Experimentally-Based Analytical Prediction of Structural Vibration

by

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This study evaluates the vibration isolation effect of various mounting systems in a heavy freight locomotive cab, and provides an analytical method for the prediction of structural vibration. The cab is set up in a controlled laboratory environment in a manner similar to the installation on a locomotive. Field measurements are used to emulate actual vibration input to the cab structure. A 16-channel data acquisition system is used to collect vibration data at various points on and inside the cab structure.

The cab was isolated from the sill structure through six elastomeric mounts fixed at the base of the cab and at the crash posts. The mounts at the base were selected such that they support the static weight of the cab and offer good lateral and longitudinal stability. Two cylindrical elastomeric mounts were placed between the cab structure and the crash posts which attach to the front of the sill structure.

Upon establishing the baseline for laboratory vibration measurements and correlating them with field data, acceleration data was collected at discrete locations, both inside and outside of the cab. The data was used in conjunction with an analytical formulation to generate vibration approximations of the discrete locations. To validate the analytical approximations, experimental results were compared with the analytical predictions using simulated field input to the cab

The test results from the analytical model approximations proved to have a strong correlation with experimental results. Vibration approximations of locations outside the cab had a higher correlation to the experimental data than the points on the inside. Although the model did not yield exact results for several positions inside the cab, it resulted in several recommendations for future work.

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