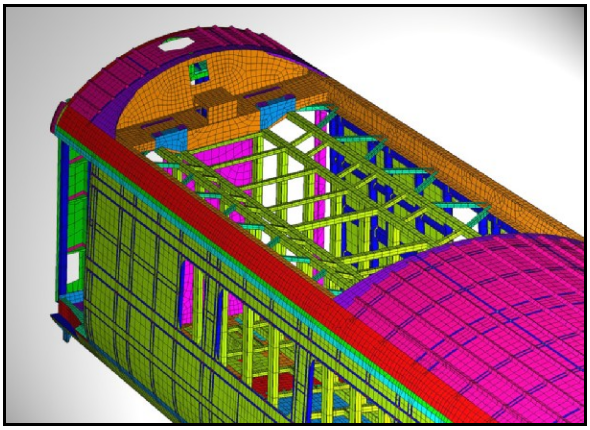
Vehicle Design & Modification

DeltaRail has been involved with track recording technology since the first inertial based systems were developed in the 1960s (then as British Rail Research). When Network Rail decided to procure their next generation of track recording cars, DeltaRail were asked to take an existing passenger coach and transform it into a high-tech recording car.

VAMPIRE® was used to establish the effects on the dynamic performance of the vehicle of the significant changes made to mass and mass distribution in the coach during modification. It also provided a key tool to help design the active pantograph assembly.

Evaluating the Effect of Changes to Mass & Centres of Gravity

Stage one of the vehicle modifications involved stripping out the interior to install extensive rack mounted equipment plus a generator unit. Part of the roof was removed and a frame installed to support the active pantograph unit.



VAMPIRE® was used to evaluate the effects of these changes, to ensure that the dynamic performance of the vehicle would remain acceptable in terms of ride, derailment resistance and rollover.

The second stage was to add overhead wire wear monitoring equipment to the roof of the vehicle, weighing several hundred kilograms. There were concerns that adding this amount of mass high up on the vehicle structure could cause increased sway, resulting in gauge infringement.

In this case, the VAMPIRE® simulations were used to both evaluate the effect, and to help develop mitigation measures consisting of steel ballast added at specific locations in order to re-balance the vehicle.

Simulating the Active Pantograph

The vehicle being modified was not originally designed to carry a pantograph and so could sway more than normal pantograph vehicles. To counteract this sway the pantograph was mounted on a curved track on the vehicle's roof. This allowed it to be driven from side to side, using correction factors calculated from displacement transducers mounted across the primary and secondary suspension on the bogies.

There were concerns that under certain circumstances, the pantograph could still go out of gauge and pull down the overhead wire. The VAMPIRE® model was therefore enhanced to include mass and suspension elements representing the pantograph, and the power of VAMPIRE® Pro's output equations was exploited to calculate the relative position of the pantograph.

The model was then run over artificial test tracks and extended lengths of actual track data to demonstrate its safe performance, including an analysis of the effects of wind loading.

Summary

In this case, VAMPIRE® simulations were used as an efficient way to establish the effect of extensive vehicle modifications and develop mitigation measures. They also formed a key part of the safety submission to enable the vehicle to operate on UK infrastructure.

Further Information

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