

# *Application of Systems Engineering to Major Enhancement Programmes*

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# *Developing System Engineering*

A photograph of railway tracks under construction, showing the steel rails and concrete sleepers laid out in a long, straight line. The background shows some buildings and trees under a clear sky.

Extend Process to  
Industry Issues

Expand Application in  
NR

Systems Approach to  
Validation for all  
Projects

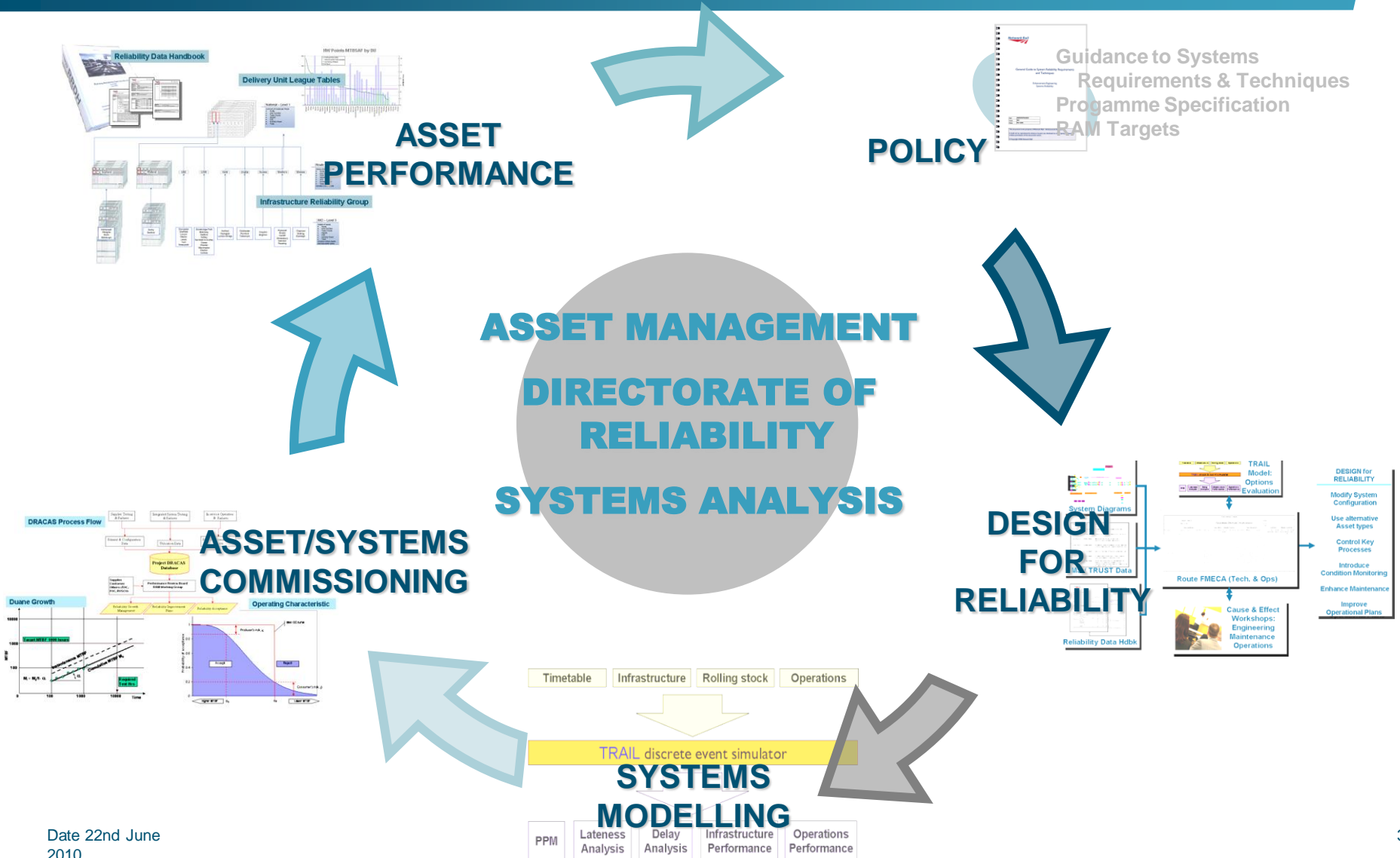
A photograph of railway workers in orange high-visibility vests and white hard hats working on a railway track. They are focused on their task, possibly inspecting or maintaining the tracks.

System Integration

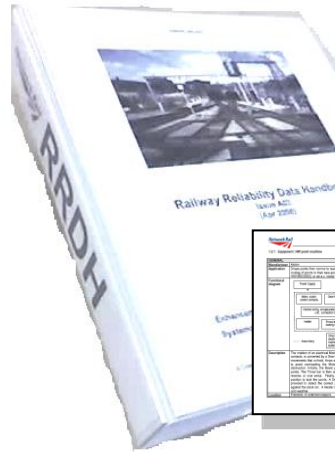
Establishing a System  
Engineering Discipline



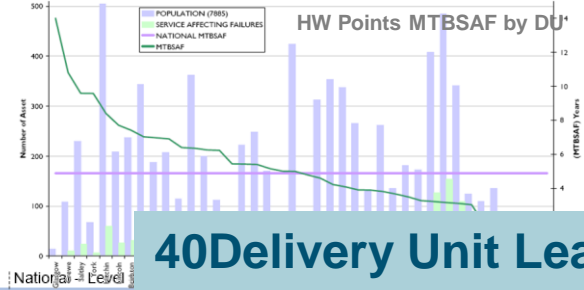
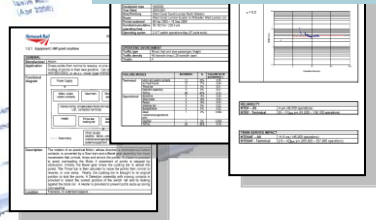
# Systems Methods for Reliability



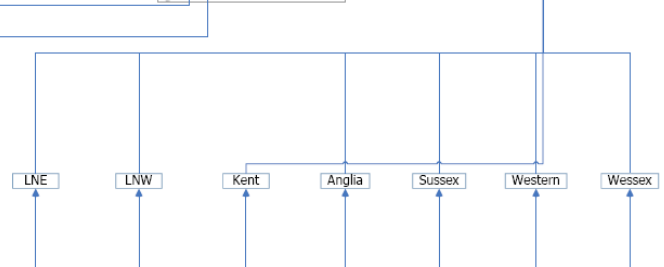
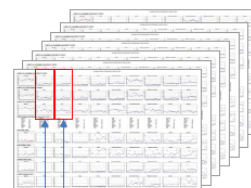
# Asset Performance – Network Wide



## Reliability Data Handbook – National Analysis



## 40 Delivery Unit League Tables : One Format – One Way



**Route – Level 2**  
 Details of Asset per IMD  
 • Points  
 • Axle Counters  
 • Track Circuits  
 • Signals  
 • OLE  
 • Auxiliary Power  
 • Track  
 Includes Critical Assets

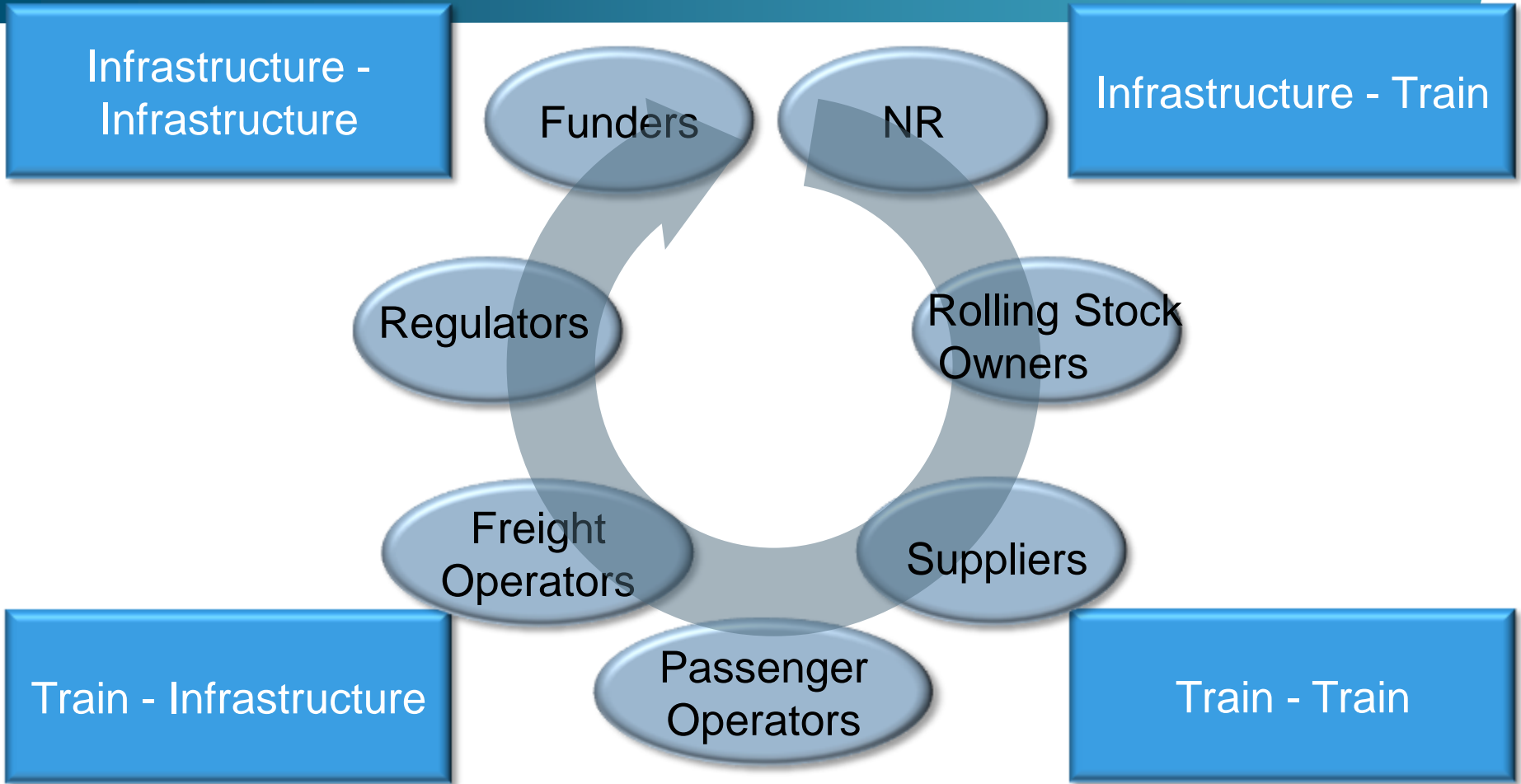
## 40 Delivery Unit 'Frontline' Reports



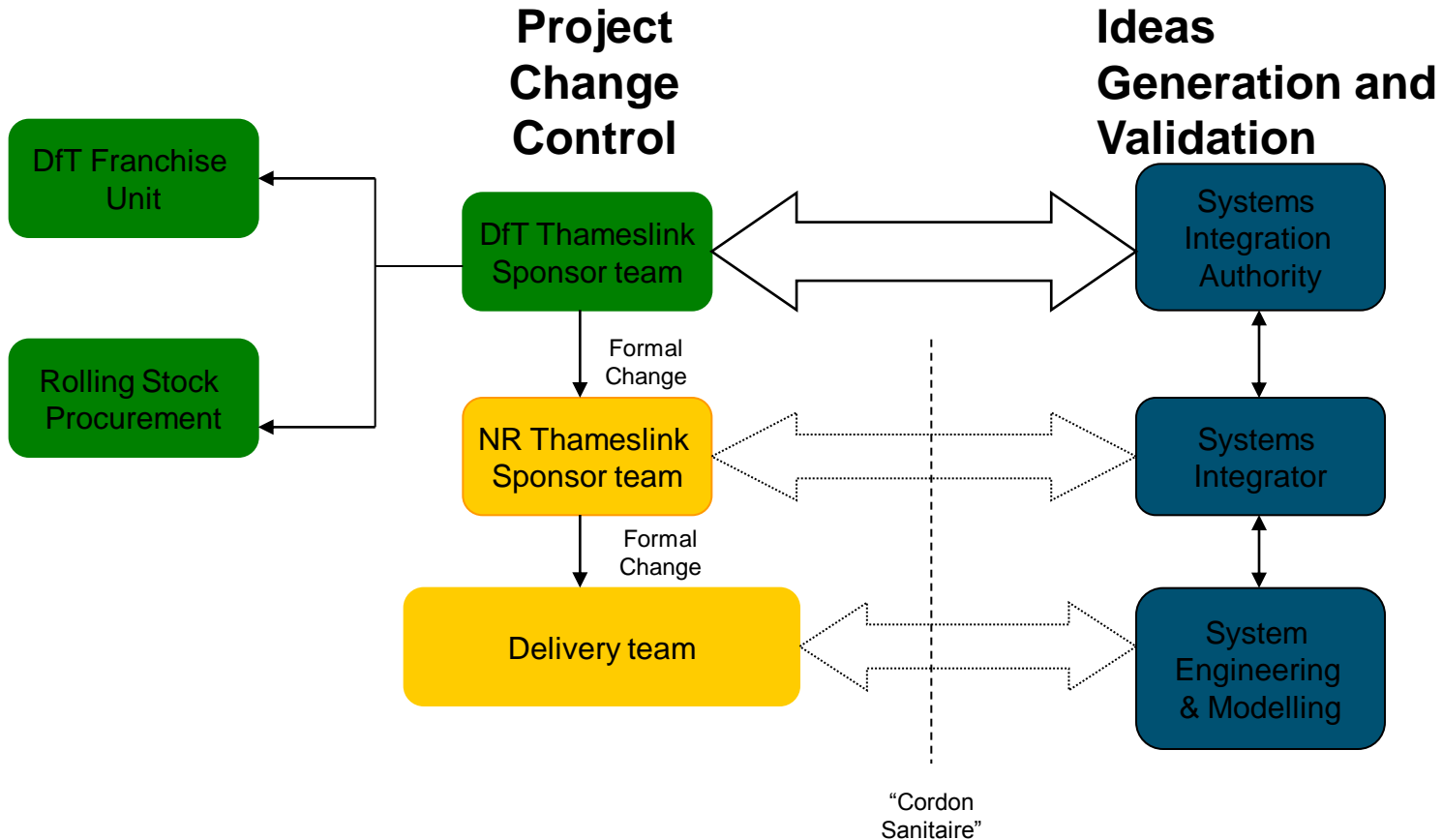
## 3 Infrastructure Reliability Groups – Actions for Improvement

**IMD – Level 3**  
 Details of Assets  
 • Points  
 • Axle Counters  
 • Track Circuits  
 • Signals  
 • OLE  
 • Auxiliary Power  
 • Track  
 Includes Critical Assets and local action plans

# Railway Industry – The Players



# System Integration – One Industry ?



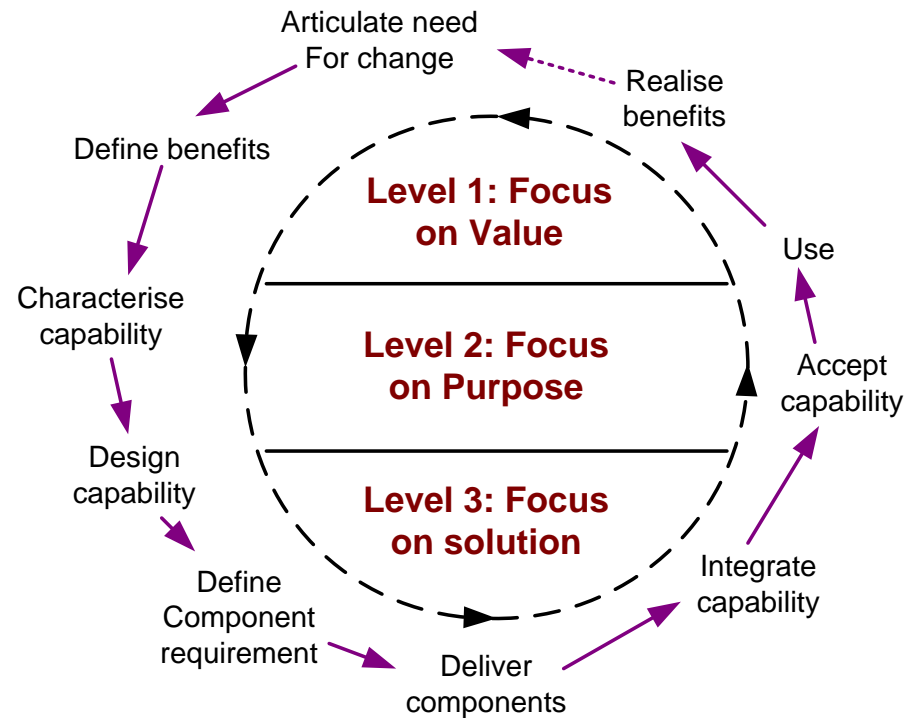
- SI - 'Free' Environment to develop Opportunities for Commercial Implementation

# Focus on the basics: Establishing requirements hierarchy

- Business case
  - Client Requirements
- Level 1**

- Concept of Operations
  - Infrastructure Functional Specification
  - Train Technical Specification
  - Train Infrastructure Interface Specification
- Level 2**

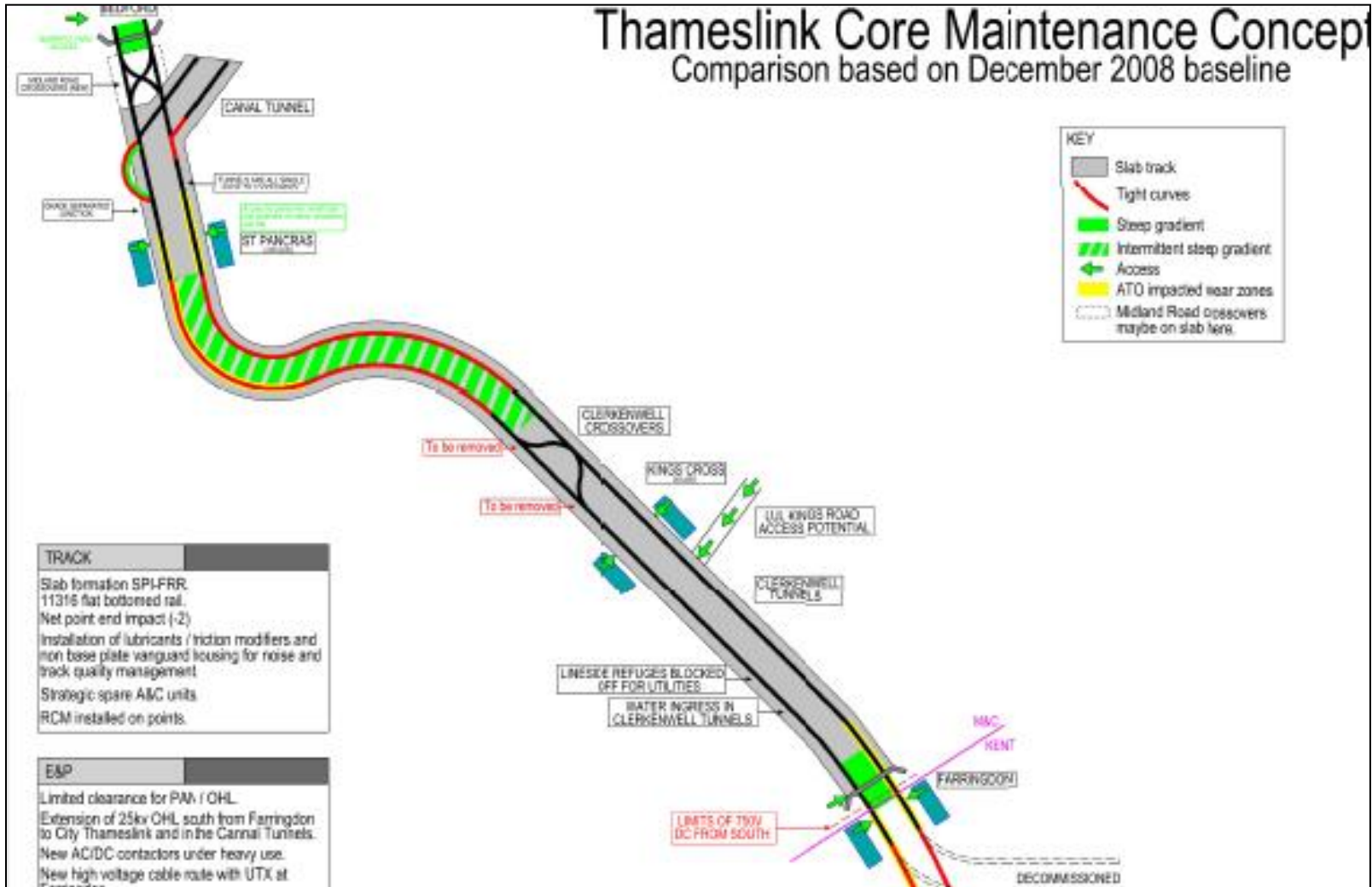
- Programme Delivery Specs
  - RS Subsystem Specs
  - Operational Requirements Spec
- Level 3**



## *Activity: System architectures*

- The objective of system architectures is to present the overall system requirements graphically.
- There can be many different views
  - Operational
  - Maintenance
  - Engineering system
  - Contractual
- Architectures allow you to identify the critical interfaces, gaps and inconsistencies.
- Gain control by helping people visualise what is coming accurately.

# Example: system architecture – maintenance view



# *Developing System Engineering*

- Good progress – Recognised ‘solution’
- Continued growth – People and Process
- Work with Industry – Incentives & Mechanisms
- Work with Experts - e.g.INCOSE

## **Major Challenges for Rail**

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**SE key to achieving them**

# *Developing System Engineering*

Q&A