R3.105 Rail Squats – Literature Review – Executive Summary

Rail Squats Literature Review

Rail squats/damage/failure is a problem of considerable economic cost. This has been exacerbated by the recent trend towards higher axle loads on heavy haul railway lines in Australia - Squats now affect a wide spectrum of infrastructure configurations and traffic types. Squats began development in Australia over 19 years ago, and in February 1999 the problem was identified as being among the top 6 high priority items.

A preliminary study was commissioned in 1994 to examine the contact stresses obtained with a range of wheel and rail profiles. Squat defects are of concern for the following main reasons:

- There has been a considerable increase in their numbers over the past 4-6 years.
- There is a danger that the secondary or minor sub-surface cracks (illustrated in Figure 2) may turn down and grow on a transverse plane similar to transverse defects, with the possibility of a complete rail failure if not detected in time.
- The depression and spalling on the running surface associated particularly with large squats increases the vertical impact wheel loadings and vibrations applied to the rails. Consequently the deterioration of both track and some vehicle components is exacerbated, in a similar way as dipped welds, rail corrugations and rail joints.
- The rail life is decreased, through the need for aggressive and expensive defect grinding.
- There is a risk that the horizontal subsurface primary cracks will cause shielding of the ultrasonic signals from deeper defects during normal ultrasonic inspections.
- There can be a considerable influence on environmental noise. In fact, the wayside noise levels (at a distance of 7-8m from the track) can increase by over 10 dBA with rails containing multiple moderate to severe squat defects.

It is also important to note, however, that to date within RailCorp, although many defects have developed, there have been no confirmed reports on rail failures of the transverse type associated with the defects. Similar observations were made previously in the Coal Lines of the Hunter Valley.

CRC for Rail Innovation Project R3-105 (Rail Squat Strategies) aims to further resolve key factors in squat initiation and growth, and to investigate tools of early detection allowing early correction. The project will seek to identify the effects of changes in operating conditions on squat formation. While focusing on experimental testing, the project will also involve development of modelling tools as appropriate to understanding the conditions in the early development of a squat.

This literature survey forms part of CRC for Rail Innovation Project R3-105. In this initial report we target squat initiation and growth. Experimental testing and modelling tools in rails under service conditions are targeted as areas for review. New experimental and modelling work will be discussed in subsequent reports. One topic discussed in subsequent reports will be the effect of a recent NASA finding that the ASTM materials characterisation tests are invalid and yield data that leads to unconservative estimates of the life of structural components has upon the analysis and testing associated with the growth of small rail squats.