

Skilled train driving performance relies on a complex mental model of the railway environment to keep ahead of the curve. This enables drivers to be aware of and anticipate the requisite changes to velocity arising from navigating very long and heavy trains (e.g., freight, heavy haul). It also helps them operate in a complex decision-making environment (e.g., passenger, urban). Train driver mental models are powered by route knowledge, a store of information that is considered to have both static and dynamic properties, the acquisition of which forms the basis of train driver learning programs. However, in spite of the importance of route knowledge, very little research has sought to examine how the various dimensions of route knowledge are encoded and compiled into mental models, and how their acquisition aligns with challenges in the driving task. To research this gap, a study was undertaken within six freight and passenger rail organisations across Australia. Data were collected from train drivers (n=42) using an innovative methodology that included focus groups with a forward thinking scenario simulation tasks.

Qualitative analysis of these data based on the pervasiveness of features in the data revealed three themes categorised by infrastructure, environmental, and operational features, emphasising different dimensions of route knowledge. This paper outlines the most represented of features in each of these categories and associated scenarios, that were found to underpin route knowledge, using illustrative examples from the data, and drawing links with driving strategy. The outcomes of this study extend the corpus of research in the area, and for rail training communities, may be used to understand the difficulties and challenges that different candidates for train driving face based on the presiding formalism underpinning their mental model. The findings may also be used to inform the design of existing driver training programs, both to optimise skills development, and to advance workforce development in the wider rail industry.