

Field Instrumentation of Supporting Structure for Mumbai Mono-Rail Project

The purpose of field instrumentation and measurement during the testing phase of the monorail is to evaluate the properties of a constructed guide-way beams and supporting structure, and relate these to the required performance parameters. Additionally, assumptions made during the design regarding the dynamic augmentation factor and the hunting loads also need to be verified using field measurements. One five-span continuous straight span frame (Frame No. 128) and one three-span continuous curved span frame (Frame 131c) have been identified for the field testing. Due to operational constraints, all external measurements of displacements and strains in the monorail guide-way beams have to be done from the bottom of the guide-way beam. Due to this constraint, centre of span is the most suited location to measure vertical and lateral displacements, and the longitudinal surface strains. For this purpose 4-strain gauges of 120 mm gauge length were placed at the centre section of the span for longitudinal strain measurements. Two strain gauges were placed on the bottom surface of the guide-way beam 150mm from the edges (SG 1 & 2) and the remaining two were placed on the side-face of the guide-way beam 150mm above the bottom surface (SG 3& 4). Additionally, four more strain gauges were put at L/3 span section – similar to the centre section (SG 5 & 6, SG 7 & 8). One multi-channel+ Data acquisition system with sampling rate of more than 50 samples per second was used for each span. Depending on the availability of the number of sets of instruments, both spans of a frame can be taken together or one by one.

For each span, total of **five load cases were studied**:

- (1) Static – monorail without pay load, (2) Static – monorail with symmetrically placed pay load, (3) Dynamic at design speed of frame – monorail with symmetrically placed pay load, (4) Dynamic at design speed of frame – monorail with un-symmetrically placed left-centric pay load, and (5) Dynamic at design speed of frame – monorail with un-symmetrically placed right-centric pay load. **All measurements were repeated six times** – monorail approaches the instrumented span from both sides three times.



Field testing of Mono rail Project



Strain gauges and Wiring