IIT Hyderabad Researchers develop Innovative Hybrid FRP Strengthening Solution for Civil Infra like existing bridges and buildings

The proposed solution can increase the service life by ~20 years and the durability of the structures with marginal cost.

Highlights:

- *FRP strengthening is more efficient than conventional techniques like concrete and steel jacketing.*
- *FRP strengthening gives high strength and stiffness to weight ratios compared to the other techniques*
- *The strength and ductility of structural elements can be improved without increasing their weight.*
- *Conventional external bonding (EB) with FRP fabric in columns is adequate only under axial compression.*
- *The near-surface mounting (NSM) with FRP laminates improves only the flexural strength of RC members.*

Hyderabad, May 06, 2022: The civil infrastructure industry is under constant pressure to upgrade the existing structures, which have deteriorated because of aging and corrosion issues. Recently survey shows that several bridges and several offshore structures are at the end of their life and require immediate structural strengthening. Also, another survey indicates that **a significant number of Indian railway bridges need immediate strengthening.** It is worth mentioning that most of the structures requiring strengthening are under service, which complicates the strengthening process. Also, the structures' present status and capacity are unpredictable, complicating the optimistic strengthening design. In the recent past, the civil engineering industry has gradually accepted FRP (fiber-reinforced polymer) composites to repair and rehabilitate concrete structures. FRP strengthening has numerous advantages over conventional strengthening methods such as concrete and steel jacketing due to its lesser weight to strength ratio, corrosive resistance, easy installation, and higher durability. However, there are no Indian standards (IS) available for FRP strengthening.

The selection of the particular type of FRP material, its orientation, and place of application will be essential for effective utilization and improving efficiency under different loading scenarios. ***Prof S Suriya Prakash's CASTCON Lab at the IITH has developed the innovative hybrid FRP strengthening technique for improving strength and ductility under different loading combinations. Also, most of the previous research work has focused on circular and non-circular columns of small size.*** However, the size of columns in the buildings and bridges are different with various shapes and slenderness ratios. Understanding the effect of hybrid FRP strengthening of columns in a real case scenario is essential. The present research focuses on understanding the size, shape, and slenderness effect on the hybrid FRP strengthening. ***The outcomes of this study lead to the development of Indian standards (IS) on guidelines for FRP strengthening.***

Congratulating the research team on this innovative hybrid FRP strengthening solution, Prof B Murty, Director, IITH, added, *"The preservation and extension of service life of the existing civil infrastructure are essential for fueling our country's economic growth. At the same time, this innovation developed by Prof Suriya and his team leads to optimum utilization of the strengthening materials. It is cost-effective for increasing the longevity of civil infrastructure. This has once again demonstrated IITH's zeal to contribute to serving society at large, through Inventing and Innovating in Technology for Humanity (IITH). "*

Proudly presenting their Hybrid FRP strengthening technique, Prof Suriya & Mr Malleswara Rao, PhD Scholar, Department of Civil Engineering, IITH, said, *"The hybrid FRP strengthening technique is a very*

efficient solution to improve the strength and ductility for the real scale structural elements of bridges and buildings. We have extensively carried out experiments to understand the size, shape, and slenderness effect on the behavior of hybrid FRP strengthened elements for various loading scenarios. We are currently developing efficient analytical models for developing the design guidelines that practicing engineers could readily use."

In this research area, Prof S Suriya Prakash and his team published more than 25+ research papers in reputed international journals and are currently developing Indian Standards on FRP composites for structural strengthening. Additionally, Prof S Suriya Prakash and his team extensively worked on various industry-relevant research work. Using locally available materials, they include using FRP rebars, developing lightweight precast panels, and Ultra-High-Performance Concrete (UHPC). They also try to understand the behavior of concrete elements under static and blast loading using the Split-Hopkinson Pressure Bar (SPHB).

Refer to the latest publication on the subject for more details:
https://ascelibrary.org/doi/10.1061/%28ASCE%29CC.1943-5614.0001152

Refer the Prof. S. Suriya Prakash's webpage for more details:
https://civil.iith.ac.in/suriya-prakash-s-profile/#publications

The Electronic Press Release about Innovative Hybrid FRP strengthening solutions for Civil Infrastructures by IITH Researchers can be accessed at: **https://youtu.be/El8bQUzra48.**

About IIT Hyderabad

Indian Institute of Technology Hyderabad (IITH) is one of the eight new IITs established by the Government of India in 2008. In a short span of **14** years, the institute has become a top-ranker. Currently, it has **260+** full-time faculty, **~3,900** students, nearly **200+** state-of-the-art laboratories, and five research and entrepreneurship centers. The institute has a strong research focus with approx Rs **575+** crore of sanctioned research funding, with PhD scholars accounting for about **30**% of total student strength. IITH has to its credit more than **7200+** research publications, **210+** patent disclosures, **1600+** sponsored/consultancy projects, and about **100+** startups.
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