IISc OPEN DAY 2025

PRESENTED BY

IISc SUSTAINABLE TRANSPORTATION LAB (IST LAB)

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At
IISc Sustainable Transportation Lab (IST Lab)

In 2025, the IISc Open Day showcased an extraordinary level of public engagement and excitement, drawing thousands of visitors to the campus. Attendees were keen to explore the cutting-edge science and engineering research taking place at the institute. A standout feature of the event was the dynamic participation of the **IISc Sustainable Transportation Lab (IST Lab),** which organized a variety of interactive activities, demonstrations, and presentations. These initiatives highlighted the critical role of scientific analysis and decision-making in addressing urgent transportation challenges with significant societal impacts. Covering topics from climate action and sustainable mobility to road safety, disaster preparedness, and quality-of-life improvements, the IST Lab unveiled innovative strategies and solutions aimed at paving the way for a more sustainable and resilient future.

Aswana presented the lab's overall research and the Kumbh Mela experiment, seamlessly connecting both to give visitors a comprehensive understanding of the lab's work. She first introduced the lab's various ongoing projects and its current members, setting the stage for the detailed discussion on the Kumbh Mela study. This Indo-Dutch collaboration, funded by the Netherlands Organization of Scientific Research and the Government of India's Department of Electronics and Information Technology, aimed to understand crowd dynamics and model crowd risk using the 2016 Ujjain Kumbh Mela data. By deploying a range of sensors—including video cameras, smartphones, drones, and GPS devices—the project captured intricate pedestrian movement patterns in one of the world's largest religious gatherings. Visitors were particularly interested in how the research was conducted, engaging in discussions about the data collection process, microscopic experiments in controlled environments, and the analytical methods used to study pedestrian movement.

Figure 1: Aswana explaining the KME work

Aswana also explained the importance of modern technologies like machine learning and deep learning in crowd management and their role in the overall project, particularly in predicting crowd behaviour and enhancing decision-making. She further highlighted the Crowd Risk Index developed in the lab, which helps assess and classify risk levels in high-density gatherings. The presentation also covered key aspects such as the IISc PedSense software, the Leader-Follower model, and various walking strategies observed in microscopic studies, along with the lab's efforts to develop an Early Warning System for crowd management. Many visitors explored the exhibit, asked insightful questions, and appreciated the study's relevance in improving decision-making for mass gathering events.

Rohit's comprehensive work on sustainable transportation was encapsulated in his poster titled "Sustainable Transportation: Links & Progress to Sustainable Development Goals." The display underscored how transportation is not merely a mobility service but a critical factor influencing environmental, social, and equity outcomes. By highlighting news clippings on Bangalore's historical CO_2 transport emissions and urban flooding, the poster illustrated how transportation contributes to global greenhouse gas emissions, traffic accidents, and severe urban challenges like the Bengaluru floods. These externalities reinforce the urgent need for a shift towards sustainability.

To further this discussion, **Rohit** detailed his research framework which culminated in the development of the Composite Sustainable Transportation Index (CSTI). Applied to the Bangalore Metropolitan Region (BMR) for projections in 2031, the CSTI provided a robust metric to evaluate progress. A scenario analysis compared the business-as-usual (BAU) case with a sustainable transport (ST) scenario, with a traffic assignment map of BMR visually delineating the potential benefits of sustainable practices.

Figure 2: Rohit explaining the UN SDG – ST Links

Complementing his technical analysis, **Rohit** conducted two surveys. The first survey focused on the social health of commuters, exploring how daily travel affects social interactions, mental health, and community resilience. This survey aligned with SDG 3 (Good Health and Well-being) and SDG 11 (Sustainable Cities and Communities), providing insights that can help policymakers and urban planners create more inclusive, connected, and sustainable transport systems for Bengaluru.

Figure 3: Two surveys also conducted by Rohit

Additionally, a second survey on equity in public transportation was undertaken. Recognizing that an equitable transit system is essential for ensuring access to jobs, education, healthcare, and other critical services, this survey examined how public transportation systems promote—or hinder—equity. It emphasized that affordable, reliable, and accessible transit options must be available to all, regardless of income, location, or physical ability.

Together, these initiatives not only advance our understanding of sustainable transportation in the context of environmental and operational challenges but also highlight the broader social and equity dimensions essential for a balanced and inclusive urban future.

Siti, one of the research fellows from the ASEAN-India Research, Training, and Fellowship Program (AIRTF), presented her initial research comparing the effects of the metro systems in Bangalore and Jakarta. This study aims to analyze how the metro's connectivity can enhance individuals' welfare by examining daily commute costs and overall life satisfaction. **Siti** explained that commuting from Lebak Bulus in South Jakarta to Jatibaru in Central Jakarta takes about 1.5 hours daily, from 6:30 AM to 8:00 AM, using the MRT (Metro) and KRL-Commuter line for last-mile connectivity. The MRT in Jakarta serves as a significant option for saving time during commutes. Visitors showed considerable interest in her comparison of metro connectivity in Jakarta and Bangalore, particularly through maps. Jakarta offers better first-mile and last-mile connectivity through its metro system, supported by Transjakarta (BRT), KRL-Commuter line (Suburban), LRT, and Microtrans. In contrast, Bangalore struggles

with last-mile and first-mile connectivity, leaving passengers with limited options beyond the metro.

Figure 4: Siti explaining the comparison of metro effect in Bangalore and Jakarta

From her initial hypothesis, **Siti** found that factors such as job-related issues, income, family situation, health, and commute challenges all contribute to an individual's well-being. Furthermore, a person's mode of transport is influenced by the availability of public transport, distance to work, vehicle ownership, work and home locations, personal income, and health. Additionally, some visitors commented on the recent fare increases for Namma Metro, which have led them to switch from using the metro to BMTC or their vehicles.

One of the highlights was “The Sustainable Transport Odyssey”, a board game designed by **Pramod & Vishwapriya** and demonstrated by Pramod. The game aimed to raise awareness about different modes of transportation and promote sustainable public transit, particularly among children. Inspired by classics like Monopoly and Snakes & Ladders, the game featured a 5x5 board with traffic signs along the path. Players used pawns representing six transport modes—both sustainable and fossil fuel-based—each governed by unique rules outlined on accompanying cards in English as well as Kannada for equitable spreading of the message. Participants rolled the dice and navigated the board while following traffic regulations specific to their chosen mode. They could also switch modes mid-game for a multimodal experience. Fossil fuel vehicles faced penalties, while sustainable options like electric buses and metro plied with relative ease through the path. This interactive approach helped players grasp the significance of eco-friendly transport and the need to decongest Bengaluru’s roads. Upon reaching the finish line, participants received gifts as a token of appreciation. With around 300 players engaging throughout the day, the event was a perfect blend of fun and learning.

Figure 5: The Sustainable Transport Odyssey conducted by Pramod

This year, alongside the ongoing research activities in our lab, we conducted a special case study on the recent increases in public transport fares for metro (up to 50%) and bus services (up to 20%) in Bengaluru. The fare hike has been a widely discussed topic in the city, generating significant public interest in understanding its impact. **Santhosh** presented this study, which focused on analyzing the changes in mode share resulting from the fare increase. Our lab conducted an in-depth analysis to assess shifts in public transportation choices before and after the fare hike. Using a multinomial logit model, we estimated the modal distribution changes among different transport options. The results indicate a 5% decline in metro ridership, with this demand shifting to alternative modes, including buses (+3%), ride-hailing services, auto-rickshaws, and private vehicles (two-wheelers and four-wheelers).

Figure 6: Santhosh explaining the work on metros and bus fare hike

An interesting observation from the study was that, despite an increase in bus fares, a significant number of women commuters shifted to bus travel. This shift was primarily due to the **Shakthi Scheme**, a government initiative in Karnataka that provides free bus travel for women. Additionally, bus fares remained comparatively lower than metro fares, making buses a more viable option for many commuters. Furthermore, some individuals opted for private vehicle usage, as it became a more convenient alternative to metro travel. This modal shift has implications for urban mobility and environmental sustainability, as the increase in private vehicle usage is likely to contribute to higher air pollution levels in the city.

The poster presented by **Aswathy** focused on two crucial aspects of urban transportation planning: adaptive policies for urban transportation to combat climate change and scenario evaluation for Bangalore's proposed suburban and metro rail network.

The first poster explored the role of Travel Demand Modelling (TDM) in assessing the impact of adaptive transportation policies on urban flood resilience in Bengaluru. The study evaluated various policy bundles using key transportation metrics such as Vehicle Kilometres Travelled (VKT), Vehicle Hours Travelled (VHT), and Cancelled Trips. By integrating transportation models with climate resilience strategies, the research highlighted how strategic planning can reduce disruptions caused by urban flooding, ultimately enhancing system adaptability.

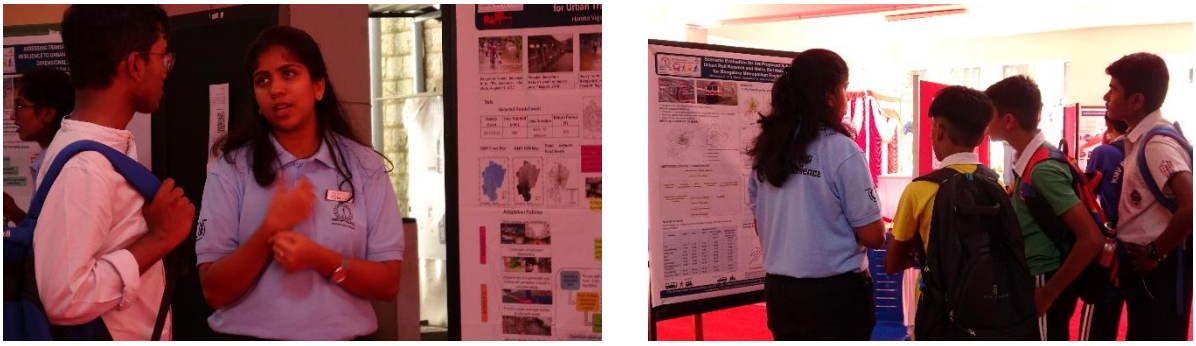

Figure 7: Aswathy explaining the work on MRTS and Climate Adaptation

The second poster, focused on the Scenario Evaluation for the Proposed Sub-Urban Rail Network and Metro Rail Network for Bangalore Metropolitan Region. This study aimed to prioritize infrastructure investments by evaluating multiple scenarios, including metro-only expansion, suburban rail expansion, combination of both, and if double-decker road and tunnel roads are introduced along with the MRTS. Using TransCAD for demand estimation and corridor-wise scenario evaluation, the study provided insights into traffic flow patterns, mode share distribution, and the impact of new road infrastructure. The results indicated that complementary interchanges between metro and suburban rail systems significantly enhance ridership, while uncoordinated expansions could lead to inefficiencies.

Ann presented her research work through a poster, highlighting the transportation systems role on mental and social wellbeing, and its impact on the overall quality of life. Her presentation

covered fundamental concepts such as quality of life, wellbeing, and a transportation framework that integrates wellbeing dimensions into mobility planning.

Figure 8: Ann explaining the transportation systems role in shaping well-being and quality of life

She also shared her motivation for undertaking this research, stressing the importance of people-centric transport policies that prioritize public wellbeing and quality of life. A key point emphasized during the discussion with the public was the lack of transportation-psychological studies in the Indian context, despite the fact that mobility choices are deeply connected to behavioral patterns, decision-making, social interactions, and human psychology—all of which play a crucial role in shaping one's overall quality of life.

Additionally, she highlighted the limitations of the Satisfaction with Travel Scale (STS), a transpo-psychometric scale developed by Ettema in 2011, which, as her previous Open Day 2024 data revealed, is not fully suitable to be used for the Indian context studies.

Alongside the poster presentation, she, with the assistance of Sanjay (M.Tech, 1st year), conducted a face-to-face survey to gather insights on social wellbeing in public transport. While last year's Open Day focused on mental wellbeing, this year's data collection shifted towards social wellbeing, examining whether public transport systems contribute to commuters' overall social health and well-being. The study aimed to gather evidence on how public transport fosters social interactions, a sense of community, and resilience, all of which play a crucial role in shaping commuters' social wellbeing.

With the support of Sanjay, she successfully conducted data collection gathering 300 responses (60 online and 240 offline) between 9:00 AM and 5:00 PM. The respondent demographic was well-balanced, consisting of both men and women, with the majority being students. The survey was primarily closed-ended, designed to capture socio-demographic details along with subjective perspectives on community resilience and social wellbeing.

Figure 9: Data collection to understand the social side of mobility

The collected data will be analyzed to assess how public transport systems enhance social engagement, strengthen community resilience, and contribute to overall social wellbeing. These insights will be instrumental in shaping future transport policies, advocating for affordable, accessible, and socially enriching mobility solutions over expensive road infrastructure projects.

Gautam Narula provided a comprehensive overview of the Green Urban Mobility Innovation Living Lab (GUMILL) initiatives. He explained that the lab, originally established by Bosch and GIZ India, was taken over by the IST Lab, IISc Bangalore, on February 25, 2025. The lab focuses on addressing urban mobility challenges through innovative, sustainable solutions. Narula highlighted the Safe Routes to School (SRTS) initiative, which aims to encourage active school travel, improve signage around school zones, and implement better traffic management plans. This pilot project, conducted in collaboration with DULT, GIZ India, Malleswaram Swabhimana Initiative (MSI), and Malleshwaram Social (MS), involves five schools in Malleshwaram. Surveys and evidence-based rating mechanisms are used to identify accessibility issues, analyze travel patterns, and address infrastructure gaps.

Figure 10: Gautam Narula explaining the initiatives taken by Green Urban Mobility Innovation Living Lab

He also discussed the collaboration between DULT, BESCOM, and GUMILL to establish green Electric Vehicle (EV) charging stations across Bengaluru. This initiative, part of the Indo-

German Development Cooperation project, aims to promote sustainable and climate-friendly e-mobility in India. It was emphasized that the accessibility audit conducted by the 'Ramp My City' team in June 2023, which evaluated the ease of accessibility for Persons with Disabilities (PwD) in the Malleswaram area. This effort aligns with the Government of India's Accessible India Campaign (Sugamya Bharat Abhiyan). Additionally, the Urban Mobility Berlin India (UMBI) project, was explained, which connects German and Indian actors to address urban mobility challenges. The IST Lab, as a challenge owner, proposed two key challenges: "Handling Freight with Finesse" and "Creating a Gender-Inclusive System." He also announced an all-expenses-paid innovation sprint in February 2023, inviting five Indian and five European startups to develop solutions for urban mobility challenges.

Bengaluru, known for its severe traffic congestion, is currently witnessing a debate on whether to invest in expanding road infrastructure or to focus on improving public transport. During this Open Day, a public vote was conducted by **Jatin** (1st year, M.Tech) to gauge public opinion on this critical issue. The results overwhelmingly indicate that citizens prefer affordable and accessible public transport over costly road expansions.

Figure 11: Public voting their preference for "Affordable, Accessible Transit vs. Expensive Road Infrastructure or stay Neutral?"

A total of 200 people participated in the voting:
183 votes **(91.5%)** were in favor of prioritizing affordable and accessible public transport.
12 votes **(6%)** supported investment in expensive road infrastructure.
5 votes **(2.5%)** remained neutral on the issue.

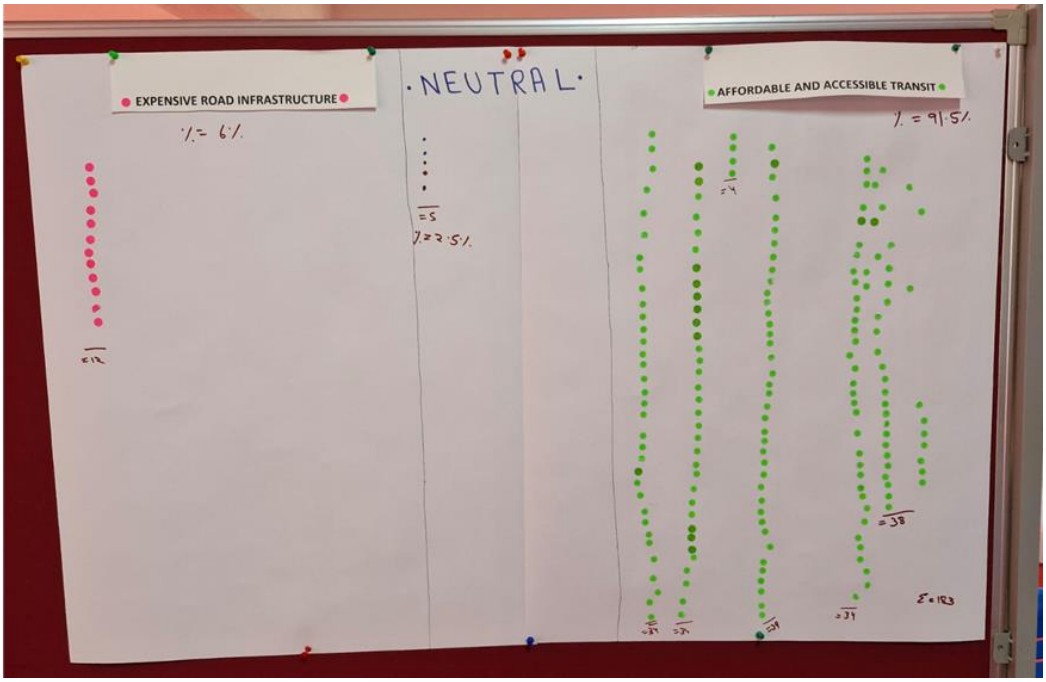

Figure 12: Final Voting Results- Public Preferences for Affordable Transit, Expensive Road Infrastructure or Neutral?

The results suggest that a vast majority of people recognize public transport as the more effective solution for Bengaluru's mobility challenges. Expanding road infrastructure may seem like a temporary fix, but it often leads to induced demand, resulting in even more congestion over time. On the other hand, investing in a robust and well-connected public transport system can provide long-term benefits, including reduced traffic, lower pollution, and improved urban livability.

With such strong public support for public transport, policymakers must take note and prioritize investments in metro rail expansion, better bus services, and last-mile connectivity solutions. Instead of costly road expansion projects that benefit only a fraction of road users, a well-planned and efficient public transport network can serve a much larger population, making Bengaluru a more sustainable and commuter-friendly city.

The overwhelming preference for public transport, as reflected in this vote, highlights the need for immediate action to enhance accessibility and affordability in Bengaluru's transit system. Will decision-makers listen to the voice of the people and steer the city towards a more sustainable future? Only time will tell.

While transportation policies often incorporate considerations for infrastructure development, long-term planning frequently overlooks the need for resilient adaptive strategies. **Maneesha B.** presented her research, which focuses on enhancing the disaster resilience of urban transportation systems. Drawing on the framework developed by Bruneau et al. (2003), her study examines resilience through four key dimensions: infrastructure, social factors, organizational structures, and economic considerations. The goal of the research is to develop a comprehensive framework that evaluates resilience from these various perspectives. Engaging conversations took place with visitors, highlighting how various cities across India are facing flooding challenges and the strategies they have implemented to overcome them.


Figure 13: Maneesha explaining her work and her Equity in PT survey

Exploring the role of public transportation in promoting equity, especially in times of resilience, **Maneesha**'s preliminary analysis revealed how transportation networks often become fragmented and less connected during crises, leading to significant loss in connectivity. Building on this idea, she also conducted a survey among visitors to assess the equity of public transportation in Bengaluru. Around 200 participants shared their experiences, with many citing the lack of availability, longer travel times, and extended waiting periods as reasons for not regularly using public transit. Further analysis of the data will provide deeper insights into how these challenges intensify during urban floods.

Harendra Pratap Singh presented research on the overall risk analysis of VRU (Vulnerable Road Users), specifically pedestrians and bicyclists. He has identified VRU fatality hotspots and grey spots in Bangalore urban and Bangalore rural districts of Karnataka. He shows spatial hotspot clustering within traffic analysis zones using Point Kernel Density Estimation (PKDE) and Network Kernel Density Estimation (NKDE) methods.

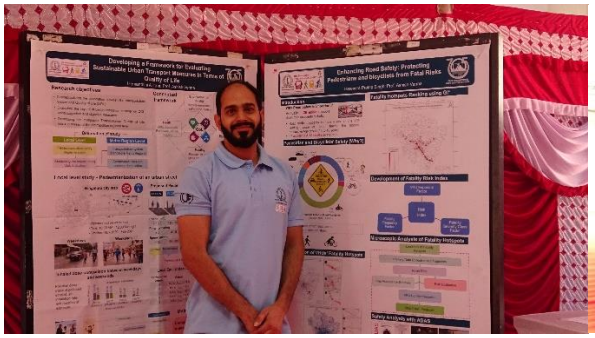


Figure 14: Harendra explaining pedestrians and bicyclists' fatality hotspot analysis; and the interaction between sustainable transportation measures and quality of life

Further showcased VRU Fatality Risk Index development utilizing the locational and demographic variables. To dive deep into the hotspot's region, develop microscopic analysis, i.e., driver behavior and conflict prediction model.

Figure 15: Demonstration of pedestrian collision warning in ADAS-equipped vehicle

Ultimately, he showcases the Advanced driver assistance system (ADAS) functioning to get the warning-influenced driving behavior while interacting with VRUs, categorizing these warnings and identifying the VRU hotspot and grey spots corridors.

He also presented a poster of Dr. **Hemanthni Allirani's** research work**,** which aims to understand the interaction between sustainable transportation measures and Quality of Life (QOL) by combining subjective and objective indicators. The study involves two levels: (1) Local level - understanding the impacts on QOL due to pedestrianization of urban streets (2) Metropolitan, regional level - evaluating the network level effects on QOL due to sustainable transport measures.

Dr. Furqan interacted with the open-day audience about the focus of ITES, its conceptualisation, challenges & opportunities for the centre, and how the IfCa project led the path towards the inauguration of ITES. The poster presented by Furqan focused on the work carried out under the umbrella of the IfCA project. It concentrated on two aspects: 1) EV infrastructure modelling and the need to identify innovation areas to enable mass adoption of EVs; 2) Clean Air Street. The first objective detailed the implementation of 221 fast charging stations for electric vehicles across Bengaluru and demonstrated how the public can access the dashboard with all the information related to the charging infrastructure. The second objective highlighted the exclusive benefits, both qualitative and quantitative, such as improved air quality, reduced noise pollution, decreased congestion, and an overall enhancement in the quality of life for people, resulting from the pedestrianisation of Church Street.

Figure 16: Furqan explaining posters on ITES

Vishwapriya Sahran actively interacted with the open-day audience, serving as a guide to the various groundbreaking projects undertaken by the ITS-Lab. Vishwapriya introduced the **Kumbh Mela Experiment**, a large-scale crowd dynamics study conducted during the Kumbh Mela in 2016 —the experiment aimed to understand pedestrian crowd behavior under high-density conditions. Next, the **Church Street Experiment** was showcased, a significant project conducted as part of the Smart Cities initiative. This project focused on reclaiming pedestrian space by transforming Church Street in Bangalore into a pedestrian-friendly zone. The **Electric Vehicle (EV) Project under the India-UK Partnership** was explained. This project aimed to model the impact of electric vehicle adoption on the transport system, particularly in Indian cities.

Figure 17: Vishwapriya explaining the various videos of IST Lab's works

With these projects, the **patents held by the ITS-Lab** were highlighted with the help of video. Vishwapriya also discussed the **VISSIM simulation model of the CNR Rao** Underpass to Sadashivnagar police station intersection road, which was done to see the vehicle interactions in different scenarios. The audience acknowledged the work done by the IST lab on the pedestrianization of Church Street and the intangible benefits it offered. Additionally, people were curious about the Kumbh Mela Experiment and asked how the Kumbh mela experiment would help avoiding stamped situations.

The Traffic Signs Quiz Game, developed by **Gautam Narula** (PhD student, IISc) using Python coding, is an interactive educational tool aimed at enhancing road safety awareness. Featured as part of Open Day 2025 at IISc, our game is part of the Sustainable Transportation Lab (IST Lab). Hosted by **Prince Patel** (MTech 1st-year student, IISc), the Traffic Signs Quiz Game engaged visitors in a fun yet informative way, requiring participants to correctly identify at least three out of five traffic signs to win. Built with a user-friendly interface, the Python-based quiz provided instant feedback, making learning both interactive and engaging. This initiative

was part of IST Lab's broader mission to promote sustainable and safe transportation, alongside activities such as pedestrian simulations, electric vehicle research, and interactive games. The Traffic Signs Quiz Game successfully attracted visitors of all ages, merging technology and education to foster safer and smarter urban mobility solutions.

Figure 18: Prince making audience playing the traffic sign game

Finally, **Ms. Ambika** gathered feedback from the visitors, and the response was overwhelmingly positive. The IST Lab enjoyed one of its highest turnouts in over 15 years of participation at the IISc Open Day, attracting more than 3000+ visitors who engaged in diverse activities, interactive demonstrations, and games.

Figure 19: Feedback Collection from Visitors

Attendees praised the lab's clear presentation of sustainability-focused ideas, its advanced technological research, and hands-on demonstrations that illustrated how traffic conditions could be improved with minimal infrastructural changes. Many also appreciated the effective integration of sustainability themes within transportation systems research. Overall, the enthusiastic feedback underscored the IST Lab’s successful communication and educational efforts, inspiring the public to embrace sustainable behaviors.