

From Problem Space to Executional Architecture: The Development of a Simulator to Examine the Effect of Autonomy on Mainline Rail Capacity

Authors : Emily J. Morey, Kevin Galvin, Thomas Riley, R. Eddie Wilson

Abstract : The key challenges faced by integrating autonomous rail operations into the existing mainline railway environment have been identified through the understanding and framing of the problem space and stakeholder analysis. This was achieved through the completion of the first four steps of Soft Systems Methodology, where the problem space has been expressed via conceptual models. Having identified these challenges, we investigated one of them, namely capacity, via the use of models and simulation. This paper examines the approach used to move from the conceptual models to a simulation which can determine whether the integration of autonomous trains can plausibly increase capacity. Within this approach, we developed an architecture and converted logical models into physical resource models and associated design features which were used to build a simulator. From this simulator, we are able to analyse mixtures of legacy-autonomous operations and produce fundamental diagrams and trajectory plots to describe the dynamic behaviour of mixed mainline railway operations.

Keywords : autonomy, executable architecture, modelling and simulation, railway capacity

Conference Title : ICRSEM 2023 : International Conference on Railway Systems Engineering and Management

Conference Location : Reykjavik, Iceland

Conference Dates : November 20-21, 2023