The Context

• Changing – climate, demographics, economics, technology
• Railways – growing networks (scale, volume) electrification, signalling and ticketing technology, business models
• Transport key to modern society, fundamental to personal mobility, most sustainable
• Not a technical issue – engineers can solve
• A managerial issue
• Adaptation hard – financial, technical, political, societal
• Complex, dynamic, needs a ‘whole system’ appreciation to solve it
Seven Inter-acting Sub Systems

1: Rail Services
2: Rail Infrastructure
3: Political Governance
4: Finance and Funding
5: The Business Model
6: Climate and Weather
7: Supply Chain
Management at ALL levels

Each level contains and constrains the level below

Socio-Political conditions
Strategic
Strategic conditions Operational
Operational conditions
Local/Specific
Asset Criticality and Network Resilience

Influence:
THIS Asset depends on THAT

Supply

Process

Environmental

Outfluence:
THAT Asset depends on THIS

Supply Vulnerability
Process Vulnerability
Environmental Vulnerability

Asset Criticality = \sum (Onward Asset Dependence \times Onward Asset Criticality)
Supply Criticality = Asset Criticality \times Supply Vulnerability
Process Criticality = Asset Criticality \times Process Vulnerability
Environmental Criticality = Asset Criticality \times Environmental Vulnerability
Asset Vulnerability = \text{Max of Supply/Maintenance/Environmental Vulnerability}
Continuously Dissolving
The Problem

Client

Client Model of Problem

Check Understanding

Idealised VSM

Emergent Model of Problem

Shared Model of Problem

Outline Solution

Prepare a Proposal

Agreed

Yes

No

What has been misunderstood?

Outline Solution

Check Solution

What has been misunderstood?

Outline Solution

Check Solution

What has been misunderstood?
Continuously Dissolving
The Problem

Stakeholder Engagement (Users, Owners, Operators, Engineers, Funders etc.)
• Railways must be managed as ‘whole systems’
• Challenges and opportunities cannot be addressed in isolation from each other
The Intelligent Organisation