

## Wheel Rail Profile Optimisation

The shape of the wheel / rail contact greatly influences a number of key factors important to running a safe and efficient railway:

- vehicle stability & ride comfort
- vehicle and ground borne noise and vibration
- wheel and rail wear rates
- derailment (flange climb in particular)
- the occurrence of corrugations
- the occurrence of Rolling Contact Fatigue (RCF)

Very small changes to the shape of either wheel or rail profile can result in large changes in behaviour or performance of this critical interface. One effective way of assessing the compatibility of wheel and rail profiles and assessing the effect of possible changes is to use dynamic simulation. VAMPIRE® has been used in this area for many years, and this case study describes two recent studies that have been undertaken.

### KCRC Wheel Rail Interface Study

DeltaRail were approached by the Kowloon-Canton Railway Corporation (KCRC) in 2005 to undertake a detailed investigation of wheel/ rail issues on the West Rail line in Hong Kong including:

- wheelset life
- vehicle vibration due to lateral instability
- a rapid growth of rolling contact fatigue damage on the high rail in curves

A team from DeltaRail travelled to Hong Kong and collected detailed information on the nature of the problems being experienced. The team also undertook detailed and extensive measurements of track geometry and rail and wheel profiles and noted the location and severity of Rolling Contact Fatigue (RCF).

The track geometry and rail profile information was incorporated into a VAMPIRE® model of the entire route and a model of the SP1900 train was also constructed, incorporating the measured wheel profiles. VAMPIRE® was then used to predict the locations of RCF. A remarkably close match was shown between predicted and observed locations of RCF.

Further simulations were then undertaken with a number of changes to both wheel and rail profiles with a large number of calculations being carried out to find a better wheel / rail profile combination.

A year long trial was then undertaken on West Rail, where four sites were ground to the revised rail profile, and some trains used a revised wheel profile.



The combination of revised wheel and rail profiles with the reformulation of the rail lubrication grease resulted in:

- improved running stability
- an increase in re-profiling interval from 120,000km to 200,000km
- a dramatic reduction in the occurrence of RCF from over 21km in 2005 to less than 5km in 2007

A very similar study was subsequently undertaken for the more recently opened Ma On Shan line. Again, VAMPIRE® modelling was used to determine whether the adoption of changes similar to those made on West Rail would be of benefit. This again predicted a significant improvement in terms of vehicle stability and so the revised wheel and rail profiles were subsequently also adopted for this line.

### Further Information

For further information please contact the VAMPIRE® Helpdesk:

email: [vampireadmin@deltarail.com](mailto:vampireadmin@deltarail.com)

web: [www.vampire-dynamics.com](http://www.vampire-dynamics.com)

