Edition #90 July 2024

NVSAGE

Newsletter on Noise and Vibration Engineering

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NV DYNAMICS
VIBRATION. ACOUSTICS. BEYOND

FOREWORD

By Krishna Balamurali, Principal Engineer

For over 10 years now, NV Dynamics has conducted various types of ground vibration related activities, it all began with Delhi Metro Rail related projects.

But the evolution happened with the refinement of the sensors, methodology, compliance requirements and deliverables for various ground borne applications. What began as the assessment of ground vibrations in construction related activities moved on to assessing high precision laboratory spaces to chip manufacturing facilities and even to nano-engineering spaces.

This expertise and experience got extended to taking up full scale assessment of civil structures for their dynamic behavior and to offer consulting on structural modifications and other mitigation plans.

NV Dynamics is currently working on a structural testing, consulting and mitigation task with a large corporate who is in the business of developing real estates and properties across India and beyond.

The present case is of a boardwalk inside an IT park area designed for pedestrian walking as the main purpose; the design and construction has specific considerations for aesthetics and space optimization as the boardwalk supports has run through the pedestrian path at the ground level. The task has the composition of analyzing the structural stability and to conduct comfort analysis for human walking on the boardwalk. With multiple tests and trials already conducted at site and its data interpreted, we are working with the client in implementing some of the innovative solutions to address the issues. The modification proposals are underway to be followed by validation studies.

We also have an interesting case of Modal parameter evaluation for a new car development project; this is an ongoing task and I will be sharing the details of the assignment and many more of upcoming task is the next edition of NVSAGE.

BOARDWALK VIBRATION ASSESSMENT

By J Guru Kiran, Sr. Engineer - Technical Services

THE CHALLENGES AND APPROACH

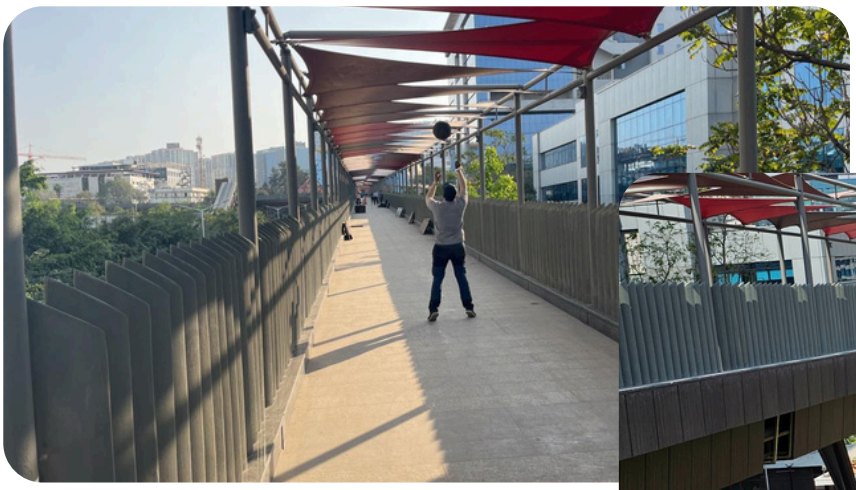
This detailed case study examines the low-frequency oscillation characteristics of a steel boardwalk structure located in an IT park area. The boardwalk, spanning around 160 meters, experienced low-frequency oscillations/vibrations in specific areas when pedestrians crossed it, prompting safety concerns from the client. To address these concerns, the boardwalk was temporarily closed. Extensive test plans were proposed and discussed with the client's structural engineering team to establish clear testing objectives. The assessment involved gathering, evaluating and analyzing vibration data, along with suggesting solutions to address the structural issues of the boardwalk.

TASK TAKEAWAY

After conducting various dynamic tests and assessments, the oscillation frequencies and corresponding amplitudes in the primary orthogonal directions were precisely identified. Following the tests, a solution has been proposed involving adjusting the oscillation frequency and decreasing the overall amplitudes. The suggested mitigation strategies are currently being implemented and will soon be validated before the boardwalk is reopened to pedestrians.

SITE ACTIVITIES

Vehicles in the vicinity of the boardwalk were diverted during the entire task to reduce their influence on the boardwalk. Ambient measurements were taken to estimate the baseline vibration of the boardwalk from any potential external sources. Natural frequency tests were performed with the help of weight drops (a high density rubber ball with sufficient mass was used in this case). The boardwalk platform and its columns were tested in about six different conditions, involving multiple load and dynamic combinations to understand its characteristics. The results obtained were presented in the form of graphs and animations which were referred to applicable bridge standards, to understand and correlate with the boardwalk structure. Mitigation measures were also proposed based on NV Dynamics previous experience with similar tasks.



FREQUENCY RESPONSE TESTING ON PASSENGER CAR MOTOR-STATOR

By Hruthik H R, Engineer - Technical Services

THE CHALLENGES AND APPROACH

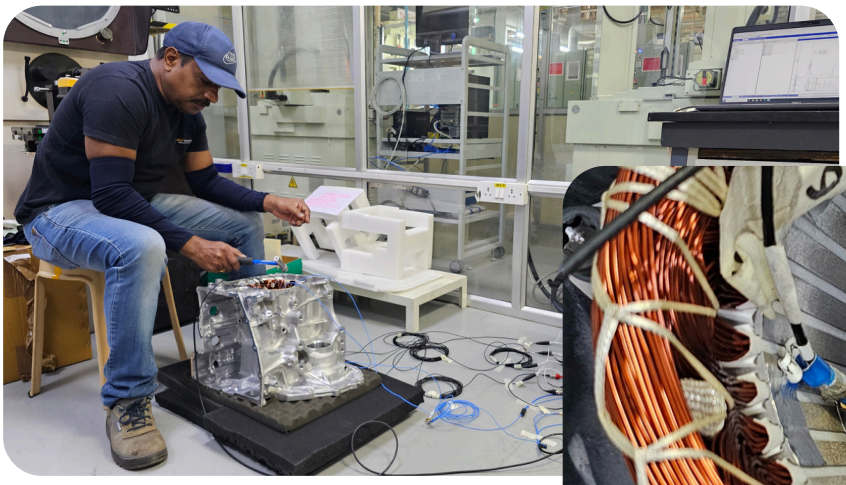
Automotive parts subjected to Finite Element Based Analysis need physical validation to confirm adherence to design and operational specifications. In a recent project, our team conducted Frequency Response Function (FRF) tests on a motor stator assembly for a renowned car manufacturer near Bangalore, India. These tests are essential for identifying the natural frequency of the motor stator, analyzing its reaction to different excitation frequencies, pinpointing response peaks and understanding resonance characteristics based on operational frequencies.

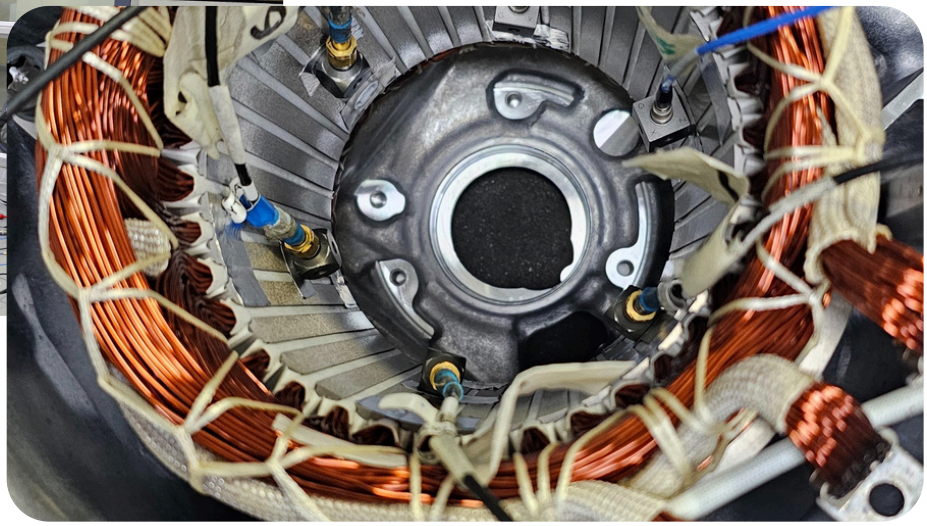
TASK TAKEAWAY

Task involved testing of about 58 motor-stators over multiple site visits, where gradual increase in natural frequency of the motor-stators are noted based on the design iterations performed by the customer. Frequency response testing provided detailed insights of vibrational properties and dynamic behavior of the stators that helped in achieving the desired frequency range.

SITE ACTIVITIES

To test the natural frequency of the motor-stator using the frequency response function. Initially, the motor-stator and casing were securely positioned on a stable surface to prevent external influences on the data and frequencies of interest. Triaxial accelerometers were then installed on defined locations along the inner circumference of the motor-stator units and linked to a multi-channel data acquisition system. An impact hammer with a force transducer was utilized to stimulate the natural frequencies of the stator. The data collected from the accelerometers was used to create FRFs and pinpoint the natural frequencies of the motor-stator assembly. The stator manufacturer utilized these outcomes to adjust and enhance the manufacturing/assembly process until the desired frequency responses were achieved. The entire testing and validation procedures spanned over a 3-month period and maintained a high quality of testing standards with deliverables.



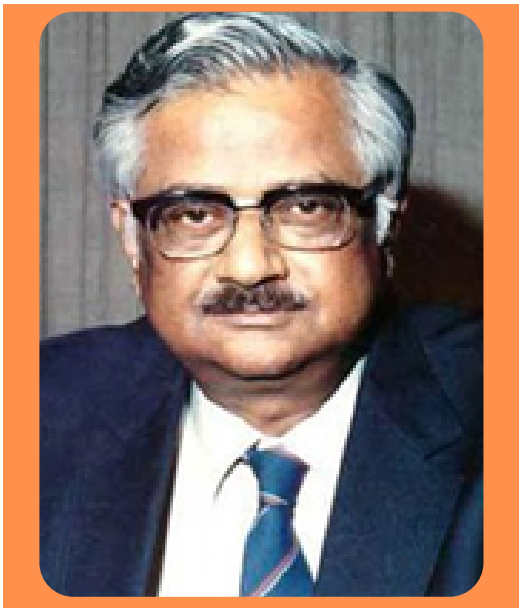


PHYSICS TO KNOW

Elephants use feet stomping to create seismic signals, low-frequency vibrations that travel through the ground over long distances, up to several kilometres. They detect these vibrations with sensitive cells in their feet and trunks, crucial for coordinating group movements, signalling danger, and finding mates. The thick, padded soles of elephants' feet enhance the transmission of these signals. Researchers leverage this understanding to investigate elephant behaviour and devise conservation strategies, safeguarding these intelligent animals from threats such as poaching and habitat loss.

GREAT MINDS & THEIR CONTRIBUTION TO THE WORLD OF SCIENCE

Dr. Raja Ramanna who hailed from Tiptur, Karnataka, was a distinguished Indian physicist and a key figure in Indian nuclear program. Known for his leadership in the development of India's first nuclear bomb, he played a crucial role in the successful Pokhran-1 test in 1974 which was code named as operation smiling buddha. Ramanna's academic prowess spanned nuclear physics and defense technologies. He served as the director of Bhabha Atomic Research Center (BARC) and later as Minister of State of Defense. Honored with numerous awards including Padma Vibhushan, Ramanna's contributions extended to various scientific institutions and policy-making bodies, significantly advancing India's scientific and technological landscape. He also authored several books, blending his scientific expertise with cultural and philosophical reflections.



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