RE: Summary of the Research Project to be presented – "Decision Reliability using Incomplete or Inaccurate Asset Data"

The goal of this PhD project is to develop a framework for an automated and reliable decision-making system under data uncertainty, as a response to the consequences of extreme weather on rail infrastructure management. The project will utilise the principles of cybernetics and systems thinking to create an adaptive tool capable of making decisions in real time based on incomplete or inaccurate data. It also aims to develop a philosophy and set of principles of adaptation for decision making under conditions of data uncertainty, embracing, and making explicit the limits to the accuracy and availability of data.

The project's significance lies in its potential to enhance rail infrastructure resilience, thereby improving the safety and continuity of rail transportation, which is crucial for commerce, society, and the economy. It is an immediate response to the tragic derailment at Stonehaven in 2020 and the independent report written by Network Rail and the Department of Transport. It represents a component of a larger effort to address the challenges posed by extreme weather events, climate change, and other unpredictability that can disrupt rail infrastructure.

The research methodology will include a scoping review of existing literature on managing uncertainty and incomplete or poor data in rail infrastructure management and other industries, such as law enforcement, agriculture, energy, and environmental management. This review will identify literature gaps and serve as the basis for the development of the framework. Case studies and simulations will be employed to test and validate the results.

It is anticipated that the research outcomes will contribute to the creation of decision-making tools and strategies applicable not only to rail infrastructure management but also to other industries facing comparable challenges. By accepting the limitations of data accuracy and availability and adopting a cybernetic approach, decision makers would be able to make more informed and reliable decisions in complex and uncertain environments. Ultimately, this project seeks to enhance the resilience of critical infrastructure systems and the capacity of society to withstand unforeseen disruptions.