Transportation Research @ IITH

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A country's socio-economic progress hinges on the effectiveness of its transportation network. Highways, among various transportation systems, are the primary infrastructure driving growth and fostering national cohesion, particularly in developing nations like India.

As of the end of 2022, India boasts the world's second-largest road network, spanning a total of 6.33 million kilometres. Remarkably, in 2020, India set a record by constructing 13,000 kilometres of highways.

The Ministry of Road Transport and Highways (MoRTH) has sanctioned 12,376 kilometres of National Highway (NH) projects for the year 2022-23. The nation's ambitious goal is to achieve a daily road construction rate of 40 kilometres, with a government investment target of approximately 5.35 lakh crores (equivalent to US$ 74 billion) by 2023.

Furthermore, India plans to invest around 15 lakh crores (approximately US$ 213 billion) in constructing 65,000 kilometres of roads and highways under the Bharatmala Pariyojana initiative. India's highway network carries roughly 70% of freight and approximately 85% of passenger traffic.

Nevertheless, agencies and consortia involved in road construction face multifaceted challenges, from sourcing high-quality construction materials to addressing sustainability and circular economy concerns associated with the highway infrastructure.

The availability of superior construction materials is a primary hurdle for road agencies, as it takes approximately 15,000 tons of aggregates to construct just one kilometre of a National Highway. This issue is particularly acute in India's northeastern states, where the aggregates are of subpar quality. Consequently, these regions must procure aggregates from distant places like Bihar or Jharkhand, which are nearly 2,000 kilometres away, thereby inflating construction costs.

Furthermore, India is investing in enhancing last-mile freight connectivity through the Gati Shakti Scheme, a significant multi-modal transportation infrastructure project. India is also preparing for advanced technologies such as smart mobility and autonomous vehicles, although the existing highway infrastructure is not yet equipped for these futuristic advancements.

To tackle some of these challenges, the National Highways Authority of India (NHAI) has partnered with the Indian Institute of Technology Hyderabad to establish a 'Transportation Research and Innovation Hub (TRI HUB). The TRI HUB is presently engaged in cutting-edge research to develop innovative and cost-effective solutions for highway construction. These solutions include technologies like geosynthetics, reclaimed and recycled materials, and fibre-reinforced concrete for bridge construction, all aimed at enhancing structural stability lifespan and promoting a circular economy.

This collaborative effort between NHAI, IITH, and IRC exemplifies a concerted endeavour to modernize and optimize highway construction practices, ultimately benefitting both the infrastructure and the nation as a whole.

~NHAI

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NHAI encourages the deployment of these technologies in real-world conditions to assess their performance under actual traffic and loading scenarios. Notably, some of these technologies, such as geosynthetics in highways, have gained acceptance from the Indian Roads Congress (IRC) for immediate implementation in the field. **The research team at IIT Hyderabad is closely collaborating with IRC committees and NHAI to establish guidelines and standards for these innovations.**

Transportation Geotechnics is a fairly new emerging research area that addresses the practical issues of highway pavements from the geotechnical engineering point of view. There is a huge career potential in this area as India envisions investing heavily in infrastructure for national development.

NHAI's Message for IITH:

The National Highways Authority of India (NHAI) was constituted under an Act of Parliament in 1995. NHAI is responsible for the development, maintenance, and management of the National Highways in India. The Authority is not only constructing National Highways and Expressways but is also contributing towards nation-building.

Over the years, NHAI has maintained a continuous focus on the development and integration of novel technologies within the realm of highway construction. An active player in this endeavour is the transportation research group at the Indian Institute of Technology Hyderabad (IITH).

In 2022, NHAI entered into a Memorandum of Understanding (MoU) with IITH, fostering a collaborative effort to address critical issues associated with highway construction. **Currently, IITH is engaged in ten distinct projects that delve into various aspects of highways and bridges.** These endeavours aim to enhance existing technologies or introduce innovative methods to streamline construction processes and prolong the lifespan of these vital infrastructures. Additionally, these projects are geared towards cost control and the promotion of sustainability. A recent review of these projects has left NHAI deeply impressed with the progress achieved thus far. Some technologies, such as incorporating geosynthetics in various pavement layers, have already found practical applications in select highway projects. **The IITH team is closely coordinating with the Indian Roads Congress (IRC), an organization responsible for shaping codes of practice and guidelines for highway construction that incorporate these new technologies.**

Officials from IITH & NHAI during the MoU Signing in Jul 2022

Prof Sireesh Saride
Chair, TRI HUB and
Professor - Civil Engineering, IITH