



# Engineering Safety Management on Complex Infrastructure Projects

Practical Application of CSM-REA  
System Safety GWML Electrification

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# AGENDA

- **The Safety Story and Challenges**
- **Electrification - EiS Area 1 of Great Western**
- **Application of CSM-REA**
- **Scope of Risk Assessment**
- **Hazard Record Management**
- **Key Risks and Mitigations**
- **Summary of Risk Assessments**
- **Programme Interactions**
- **Conclusions**

*CSM is still relatively new so this presentation will highlight how the project is learning and improving*

# THE SAFETY STORY AND CHALLENGES

*“System Safety – the **legacy** that the project will leave behind on the railway system – rather than construction safety during the project works” (NR Sponsors Handbook)*

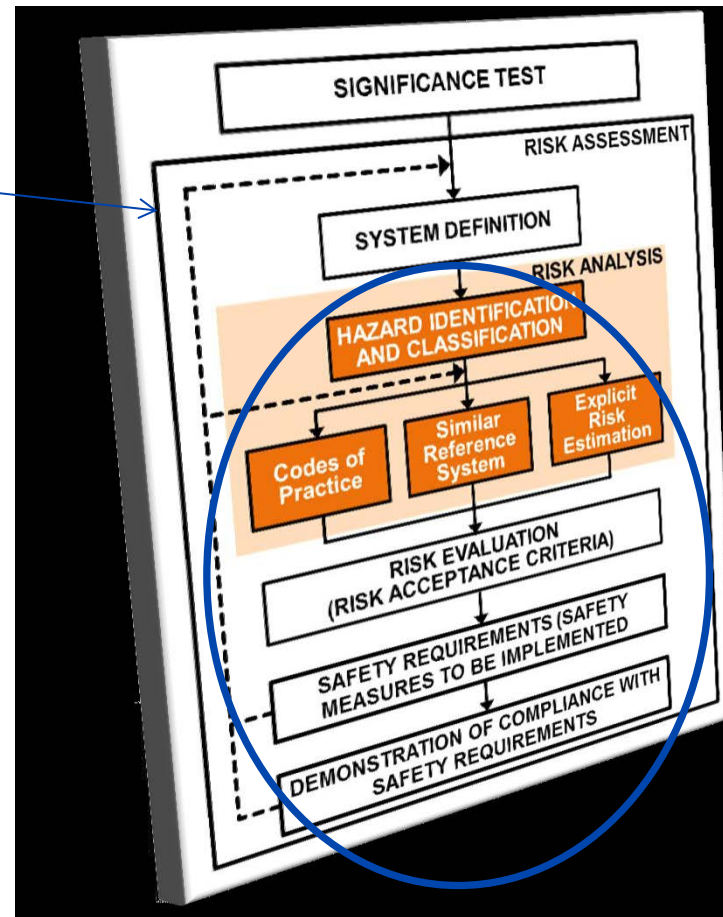
## Challenges

- CSM-REA defines the risk assessment process
  - Migrated from Safety Verification
  - Required by NR Health and Safety Management System
  - Engage with Assessment Body (Ricardo Rail)
- Impact of Safety Risk to
  - Workforce, Passengers, Members of Public, Emergency Services
  - TOCS/FOCS and third parties (eg LX users)
- Legislation defines NR duties that result from the change

# APPLICATION OF CSM : KEY DOCUMENTS

Safety Plan  
Defining the actors  
and their roles

Assessment Body  
Remit  
What to review and  
when



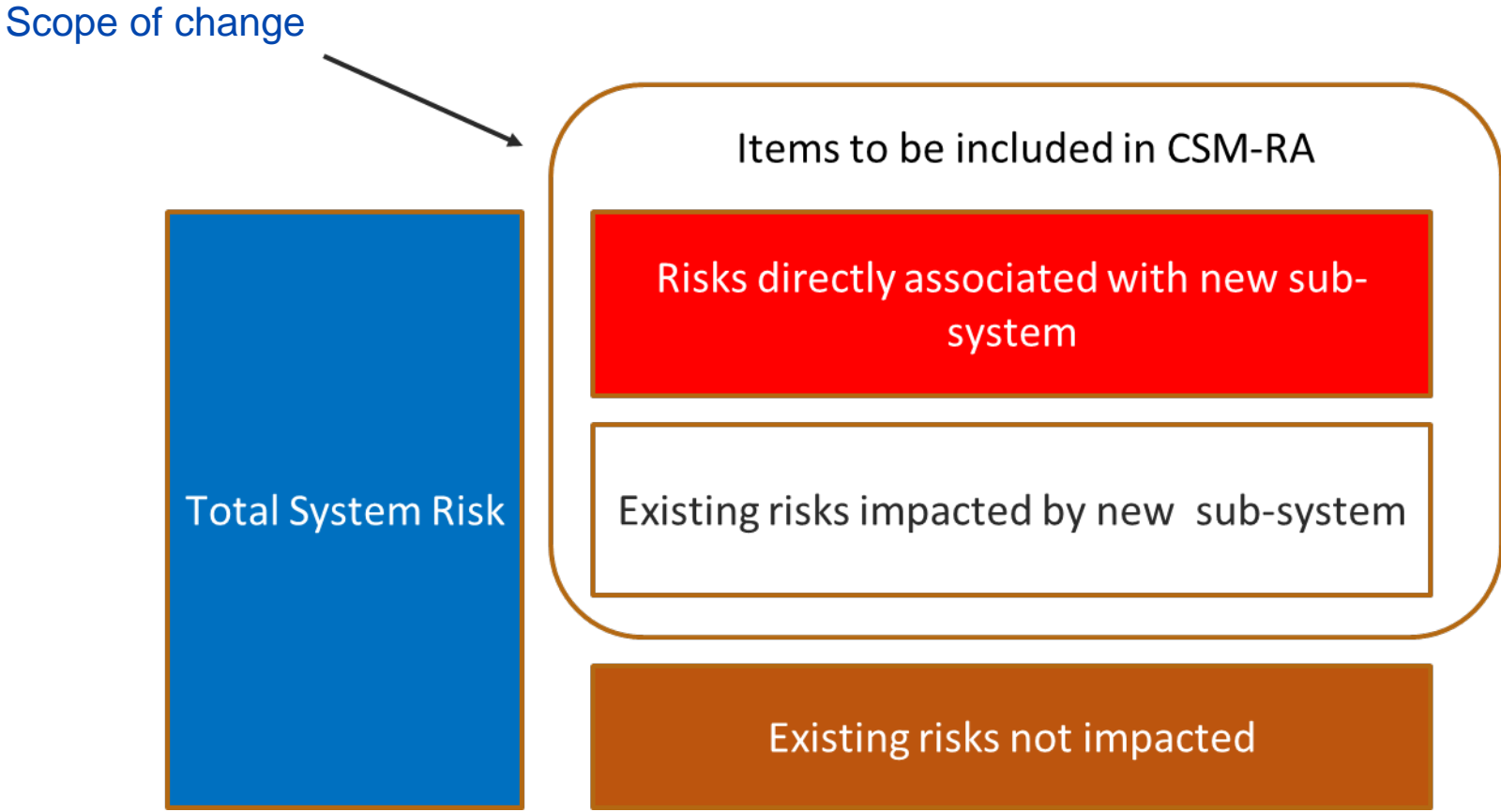
*Electrification is a  
“significant change”*

System Definition:  
*Define the change*

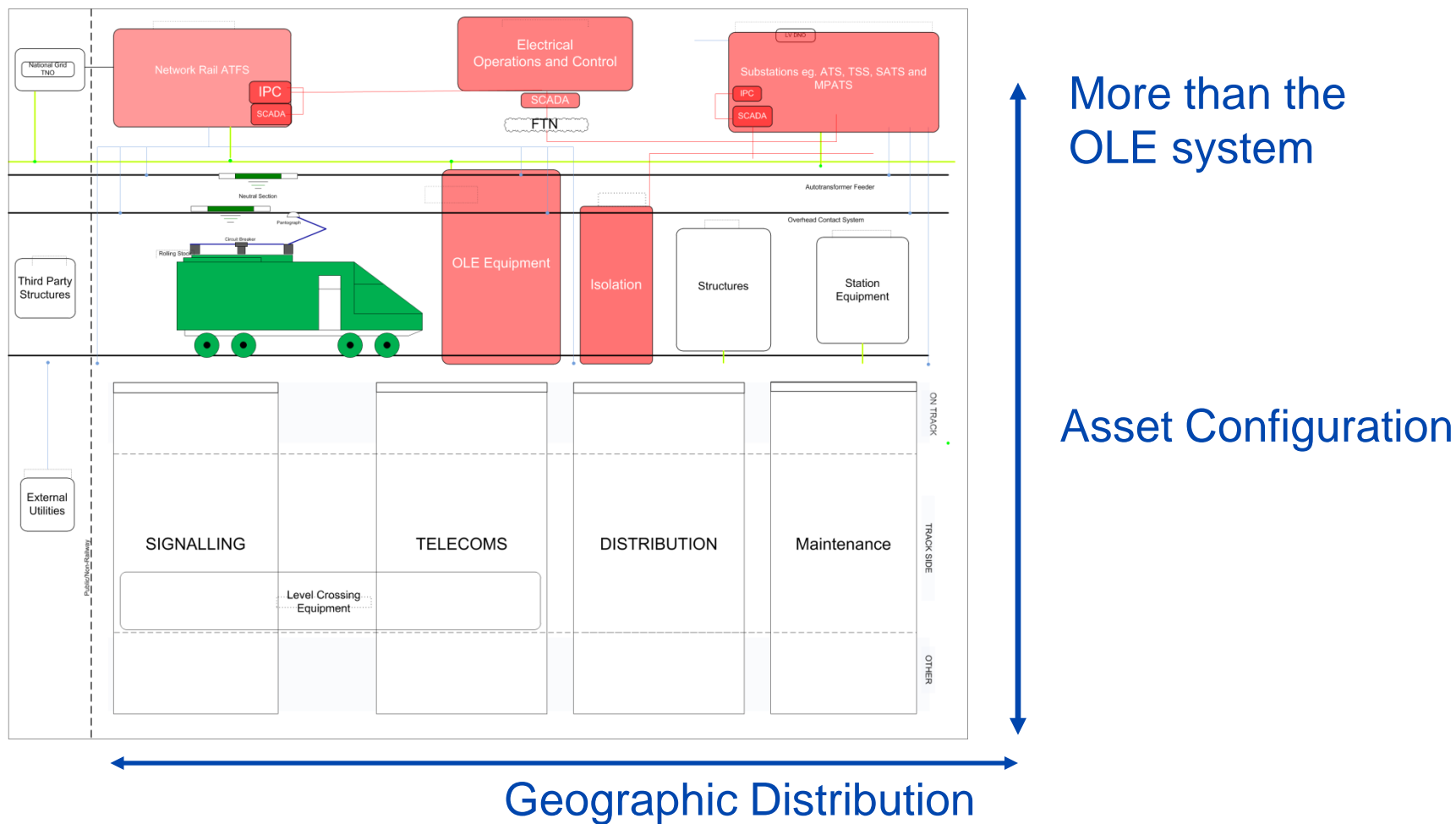
Hazard Record :  
*Managing the  
process  
and providing  
evidence links*

*Learning what good looks like*

# CSM-RA RISK IDENTIFICATION SCOPE CHANGE IN RISK PROFILE



# SYSTEM BLOCK DIAGRAM (SIMPLIFIED)



*Ensure the “change” is fully understood (boundaries, interfaces etc) and update as the project develops*

# IDENTIFICATION OF RELEVANT LEGISLATION : NEED TO INFLUENCE DESIGN AND OPERATION

Examples :

- Regulation 19 of ROGS and Regulation 3 of the Management of Health and Safety at Work Regulations 1999 (MHSWR), which require a suitable and sufficient risk assessment to be undertaken.
- Electricity at Work Regulations 1989 (directly related to system design and use)
- Work at Height Regulations 2005 (for the future maintenance and use of the structure and during construction phase)

*Projects must understand what the relevant legal duties are and whether they are absolute or subject to the test of reasonable practicability.*

# SUMMARY OF HAZARD IDENTIFICATION

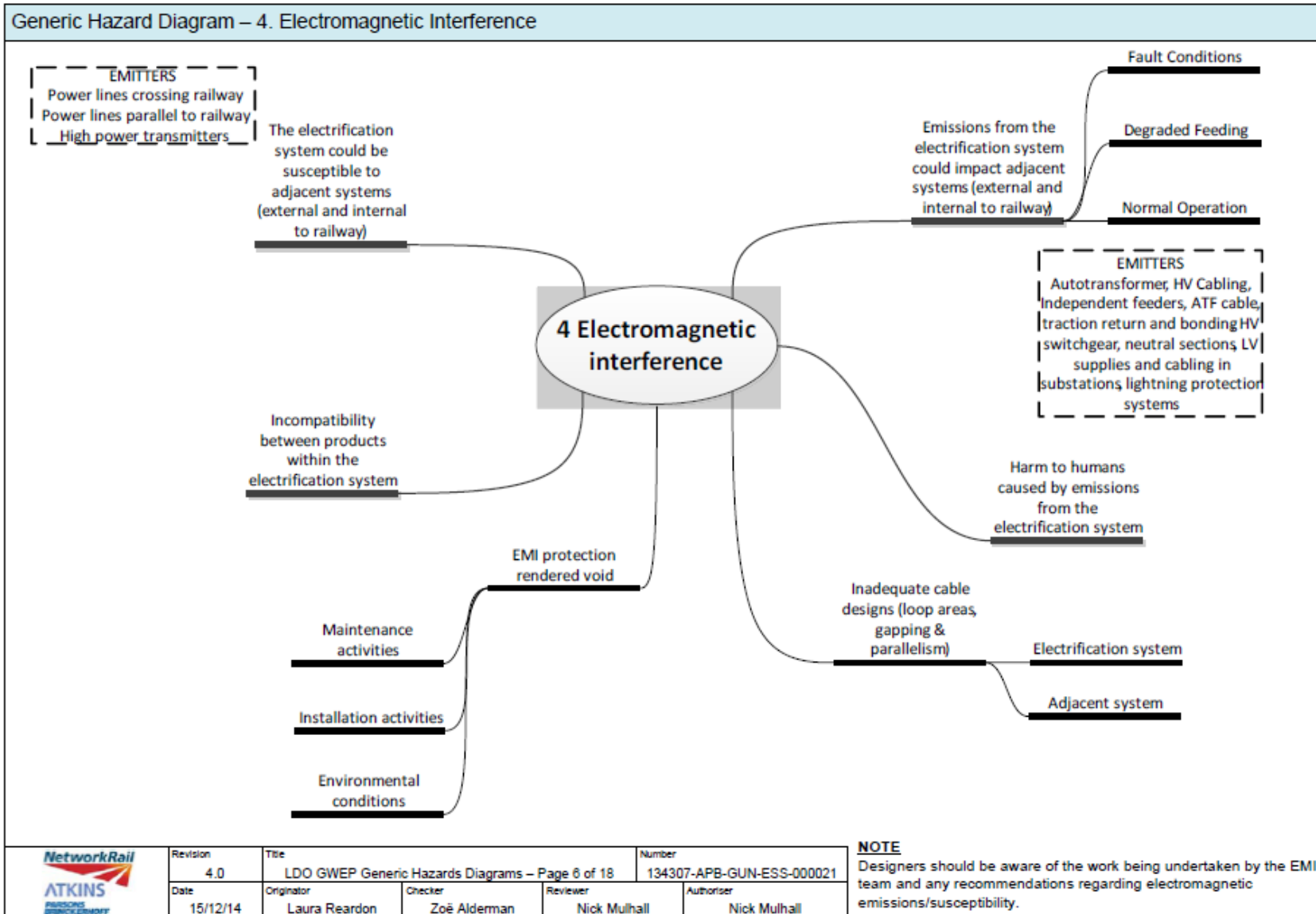
**Assess the impact of “the change” (ie Electrification) on operations and maintenance of the Railway System.**

- System FMECA
- Geographic Location (by Route section)
- Generic Electrification System
- Interface Hazard Analysis
- Work Activities at Stations

Participants include:  
Designers,  
Contractors,  
Asset Managers,  
Maintainers,  
Operations,  
TOCS/FOCS



# GENERIC HAZARD DIAGRAMS



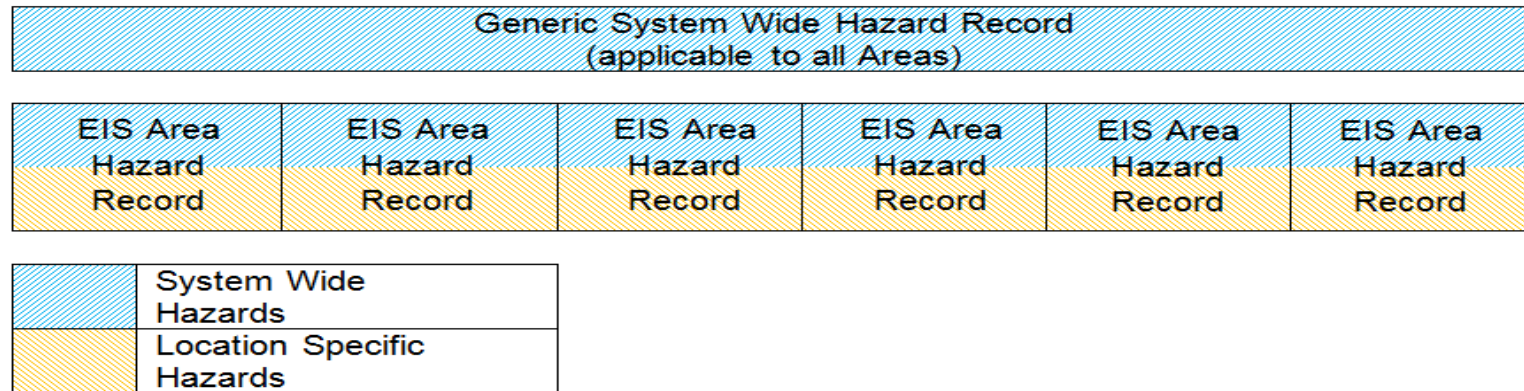
16 Top Level Hazards Identified that result from Electrification

# WHAT'S (MINIMUM) REQUIRED IN HAZARD RECORD

<b>Hazard identified</b>	A unique identifier for the hazard
<b>Hazard description</b>	A description of the hazard, which is meaningful enough to convey the essential nature of the hazard to the reader.
Hazard consequence	The ultimate accident consequences of the hazard
Hazard cause	How the hazard arises
<b>Risk Acceptance principle</b>	Codes of Practice, Reference System and Explicit Risk Assessment
<b>Safety requirements</b>	A reference, typically, identifier and title, to a safety requirement
<b>Safety Requirement verification</b>	The means by which compliance with the safety requirement has been demonstrated or will be demonstrated with references to any documents which demonstrate this.
Assumption	System assumptions identified
State	open, controlled, cancelled, closed or transferred

Understand the hazard is not closed until verified : as built, procedures updated or transfer accepted

# HAZARD RECORD



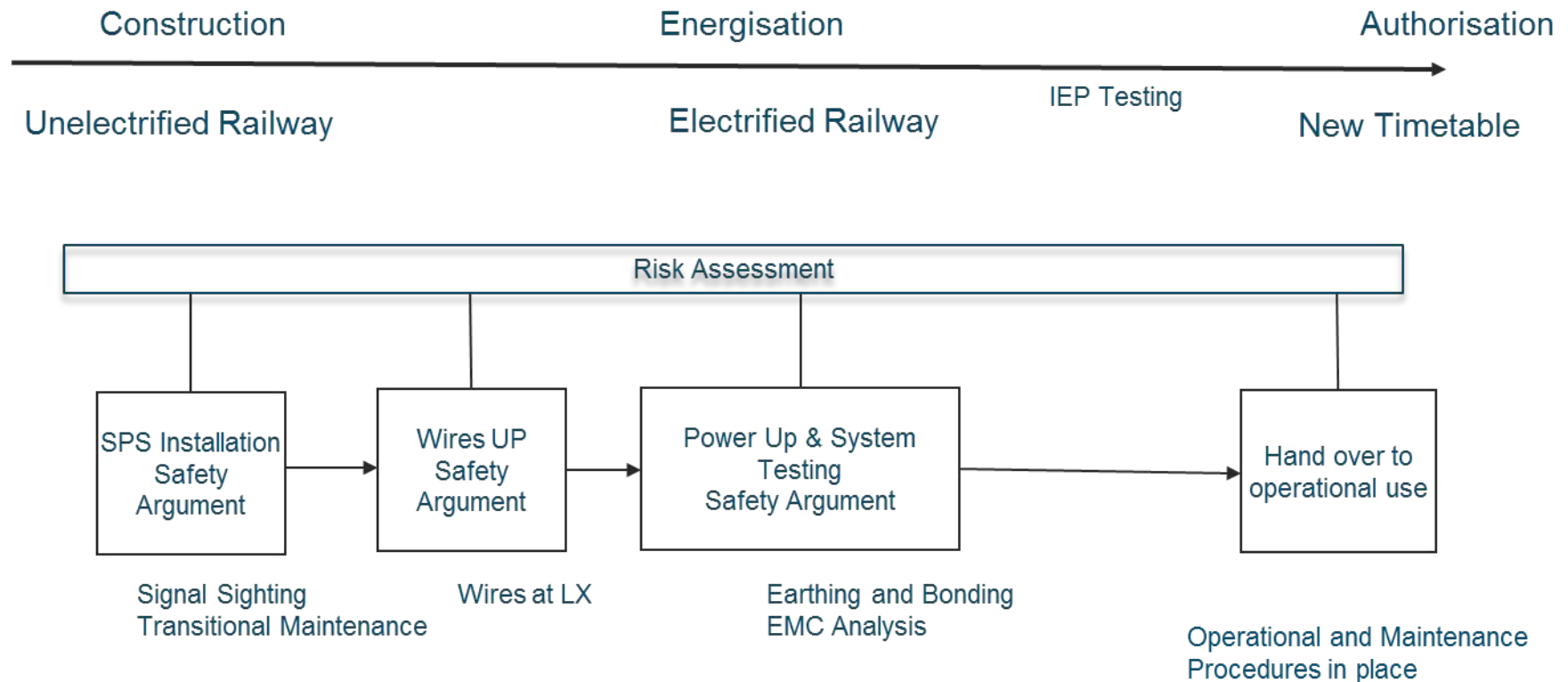
- System-Wide (applicable to all areas). These may be closed out generically across the system, or may be closed out with location-specific evidence. (sub system Integration)
- EIS Specific (applicable to a particular location only).

*The activities to develop the Hazard Record and the roles of the actors must be detailed in the Engineering Safety Management and Hazard Management Plans.*

# EXAMPLE RISKS

Hazard	Typical Controls
Direct Contact with Live parts of OLE	Maintaining clearances as per code of practice (Rebuild bridges)
Induced voltages in parts of other systems	Earthing and Bonding as per code of practice
EMI from OLE system in other systems eg information displays	Immunisation of existing system
Flashover from OLE to structure or equipment	Vegetation distance to railway as per code of practice; Clearance to structures
OLE structures impact signal sighting or LX sighting	Signal sighting code of practice via visual modelling
Inadvertent Energisation of isolations	Green Book with improvements for EWA
Unaware of OLE system being installed	Communications plans with stakeholders, WON updates, Hazard Directory updates
Contact when working at height with DNO crossing power lines	Ensure clearance to DNO wires

# EIS AREA 1 SAFETY JUSTIFICATION INCREMENTAL CONTROL OF RISK



*Need to ensure where installations (in temporary states) are left for a period of time these are safe*

# EXAMPLE DETAILED RISKS ASSESSMENTS

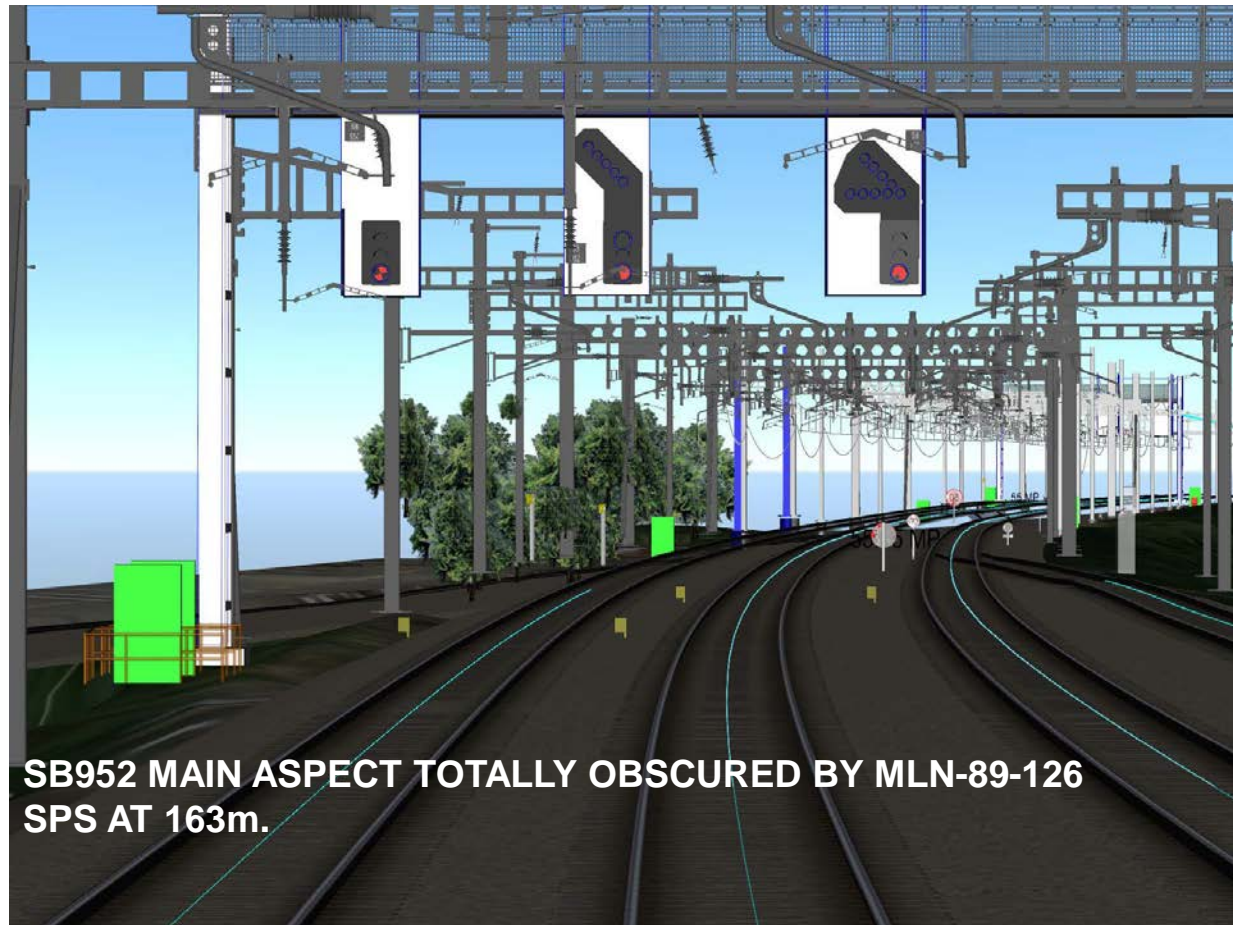
Develop possible options and control measures.  
Define the safety requirements for the change

## **Risk Assessments**

- Isolation and Earthing
- OLE clearances (Electrical)
- AT Feeder Routing in Stations
- LX Risk Assessments
- Signal Sighting
- Installation
- Transitional OLE Maintenance

Other considerations:  
Residual hazard transfers to third parties  
Product Acceptance and application conditions

# EXAMPLE DESIGN INTEGRATION SIGNAL SIGHTING PROBLEM



**SB952 MAIN ASPECT TOTALLY OBSCURED BY MLN-89-126  
SPS AT 163m.**

*Ensure resolved before construction*

# EXAMPLE POSTER

*Working with the communications team is essential*

**Network Rail**

**GWRM** Great Western Route Modernisation

**Small Parts Steel & Wires**

From February 2015 the small parts steel and wires will start to be installed from Scours Lane (East of Tilehurst) to Milton Sidings (West of Didcot Parkway)

From February 2015

At this time the OLE will be deemed to be UNDER CONSTRUCTION and will NOT be energised.

The OLE will be earthed and should not carry dangerously high voltages. Operational and Maintenance practices can remain unchanged.

Never assume equipment is isolated - ALWAYS TEST BEFORE TOUCH

**LOOK UP!**  
Before you start work always look up and check for equipment and wires.

**BE AWARE**  
Be aware of your environment. Use vertical control height limiters on OTP (On Track Plant).

**REPORT IT**  
If you notice any unsafe or damaged OLE equipment report it to: IP W&W Duty Manager on 01793 389236

W1001ANP/NOT/MIM-00001 (12 FEB 2015)



# SUMMARY

- **Start Early: System Definition, Safety Plans, Hazard Identification Workshops**
- **Engage with the Assessment Body early and get their buy-in for your proposed approach**
- **Ensure Hazard identification covers all aspects of the change from an operational and maintenance aspect;**
- **Understand the significant legislation related to the hazards identified;**
- **Document the risk assessment process and use the Hazard Record as the management tool and**
- **Work closely with the development teams to ensure the Safety Requirements are captured and verified**

