Ricardo Rail

Virtual Testing

On-track testing of new and modified rolling stock is difficult and can be expensive. Ilse Vermeij, Product Manager Testing at Ricardo, explores how virtual testing can reduce real-life test requirements, improving project performance.

Ilse-Vermeij, Ricardo Product Manager – Testing

Question: Why do we need virtual testing?

Ilse Vermeij: In the certification phase of new or modified rolling stock, I see traditional on-track testing becoming more and more difficult and consequently more costly for clients. Limited availability of test tracks, stricter safety requirements and high costs to plan and replan test runs are often key reasons for testing challenges experienced.

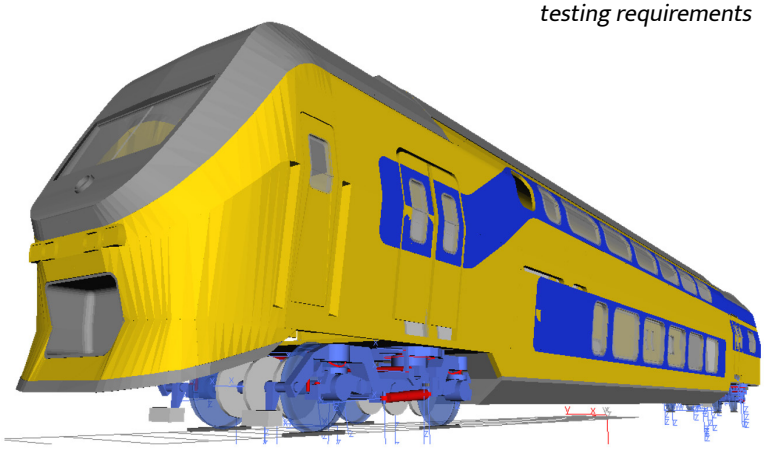
In addition, on-track tests are not always desirable from a safety perspective as some tests can be damaging to the trains or the infrastructure. Obvious destructive examples are derailment and crash tests. Therefore, to minimise costs and track testing time required, I believe that it is increasingly important to consider and use innovative alternatives where possible, to reduce the on-track testing scope in projects.

Q: What is virtual testing?

IV: Virtual testing (or virtual certification) is a useful alternative to physical testing. Virtual testing can mean full computer simulations, but it also includes tests where the system to be evaluated is placed in a simulation environment. This is known as 'hardware in the loop' or 'software in the loop' testing. At Ricardo we have developed many possibilities to test both vehicles and infrastructure virtually. In my opinion, it is likely that vehicle testing will never be fully virtual, but it can certainly help significantly reduce the on-track test requirements, saving clients both time and money.

Even if you have access to on-track test facilities, you should still consider virtual testing. Its use can reduce both planning and safety risks significantly and reduce the overall project cost. Who can ignore these benefits? How much time and money is saved depends on the balance between the effort needed to create a model, and the cost of on-track testing. If an existing model can be reused, then virtual testing becomes very interesting.

Modelling rolling stock virtually to minimise physical testing requirements



Q: What types of testing can be virtual?

IV: I believe that the following types of testing are most interesting to 'virtualise', due to the current high costs for on-track testing:

- Running dynamics
- Brakes and wheel slide protection (WSP)
- Pantograph contact force
- Noise emissions
- Electrical system compatibility / harmonics
- European Train Control System (ETCS)

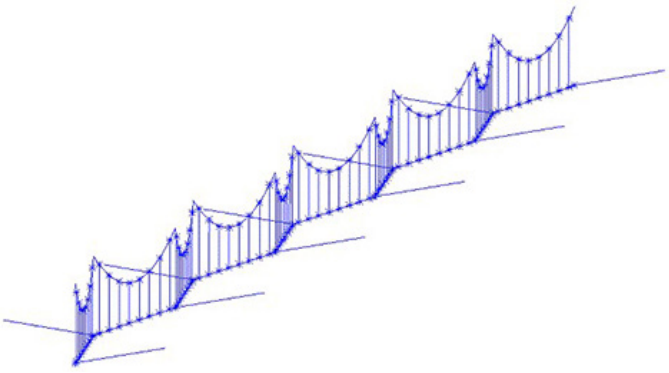
Of course, with the use of virtual testing, one of the most important aspects is that the models are validated, to ensure they represent the actual system under test. As with all models, they are only as good as their validation. Where virtual testing is already allowed by standards, those standards prescribe how the validation with measurement data needs to take place, (for instance in Annex T of EN14363).

Q: How do you validate a model if you have not yet built the train?

IV: For this reason, virtual testing makes most sense for vehicles based on a shared platform, where the differences with already tested and delivered vehicles are relatively small or where vehicle overhaul and component upgrades and modifications are to be evaluated. In these cases, the validation can take place by gathering validation data on vehicles already in operation, or better still, the measurement data of earlier type testing with these vehicles.

Q: Do you have an example of virtual testing in use?

IV: A great example of using virtual testing at Ricardo is pantograph simulations in accordance with EN50318 (a service we provide with our RiPAC tool). These simulations are often performed in combination with on track contact force measurements, to reduce the number of required physical tests. The model used is validated for a class of overhead line system and the validation is therefore independent of the type of vehicle. This means a model can be reused for other vehicles/configurations quite easily. If there is no



validated model available yet, the results of the on-track contact force measurements can be used for validation of the model in retrospect.

Q: Why invest in virtual testing models?

IV: In my experience, developing a virtual model will always be a wise investment. Once created it can be used to investigate vehicle behaviour in the design, certification and operational phases of a vehicle's life. To maximise return on investment in a virtual model, multiple stakeholders through the lifecycle of the vehicle can make use of it, for example manufacturer, owner, maintainer and perhaps even the operator. When upgrades and retrofits are completed during the vehicle life, then once again a validated model can be used as a basis to aid the evaluation of the changes before they are physically made.

If you want to find out more about our testing or virtual testing services then get in touch to discuss your testing challenges either real or virtual.

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