Comparative performance of innovative quad-trailer combinations

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In recent years there has been an increase in the use of multi-combination vehicles operating in remote areas of Australia. This increase is borne out of the requirement for local operators to meet the demands of Australia’s growing road freight task. Such vehicles are termed ‘innovative’ as they frequently comprise combinations of ‘A’ and ‘B’ couplings for which little operational experience exists. These include AAB-quad, BAA-quad, BAB-quad and ABB-quad combinations.

Presently, access for innovative vehicles is granted by local State road authorities, and is based on the assessment of the dynamic performance of the vehicle combination using Performance Based Standards (PBS) measures. Typically, this is completed by computer simulation and subsequent observation of on-road performance. An increasing, but still small number of vehicles have been approved for operation under this scheme. The PBS performance of the innovative vehicles typically rates much higher than that of conventional triple road-trains. As a consequence, there is a move to allow innovative vehicle configurations that meet with a set of physical requirements, which will ensure a vehicle will achieve an acceptable level of performance, as defined by PBS. To facilitate this, an understanding of the performance of a range of innovative combinations is required. To date, a large-scale assessment of multi-combination vehicles which seeks to investigate the difference in dynamic performance between vehicle configurations, commodity types, suspension types, and loading concessions has not been conducted. Previous work in this area consists of miscellaneous assessments of the performance of single vehicles. An analysis of the sensitivity of the dynamic performance of the vehicle to changes in vehicle geometry or characteristics is also required, to allow for the effects of these changes to be understood.

ARRB Group completed performance assessments and a sensitivity analysis of a range of innovative combinations via computer simulation using PBS. ARRB have also conducted a field test of two innovative quad combinations to better appreciate their on road performance and to understand issues not directly addressed by PBS. The computer based vehicle simulations considered all PBS measures designed to address the safety of the vehicle in on-road scenarios and the impact of the vehicle on road infrastructure.

The simulation results showed considerable differences in the high speed dynamic stability of the configurations. The ABB and BAB exhibited considerably better performance than the A-triple, with performance of the AAB and BAA falling in-between. These results were supplemented by a field test program conducted using two quad-road train combinations in Darwin, Australia. The vehicles comprised a BAA-quad tanker combination and an AAB-quad tanker combination with identical components. Instrumentation and data logging equipment was fitted to the vehicles to record longitudinal and lateral accelerations experienced by the prime mover and each trailer unit while in operation on a local haul route with known road geometry.