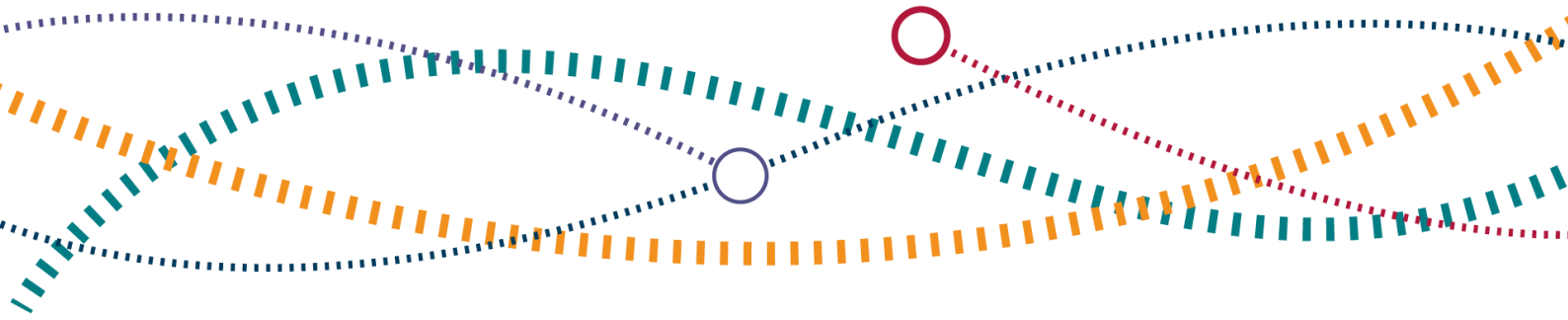
OFFICE OF RAIL AND ROAD

Safer Faster Isolation

Targeted Assurance Review

11 March 2021



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Acronyms and Abbreviations

CP6 - Control Period 6

CP7 - Control Period 7

DEAM – Director of Engineering and Asset Management

ESD - Electrical Safety Delivery group formed to implement the safer faster isolation programme

KPI’s Key performance indicators metrics for how the project will be assessed

ORR – Office of Rail and Road

PPF – Putting Passengers First

RAM – Route Asset Manager

RSSB – Railway Safety and Standards Board

SFI - Safer Faster Isolations programme

STE – Safety, Technical & Engineering Group (currently known as Technical Authority)

TA-Technical Authority

TPCMS – Traction Power Control & management System

Definitions

AC alternative current for the context of this report it is the power supply related to all parts of the overhead line contact system

DC direct current for the context of this report it is the power supply related to all parts of the 3rd rail contact system

EaWR Electricity at Work Regulations 1989

Isolation means the disconnection and separation of the electrical equipment from every source of electrical energy in such a way that this disconnection and separation is secure; in simple terms, switching and locking off

Nominated Person means the person responsible for taking the isolation and issuing of the Form C

Residual hazard means any electrical hazards that remain after an isolation has been taken such as adjacent live lines or cross track feeders

1. Executive Summary

Large sections of the mainline network are electrified, either via an AC overhead line contact system or by a DC 3rd rail contact system, which must almost always be isolated to allow even simple maintenance tasks to be undertaken.

In order to facilitate maintenance works Network Rail takes more than 35,000 isolations per year, approximately 2/3 on the AC network and 1/3 on the DC network[1]. Currently this is predominately undertaken under a labour-intensive manual process.

Automation could unlock significant benefits, notably in terms of the safety and speed at which a compliant isolation can be implemented, thereby helping Network Rail to achieve greater access time to undertake works. However, its deployment comes with a number of challenges.

The safer faster isolation (**SFI**) programme was developed to minimise the risk of serious injury or death when working on or near electrical equipment while ensuring efficient access to the rail network for essential maintenance, renewals and enhancements. It is a key aspect of the electrical safety delivery programme.

Delivery of the electrical safety delivery programme, known as **ESD**, was formally launched by Network Rail in 2015 with funding supported by ORR. ESD aims to deliver safer, faster isolations on both overhead line equipment (AC) and conductor rail (DC) areas and HV distribution. This should enable Network Rail to minimise electrical risks to track side workers, ensure legislative compliance and that critical maintenance activities are completed in a timely manner.

The SFI covers procedural, cultural and technological works streams to ensure an integrated system covering distribution, overhead line and conductor rail areas. This new framework approach is due for implementation during CP6, 7 and 8.

With the increase in electrification, the risk of not delivering the SFI successfully could result in an increase in electrical injury and greater inefficiencies leading to essential maintenance activities being missed with potentially catastrophic results.

This report finds that the ESD programme governance is robust and sets out a clear roadmap for delivery. The supporting strategic business plan (**SBP**) sets out the priorities for delivery based on a decision support tool and benefits calculator ensuring investment decisions are transparent and consistent. This methodology is evident through all stages of the programme with key outputs to be measured directly against expected benefits

[1] https://www.networkrail.co.uk/wp-content/uploads/2019/06/Challenge-Statement-EP-Challenge-Statement-1-Electrical-Safety.pdf

demonstrating robust project management and clear accountability. This should be considered as good industry practice.

The programme is on target to exceed its cost savings driven largely by the conductor rail areas adoption of new local securing and shorting technology. It is expected that lessons learned from this roll-out will be directly applicable to the overhead line equipment.

The programme shows good engagement with each of Network Rail's operating regions actively involved with the programme. However we consider that there is a need for greater awareness of this programme when enhancement investment decisions are being made and that these should be considered in the context of the wider ESD programme.

2. Introduction

Purpose

Network Rail intends to improve the safety and speed with which an electrical isolation could be performed.

The benefits of safer faster isolations include:

- Enhanced worker safety and compliance with Electricity at Work regulations 1989 (EaWR)
- Faster isolations improve productivity and performance
- It provides an opportunity for more efficient and safer work planning.

New isolation planning processes, procedures and technology have been developed and trialled with an expected rollout in CP6 into CP7 and CP8.

This report summarises the findings of the review carried out by ORR to confirm that adequate governance is in place to ensure effective planning, implementation and suitable review processes are in place.

Background

Following a number of fatalities and life changing injuries Network Rail initiated the National Electricity Safety Improvement Programme (NESIP). A number of safety improvements were made such as the Lifesaving Rules launched in 2013 and project advice note 93 aimed at improving isolations and minimising risks on new electrification projects. In addition, the increase in electrification and timetabling changes implemented in response to increased customer demand meant that implementing an isolation to enable staff safely and quickly on to the track would be essential to ensure continuing compliance with maintenance requirements.

In response to these two drivers, an electrical safety delivery programme, known as **ESD**, was formally launched by Network Rail in 2015 with funding supported by ORR. ESD aims to deliver safer, faster isolations on both overhead line (AC) and conductor rail (DC) areas and distribution. This should enable Network Rail to minimise electrical risks to persons, ensure legislative compliance and ensure critical maintenance activities are completed in a timely manner.

Regulation 12 of EaWR defines an **isolation** as ‘ *the disconnection and separation of the electrical equipment from every source of electrical energy in such a way that this disconnection and separation is secure’.* Regulation 13 goes on to describe additional

precautions needed when working on isolated equipment to prevent danger. Such precautions include earthing, permits to work and elimination of residual hazards.

The safer faster isolation aspect of ESD encompasses both these requirements. Although not immediately obvious, removing uninsulated cross track feeds that would remain live and dangerous within an isolation would fall under this programme as it would remove a **residual hazard** (live parts within an isolation) and make the taking of an isolation quicker by removing the need for additional controls such as warning signs to demarcate the area. Likewise, giving a depot an independent supply would make isolations quicker and reduce the risks associated with working adjacent to live lines.

The project is split into two distinct work streams:

- **Technological** – Development and deployment of new technologies to enable remote switching, earthing on AC or shorting on DC and securing of the points of isolation. Enabling steps include installation of 3 position switches on AC circuit main shorts on DC. TPCMS will be a key enabling technology to achieve remote securing.
- **Procedural** -- Roll out of the single approach to isolation (**SAI**). SAI replaces the isolation procedures set out in NR/L3/ELP/29987, also known as the 'Green Book'. It is a framework risk-based process with clear lines of responsibility applicable to distribution, overhead line and conductor rail. New roles of risk assessor and verifier to add rigour and improve efficiency through improved planning and delivery.

Since inception the programme has seen significant expenditure on the DC network with the introduction of remote switching and shorting devices. On the AC network, progress has been focused implementing a new ***single approach to isolation*** **(SAI) procedure,** requiring significant cultural and procedural changes. The SAI is a risk based methodology that reflects the unique operating challenges of the rail network. The SAI began trials in Network Rail's Northwest and Central region, but these were paused due to COVID 19.

The CP6 fund value is £263m with a route demand of £439m in January 2021. This demonstrates a significant appetite from regions to invest in safer faster isolations. A review of fund allocation commenced in October 2020 to ensure the remaining CP6 fund is allocated to maximise safety and financial benefits at a network level.

Funding is in place until April 2024 and Network Rail are working on a business case to secure funding for CP7 as part of the multi-control period business case.

As at January 2021, £135.5m of the CP6 fund is authorised and route finance benefit returns total £50.8m which is higher than the SBP benefit commitment of £47.8m.

This Targeted Assurance Review focused on the governance and progress Network Rail have made in implementing the safer faster isolation methodology

The aim of the review was:

- To ensure adequate governance was in place to monitor delivery of SFI against agreed outputs
- To understand the risks and opportunities and expected outputs in terms of efficiencies and safety benefits.
- To understand how investment decisions were made following devolution
- To understand the engagement with Infrastructure projects to ensure effective delivery

Review Approach

This review was carried out based on information provided by Network Rail's Technical Authority (**TA**) and from the Electrical Safety Delivery (**ESD**) programme.

This review did not directly engage with the routes or regions as the information provided was considered sufficient for the scope and level required of this review and because the aim of the review was to ensure adequate governance and oversight was being applied to the programme. It was expected that the TA would have sufficient oversight and control to provide any information requested.

In addition the review engaged with Network Rail's capital delivery arm to understand how the ESD programme informed design decisions for enhancement projects.

A summary of the findings are provided in the following section.

3. Findings

The overall finding of the review is that Network Rail has put in place the fundamental elements of governance needed to support and steer the SFI programme.

The key findings of the review are provided in the following sections.

Current Funding

Of the £263m allocated over CP6, £137m has been authorised with expected savings of over £47.8m.This would exceed estimates included within the original business case. Concerns were raised that by annualising spend and benefits, the full benefit of the changes would not be adequately demonstrated. Work is ongoing to demonstrate returns into CP7 and CP8 to better reflect the multi-control period investment and returns of implementing major structural and technological changes. A full suite of financial and safety KPI's, based on the SBP, are currently under development. These will be used to support and refine investment decisions into CP7 and beyond.

Governance of ESD

ESD has established a framework for governance to provide the necessary linkage, oversight and control mechanisms. The governance is established at different levels – organisational level, programme/project level, and by stakeholder groups.

Corporate level governance arrangements cover areas such as technical standards and policy setting, investments and benefit planning, and business review groups.

Programme level governance covers sponsors review, management review, risk review, transition working group, technology development and programme implementation. In addition, there are project level progress monitoring review and working groups.

Stakeholder engagement governance allows collaboration with internal and external stakeholders.

The various elements of the ESD's governance framework is illustrated in Appendix A.

ORR believes that the governance arrangements put in place by the ESD are robust and appropriate for the successful implementation of the SFI programme and subsequent delivery of its target benefits. We found that the governance addresses the key requisites such as:

- Continuous linkage to business strategy and direction
- Structured and well-defined decision-making process and authority

- Effective oversight of programme progress and direction
- Executive control over programme development and outcomes

Planning

To ensure consistency, transparency and accountability across the regions a decision support tool and benefits calculator are being used to assess investment decisions.

The decision support tool considers regulatory impact, whole life costs, and expected safety and performance improvements for each project. This forms the basis for the review and impact assessment as the project progresses. This in turn ensures that support is focused on the regions with the most significant risk and that the fund delivers the best value for money.

The benefits calculator allows each region to quantify a range of financial benefit opportunities presented by delivering ESD Interventions, covering either:

- **Performance** - reinvesting time saved into avoidance of work site overruns e.g. to protect the morning peak
- **Productivity** - reinvesting time saved into doing more work (renewals or maintenance) whilst keeping the isolation duration the same e.g. completing two track welding tasks in one isolation without returning the next night and avoiding a temporary speed restriction in the day between the two overnight works

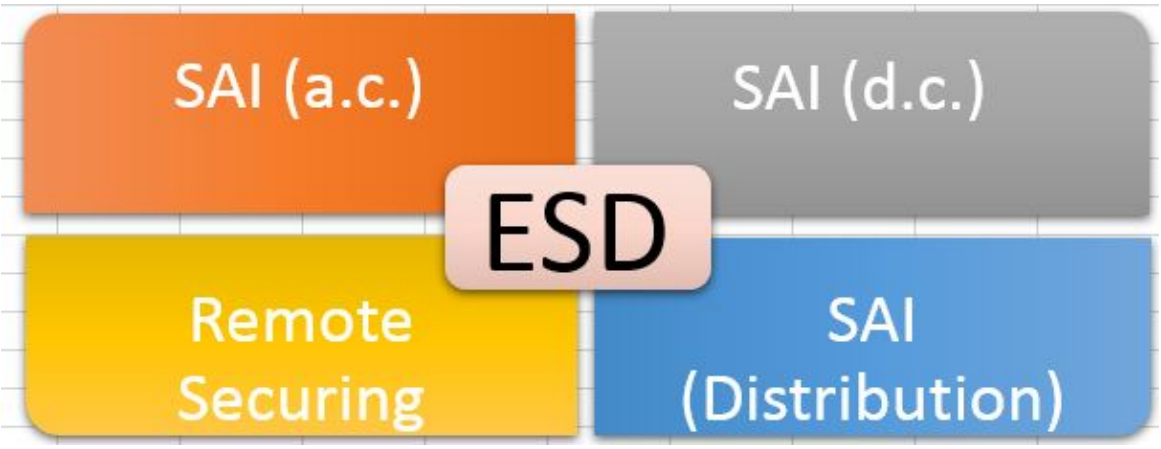
The benefit accrued will be a factor of the hours saved and what the hours are used for. In simple terms, an hour saved on the mainline railway will be valued more than an hour saved on a branch line. An overview of the benefits calculator is given in Appendix B.

Implementation Strategy

The programme has a clear strategy to ensure the key enablers for CP6-7 delivery are on a roadmap for delivery to January 2024. The roadmap is given in Appendix C and it shows that most of the milestones are on track with the only significant risk being the delays to the single approach to isolation trial on North West and Central due to COVID 19. Continuing delays to the SAI would have a significant impact on the programme's ability to deliver and is under constant review. Although the SAI trial is suspended it is expected that improvements identified by the programme can still be made within the existing process. For instance, better management of residual hazards.

The rollout of **TPCMS (Traction Power Control and Management System),** a new remote operating system to control the electrical network has increased functionality that should facilitate remote securing and earthing. A trapped key remote securing solution is also under development with Scotland and Wales and Western.

The strategy for SFI is based on a four-pronged approach to isolation that is aligned to the core principles of the ESD.



The single approach to isolation (SAI) is a fundamental aspect of the ESD delivery. It involves moving to a framework approach and standardising across overhead line equipment, conductor rail and high voltage distribution. It represents a significant culture change with greater clarity over the roles and responsibilities with the introduction of a formalised risk assessment process.

Status of SAI Distribution

Distribution have well developed processes that closely align with the SAI process and favourably benchmark against the distribution industry and the Electricity at work regulations 1989 (EaWR). It is expected that any changes will be minimal and easily adopted.

Status of SAI (AC)

When considering the SAI for overhead line equipment, the challenges of benchmarking against industry and EaWR are considerable. Implementing a safe system of work in these circumstances is challenging and fundamental changes must be carefully trialled and agreed by all stakeholders.

Status of SAI (DC)

The challenges associated with the OLE system are compounded on the conductor rail (DC) network as persons are deployed adjacent not underneath conductors increasing the risk of contact with the conductor. Based on this additional risk the rollout of technological solutions, such as remote switching and shorting devices was prioritised. This deployment effectively eliminates the requirement for persons to work adjacent to the live conductor rail.

Status of Remote securing

The introduction of TPCMS (traction power control and management system) will allow incremental improvements, such as additional inhibits, to be trialled and evaluated to support the proposed remote securing App/App2i infrastructure trial. The ESD fund is also supporting regional development of remote securing solutions including a ‘trapped key’ variant in Scotland. The deployment on the conductor rail network of remote switching and circuit main short gives a level of confidence that can be mapped to the overhead line rollout. Rollout of the remote securing is not expected before CP7.

Regional view

Evidence was provided to demonstrate a bottom up approach to the regional funding for both CP6 and CP7. This can be shown by the differing positions of each region detailed in Appendix D. It can be seen from this that each region has contributed to the ESD programme. The application of the decision support tool and benefits calculator ensured resource was targeted on the area at most risk or offering the most improvement.

Performance Indicators

The programme is developing a number of financial and safety KPIs that will directly compare expected and achieved outputs. The description of KPIs and the roadmap for their implementation is given in Appendix E.

The financial benefit road map is based on the benefits calculator and will factor in both performance and productivity improvements described above.

The programme will also develop a number of safety KPIs to compliment the financial returns. With the aim of minimising fatal and life changing incidents, a number of leading indicators are being developed. These include:

- Lifesaving rules breaches such as applying earths to a live line
- Close call monitoring and actioning
- Isolation irregularities such as going to the wrong place
- Late isolation requests
- Percentage of “all lines dead” minimizing live work
- Quality of isolations requests by increased audit
- Number of persons upskilled

Programme Review

As described previously the ESD project governance ensures that the SFI programme is under constant review with formalised engagement of all stakeholders. In some ways this can cause frustrations as progress can seem to be unnecessarily difficult and slow. This perception is mistaken. The challenges of delivering thousands of isolations a year - on legacy infrastructure, over multiple worksites, for non-electrically trained persons - often for only a few hours cannot be overstated. The potential consequences of ill thought out changes could lead to serious injury or death.

The programme has demonstrated a good understanding of these challenges and the review is integrated with a clear line of sight through the KPI's and implementation to the decision support tool and the initial strategic business plan.

This constant review also enables iterative improvements to be made across the network while working within existing rules. Examples include improved demarcation or removal of residual hazards, virtual walkouts and improved training capacity.

Engagement with Capital Projects and Enhancement

ORR conducted a number of interventions with new and enhancement projects and found that no current operations and maintenance strategy adequately considers the impact of electrification in a railway environment. It does not take into account the following:

- The amount of time required to carry out essential maintenance
- The time to carry out an isolation and get people on track

This general omission means that design decisions that could improve isolation planning and execution to maximise time on track and minimise whole life costs are missed.

Examples that could improve safety and access times are well known but often missed. These include:

- Aligning possessions with isolation points
- Co-locating isolation and access points
- Minimising residual hazards such as bare cross track feeders
- Electrically separating depots from the main line
- Fitting of remote isolation devices or three position switches

This failure to adequately consider and improve safety and access time at the design stage risks perpetuating difficulties and risks the efficient delivery of the SFI programme.

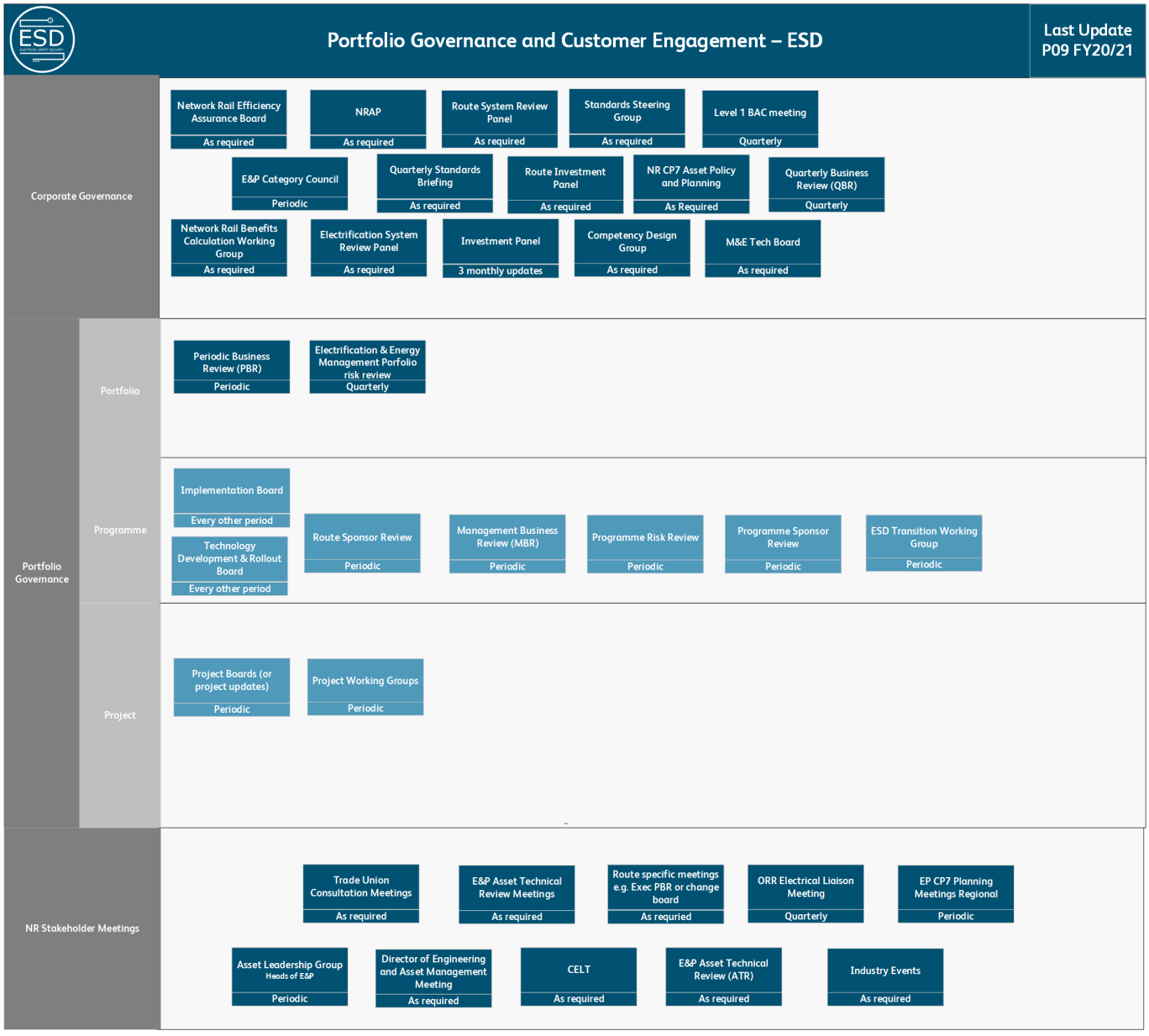
4. Conclusions and Recommendations

- The governance of the ESD project is robust. There is a clear line of sight between the plan, implementation and review. This transparency, consistency and accountability gives confidence that the programme will be managed to deliver significant efficiency and safety benefits into CP6, 7 and 8.
- Realising the full benefits from the investment made in CP6 to develop capability is dependent on securing further funding into CP7 which ORR supports. Failure to deliver is likely to lead to an increase in serious and fatal incidents, further timetabling constraints, reduction in maintenance volumes and failure to meet minimum legal standards.
- The ESD programme and regions should continue working collaboratively to secure funding for future control periods and to support new initiatives. It is expected that improvements and lessons learned from trials can be implemented across the network within the existing framework without undue delay. For instance, better identification or removal of residual hazards.
- The programme should be extended with a clear input to decisions made by capital delivery. Major projects present a once in a lifetime opportunity to enable the infrastructure to efficiently deliver the SFI project. Capital delivery does not effectively consider isolations and their effect on operation and maintenance of the system at the design stage and this could have detrimental effects into CP6, 7, 8 and 9.

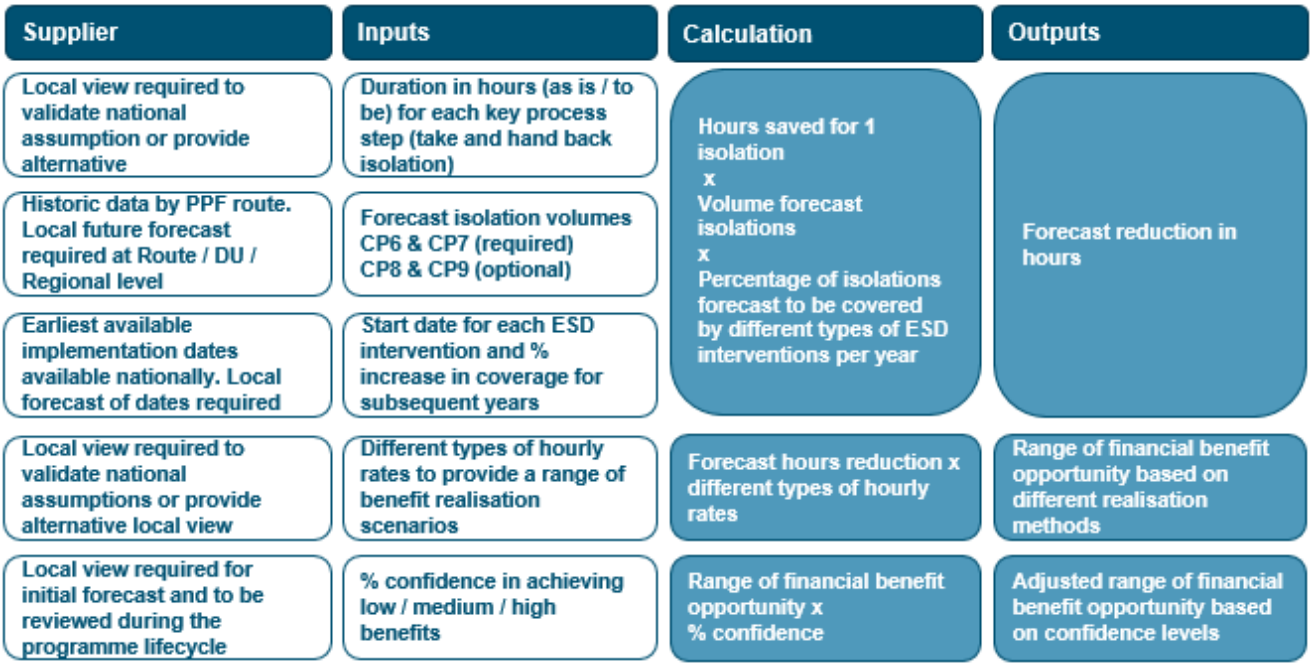
5. Recommendations and Next Steps

- ORR is satisfied that the ESD programme can be monitored during our normal interactions with Network Rail such as at the quarterly liaison meetings.
- ORR will continue to engage with ESD and capital delivery to ensure delivery of the SFI Programme is integrated into enhancement and renewal activity.

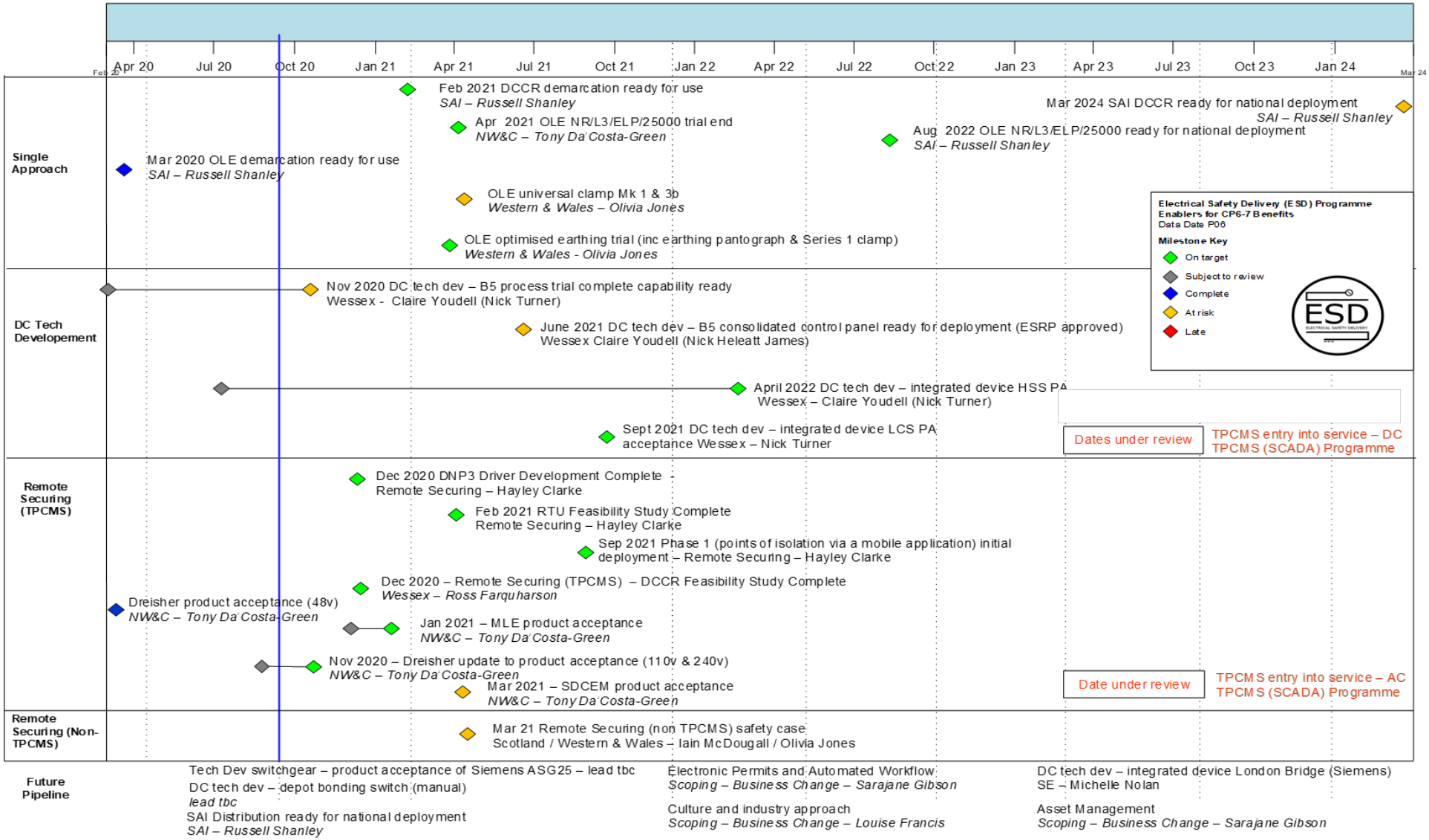
Appendix A - Governance Framework



Appendix B - Benefits Calculator Overview



Appendix C – Programme Roadmap



Appendix D – Regional Position

For Conductor Rail

North West and Central;
- 100% coverage end to end Circuit Main Shorts (CMS) Merseyrail and Euston / Watford
- Boots off ballast on end to end isolation (Euston / Watford) achieved following delay due to COVID 19
- Boots off ballast for end to end isolation (Merseyrail) planned March 2021
- Reviewunderway to identify the benefit opportunity from use of CMS ahead of remote securing rollout

Eastern - East Mids/Anglia;
- LNE – Tyne and Wear Sunderland metro NSCD scheme under development
- East Mids – Northern City & East London Lines 100% coverage Circuit Main Shorts (CMS). Northern City Line NSCDs installed December 2020 actions. .
- Anglia – NSCD scheme underway, benefit opportunity now quantified and included in November 2020 business plan submission

Southern;
- Wessex – 100% coverage in CP6 om end to end Circuit Main Shorts (CMS). OPPORTUNITY to install mid section Control Track Switch (CTS)
- South East– 60% coverage in CP6 on end to end Circuit Main Shorts (CMS). OPPORTUNITY to rollout 100% coverage in CP6
- The opportunity to realise 100% fitment in CP6 is at risk due to constraints in funding.

Key Challenges / mitigations;

Southern Region investment return is at risk due to ;	**Mitigation**
• Unit cost variances including high abnormals • Risk to further go live on NCDS usage in delivery units for the industry • Risk that further funding to accelerate delivery in SE will not be made available • Impact of delays due to COVID 19 (factory and testing house closure, contractor capacity for delivery and industry go live for B4 isolations and use of NSCDs)	• Unit costs review by commercial scheme sponsor, working group set up with supply chain operations • Transition support no in place from the central business change team to support industry go live • Review of route allocation underway using principles agreed by the Regions in December 2021 • Local risk management and discussion of mitigation actions with suppliers supported by the working group now set up with supply chain operations

For OLE

Scotland;
- **Scotland** are collaborating with Eastern, Wales and Western on developing the safety case for Remote Securing (trapped key). Initial view of unit costs Some unit costs received to inform the review of route allocation

North West and Central;
- NW&C supported by the ESD Programme team are reviewing the next steps for trial, following the suspension due to COVID-19.
- Switchgear Circuit Main Earths (CMEs) product approval ongoing; OLE remote securing rollout plans under review as part of the review of route allocation

Wales and Western;
- W&W are leading on the safety case for Remote Securing (Trapped Key) and funding principles for the shared safety case has been agreed
- Optimised earthing trial findings are being integrated into the SAI OLE final development workstream. Work to develop the earthing clamp continues.
- Deployment of CMEs to GWML 0-12m (Paddington-Maidenhead) continuing – brings legacy sections up to the same standard as GWEP

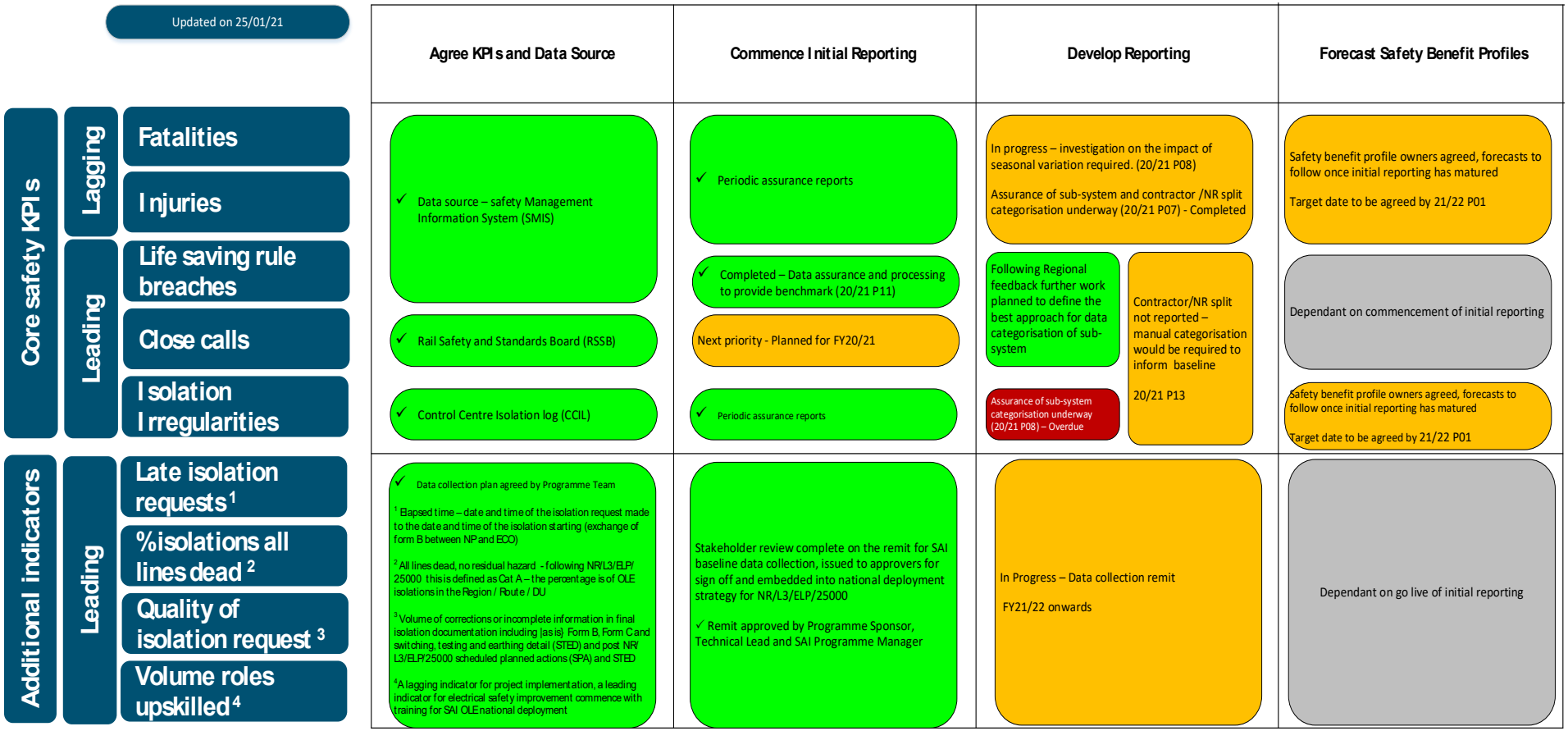
Eastern (Anglia and LNE)
- Anglia and LNE have commissioned remote securing feasibility studies to inform route business plans for OLE and have reviewed the benefit opportunity for the Region as part of the review of route allocations

Key Challenges / mitigations;

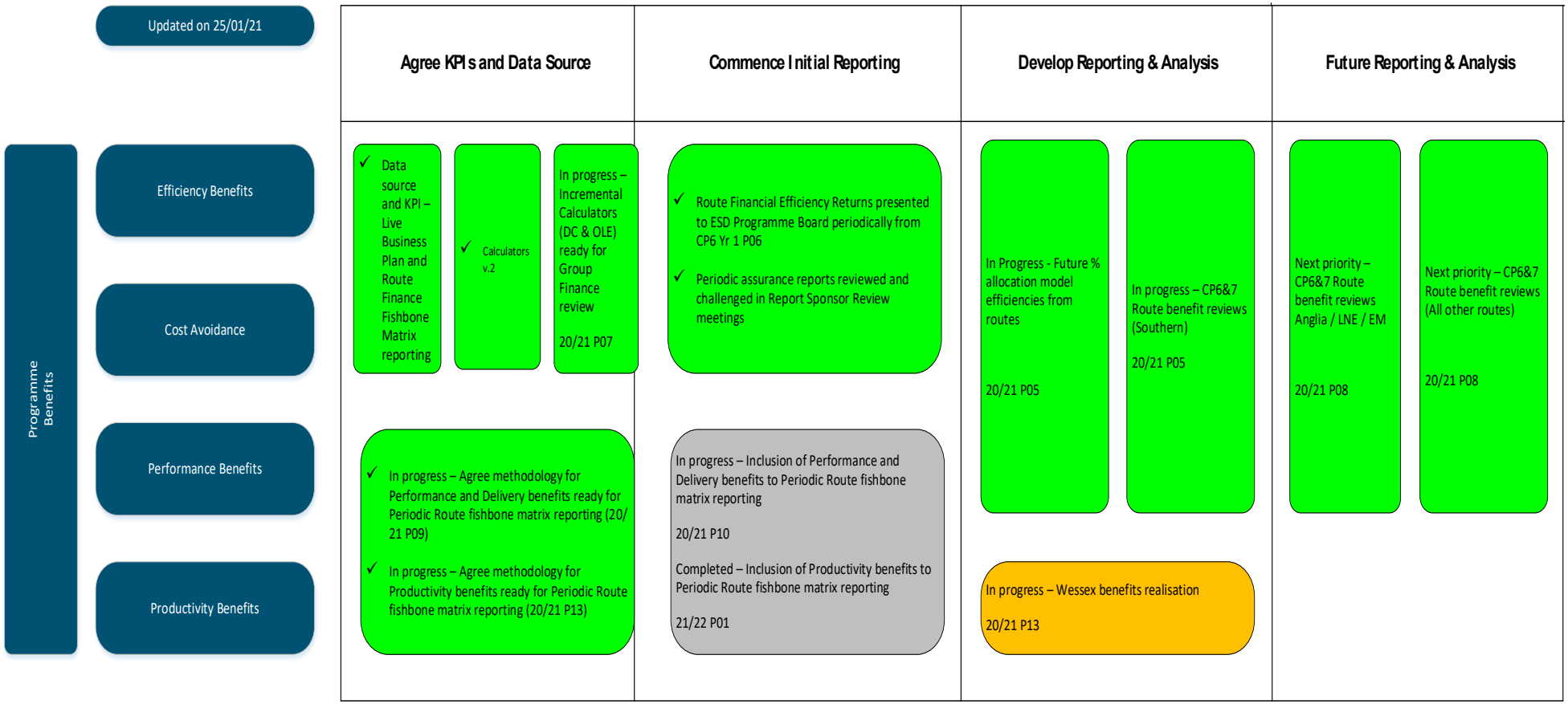
All OLE Routes • New technology – OLE is immature in comparison with progress made on DC and slow progress for rollout of TPCMS is a threat to all benefits attributed to Remote Securing (App) on TPCMS. • Safety incidents keep happening on OLE – this has prompted challenge over the prioritisation of initiatives. Routes are focused on tactical measures (e.g. PPE) at the expense of strategic improvement.	**Mitigation** • To increase confidence with stakeholders a full end to end demonstrator was showcased to the Regions. The remote securing toolkit also provides a solution independent to TPCMS using a trapped key • Mapping of EaWR to ESD interventions against the Electrical safety principles and a re-run of the DST for AC and DC is complete and reviewed the review of route allocation
NW&C Region SBP financial benefits are at risk due to; • Delivery to date has been optimistic with an underspend in the last 3 years and impact of COVID 19 • NW&C route finance efficiency benefit return is at risk due to the dependency on remote securing	**Mitigation** • The central team have supported NW&C with a review of the business plans and re-forecast of benefit opportunity

Appendix E – KPI Implementation Road Map

Safety KPI Road map



Financial KPI Roadmap



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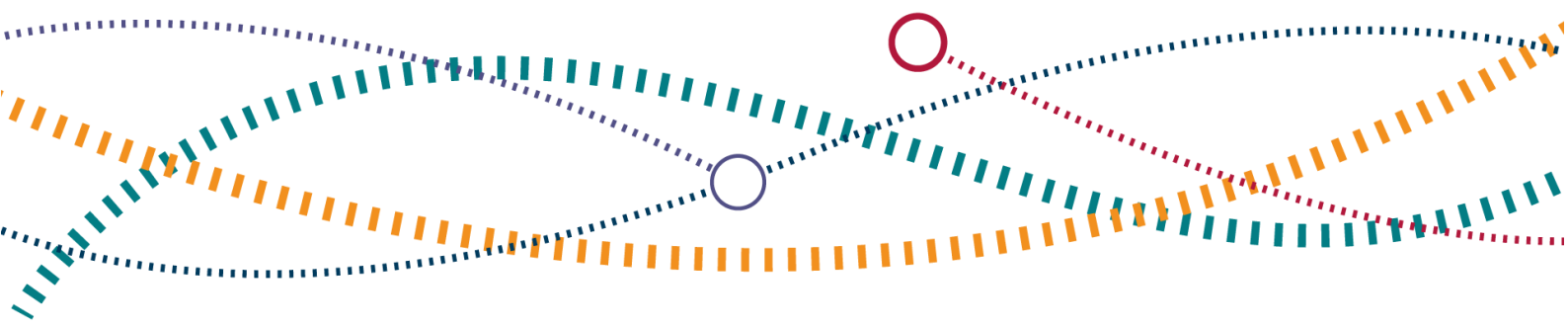
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