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NVSAGE

Newsletter on Noise and Vibration Engineering

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NV DYNAMICS
VIBRATION. ACOUSTICS. BEYOND

FOREWORD

By Ajith Krishna,
Lead Engineer

Change is a constant. It shapes technologies, regulations and expectations — and in N&V application space, it demands that we adapt with rigor, foresight and measured innovation. I will be taking over writing this foreword from Krishna Balamurali and I am honored to carry forward his commitment to provide technical insights and evolving business dynamics of the NVH domain.

20 YEARS OF ENGINEERING DYNAMICS 2005-2025

In India, the noise and vibration landscape is developing rapidly. The rise of semiconductor fabrication and allied chip-manufacturing facilities demand stringent acoustic and vibration control requirements, while large infrastructure projects - notably the expanding metro networks - are intensifying demand for refined and professional N&V expertise to protect structures, equipment and communities.

I am pleased to highlight our current engagement with L&T for the Mumbai Metro Line 4. As I am writing this, our team is executing comprehensive noise and vibration assessments across the entire 19+ km alignment, combining field measurements, predictive modelling and mitigation planning to ensure compliance and operability throughout construction and commissioning phases.

Furthermore, to support expanding maritime and field activities, we have placed an order for a dedicated portable data-acquisition system. This capability will enhance N&V testing onboard ships, enable efficient in-situ balancing and improve our assessment of ground vibrations to comply with internationally recognised vibration-criteria curves. As we move forward, these initiatives reflect our commitment to staying ahead of change and delivering value to our partners and clients.

MODAL ANALYSIS AND VIBRATION TESTING OF MONORAIL STRUCTURAL BEAM

By Hruthik H R, Engineer - Technical Services

BACKGROUND

Modal analysis is a key technique in structural dynamics used to identify eigenvalues such as natural frequencies, mode shapes and damping characteristics of mechanical systems or structures. It provides insights into how structures behave under dynamic loading by revealing their intrinsic vibrational properties.

Medha SMH Rail has developed new monorail vehicles for the Mumbai monorail and is interested in understanding the modal responses of the structural beam during monorail operation. A Finite Element Model (FEM) of the beam and its modal responses have already been developed and experimental modal analysis is to be conducted to correlate the results obtained from the FEM.

TASK TAKEAWAY

The modal analysis and vibration testing successfully identified key dynamic properties of the monorail structural beam, including natural frequencies, damping, and mode shapes. Experimental results validated the finite element model, confirming natural frequencies and mode shapes. The correlation enhances confidence in the structural design and its vibrational performance. Pass-by vibration data further supported the findings, ensuring safe and efficient monorail operation under real-world dynamic loading conditions.

SITE ACTIVITIES

Modal analysis was carried out on a straight monorail beam section and its supporting columns under two boundary conditions: no load (empty beam) and loaded (with monorail car). Sixteen (16) modal response locations were identified by the client, eight on the beam and four on each vertical pier. Two driving points were defined at the beam's midpoint and quarter point. Bi-axial vibration transducers were installed at all 16 response locations, while uni-axial transducers were used at the driving points. All sensors and the impact hammer were connected to synchronized multi-channel data acquisition systems (DaQs). Signal checks, including reciprocity and linearity, were made before testing. Once the data confidence was established the modal tests were conducted.

In addition to modal testing, vibration responses during monorail pass-by were recorded from four consecutive straight beam sections. For this, tri-axial vibration transducers were mounted at the midpoints of each section and connected to the multi-channel DaQ system.

VIBRATION IMPACT ASSESSMENT FOR PHASE 2A MAHINDRA INDUSTRIAL PARK ENSURING SUITABILITY FOR SENSITIVE EQUIPMENT

By Varun Yadav, Engineer - Technical Services

BACKGROUND

As high-tech industries continue to expand in India, sectors such as advanced manufacturing are increasingly assessing ground vibrations as the ground borne vibrations pose a direct threat to the operational efficiency and cause performance disruptions of sensitive equipment, this evaluation helps ensure that site conditions are optimal for the installation of sensitive equipment.

Mahindra Industrial Park Chennai Ltd is developing Phase 2A of the Origins industrial park near Chennai, a future-ready space designed to host a range of advanced industries. Since the phase 2A of the industrial park location is in close proximity to a busy railway line, assessing the potential impact of ground-borne vibrations from train movement is essential to ensure long-term suitability for vibration-sensitive infrastructure.

TASK INSIGHTS

The vibration assessment was successfully conducted focusing on evaluating ground-borne vibrations from train movements at four specified locations. NV Dynamics applied its expertise in vibration monitoring, utilizing seismic-grade transducers and standardized data processing techniques. The recorded data were analysed in 1/3rd octave bands and compared against Collin Gorden's Vibration Criteria (VC) curves. The final results provide a clear understanding of existing vibration levels under the measured conditions.

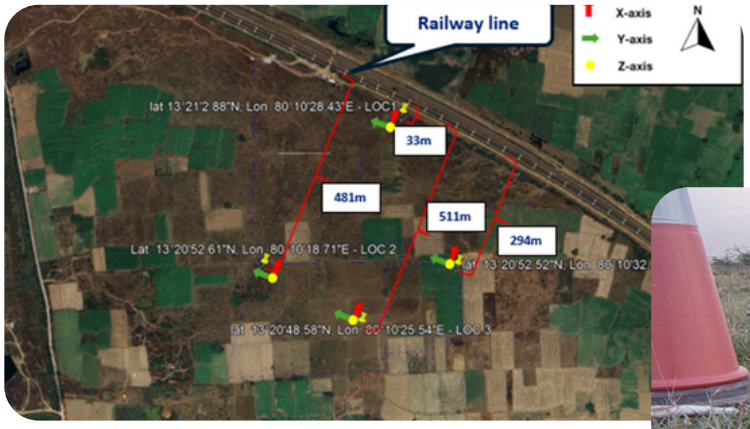
SITE ACTIVITIES

The vibration monitoring exercise was conducted at four key locations identified by the client, across the Phase 2A area; one directly adjacent to the railway track and three others at defined setback distances from the railway track.

Seismic-grade ultra-sensitive transducers were deployed at all four locations simultaneously to record vibration acceleration in three orthogonal directions to understand how vibrations propagate across the site.

Monitoring was carried out for a six-hour period when the commercial and passenger trains on the adjacent rail track were operating at peak frequencies. Ambient vibrations in the absence of train movements were also recorded and this allowed to analyze the true impact of rail activity on the designated Phase 2A area.

The acquired vibration acceleration data was integrated into vibration velocity by considering frequency range of 1 to 80Hz and was evaluated against the Vibration Criteria (VC) curves.

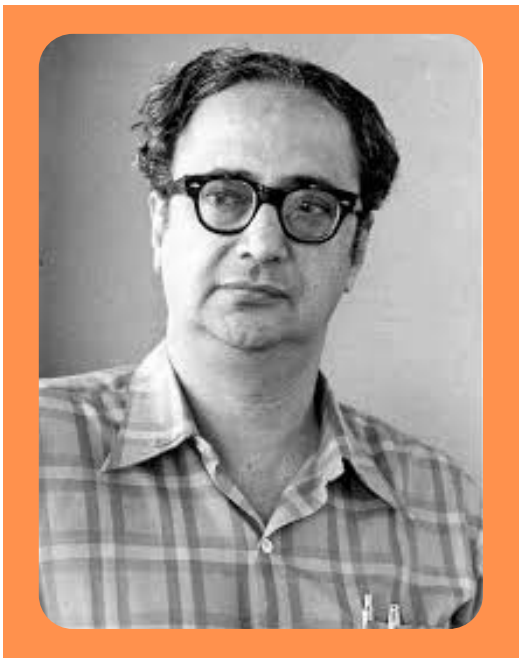


PHYSICS TO KNOW

Moles spend most of their lives underground, where vision is limited and sound behaves differently in soil than in air. To survive, they rely on vibration sensing rather than sight. Their bodies are adapted to detect subtle ground movements from predators or prey like worms and insects. Sensitive receptors in their snouts and skin pick up these vibrations, enabling them to judge direction and distance with remarkable accuracy. This unique ability allows moles to navigate, hunt, and remain alert to danger in their dark underground world.

GREAT MINDS & THEIR CONTRIBUTION TO THE WORLD OF SCIENCE

Badanaval Venkatasubba Sreekantan (1925–2019) was a renowned Indian scientist and cosmic ray physicist who made pioneering contributions to space science and astrophysics. A student of Nobel laureate C.V. Raman, he spent much of his career at the Tata Institute of Fundamental Research (TIFR), where he advanced research in cosmic rays, high-energy physics, and X-ray astronomy. Sreekantan was instrumental in initiating balloon and satellite-based experiments to study cosmic phenomena, laying the foundation for India's future space astronomy missions. As Director of TIFR (1987–1992), he strengthened the institute's research capabilities and fostered international collaborations. Widely respected as a mentor and visionary, he was elected to leading scientific academies and honored with numerous awards. His legacy continues to inspire India's progress in space science and fundamental physics.



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