# Managing the Electrical Clearances from Overhead Line Equipment

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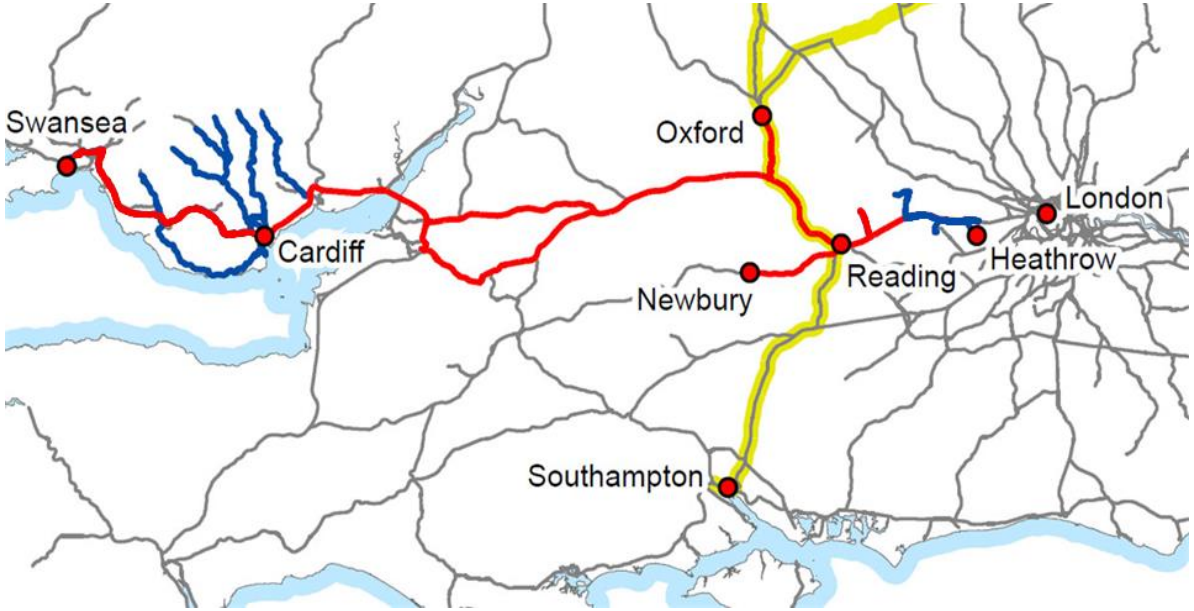
# Overview

- Taking Safe Decisions – Step by Step:
  - Scope the problem
  - Analyse the options
  - Select Options
  - Define the change
  - Determine Safety Measures
  - Demonstrate Compliance
- Difficulties and Key Points



# Taking Safe Decisions – Step by step

Electrification

Great Western Route Modernisation

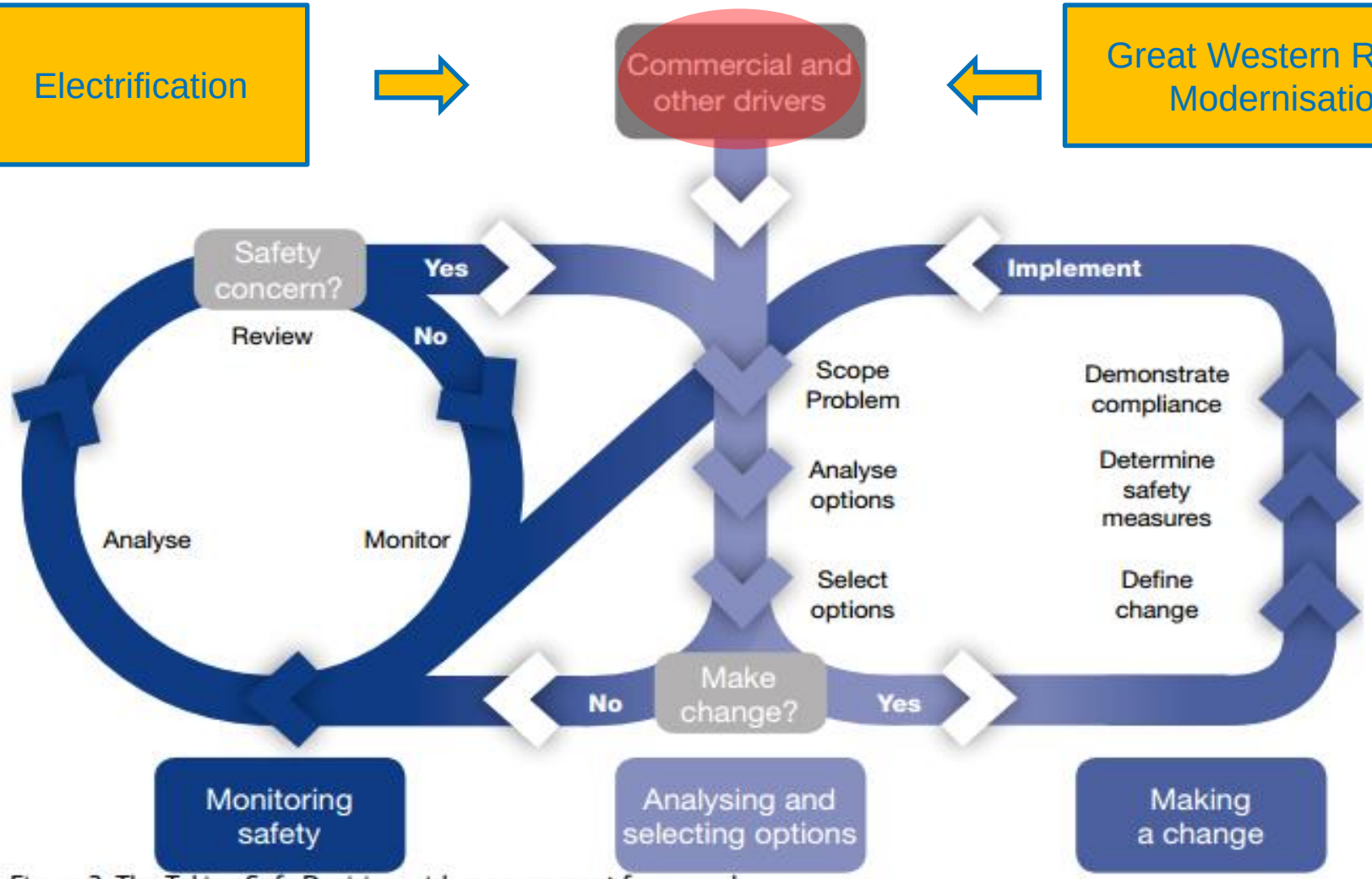



Figure 3: The Taking Safe Decisions risk management framework

# Scope the Problem – High Level Requirements

## Safety Requirement

Electrical clearances must meet requirements specified in legislation and standards e.g. Electricity at Works Regulation (EAWR), Railway Group Standards (RGS) and Company Standards in order to control risk from:

- Flashover
- Prevent direct contact

## Performance Requirements

Timetable, performance and capacity targets

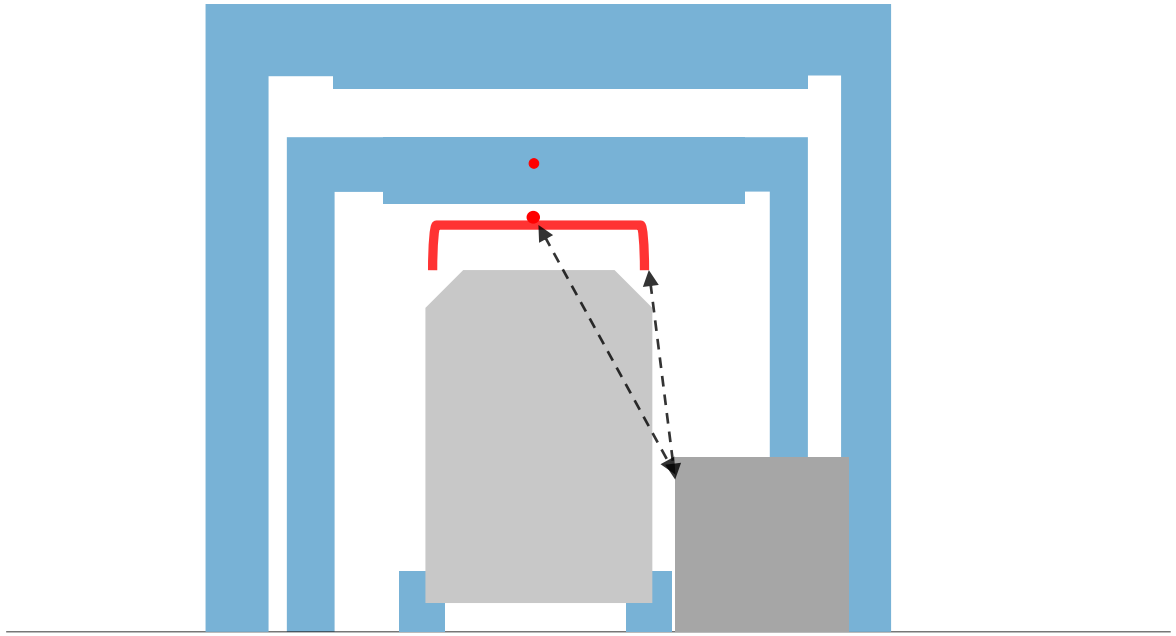
## Project Requirements

Delivering to time, cost and quality

# Scope the Problem – Overline Structures (OLS)

## Engineering Challenge

**HAZARD:** Reduced electrical clearances



Reduced electrical clearances permitted when supported by a risk assessment that concludes:

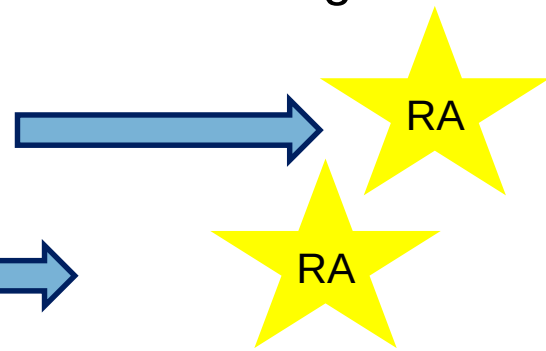
- Infrastructure changes are not reasonably practicable
- Risks are reduced to an acceptable level (SFAIRP)

# Scoping the Problem – Assessment Requirements

## Great Western Route Modernisation

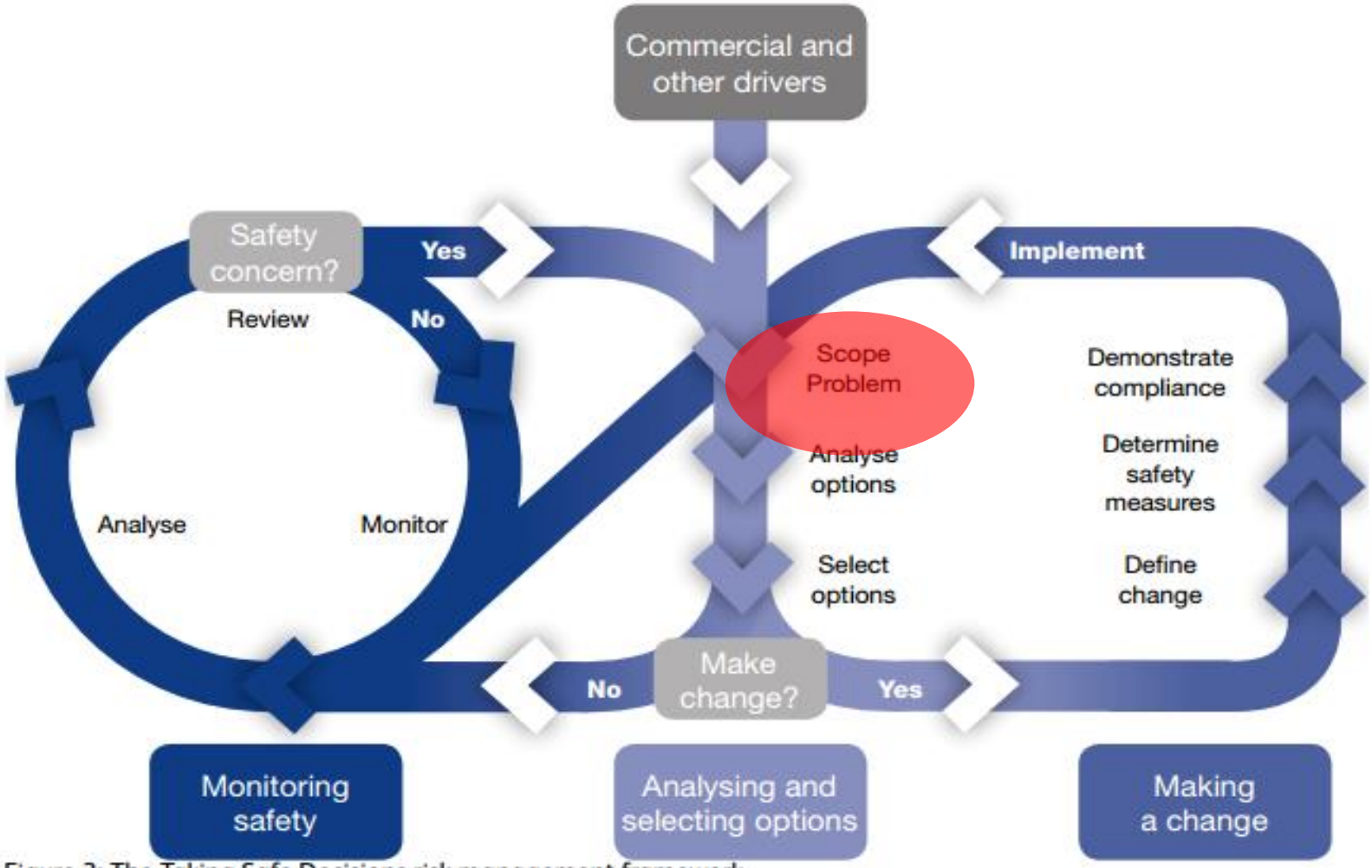
- New RGS standard GL/RT1210 came into force between Option Selection and Detailed Design

  - Multiple bridges with reduced clearances (many listed by English Heritage)
  - Multiple stations with reduced clearances to pantograph horn
  - Multiple disciplines: Civil Structures, Track, OLE, Operations and Maintenance
  - Multiple projects involved in making design decision




CONSISTENT APPROACH REQUIRED

# Taking Safe Decisions – Step by step

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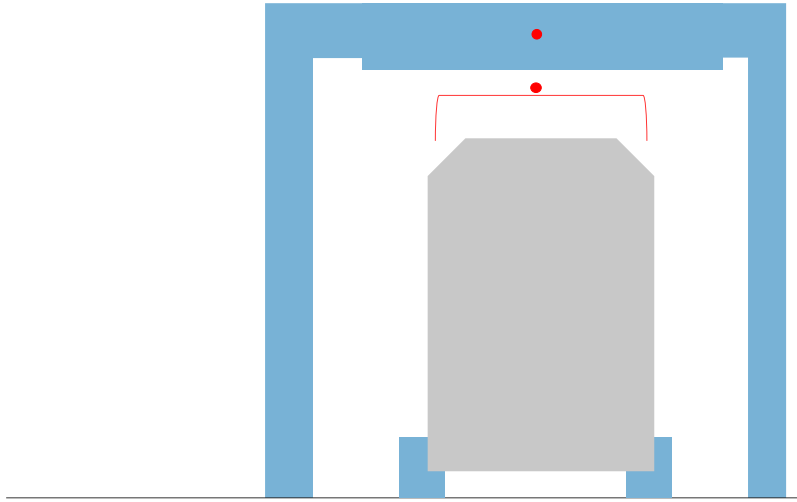
# Analyse the options

## Identify Infrastructure Modifications

Where optimisation of OLE Design cannot achieve normal electrical clearances

Bridge Modification

Track Lower



# Analyse the Options

## Safety Risk

- Safety Model developed to estimate the safety risk associated with design options
- Excel Model based on output from RSSB's Safety Risk Model (SRM)
- Assesses the hazards associated with reduced electrical clearances accounting for:
  - Modern OLE Design
  - Electrical clearances
  - Local risk factors: exposure (staff, passengers and public), trespass etc
- Model outputs risk in Fatality and Weighted Injuries per Year for each design

# Analyse the Options

## Life Cycle Cost Model

- Model identifies capital and ongoing costs of selected options over 60 years (half life time of civil OLS)
- Calculates the minimum life cycle costs of chosen options
- Used in conjunction with the Safety Model, it undertakes a CBA to determine whether it is reasonably practicable to modify the infrastructure further to improve clearances and safety

# Analyse the Options – Cost Outputs


In line with the Green Book:

Costs discounted over the lifetime

# Taking Safe Decisions – Step by step

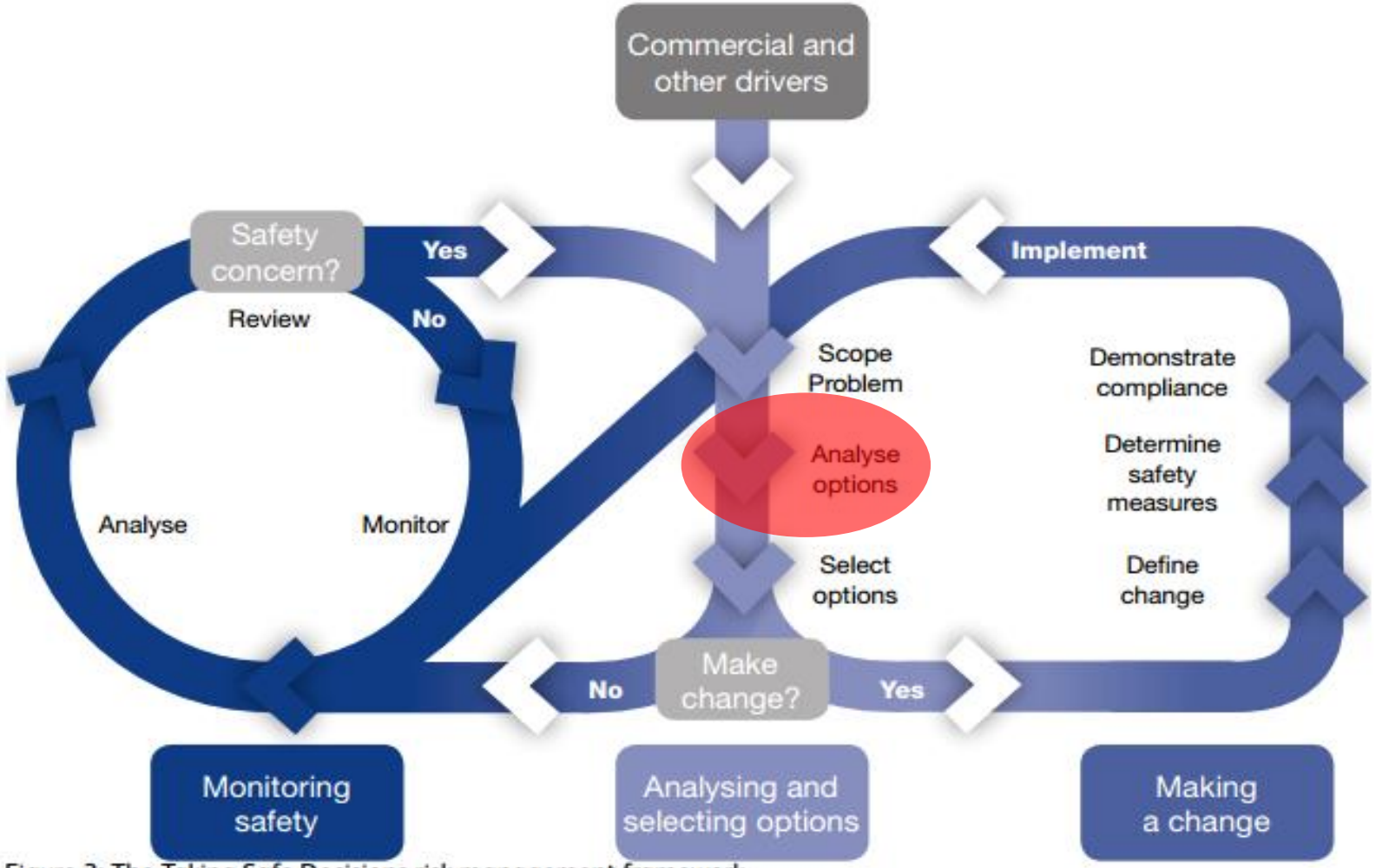



Figure 3: The Taking Safe Decisions risk management framework

# Select the Option

| | 1a(i) | 0d(iii) | 1b(i) | 2b(ii) |
|---|---|---|---|---|
| Safety Cost | £65,038 | £194,258 | £104,122 | £104,122 |
| Planned maintenance | £2,880,811 | £3,307,794 | £2,882,323 | £8,842,807 |
| Performance Costs | £163 | £297,447 | £1,625 | £97,794 |
| Capital Cost | £4,200,000 | £50,000 | | |
| Total Costs | £7,146,125 | £3,849,498 | | |
| BCR | 0.04 | Base | | |

When the BCR is '+' and over 0.1 then this option is ent wh
When the BCR is '+' and under 0.1 then the option is ver the de oly practicable to
implement given that the additional cost to implem ecase' is over 1 chieved.
BCR is '-' then the option is not as safe and more expensive than the 'Basecase'

- The LCC Model determines a Benefit to Cost Ratio (BCR) to indicate whether:
  - The cheapest LCC option (Basecase) should be selected; or if
  - A more expensive but safer option is reasonably practicable to implement

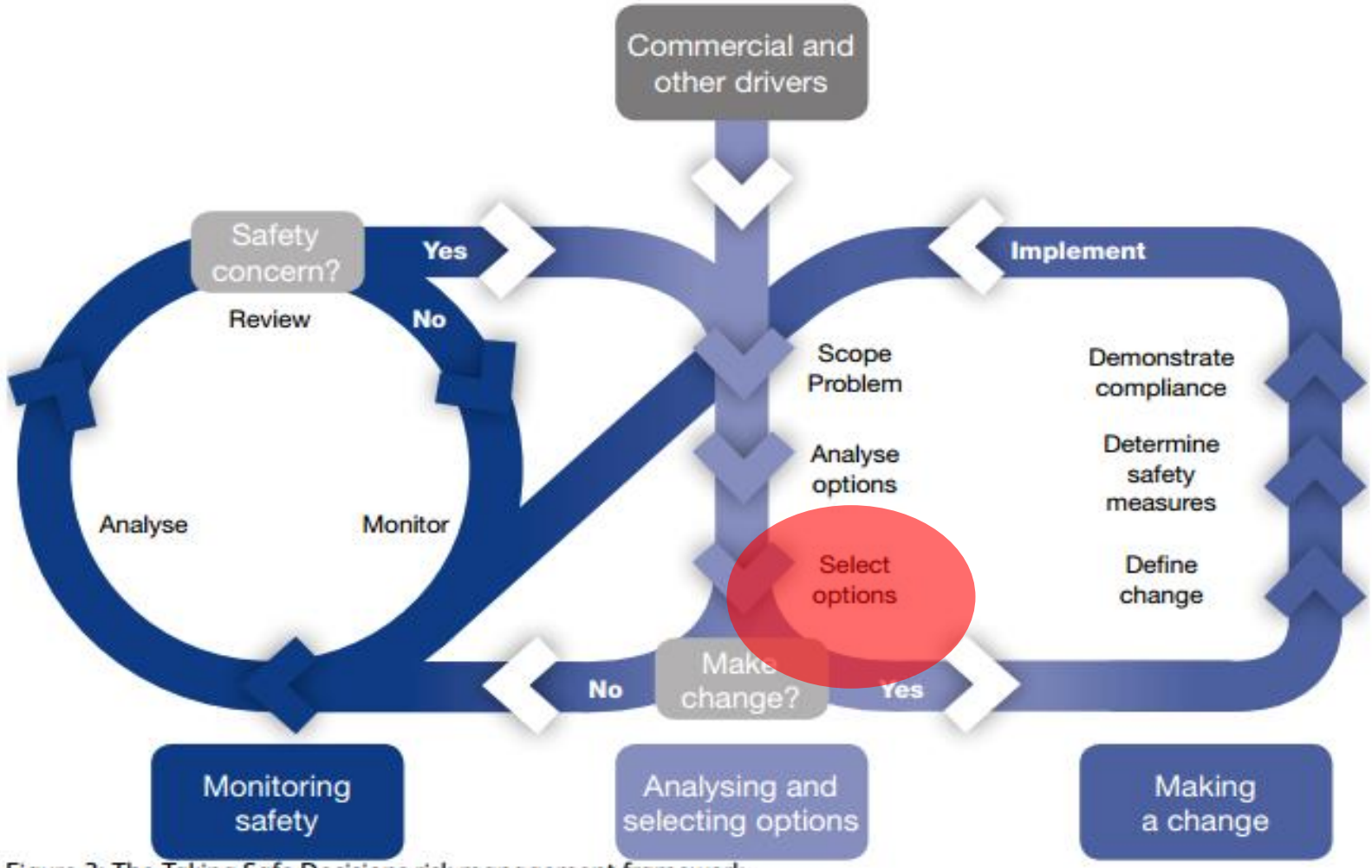
What is ' ' practicable to implement?

A BCR of 0.1 or above would therefore be reasonably practicable to implement and should be taken forward to detailed design over the 'Basecase'

How much money to spend compared to Safety Benefit gained?

- For GWRM, projects should be spending up to 10 times the safety benefit gained

# Taking Safe Decisions – Step by step

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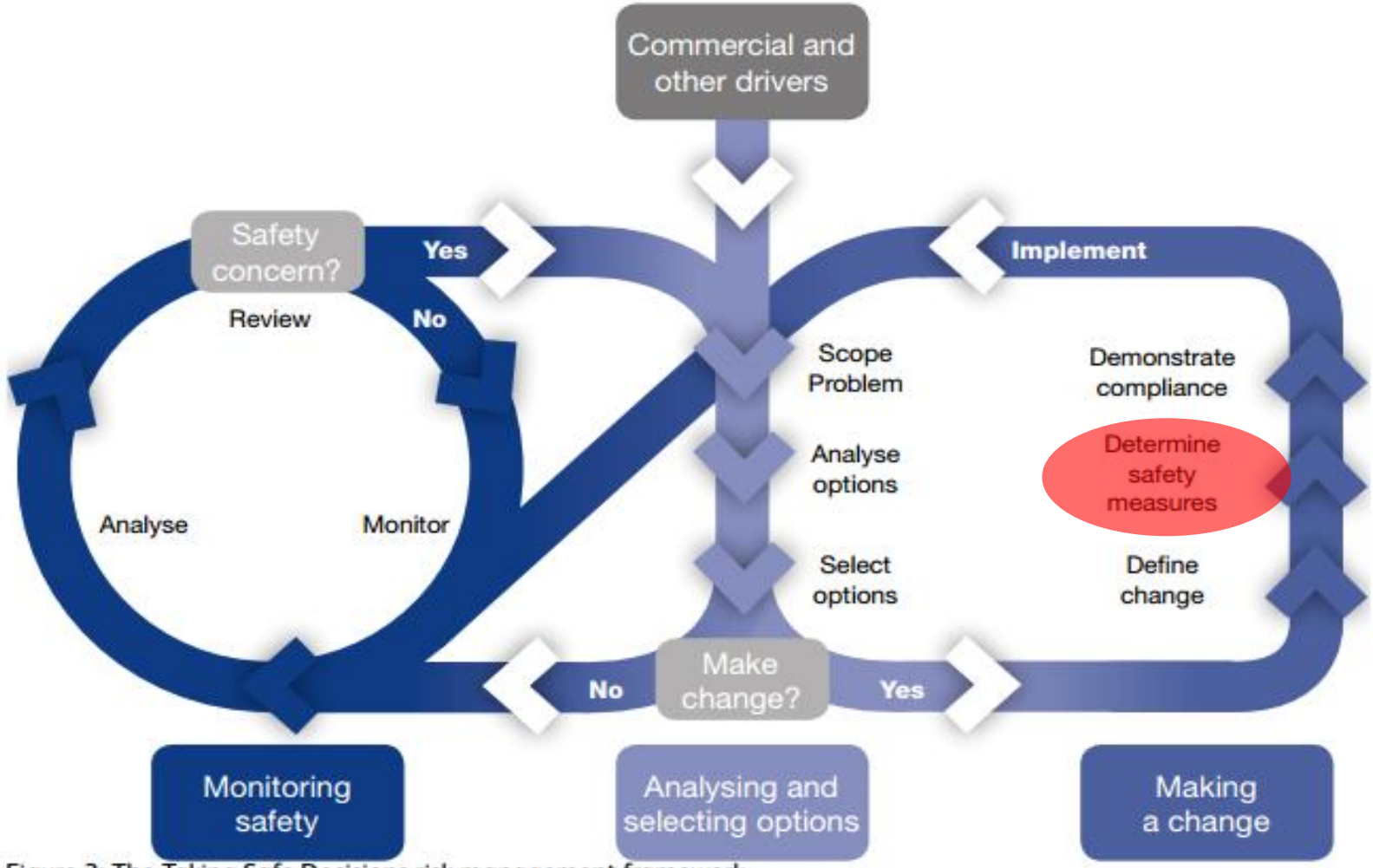
# Determine Safety Measures

## Reduce the risk SFAIRP

- Examples of mitigation that formed part of the assessment include:-
  - Stopping position of train
  - Signage
  - Removal, addition, modification of platform furniture
  - Modification of passenger flow. For example: installation of a new access/entrance
  - Education programs and public consultations e.g. school visits

- Generally a workshop was held to determine any mitigations that are viable to implement and identify any additional mitigations

# Taking Safe Decisions – Step by step

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# Demonstrate Compliance

## Safety Argument

- Identification of options
- Assessment of options
- Option Selection
- Assessment and selection of additional risk mitigations for residual risk – demonstrate SFAIRP

## Review and Acceptance

- Safety Review Panels
- Assessment Body Review
- ORR Review

# How did it go?

## What worked / went well?

- Models allowed for consistent decisions to be made with regards to infrastructure changes and investment
- Ensured that a system approach was taken for electrification
- Process ensured that all stakeholders were involved
- Life cycle cost model – promoted the benefits of looking beyond capital costs

## What were the challenges?

- Timing of the decisions
- Communicating decisions, changes in approach and requirements
- Agreeing approach to societal concern and changing human behaviour
- Defining the System Definition - inputs from many and in constant change
- Ensuring that the quantified CBA was not the only part of the safety assessment

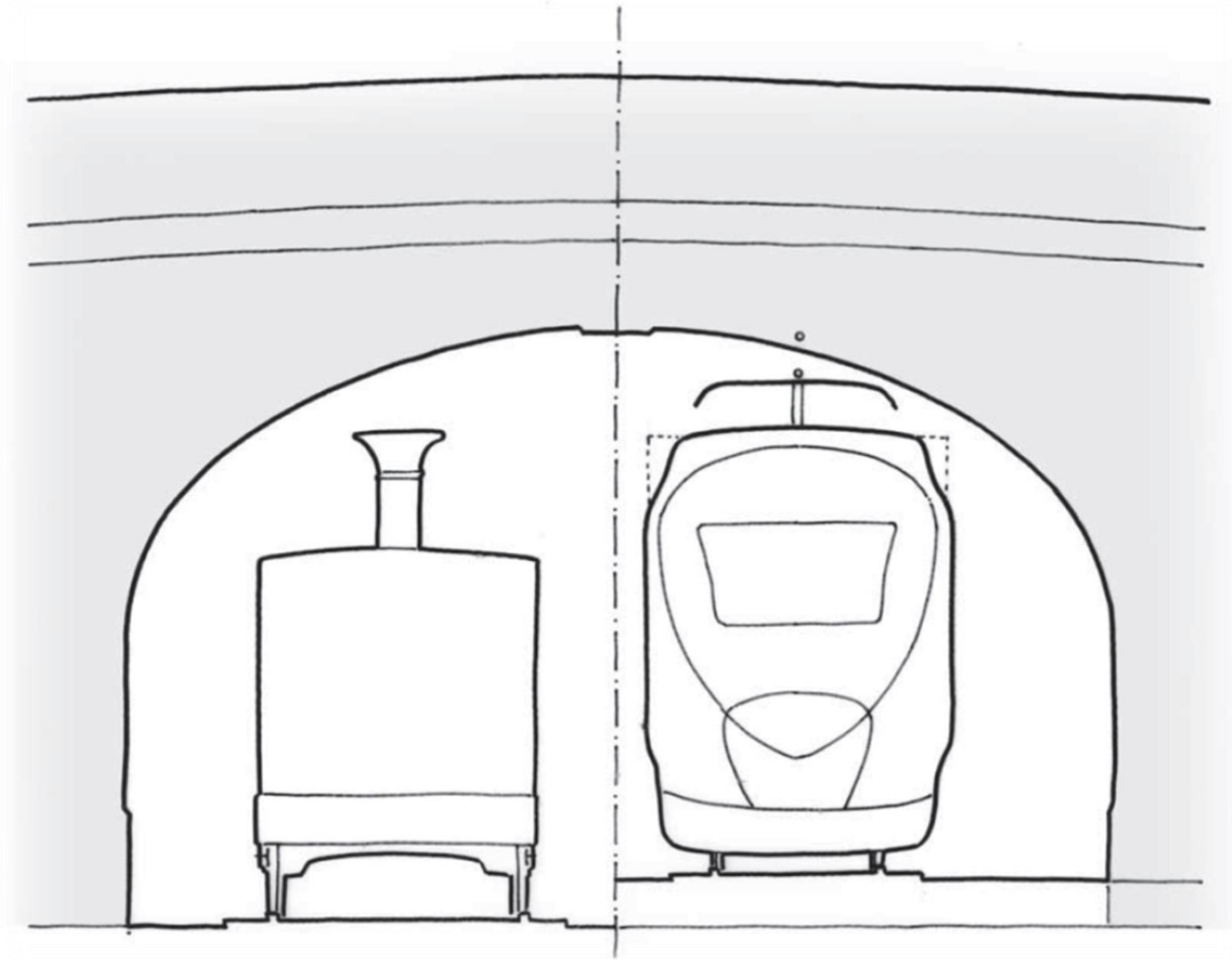
# Key Points for Large Infrastructure Projects

1. Large infrastructure are incredibly complex:
   - Don’t under estimate the time it takes to get decisions agreed
   - Don’t under estimate the benefits in taking the time to get ‘buy in’ from all stakeholders

2. Have an ‘owner’ of the decision process:
   - Ensure that stakeholders understand their role and contribution to the process
   - Keep it up to date and communicate changes out
   - Ensure that roles are passed on when people move on
   - Models are updated and people are trained to use them

3. Ensure that there is an understanding that QRA does not constitute an SFAIRP case on its own:
   - Models should be viewed as tools and not decision makers, it will only ever be PART of the assessment
   - SFAIRP not the only criteria - QRAs might also be used for business cases that go beyond that

4. Work closely with the operators and maintainers that you are handing over to:
   - They will support RAM and Safety Engineers in the decision making



*Thank you for listening*