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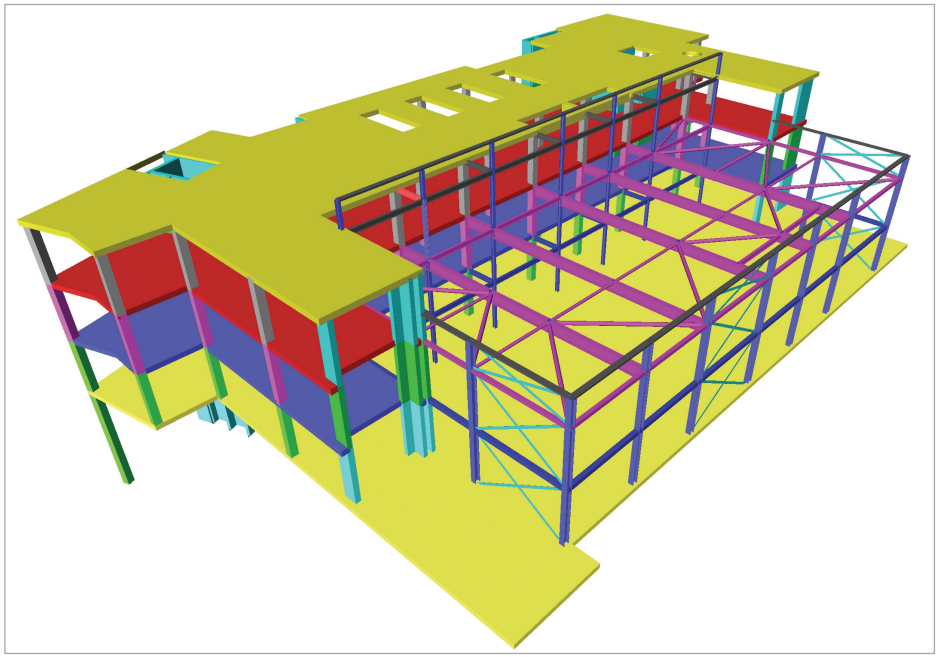

Software: Scia Engineer

Heartlands High School - London, United Kingdom

Heartlands High School is a new build secondary school in Haringey, London and will receive about 1.100 students. It is situated on an old railway yard adjacent to the East Coast Mainline railway. The long, narrow site runs alongside the railway lines and slopes down approximately 7 - 10 m over its width.

A sheet piled retaining wall was installed through the middle of the site to create an upper level next to the railway lines and a lower level (set 7 m down) to match the surrounding ground level at the bottom of the old embankment. The new school comprises of a 3 storey structure at the higher level with two 5 storey "wing" buildings sitting at the lower level which tie into the upper building at third floor.

Key structural design features

- Analysis for ground-borne vibration due to close proximity of passing trains
- Steeply sloping site

Foundations

Displacement piled foundations and a suspended concrete slab were used due to the relatively poor ground conditions on the site.

Structural frame

The structural form for the majority of the building is an in situ reinforced concrete flat slab supported by concrete columns and stabilized by concrete shear walls.

At areas requiring large clear spans (such as sports and performance halls) the structure changes to a steel frame.

Design for rail vibration

Heartlands High School is situated adjacent to the very heavily used East Coast Mainline Railway. Concerns over the level of ground-borne vibration due to passing trains led to a program of monitoring and analysis to verify the design.

The school required the building to limit the vibration experienced by the users to a specific vibration dose value. At the beginning of the project the concern was that the level of vibration being created by the trains may require the building to be set on spring bearings to isolate the structure from the ground in order to achieve the required dose value. This would have been extremely costly and hence we were commissioned with the task of analysing the building to see if we could achieve the required vibration dose value by considered design of the concrete structure.

Vibration acceleration spectra generated by passing trains were recorded via a test pile installed at the site. The spectra were then input into Scia Engineer as seismic loads using the advanced dynamics module.

Scia Engineer's contour plot of the summation of vibration acceleration in all modes was used to determine critical zones for detailed analysis. Raw accelerations for each mode of vibration at the critical node were exported to a series of spreadsheets for summation in frequency-weighted 1/3-octave bands. The key challenge of this project was to generate the right amount of data. Exporting spreadsheets containing acceleration data for every node and every mode would have overwhelmed most computers. Instead, sub-regions of the slab were used to target specific areas for data export. The final stage of calculation using these spreadsheets was to combine the predicted floor vibration levels into a 'vibration dose value' (VDV), which is a measure of vibration used in the UK that takes into account both the intensity and duration of vibration.

AECOM used this methodology to consider the effect of various design iterations including additional rows of columns within critical spans. AECOM's in-depth analysis gave the contractor confidence that the design would achieve the stringent vibration criteria without the need for spring bearings.

Heartlands High School

London, United Kingdom

Project information

Owner	Haringey Council
Architect	HMY
General Contractor	Willmott Dixon
Engineering Office	AECOM
Construction Period	From September 2009 to April 2011
Location	London, United Kingdom

Short project description

Heartlands High school is a newly build school in Haringey, London and will receive about 1.100 students. The building is situated on an old railway yard, adjacent to the very heavily used East Coast Railway. Concerns over the level of ground-borne vibration due to passing trains led to a program of monitoring and analysis to verify the design of the concrete flat slab structures to limit the vibration experienced by the users to a specific vibration dose value. The analysis was carried out using the Scia Engineer dynamics module by imputing acceleration spectra generated by passing trains as seismic loads.