tell the students of today is, whatever you do, don't do it because that is the thing to do or everyone else is doing or someone is telling you to do it. DO IT WITH PASSION. WHATEVER YOU THINK IS YOUR PASSION, DO IT. Being in IIT, you know you will get a job to sustain a good life but do something that is your passion, not for the sake of doing it.

PROF. BALAJI DEVARAJU

Geoinformatics Engineering

What is physical geodesy and how does it contribute to our understanding of the Earth's space and gravity freedom?

The term Geodesy is a combination of two Greek words "Geo" and "Desy," and embodies the enduring human endeavor to comprehend the surrounding world, particularly through exploration and mapping. It's part of a bigger field called metrology, which is the science of measurements. When we talk about geodesy, we focus on four main things: size, shape, rotation, and gravity. Let's say we want to know the geometry of Earth. We need to know how big it is, what shape it is, and even how it spins. But why gravity? Well, everything on Earth weighs because of gravity. Imagine putting a bunch of marbles together—they'll arrange themselves in a way that's in equilibrium with gravity pulling them down. It's like they're all trying to find their balance. Now, here's the twist: gravity isn't the same everywhere on Earth. It changes depending on where you are and what's underneath. So, when we measure the Earth's size and shape, we have to think about how gravity plays into it. It's like trying to draw a map, but the ground isn't flat, and gravity keeps pulling things in different directions. In simple terms, geodesy is all about understanding the Earth by measuring its size, shape, how it moves, and even how gravity affects it. By doing this, we can create accurate maps and learn more about the world we live in.

What inspired you to specialize in signal processing on the sphere? How does this specialization contribute to your research?

Gravity, electricity, and magnetism are the three fundamental forces in our universe. They're called conservative vector forces because they behave in a particular way: no matter which way you move or what path you take, the energy you use stays the same. It's like walking from one spot to another—you'll use the same amount of energy whether you go straight or take a detour. Now, in these forces, there's something special about gravity. It's all about mass—like how everything has weight because of gravity pulling it down. It's like a river flowing without a beginning or an end. That's what we mean when we say there's no source or sink. When we do the math for this kind of force, we end up with something called harmonic functions. These functions are like the building blocks of signal processing, which is all about understanding the patterns that combine to form a signal, like temperature changes over time. Harmonic functions are handy because they help us compress information. Imagine you only need to know the temperature for each season to predict the weather for the next hundred years. That's possible because of these harmonic functions—they simplify complex data into manageable pieces. This connection between signal processing and gravity studies is super important. When we measure gravity from satellites, we use spherical harmonics—a fundamental term for a method of handling data on round surfaces, like Earth. And when we measure gravity from the ground, we get gravity anomalies, which are just differences from what we'd expect. So, in simple terms, signal processing helps us make sense of gravity data. It's like decoding a message from space to understand what's happening down here on Earth. By combining these different tools and techniques, we can learn a lot about how gravity works and how it affects our world.

Can you share any ongoing or upcoming projects that you are particularly excited about how they contribute to your research interest and how these projects specifically benefit the students as well as yourself who are interested in geodesy?

Let's dive into three significant advancements transforming the field of geodesy, making it more accessible, and enabling groundbreaking discoveries. Firstly, let's talk about Global Navigation Satellite Systems (GNSS). These systems, including GPS, GLONASS, and Galileo, have become household names thanks to their widespread integration into smartphones and other devices. But it wasn't always like this. In the past, GNSS technology was expensive and bulky, limited

to specialized equipment used primarily in navigation and surveying. However, advancements in technology and manufacturing has led to a dramatic reduction in costs and size, democratizing access to GNSS capabilities. Affordability has revolutionized the landscape of geodesy, opening doors for individuals, organizations, and even entire nations that were previously unable to afford such technology.

This democratization of GNSS has far-reaching implications. Imagine a small community in a remote area needing accurate mapping for infrastructure development or disaster preparedness. In the past, this would have been prohibitively expensive, if not impossible. Now, with low-cost GNSS receivers readily available, communities can take charge of their mapping projects, empowering them to make informed decisions and improve their quality of life. Furthermore, the ubiquity of GNSS technology has sparked a wave of innovation, with enthusiasts and professionals alike exploring new applications and solutions. From hobbyists tracking wildlife migrations to farmers optimizing crop management, the possibilities are endless. Next up, let's discuss the integration of GNSS technology with satellite instrumentation. Satellites have long been invaluable tools for Earth observation, providing vital data for weather forecasting, environmental monitoring, and scientific research. However, traditional satellite systems typically rely on passive sensors, such as cameras and spectrometers, to collect data. While effective, these sensors have limitations, especially in areas with dense cloud cover or at night. Enter GNSS-enabled satellite instrumentation, a game-changer in remote sensing and geodetic applications. By incorporating GNSS receivers into satellite payloads, researchers can augment traditional sensing capabilities with real-time positioning and timing data. This integration not only enhances the accuracy and reliability of satellite measurements but also unlocks new possibilities for monitoring and analysis. For example, GNSS signals can penetrate cloud cover and operate in all weather conditions, providing continuous data streams for applications such as flood monitoring, forest mapping, and urban planning. Moreover, GNSS-enabled satellites enable innovative techniques such as microwave remote sensing. By analyzing reflected GNSS signals, researchers can derive valuable information about surface properties, such as soil moisture and vegetation density. This non-traditional approach to remote sensing offers unique insights into Earth's dynamics, facilitating more comprehensive assessments of environmental change and ecosystem health. Lastly, let's explore advancements in gravity measurement technology, particularly the Gravity Recovery and Climate Experiment (GRACE). Launched in 2002, GRACE revolutionized our understanding of Earth's gravitational field by providing unprecedented insights into mass distribution and dynamics.

Unlike traditional gravity measurement techniques, which rely on ground-based instruments and local observations, GRACE utilizes twin satellites in low Earth orbit to map gravitational anomalies on a global scale.

The key innovation of GRACE lies in its ability to measure variations in gravitational acceleration caused by changes in mass distribution, such as melting ice caps, groundwater depletion, and ocean currents. By precisely tracking the distance between the two satellites, GRACE can infer changes in mass beneath their orbit with remarkable accuracy. This information is invaluable for studying Earth's hydrological cycle, climate dynamics, and geophysical processes. Furthermore, recent advancements in satellite technology promise to enhance the capabilities of gravity measurement missions like GRACE. For example, the upcoming GRACE Follow-On (GRACE-FO) mission aims to improve spatial and temporal resolution by deploying additional satellite pairs and incorporating advanced instrumentation. These advancements hold tremendous potential for advancing our understanding of Earth's complex systems and addressing critical challenges such as climate change, water resource management, and natural hazard mitigation. In conclusion, the convergence of GNSS technology, satellite instrumentation, and gravity measurement techniques represents a transformative era in geodesy. These advancements not only make geodetic tools more accessible but also enable groundbreaking discoveries and applications across diverse fields. Whether it's empowering communities with low-cost mapping solutions, revolutionizing remote sensing with GNSS-enabled satellites, or unraveling the mysteries of Earth's gravitational field with missions like GRACE, the future of geodesy is brighter than ever.

What advice would you give to the students interested in pursuing a career in geodesy or related fields based on your own experiences and journey in academia?

In my opinion, the only thing holding us back from pushing the boundaries is our imagination and creativity. When someone says, "You know civil engineering," I disagree. To me, it means they're not thinking beyond what's right in front of them. I believe the key to stretching those limits is to fully immerse yourself in what you love. If you're passionate about a certain aspect of civil engineering, dive deep into it and let your creativity soar. For instance, who would have thought when GNSS technology started that we'd have so many satellite constellations and it would be in our cell phones? It's about embracing creativity and being open to new possibilities. But here's the thing: progress takes time. Just like growing a tree, developing groundbreaking ideas doesn't happen overnight. Take the Gravity Recovery and Climate Experiment (GRACE), for example. The initial concepts for GRACE emerged in 1965, but the satellite wasn't launched until 2002—almost 40 years later! In science, you have to be patient and committed to exploring ideas without seeking immediate gains, especially monetary ones.

Sure, if you're good at what you do, the rewards will come eventually. But what truly matters is putting forth your ideas, communicating them effectively, and inspiring others to join in the pursuit of knowledge. So, whether it's geodesy or any other field you're passionate about, my advice is simple: immerse yourself. That's where the magic happens.

PROF. CHINMOY KOLAY

Structural Engineering

Can you discuss your research focusing on the behavior of structures under extreme load events such as earthquakes, windstorms, and blasts? What key advancements have you witnessed in recent years?

I focus on the behavior of structures under extreme events, both natural (earthquakes, windstorms) and manmade (impacts, blasts), aiming to mitigate their effects. I use advanced experimental techniques, like hybrid simulation, where conventional elements are modeled using finite elements, and complex components, such as dampers, are tested in the lab with appropriate boundary conditions. My work primarily involves dampers like tuned liquid dampers and SMA dampers, which dissipate energy to minimize or prevent structural damage.

Structural dynamics and control are key aspects of your research. How do these elements contribute to designing structures that can withstand dynamic forces, and can you provide examples of their practical applications?

Understanding structural dynamics is crucial because extreme events cause structures to oscillate, making their response time dependent. Unlike static responses where loads are applied slowly, dynamic events like earthquakes make structures vibrate. This understanding is essential for controlling the response, especially in tall buildings that need to limit swaying to acceptable levels under extreme loads.

What is the purpose of Soil Structure Interaction (SSI) in structural analysis? How does your research address the complex interplay between soil and structures? Are there any innovative approaches or technologies you are exploring to improve our understanding of soil-structure interaction?

Soil-structure interaction (SSI) involves understanding how soil flexibility affects a structure's dynamics. For instance, a cantilever beam's stiffness decreases if its base is on deformable soil, altering its dynamic response and natural period. Engineers use finite element modeling to simulate the mutual effects of soil and structure, especially during earthquakes when soil waves impact the structure's response. Although finite element methods are standard for SSI problems and I have worked on them before, it is not my current focus but addressed when necessary.

Numerical techniques play a crucial role in your research. Can you discuss the computational methods and modeling approaches you employ to study the behavior of structures under extreme loads?

In structural dynamics, the equation of motion is a second-order ODE, with inertia, damping, and resistance on the left side and input excitation on the right. For nonlinear structures, this becomes a nonlinear ODE, which is challenging to solve, especially with arbitrary excitation. Time-stepping methods integrate the ODE to get the response. I developed an explicit integration algorithm, the KR-alpha method, which predicts the current response from the previous time step and is unconditionally stable, ensuring accurate, bounded responses. It also includes numerical damping to handle spurious higher modes in finite element simulations. This algorithm is particularly useful in hybrid simulations, where part of the structure is physically tested while the rest is modeled on a computer, solving the equations of motion effectively at each time step.

Real-time hybrid (pseudo-dynamic) simulation is mentioned in your research interests. Could you simply explain this simulation technique and highlight its significance in studying structural behavior during extreme events?

Real-time hybrid simulation involves both numerical and experimental domains interacting in real time, necessary when lab devices have force dependent on velocity as well as displacement. Displacement is controlled to achieve the correct velocity. The simulation must match

real-time events, such as a 30-second earthquake simulated in 30 seconds, with computations done rapidly at each short time step (e.g., 1 millisecond). Both simulation parts must work simultaneously within these brief periods, making real-time hybrid simulation challenging.

With advancements in sensor technologies and data analytics, how do you leverage real-time data in your research on structural dynamics and control? Can you share examples of how monitoring and control systems have been implemented to enhance the resilience of structures in response to dynamic loads?

In real-time hybrid simulation, it's essential to use the latest sensor technology to accurately measure the response from the laboratory. Advanced load cells are crucial because they provide low-noise measurements that interact with your system. I use the most up-to-date sensor technology available. Once we understand the structure's behavior through this advanced testing, we can develop devices and methodologies to mitigate structural responses. However, my focus isn't on analyzing data to predict outcomes. Instead, I concentrate on understanding the structural behavior based on the measured responses.

Nonlinear structural analysis is known for its complexity. Can you discuss any innovative methodologies or tools you have developed or employed to address the challenges associated with nonlinear analysis? How do these approaches contribute to a more accurate understanding of structural behavior?

Non-linear analysis is crucial for understanding structural behavior under extreme loads, as structures often exceed the linear elastic range, particularly during events like earthquakes. This necessitates non-linear structural dynamics analysis. We've developed finite element tools using the KR alpha method for this purpose. Additionally, I created an advanced course, CE624: Non-linear Structural Analysis, covering techniques for performing non-linear analysis. Fundamental concepts in both linear and non-linear analysis include equilibrium, compatibility, and constitutive relationships.

In the context of your research, how do you see the future of structural engineering evolving, especially in addressing challenges posed by extreme load events? Are there emerging technologies or methodologies that you believe will have a transformative impact on the field?

Previously unimaginable, base isolation technology and dampers are now crucial in mitigating earthquake loads in important buildings and bridges. Damping devices like elastomeric and viscous dampers are used in real buildings. As research progresses, new systems and technologies are developed. Historically, earthquake-resistant design aimed to ensure life safety under the design-basis earthquakes, accepting some damage. The focus is now on creating resilient, damage-free structures using sacrificial elements or energy-dissipating devices. Advanced countries like Japan and the US have adopted these technologies, but countries like India lag. The 2001 Bhuj earthquake highlighted the need for updated design codes in India, which currently lack provisions for modern technologies like Buckling Restrained Braces and Eccentrically Braced Frames. Updating these codes is crucial for a more resilient built environment.

As a professor specializing in the behavior of structures under extreme load events, how do you integrate real-world case studies into your teaching curriculum? Can you share an example of how your research findings have influenced or enriched your approach to educating the next generation of structural engineers?

The understanding I gain through research naturally enhances my teaching. As a structural engineer, it's crucial to understand how structures behave under various loads, both extreme and every day. To illustrate this, I used a structural analysis kit from Brazil to demonstrate simple structural behaviors. Comprehending structural behavior is essential for mitigation efforts. My teaching evolves with my research, enriching lessons with a deeper understanding rather than specific studies. This approach aims to engage students in the core principles of structural engineering.

What inspired you to specialize in this area, and specifically in structural engineering?

In high school, my favorites were physics and math, leading me to civil engineering, and eventually to a passion for structural engineering and earthquake-resistant design. My advice is to follow your interests. Spend time exploring subjects to see if you truly like them. This applies to any field, not just structural engineering. If understanding how structures behave under loads excites you, consider structural engineering. If you're undecided, give yourself time to explore different domains. Your career is long, and your studies guide but don't limit you. Ultimately, enjoying what you do will naturally guide your choices.

PROF. PRANAMESH CHAKRABORTY

Transportation Engineering

How does transportation engineering differ from other engineering specialties? And what are the current hot topics in the transportation research area?

In my opinion, one of the most distinctive aspects of transportation engineering is its profoundly multidisciplinary nature. In Transportation, humans are engaged. Therefore, we need to study human behavior. It needs corresponding expertise on human cognition, which makes it entirely distinct in the field of civil engineering. On the other hand, we also have pavement engineering where the study is completely focused on material and its behavior under different circumstances. So, once we have a road, it's the combination of humans who are driving on it and the materials that are at the bottom of it. So that is one of the things that, I would say, is unique, which makes it very interdisciplinary compared to other fields. There are several hot topics in different domains of transportation. Related to my research area, currently there is a lot of interest on how to handle and process the massive scale of data that sensors generate. For example, we have thousands of cameras all along our highways and intersections. Also, if we consider the data generated by smartphones while we are traveling, we have large-scale data coming in. If we want to take in all this data for each of these vehicle trajectories, then it's a huge amount of data. Even if we aggregate the data generated from the smartphones of each vehicle, we can have the traffic information of all our road segments at every subminute interval 24x7. Such large-scale data can be processed and analyzed in real-time to disseminate traffic information to the users. This can help transportation users to utilize their time in a better way.

What are the uses of simulation software while analyzing the data taken from the natural state driving states? What are their applicability in Indian conditions?

There are different simulation software out there. One of the most popular is Vissim. It uses car-following models that are related to human psychological behavior, along with the other standard behaviors of how humans drive. There are many other simulation platforms also in this domain. But in India, transportation is uniquely characterized by Indian drivers, who drive in a significantly different way from how drivers in developed countries behave. Therefore, anything that we must do here needs to be recreated considering the Indian driving behavior. So, anything that you want to do currently for Indian conditions, you will have to develop on your own. Currently, there is a significant investment in highway construction and maintenance: looking into not just creating the highways but also operating the highways in a better way. We have to understand the driver's behavior and, accordingly, decide what we should do. So, there are a lot of open areas where people can work to find solutions for Indian conditions.

How do you implement it in your academic module?

One of the things that we can try to approach first is obviously how these models work. The other usage is for data creation for machine learning models. It is extremely hard to get real-world data for all possible scenarios. We can create such cases using simulation software. Besides this, generating data samples with generative AI has become an interesting research work. Another domain is based on it, which is called few shot learning and zero shot learning, where we are giving only a few samples because we do not have enough samples that we can give. We are giving a few samples, and then we are trying to generate something based on that. So, these two will be the tools that need to be used to determine the failure cases. Even if I do driving studies in US conditions, how many crashes can we capture? A very small number of crashes. But ultimately, for these autonomous vehicles, their major failure point will be crashes. So, we have to generate those. Generating rare-end event cases for autonomous vehicles will be crucial in determining their major failure points.

By conducting driving studies and capturing as many crashes as possible, we can better understand the potential risks involved in autonomous driving. Ultimately, creating these rare event cases will allow us to proceed with developing safer and more reliable autonomous vehicles.

What are the challenges being faced in the field of transportation engineering in India as of today and how can they be addressed?

One of the major challenges is the uniqueness of Indian driving. Anything that we want to do, we will have to build it focussing on Indian traffic conditions. But I will say that as science is progressing, we can easily adapt them and make them more catered towards Indian transportation systems. We have the correct time where I think we can put those things because we have a lot of funded projects and a lot of funding that is coming in in our transportation domain, not just building, operating, and maintaining the roads but also for the advancement of technologies. To the current new students who are graduating, I will strongly encourage them to consider transportation as the domain where they can work on these exciting real-world problems, utilizing the knowledge gained during their UG or PG times. It's a very exciting time, I would say, for all graduating students.

As a professor of big data analytics, how can you relate real-world studies to your teaching field? Can you please share an example with us?

The things that I work on, we consider real-world cases. For that, we need to collect and work on large datasets. It requires a huge amount of resources. Previously we had limitations in terms of processing power, and storage power. Currently, we do not have those limitations. Our processing power and storage power have significantly increased. So, we collect as much data as we can, using different sensors wherever we want. However, the data that we get is significantly noisy. Now, if we just give some model to infer from the noisy data, we will not get fruitful results. So, we need to visualize the data and see what is coming in. So rather than keeping it as a black box, we should try to first check the data to find out what kind of noises are there and how to remove the noises. That can lead to finding solutions and applying them in the real world.

For example, let's say when we put CCTV cameras on traffic intersections, we try to put it in a definite way, but then we can't assume that it will be fixed all it's exact position all the time. It can have some minor fluctuations because of wind. It may lead to completely erroneous data and alerts generation. These kinds of problems will always be happening on the field. So, we do try to consider those cases and accordingly make sure a lot of cameras will be pan-tilt-zoom. Accordingly, we can tweak our model to make them work in the real world.

Any current or planned initiative or project that you like?

Currently we are looking to work on understanding the Indian driver behaviour. We are trying to study where the driver looks while driving and getting affected by surrounding traffic conditions. Then if we put in other sensors that can track human heart rate, etc., we can get other insights. For example, when the drivers are going through a region where the cognitive load is higher, then how much cognitive load is coming on the driver, and how does it change with the amount of time the driver is driving? So, human cognition needs to be considered because humans are not machines. I will say that this is an exciting time for the transportation engineering domain. So, I urge the students to consider this as a possible domain where they can apply the knowledge that they have gained in their UG or PG days to exciting real-world problems both directly on the field and even while working remotely to create models for application.

PROF. CHIRAG KOTHARI

Infrastructure Engineering & Management (IEM)

What are the biggest problems in managing infrastructure today, and how do you think they will change in the future?

As you are aware, India is focusing heavily on infrastructure construction. We have undertaken far more construction projects in the last decade than in previous decades. For example, we have built as much new infrastructure on our campus in the last decade as in the years before that. Thus, the overall infrastructure volume is increasing substantially.

Ensuring we maintain cost, safety, and quality standards during construction, is crucial when doing construction at such a rapid pace. Additionally, these infrastructure assets will begin to deteriorate over time. While our current focus is on building new infrastructure, we must also develop strategies for maintaining and rehabilitating them. If we fail to perform maintenance at the right time, our assets will deteriorate at a higher rate, and the overall cost of maintaining them will increase. I believe this problem will intensify because the volume of infrastructure is expanding.

This important aspect needs to be emphasized moving forward: how can we be more proactive about maintaining our infrastructure assets? We will soon face a challenge where substantial funds and resources will be needed to maintain and rehabilitate our assets.

What are the most important parts of building sustainable smart cities, and how can we ensure they work well together?

To truly grasp the idea of smart cities, we must break down these concepts of sustainability and smart cities. Sustainability, by definition, is about meeting current needs without compromising the ability of future generations to meet their own needs. However, this definition, while important, is somewhat intangible.

A more practical approach to understanding sustainability is through the 3E framework, which stands for economics, environment, and equity. Any sustainable solution must be economically viable, meaning it should generate enough revenue to cover costs and meet demand, ensuring long-term financial stability for cities or nations. Economic sustainability should not come at the expense of the environment, so practices must be environmentally friendly to maintain ecological balance. Lastly, often overlooked in the social equity aspect, which focuses on the social dimensions of sustainability, ensuring fair distribution of resources so that those with higher needs receive adequate support. Every infrastructure project has a socio-economic impact, and decisions should be made with social equity in mind. So that's sustainability.

Next, when discussing smart cities, we refer to integrating IoT, sensors, and information technologies to collect and utilize data to facilitate informed decision-making. A smart city has various components, including smart governance for efficient management of city services, smart mobility for improved transportation systems, smart communication systems for enhanced connectivity and information dissemination, smart alert systems for advanced warning and emergency response, and smart assets. For example, in a future pandemic scenario, smart hospitals with data-sharing capabilities can help agencies manage resources like oxygen and ICU beds more effectively. Smart cities aim to enhance residents' lives by seamlessly integrating these technologies to improve decision-making and overall quality of life.

Could you provide an example of how digital twins enhanced the performance and sustainability of an infrastructure project?

Digital twins are essentially digital replicas of physical assets. For example, creating a digital twin of a building involves capturing all the relevant information about the physical structure and recording it in a digital system. The concept of a digital twin is straightforward: you want a replicated system with numerous potential applications throughout the project life cycle, from planning, designing, and construction to operation and maintenance.

However, creating digital twins for entire cities poses a significant challenge. Singapore's ongoing project is a notable attempt to develop a digital twin of the city. The process involves much more than installing IOT-based devices, which can be cost-prohibitive. Thus, understanding the use case for digital twins, conducting thorough research to determine what information is required for decision-making, and performing a cost-benefit analysis are essential.

Digital twins have been effectively implemented in specific areas, such as airports. For instance, Vancouver and San Francisco airports have digital twins for operations, such as flight schedules, gate information, and real-time camera data to predict traffic and monitor passenger movement. This allows efficient resource allocation. Another application of digital twins is in energy conservation. Buildings and airports use motion-sensor lights and air conditioning systems that adjust based on occupancy/airport traffic, reducing energy bills and promoting sustainability. Baggage handling systems in many airports, including those in India, rely on digital twins. These automated systems automatically sort luggage, minimizing the need for human intervention. Operators can oversee the entire process remotely, ensuring smooth operations.

These examples illustrate the diverse applications of digital twins and their potential to enhance efficiency, sustainability, and resource management.

How, in your opinion, has the application of building information modeling changed how infrastructure projects are planned and carried out?

Building Information Modeling (BIM) has the potential to revolutionize the infrastructure industry by transforming how we plan and carry out the three phases of a construction project: pre-construction, construction, and asset maintenance. In the pre-construction stage, BIM is a game changer. BIM is essentially an information system that consolidates all the data in one place. Traditionally, stakeholders, such as architects, structural designers, and electrical and HVAC agencies, worked in silos, leading to coordination and constructability problems. BIM allows them to collaborate on a single platform, facilitating clash detection and conflict resolution at an early stage. Additionally, quantity takeoffs have become automated, allowing for real-time cost estimations and adjustments based on changes in materials or design.

As far as the construction stage is concerned, BIM is gaining momentum, though there is still room for development in managing activities using BIM. Large-scale projects with thousands of workers and numerous concurrent activities can benefit from BIM's 4D and 5D visualizations. These visualizations help ensure that resources are available, permissions are secured, the work front is available, and work is carried out in the correct sequence. BIM can significantly enhance project management by streamlining these processes.

The application of BIM in the final phase is still under research.

A digital twin of a building can provide valuable information for rehabilitation and maintenance. Real-time information coupled with BIM models can optimize maintenance schedules and resource allocation. Despite its potential, a significant challenge with BIM is the lack of skilled personnel. To realize its full potential, academic curriculum, and industry training programs must promote BIM and related technologies.

What are your thoughts on how modular construction techniques may affect the future of infrastructure development? Are there any recent innovations in this field that have piqued your interest?

The possibility of doing modular construction has positively impacted infrastructure development. It has allowed construction work to be conducted off-site. This approach means many components are prefabricated in a controlled factory setting instead of construction sites.

This shift offers several advantages. For instance, in metro projects, many segmental lanes, piers, and even station building blocks are now constructed off-site and then transported to the site for assembly. As a result, it is more productive, reduces waste, and provides better quality control. Additionally, it minimizes on-site disruptions, which is crucial for projects in busy areas.

Modular construction will increase as our cities become more complex and dense. The controlled environment of offsite construction allows for greater efficiency and precision. However, scalability remains a challenge. Developing effective methods for large-scale modular construction and navigating the necessary regulations is critical.

Another exciting aspect is the potential to integrate robotics and automation. The difference between traditional construction sites and manufacturing units is noteworthy. In a manufacturing setting, such as producing laptops, the product moves along an assembly line with stationary machines performing tasks. Conversely, in construction, the building remains stationary, and the equipment moves to perform the necessary functions. The potential to do construction work in a factory setting offers numerous opportunities for incorporating robotics, AI, and other Industry 4.0 technologies into construction. By moving parts of the construction process off-site, we can adopt a manufacturing-style approach where the product moves through various stages of assembly in a controlled environment.

SANKALAN 2024

ABOUT SANKALAN

Sankalan'24, the inaugural civil engineering conclave organized by the Society of Civil Engineers at IIT Kanpur, marked a significant milestone in the academic calendar. Held on January 27-28, 2024, this pioneering event brought together students, faculty, industry professionals, and thought leaders in civil engineering, fostering an environment of learning, collaboration, and innovation.

Key Highlights:

1. The event attracted over 200 attendees, reflecting its widespread appeal.
2. 103 participants were external, representing various engineering colleges and institutions from across India.
3. The diverse group included students, faculty, and industry professionals, all contributing to the vibrant discussions and activities.

Event Overview:

- Pre-Events:

·Civil Engineering Cricket Tournament: Engaged participants in a friendly competition, building camaraderie among students.

·5km Run: Promoted health and wellness, offering a refreshing start to the conclave.

·Campus Visits: Teams visited several engineering colleges in Kanpur and Lucknow, including Harcourt Butler Technical University, Allenhouse Institute of Technology, and BBD University, to spread awareness about the conclave and encourage participation.

- Main Events:

·Opening Ceremony: The conclave was officially inaugurated with a lamp-lighting ceremony, followed by inspiring speeches from distinguished professors such as Prof. C.K. Sahu, Prof. Priyanka Ghosh, and Prof. Tarun Gupta, who shared their insights on the future of civil engineering.

- Technical Talks:

·"Unveiling the Unthinkable: A Journey Through Unprecedented Civil Engineering Wonders" by Prof. Srinivas Mantrala, exploring groundbreaking innovations in civil engineering.
·"Driving Progress: Lessons from the TiHAN Test Bed in Autonomous Vehicle Research" by Prof. Digvijay S. Pawar, highlighting the intersection of civil engineering and autonomous vehicle technology.
·"Mechanisms of Vegetation-Induced Cooling in Urban Canyons" by Prof. Simone Fatichi, focusing on sustainable urban design.

- Panel Discussion:

A session on Bridge Health Monitoring Systems brought together industry experts and academicians, including Dr. H.R. Yadav and Mr. V. Karthik, to discuss the latest advancements and challenges in the field.

- Workshops:

1. AI in Smart Cities: Led by Ms. Sanjita Prajapati, this workshop provided insights into how artificial intelligence can transform urban infrastructure.
2. Structural Design Practices Using Soft Computing: Conducted by Mr. Rohit Yadav, this session offered practical knowledge on modern design techniques.

- Competitions:

A Paper Presentation Competition allowed students to showcase their research, with topics ranging from innovative materials to sustainable construction practices.

- Lab Tours:

Participants were given the opportunity to explore advanced civil engineering labs at IIT Kanpur, gaining hands-on exposure to the latest research and technologies.

- Cultural Evening:

The day concluded with a cultural event, providing a platform for participants to relax and enjoy performances that celebrated the rich heritage and diversity of India.

Sankalan'24 was more than just an academic event; it was a celebration of the civil engineering community's collective efforts to innovate and push the boundaries of what is possible. The conclave successfully brought together a diverse group of individuals, fostering connections that will likely lead to future collaborations and advancements in the field. The dedication of the organizing team, coupled with the generous support from sponsors like Rodic Consultants and Anton Paar, ensured that Sankalan set a high standard for future events at IIT Kanpur. This conclave laid a strong foundation for what promises to be an enduring tradition, positioning IIT Kanpur at the forefront of civil engineering education and research.

Websites:

- Official IIT Kanpur website: https://www.iitk.ac.in/new/sankalan24
- Civil Engineering IIT Kanpur's Notice: https://www.iitk.ac.in/ce/
- Media Coverage IIT Kanpur: https://iitk.ac.in/new/media-coverage-sankalan24
- Sankalan Official website: https://sankalaniitk.in/
- Society of Civil Engineers Official website: https://soceiitk.org/

SANKALAN PRE-EVENT CE CUP 2024

The CE Cup'24, organized by the Society of Civil Engineers (SoCE) in 2024, marked a significant revival of the cricket tournament last organized in 2007. The competition was held on a larger scale this year, with the expectation of increased participation and competition. Three months of intense competition, starting on October 14th, 2023, included participation from over 12 teams of UG and PG (undergraduate and graduate) students, for a total of over 120 players.

The matches took place in Halls 5 and 8, which offered plenty of room for the intense battles that took place over the course of the months. The tournament concluded on February 11, 2024, following months of fierce competition. The final match drew a significant crowd, with numerous students from the department turning out to support their favored teams.

The championship title match between the UG and PG teams marked the event's high point. The UG team of Y21 triumphed and took home the coveted CE Cup trophy amid wild applause and excitement. Each competing team received a medal, and the victorious team received the coveted trophy.

The strong bonds between UG and PG students at the CE Cup'24 stood out above the thrill of the matches. This was one of the event's standout features, fostering a sense of unity and solidarity within the department. In terms of sportsmanship and community spirit, the tournament was praised as a huge success overall.

HIGHLIGHTS 2023-24

AWARDS and RECOGNITIONS

Following students from Department of Civil Engineering have received awards in different categories-

IITK Excellence in Art and Cultural Activities-
Parth Bhatt, 200669
Anjali Jain, 200132
Nikhil Singh, 200636

IITK Excellence in Community Services-
Mohammad Imad Khan, 190499
Shivangi Yadav, 200944

Best All-Rounder Girl Student of 2 year Master's Programme Gold Medal-
Mansi Pradip Koshti, 22103031

Bhagwani Devi Maheswari Gold Medal-
Gauri, 200381

Prof. ASR Sai Memorial Medal-
Aryash Pateriya, 190189

Prof. ASR Sai Gold Medal-
Prajak.ta Prasad Kapre, 22103040

Dr. S.D. Bokil Memorial Medal-
Saurabh Kumar Maurya, 22103059

Outstanding Ph.D. Thesis Award-
Suaiba Ali Mufti, 18103278
Vikram Chaudhary, 18103281

General Proficiency Medals-
Aryash Pateriya, 190189

Envirotech GD Agrawal Award-
Surya Sujathan, 16203265
Akshat Verma, 18103263

DEPARTMENT NEWS, PROJECTS and PUBLICATIONS

FOR MORE INFO, on Latest Publications and Department News, Please visit : ***https://www.iitk.ac.in/ce/***

PROJECTS:

IIT Kanpur's Department of Civil Engineering has been at the forefront of innovative research, concentrating on a variety of fields including structural engineering, geotechnics, environmental engineering, hydraulics, and transportation engineering.

Notable projects include:

The design and retrofitting of large bore engines powered by methanol for use as locomotives and power plants, as well as the creation of a cleaner Ganga River template and an assessment of the effects of agriculture on the water balance of the Hindon River. The department has also achieved great progress in geoinformatics, producing and labeling LiDAR point clouds for CNN-based automatic classification. The department's emphasis on creative and sustainable engineering solutions is demonstrated by its work on advanced parking management systems, hydro-mechanical behavior, and MSE wall seismic performance. The department is dedicated to tackling important environmental issues, as evidenced by its ongoing research on soil moisture variability, DME-fueled tractor engines for ultra-clean emissions, and the partitioning of evapotranspiration fluxes. Advances in civil infrastructure can be attributed to studies in structural engineering on stress concentration factors in curved plates and the seismic performance of infrastructure. Transportation engineering projects demonstrate the department's focus on enhancing long-term infrastructure performance. Examples include modeling passing behavior on highways and examining the physicochemical properties of cementitious materials. Ultimately, the department's focus on real-world applications is demonstrated by the development of products like smartphone video recording setups and a collapsible multiple drawing sheet holding device, which highlight the department's unique combination of cutting-edge research and real-world innovation.

Department news:

- The Devendra Shukla Distinguished Lecture Series Seminar was organized on April 10, 2024, with Mr. Krishnamurthy Subramanian, Executive Vice Chairman of Afcons Infrastructure Limited, as the distinguished speaker.
- Prof. S. N. Tripathi was awarded the prestigious Infosys Prize 2023 in Engineering and Computer Science by the Infosys Science Foundation.
- Prof. Priyanka Ghosh was invited to join the Editorial Board of the International Journal of Geomechanics, ASCE, as an Associate Editor.
- Prof. Dipti Ranjan Sahoo, an IITK CE alumnus (M.Tech/PhD), received the prestigious Shanti Swarup Bhatnagar Prize 2022.
- Applications were invited for a Masters by Research (MSR) position in Environmental Engineering in Walk-In mode.
- Ms. Akanksha, a PhD student under Prof. S.N. Tripathi, secured the second position in the poster competition held at ICAS 2023 in Bangalore.
- A seminar on Offshore Geomechanics was conducted by Dr. Anamitra Roy from the University of Melbourne on August 30, 2023.
- Prof. Abhas Singh and Prof. Sudib K Mishra were honored with the Excellence-in-Teaching Award 2023.
- Dr. Suparno Mukhopadhyay was selected for the prestigious Professor R.N. Biswas Young Faculty Fellowship in Teaching Excellence.
- Prof. S. N. Tripathi was selected for the Sir M. Visvesvaraya Chair.
- Prof. Priyanka Ghosh was selected for the Arjun Dev Joneja Faculty Chair.
- Prof. K. V. Harish was promoted to the position of Associate Professor.
- Congratulations were extended to the graduating batch of 2024.
- Prof. Gourabananda Pahar was selected for the Sir M. Visvesvaraya Research Fellowship.

A few *department publications:*

- S. (2023). Strength and Deformation Behavior of Compacted Soils Under Varied Suction and Drainage Conditions. Indian Geotechnical Journal, Springer Nature. https://doi.org/10.1007/s40098-023-00736-1

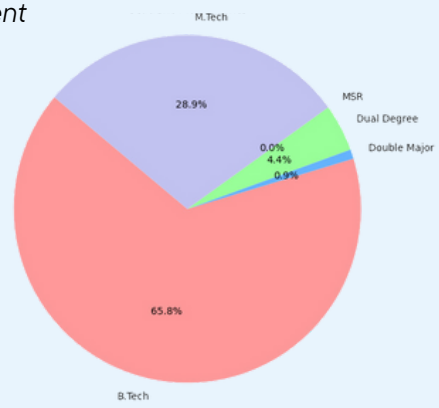
- V., and Rajesh, S. (2023). Gas flow characteristics of GCL under distortions, wet-dry cycles, and hydrating fluids. Geosynthetics International, ICE Publishers. https://doi.org/10.1680/jgein.22.00391

- Roy, S., and Rajesh, S. (2023). Tensile strength framework for unsaturated coarse and fine-grained soils. International Journal of Geomechanics, ASCE, 23(7). https://doi.org/10.1061/IJGNAI.GMENG-7801

PLACEMENTS 2023-24

Placement Statistics 2023-24

Note: *Based on the information provided by Students' Placement Office, IIT Kanpur*
Breakdown of the Civil Engineering batch of 2023-24:
Total number of registered students:
UG (Undergraduate): 104
PG (Postgraduate): 50
Dual Degree: 5
Ph.D.: 0
For SPO (Student Placement Office) placements:
Total number of registered students: 159
Number of students who secured placements: 114



Placement Postulates 2023-24

Visit soceiitk.org/postulates and read all the placement postulates in detail.
Some of the highlights of placement postulates are mentioned below of the Batch of 2024

Mr. Shubham Kumar, Y20 B. Tech | ***Management Trainee, Larsen and Toubro***

Hi, I'm Shubham, and I got placed as a Management Trainee at Larsen and Toubro. If you're confused about what to prepare, how to prepare, and where to start, don't worry; I was in the same boat. I faced many ups and downs throughout my semesters, even though I made friends, got internships, held positions of responsibility till the last semesters, organized a civil engineering conclave (Sankalan), got placement, and created lasting memories. Even though things didn't always go as planned, I managed to find opportunities...

Mr. Utkarsh Srivastava, Y20 B. Tech | ***Model Validation Analyst, ICICI Bank***

Hello everyone! I'm Utkarsh Srivastava (Y20) a recent B.Tech graduate from Civil Engineering department. I know most readers of this blog are going to go through this just around their placement season, so first of all, All the Best, Keep Calm and "chaap dena". Also, those who are short of time, can skip the journey and read the placement tips at the last.
My journey from a fresher to a Model Validation Analyst at ICICI Bank has been like a game of snakes and ladders...

Mr. Sameer, Y20 B. Tech | ***Senior Management Data Science, ICICI Lombard***

Hii! I am Sameer, and an apt way to describe myself will be the term 'Y20 from Civil'. Before beginning my whole journey, let me pen down the expectations which I have had before entering IITK : landing a good job(obviously), getting a decent hold of academics, and finding new friends as life becomes far more beautiful and easy among a bunch of good and trustworthy people. And I am quite at peace with myself right now because I was able to achieve all these goals in college.
Since, there are numerous things that people do in their campus life,...

Mr. Ajeet Kushwaha, Y20 B. Tech | ***Consultant, Deloitte***

Hi everyone. Myself Ajeet Kushwaha and I'm placed in Deloitte as a consultant. This is my story of how I navigated my way to placement. Although many of you might me knowing me as I have consistently shared semester related materials and placement materials in groups, but through this postulate I'll try to reach a wide audience. Many of us are often shy to ask seniors for any help and guidance and end up doing wrong things. Later we realize that "someone should have guided us".Let's say this 'someone' is me :) ...

CAREER CHOICES

Ms. Radhika Ravi,

B. Tech (Double Majors in Civil and Electrical Engineering), IIT Kanpur

Miss Radhika Ravi, an **alumnus** of **Year 11**, shared her career journey during a recent session. She holds a double major in **Civil** and Electrical Engineering and pursued her master's, PhD, and postdoctoral research at **Purdue University** and the **University of Michigan**, respectively. During the session, she reflected on her academic journey, beginning at **IIT Kanpur**, where she cultivated a passion for **LIDAR technology** and autonomous vehicles.

Radhika discussed how her undergraduate studies laid a strong foundation in engineering principles, which later fueled her interest in interdisciplinary fields like **LIDAR systems** and their application in self-driving cars. She emphasized the importance of adaptability, continuous learning, and following one's curiosity, which led her to explore various domains within engineering.

Her work in these cutting-edge fields showcases the dynamic nature of engineering and the potential for innovation. The session provided valuable insights for students interested in pursuing advanced studies and research careers.

Dr. Anudeep Sure,

PhD *(Geoinformatics), IIT Kanpur*

Dr. Anudeep Sure, a **Y13 alumnus**, shared his journey from an electronics background to becoming a remote sensing specialist. He discussed how his expertise has evolved to include passive microwave, optical, and hyperspectral remote sensing, focusing on agricultural applications.

Dr. Sure explained his research on the interrelationship between crop water requirements, soil moisture, and **meteorological** factors, and how he uses **machine learning algorithms** to advance these studies. He also highlighted his work in **flood modeling**, **spatial downscaling**, and **crop classification**, emphasizing the critical role of remote sensing in addressing challenges related to natural catastrophes, climate change, and agriculture.

His talk provided valuable insights into the diverse applications of geoinformatics and the importance of interdisciplinary research.

SoCE DIARY 2023-24

Session: MITACS Globalink Research Internship Programme Session
Speakers: Nidhi Kansal and Om Jee
To allay any doubts or concerns among students, a session was held in recognition of the importance of the MITACS Globalink Research Internship Programme in providing research opportunities and fostering collaboration with renowned faculty members. The session's goal was to encourage participation in this competitive program, which offers 12-week research internships at Canadian universities to international undergraduates under the direction of academics from a variety of academic fields. Informed decision-making about program participation is the goal of this initiative, which aims to support and encourage research-oriented students.
Status: Conducted in L1 on August 21, 2023

Event: Freshers '23 Welcome Party
The highly anticipated Freshers '23 Welcome Party took place with great success, bringing the whole Y23 CEUG/PG batch together for a fun-filled evening of fellowship. This marked the beginning of their academic journey in the Department of Civil Engineering, and it was a momentous occasion. The students had the perfect setting to interact with their peers, make new friends, and strengthen departmental cohesion during the evening's energetic dance performances, musical entertainment, fun games, and delectable food.
Status: Outreach Stadium on September 6, 2023

Session: Research Seminar Series
To promote cooperation and understanding among the different specializations within the Civil Engineering Department, the Society of Civil Engineers (SoCE) successfully hosted two sessions of the Research Seminar Series on Engineer's Day. Students from various specializations presented their research during these sessions, demonstrating the department's wide range of academic interests. A lively Q&A period ensued after every presentation, fostering an interactive atmosphere that benefited both speakers and listeners. Esteemed faculty members, including Dr. Sudhir Mishra, Dr. Partha Narayan Mishra, and Dr. Praveen Kumar Ashish, were present, offering their invaluable insights and guidance to the discussions. Their contributions enhanced the discussions and ensured that every participant left with insightful new ideas to help them continue their academic and professional endeavors. The following studies were presented: Fog Prediction for Northern India using AI by Prasad Deshpande; Stability of vertical plate anchors in unsaturated clay by Mansha Mushtaq; Distortions in MLS Lidar data of moving objects by Aman Kumar Singh; Concept of travel time reliability, its measures, and application in the analysis of passengers' journey time and delay of ferry transport across the National Waterway-1 by Debabrota Das; Water movement in agricultural fields with heterogeneous soils by Uma Mahesh; Influence of aggregate distribution and load-induced cracks on the chloride permeability of concrete by Pankaj Mishra; A Hybrid Reliability Model Considering the Combined Effects of Aleatory and Epistemic Uncertainties on Rock Tunnel Stability by Surabhi Maurya; Current Knowledge, Challenges, and Facilitating Factors from the National Survey on Sustainability in the Building and Construction (B&C) Sector by Shivam Srivastava; Analysis of Unbonded Soft Rigid Granular Mixes by Mehdi Alam; Non-Destructive Techniques for the Quality Assessment of Cement-Stabilized Flexible Pavements by Ankit Mishra.
Status: Conducted in WLE301A on September 15, 2023

Session: Understanding the template
Speakers: Mohd. Rahbar and Arpit Raj (DUGC Student Nominees); Koustav Saha (Ex-DUGC Student Nominee); Arnesh Dadhich (Department Mentor)
For the 2023-24 Sem-II pre-registration, an interactive session was conducted where the DUGC student nominees provided valuable insights on how to design an effective timetable for the upcoming semester. Guidance in OE/DE course selection to maximize students' academic schedules was the main goal of the session. All students interested in learning more about their academic template and course options, as well as those who planned to take DE courses next semester, were welcome to attend.
Status: Conducted in L13 on November 1, 2023.

Session: Career Choices
Speaker: Radhika Ravi (Y11 Alumni) Senior Research Engineer (AR/VR/XR) at Samsung Semiconductor Inc.
The session focused on addressing doubts and offering guidance to students regarding their career choices, particularly in the context of emerging technologies such as AR, VR, and XR. The alumna encouraged the students to follow their career goals by offering insightful counsel, inspiration, and motivation based on her own experiences and observations. With a wealth of experience, including a PhD and MS in Civil Engineering from Purdue University with a focus on geomatics and a Postdoctoral Research Fellowship at the Robotics Institute, University of Michigan, Radhika Ravi shared her experiences and journey in the field of advanced research and autonomous vehicles. This initiative aimed to support students in effectively navigating their future paths and making well-informed decisions, particularly in the field of cutting-edge research and technologies.
Status: Conducted virtually on November 12, 2023

Social Media: The Historic Line
Topic: Virupaksha Temple in Hampi
Credits: Harish Choudhary (Y22 UG)
Status: Released on November 15, 2023

Merchandise: Winter Merchandise Release
We conducted the release of winter merchandise for civil engineering, including hoodies, with the intention of fostering a sense of belonging and commemorating shared memories within the CE community. Hoodie: Rs. 780/-, with the option to customize with an individual's name.
Hoodie: Rs. 730/- without customization of name.
This initiative aimed to provide tangible representations of the CE community and strengthen the bonds formed within it through the winter merchandise.
Got a great response from UG and PG batch.
Status: Released on December 17, 2023

Projects: Winter Projects 2023
With the assistance of undergraduate and postgraduate students, for the first time we efficiently offered a total of eighteen projects during the winter term 2023. A significant number of students enrolled and received valuable insights into their respective assigned projects. Our initiative aimed to provide students with learning opportunities and in-depth knowledge related to their chosen projects.
Status: Released on November 29, 2023
Social Media: Uttarkashi Tunnel
Topic: 2023 Uttarkhand tunnel rescue
Credits: Pragyansh Mishra (Y22 UG)
Status: Released on December 2, 2023

Event: 5km Campus-Wide Run
The 5km campus-wide run, organized in collaboration with the Adventure Sports Club IIT Kanpur and sponsored by Think India, took place as a pre-event for Sankalan '24. It offered participants a chance to engage in fitness and community spirit, with medals, certificates, and t-shirts awarded to winners. The event was well-received and fostered enthusiasm and camaraderie among participants.

Status: Conducted on January 21, 2024

Event: Outreach for the Civil Engineering Conclave
The Society of Civil Engineers, IIT Kanpur, embarked on a mission to inspire future innovators by reaching out to colleges from Kanpur to Lucknow. Engaging with Heads of Departments and Directors, the team invited aspiring engineers to participate in the upcoming Civil Engineering Conclave, aiming to foster collaboration and enthusiasm within the engineering community.
Status: Completed by the third week of January 2024.

Event: Sankalan'24
Sankalan'24, an esteemed initiative organized by the Society of Civil Engineers (SoCE) in collaboration with the Department of Civil Engineering, IIT Kanpur, was held on January 27-28, 2024. This grand event marked a significant milestone in the department's calendar, drawing a diverse audience of over 200 participants, including 103 external attendees from various engineering institutions across India.
Event Highlights: Pre-events:
- Civil Engineering Cricket Tournament: A spirited competition showcasing the athletic talent and camaraderie within the civil engineering community.
- 5km Run Event: An energizing campus-wide run promoting fitness and engagement among participants.
- Campus Visits: Sankalan'24 featured visits to several prominent institutions
- Opening Ceremony: The event commenced with a grand opening ceremony at L20, highlighted by the lighting of the lamp and inspiring speeches from distinguished faculty members: Prof. C. K. Sahu, Prof. Priyanka Ghosh, Prof. Tarun Gupta
- Technical Sessions: Unveiling the Unthinkable: Prof. Srinivas Mantrala from

IIT Kanpur presented a captivating session on unprecedented civil engineering wonders.
- Driving Progress: Prof. Digvijay S. Pawar from IIT Hyderabad shared insights from the TiHAN Test Bed in autonomous vehicle research.
- Mechanisms of Vegetation-Induced Cooling: Prof. Simone Fatichi from NUS, Singapore, discussed urban canyon cooling mechanisms.
- Panel Discussion: A dynamic discussion on bridge health monitoring systems featuring experts such as Dr. H. R. Yadav, Mr. V. Karthik, Mr. M. Bharti, and faculty members from IIT Kanpur.
- Workshops: AI and Smart Cities: A comprehensive workshop led by Ms. Sanjita Prajapati, focusing on the role of AI in enabling smart cities.
- Structural Design Practices: Mr. Rohit Yadav conducted a workshop on soft computing applications in structural design.
- Competitions and Lab Tours: Participants engaged in a paper presentation competition and explored various labs within the Civil Engineering department.
- Cultural Evening: The event concluded with a vibrant cultural evening, showcasing the creative talents of the participants and fostering community spirit.

Status: Sankalan'24 was a resounding success, providing a platform for academic exchange, professional development, and community building within the civil engineering domain. The event fostered meaningful interactions among participants, showcased cutting-edge research and practices, and celebrated the vibrant culture of the department.

Session: Career Choices
Speaker: Dr. Anudeep Sure (Y13 PhD Alumni), Associate Director at Moody's Risk Management Solutions
In this session, students received guidance on a range of career paths, and questions pertaining to careers were addressed. With a focus on research and development (R&D), Dr. Anudeep Sure, a Y13 PhD alum from the Department of Civil Engineering and current Associate Director at Moody's Risk Management Solutions, shared his insights on possible career paths in academia and business. Dr. Sure provided insightful counsel, inspiration, and viewpoints to assist students in navigating their future career choices and exploring a variety of professional paths. He did this by drawing on his vast experience in risk management and his academic background.
Status: Conducted in L3 on February 12, 2024

Event: CE Cup'24
The cricket competition was successfully brought back after a lengthy break by the Society of Civil Engineers (SoCE) with the CE Cup'24. More than 12 teams of undergraduate and graduate students competed in the competition, which ran from October 14, 2023, to February 11, 2024. The department's unity and sportsmanship were commended for being fostered by the Y21 UG team, who emerged victorious in the tournament.
Status: Concluded on February 11, 2024.

Session: Surge-Summer Research Internship 2024
Speakers: Abhay Shukla and Eshika Yadav (Y21 UG)
The Surge-Summer Research Internship 2024, hosted by IIT Kanpur, welcomed the unmatched voyage of intellectual illumination and provided a remarkable chance for students to delve into the world of research internships. The speakers gave insightful advice and related their own experiences to help attendees land a research internship. With the goal of elucidating the what, why, and how of the internship and assisting students in navigating the process in order to have a successful research experience, the online meeting was organized to answer any questions regarding the Surge 2024 program.
Status: Conducted virtually on February 13, 2024.

Merchandise: Alumni T-Shirt Launch
We conducted the launch of the Alumni T-shirt for the graduating class of 2024, offering a commemorative token to celebrate their journey and achievements. Priced at Rs. 350/-, this initiative was aimed at honoring the contributions and guidance of the graduating seniors, providing them with a meaningful keepsake of their time in the Civil Engineering Department. The response from the graduating students was highly positive.
Status: Launched on March 20, 2024.

Event: Devendra Shukla Distinguished Lecture in Civil Engineering
Speaker: Mr. Krishnamurthy Subramanian, Executive Vice Chairman, AFCONS Infrastructure Limited.
This year's Distinguished Lecture was delivered by Mr. Krishnamurthy Subramanian, Executive Vice Chairman of AFCONS Infrastructure Ltd. Refreshments were served. The event provided a valuable opportunity for attendees to witness an engaging talk and interact with Mr. Subramanian.
Status: Conducted in L17 on April 10, 2024

Event: Farewell: Class of 2024
The Society of Civil Engineers proudly organized and hosted the farewell event for the esteemed UG and PG classes of 2024 in civil engineering in the evening. The event was a memorable occasion, featuring captivating performances by junior batches, inspiring speeches from respected professors, and the distribution of well-deserved mementos.

Status: Conducted in L17 on April 17, 2023

PERSONAL ARTICLES

Marvel in Making: Kanpur's Underground Metro Tunnel

Ajeet Kushwaha

On 3rd February, 2024, we a group of 24 students got an amazing opportunity to visit a marvel in making, Underground Metro tunnel in Kanpur. This initiative was taken by one of finest professor in IIT Kanpur, Dr Srinivas Mantrala Sir.

On the fine morning that day, we boarded a bus to casting yard (Khyora neighborhood) for Kanpur underground metro tunnel where ring segments for the tunnel were being cast. Upon reaching, we were briefed about the project and safety by the Project Manager. Every member of our team was also handed visitor's safety helmets and vests for field inspection. In the casting yard, tunnel ring segments were being made and stored to be transported. There was also a concrete mix batching plant for the materials required in the ring. We were shown different stages of ring casting from inner iron framework to outer concrete cover. I was specifically amazed by the intricate design of the ring and specific purpose each part play. Site engineers were humble enough to tell us the various reasons for the holes in the rings, little circular bumps, and the material being applied on the ring during curing.

Infographic:

Phase-1 Kanpur metro: 32.4Km

Each reinforced concrete ring, integral to the tunnel structure, boasts dimensions of 1,400mm width by 275mm thickness. Comprising five segments plus one smaller 'key' segment.

Owner: Uttar Pradesh Metro Rail Corporation Ltd. (UPMRC)

From there, we went to the central station of Kanpur where through cut & cover method, underground metro station was being build. There were also two cutting-edge Terratec EPB tunnel boring machines in operation. The dept of the station from ground level was approximately 20m. We got down through stairs amidst ongoing construction. Upon reaching down, we saw two tunnels with EPB Tunnel Boring Machines operating.

Because of space crunch, we were divided in batch of two to go inside the tunnel to see one of the operating TBM. This tunnel was almost 600m long, and to access it we had to go via a side rail structure. While travelling, we saw mud carrying wagon rail being operational. From the safety point of view, there was no stone left unturned. There were fire extinguishers, ventilation saft pipes, alarms throughout the way.

The EPB tunnel boring machine was itself a moving factory. The machine operator was kind enough to answer our novice question. He explained everything in laymen term for us to understand easily.

I will remember this visit throughout my life. We are seeing a new India in making. Not everyone gets a chance to visit such places that we as a student got. I personally thank our professor Dr Srinivas Mantrala who took such an initiative to inspire us. We also sincerely express our gratitude to Shri Manu Govilji, Project Head of AFCONS and his team.

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This tunnel was almost 600m long, and to access it we had to go via a side rail structure. While travelling, we saw mud carrying wagon rail being operational. From the safety point of view, there was no stone left unturned. There were fire extinguishers, ventilation saft pipes, alarms throughout the way.

The EPB tunnel boring machine was itself a moving factory. The machine operator was kind enough to answer our novice question. He explained everything in laymen term for us to understand easily.

I will remember this visit throughout my life. We are seeing a new India in making. Not everyone gets a chance to visit such places that we as a student got. I personally thank our professor Dr Srinivas Mantrala who took such an initiative to inspire us. We also sincerely express our gratitude to Shri Manu Govilji, Project Head of AFCONS and his team.

Winter Chitrakoot Camp

Sanchit Hari and Adarsh

Chitrakoot's winter camp was flawlessly planned and executed, providing each student with a wonderful opportunity and a captivating experience. Nestled in the tranquil and spiritually energizing surroundings of Chitrakoot, we set out on an educational adventure that skillfully combined academic understanding with real-world application. During the camp, we had the opportunity to learn new geoinformatics techniques and gain practical experience with sophisticated equipment like the Total Station, Auto Level, GNSS receiver, handheld Juno3b receiver, and GNSS receiver.

We were very kindly hosted at "Aarogyadham," which is well known for its peace and scenic surroundings. Making a thorough contour map of the surroundings was our main responsibility. The camp lasted for six days and was fully sponsored by the institute, demonstrating their dedication to our overall education and professional development. Our ability to apply classroom concepts in real-world scenarios was greatly enhanced by the challenging terrain and the presence of diverse geographical features.

As a result, we were able to apply geoinformatics concepts effectively and practically.

Day 1: Our journey commenced with Juno traversing Parikarma Marg, allowing us to familiarize ourselves with the equipment and the terrain. The groundwork for the subsequent intensive learning was laid by this preliminary investigation.

Day 2 onwards: We delved into the intricate process of contour map generation for Aarogyadham. We diligently worked towards our goal by carrying out precise data collection and map-making exercises. Our success was largely due to the unwavering support we received from our lab staff and professors. Their friendly demeanor and sincere curiosity about our advancements turned them from distant, authoritative figures into encouraging colleagues, creating a cozy atmosphere.

The roughly 200-meter distance between the mess and our residential quarters made for a nice break that let us take in the scenery and reflect on the lessons we learned that day. The glow of bonfires characterized our evenings as we gathered to exchange stories, laughs, and reflections, ultimately fortifying the bonds of respect and friendship between mentors and peers.

The main goal of our camp was accomplished when we collaborated to successfully create a comprehensive map of the assigned area.

We spent the last evening together around a campfire to commemorate this achievement, relishing the happiness of sharing experiences and feeling fulfilled.

The Chitrakoot winter camp was a life-changing experience that enhanced our comprehension of geoinformatics and filled our lives with enduring memories and relationships. It was more than just an academic exercise. Years to come will be filled with memories of the harmonious fusion of learning and play that was made possible by the calm beauty of Chitrakoot and the demanding academic schedule.

GALLERY

Freshers 2023 Event held for Batch of 2023

Campus Visit to Lucknow for Sankalan, Inaugural Edition

Participants of CE Cup 2024 held as a part of Pre-Sankalan Events

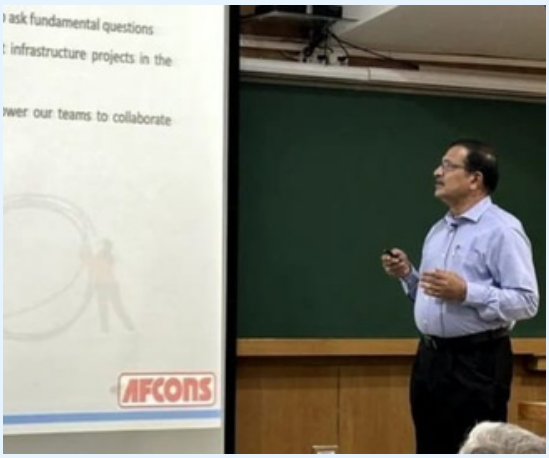
Session on Introduction to 4th Semester for Batch of 2022

Group Photo of Coordinators, Society of Civil Engineers 2023-24 with Ex-Coordinators and Secretaries at Farewell'24

SoCE 2023-24

GALLERY

Sankalan Inaugural Ceremony 2024



Devendra K. Shukla Distinguished Lecture Series by Mr. Krishnamurthy Subramanian

Group Photo with Participants, Day 2, Sankalan 2024

Campus Run event organized as a pre-event for Sankalan

Formal farewell photograph of the esteemed Civil Engineering students from the Class of 2024

Research Seminar Series held as a part of Sankalan Pre-Event

SoCE 2023-24

TEAM

HOD: Dr. P. Ghosh

Faculty Coordinator: Dr. Chunendra Kumar Sahu

UG-Coordinators (B.Tech Y21): Aadya Umrao, Shambhavi Agarwal, Shrey Patel, Sandipan Dutta, Vedant Adlak, Saurabh Meena

PG-Coordinators: Aditya Mishra, Baban Kumar

Secretaries (UG):
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Abhiram Shukla, Pankaj Mishra, Shivam Srivastava, Mansha Mushtaq, Govinda Bakna, Ankit Goyal, Miska Singh, Rahul, Satyapriya, Saurabh Kumar Maurya, Shiva Singh

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SoCE 2023-24

NOTES

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The End

STRENGTHS

A magazine from the Society of Civil Engineers

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