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By email

23 September 2022

Dear Minister

ORR's supplementary advice on the development of your HLOS and SoFA

We wrote to you on 17 June with advice ahead of your decisions later this year about Network Rail Scotland's funding and outputs for CP7 (the control period starting on 1 April 2024) and said that we would provide supplementary advice in August and September. We provided the first part of that supplementary advice on 26 August and have also had discussions with Transport Scotland on the issues raised.

Our June advice was largely based on our review of Network Rail Scotland's March submission which set out its initial view of activity and expenditure for CP7. That submission took into account a clear steer from Transport Scotland to provide a submission as close as possible to CP6 levels of funding. This resulted in an indicative funding level for operations, support, maintenance and renewals (OSMR) of around £4.7 billion (in 2023/24 prices) over CP7. It has since provided targeted additional analysis that has informed this letter. In this letter, and accompanying annexes, we provide supplementary advice on three key issues:

- Network Rail's delivery in the current control period (CP6);
- the impact of reduced renewals levels on maintenance costs; and
- Network Rail's digital signalling plans.

We have also provided advice to UK Ministers on these issues. Where appropriate we are providing the same advice to both funders. We will write to you shortly

regarding the System Operator (SO) and National Functions' costs (a portion of which are paid by Network Rail Scotland).

Network Rail Scotland's delivery in the current control period (CP6)

There are risks to Network Rail Scotland's delivery in CP6 that may have implications for the funding that is needed for CP7.

In our June advice, we expressed concerns about whether Network Rail Scotland's assumption that it will broadly deliver its CP6 outputs was realistic. Network Rail Scotland updates its CP6 plans regularly, and we have reviewed the latest iteration.

There are significant (and related) issues that could compromise Network Rail Scotland's overall ability to deliver its CP6 commitments.

- **The latest forecasts we've seen from Network Rail Scotland indicate it only has £20 million of unallocated risk funding remaining. This compares with £45 million of known risks, and several additional emerging risks, which Network Rail Scotland has not yet valued.** Network Rail has identified the renewals it will defer to increase risk funding to manage these risks. [Redacted]
- **Rising inflation compared with Network Rail's June submission will add to these pressures for the remainder of CP6.**
- **The original volumes budget set for year four of CP6 was incorrect,** we consider this shortfall may be due to a lack of sufficient governance and assurance and we have escalated our concerns to Network Rail Scotland's executive. We have since received an improvement plan from Network Rail Scotland's Executive to address these issues. Accurate reporting is critical to ensure that we understand what Network Rail Scotland will deliver in CP6, as well as any potential impact on CP7 of under-delivery.
- **Network Rail Scotland is forecasting significant deferrals** to renewals and changes to the types of interventions being undertaken.

Further detail on Network Rail's CP6 performance and plans is provided in Annex 1.

The impact of reduced renewals on maintenance costs

There is likely to be an additional maintenance requirement in CP7 under the [redacted] funding scenario, but the impact is likely to be felt most in later control periods. The deferral of CP6 asset renewals means the asset condition at the end of CP6 will be worse than assumed in Network Rail's March submission.

In our June advice, we noted that the [redacted] scenario presented by Network Rail Scotland indicated potential increases in maintenance costs in CP7. This was driven by spend on renewals being below Network Rail's modelled level required to maintain the current asset condition. Network Rail Scotland had identified an uplift to maintenance costs of between 3% and 5% which equated to £100 million across the control period. This was based on an assumption that Network Rail Scotland would broadly deliver its CP6 outputs.

Network Rail Scotland's March submission did not include evidence to support this level of increase. Through ORR's challenge process we established that Network Rail does not have the data needed to robustly model this impact and instead Network Rail provided a qualitative assessment for the purpose of this advice.

We agree with Network Rail Scotland's conclusion that there is likely to be an additional maintenance requirement under [redacted] funding scenario. However, it is likely that this would not be fully felt until midway through CP7 and would continue into later control periods.

As discussed in our June advice, if Scottish Ministers were to set CP7 funding at [redacted], additional funding for renewals would be required to recover asset condition in CP8 and CP9. To recover deferred renewals, we agree with Network Rail Scotland's estimate that funding would need to increase from CP7 [redacted]. This estimate excludes the additional maintenance cost and, when these are combined, it could represent an affordability challenge in those later control periods.

Further detail on Network Rail's analysis and our conclusions is provided in Annex 2.

Digital signalling

There has been good progress on developing a signalling strategy for Scotland. The planned rolling stock changes in Scotland mean that (where feasible) a phased introduction of digital signalling in Scotland would be possible and would benefit the network through improved performance, resilience and lower renewals costs. We will follow up shortly with further information on the allocation of central costs, including in relation to digital signalling.

The UK and Scottish governments have different positions on the roll out of digital signalling. In 2019, in response to a request from the Secretary of State for Transport, Network Rail developed its [long-term deployment plan](#) (LTDP) which sets out the strategy for the deployment of digital signalling across the network. The LTDP doesn't fully reflect Transport Scotland's position on digital signalling.

Network Rail Scotland has recently updated its signalling strategy, called Signalling Scotland's Future (SSF, formally the whole system signalling strategy (WSSS)). The SSF (which has now been endorsed by Transport Scotland) sets out the signalling strategies across Scotland's strategic lines of route which will be determined by the operational, economic and asset needs with the appropriate technology (including future digital signalling and fleet fitment). We expect Network Rail to have a GB-wide signalling strategy that aligns the SSF and LTDP.

It is our view that digital signalling would provide benefits to the network in Scotland, through improved performance, resilience, and lower renewals costs. It would also avoid reliance on a conventional signalling supply chain which is downsizing across Europe as digital signalling becomes more common and, as a result, conventional unit costs are increasing. Whilst there may be parts of the Scottish network not suitable for the deployment of digital signalling (e.g. the Far North Line), there are some aspects of digital signalling where the opportunities are greater in Scotland than in England & Wales. For example, forward plans for infrastructure in Scotland are more closely aligned with plans for new rolling stock. Also as planned rolling stock changes (where cabs are likely to come fitted with the technology needed) are clearly connected to particular 'lines of route' this would make the phased introduction of digital signalling simpler.

Network Rail Scotland's plan for CP7 does not include any direct expenditure on digital signalling renewals but does include an allocation of GB non-infrastructure

costs. These costs include fleet fitment for passenger, freight, on track machines (OTMs), and heritage and charter (H&C), enabling costs and research and development (R&D) costs. We consider it is appropriate for Network Rail's GB CP7 plans to include these costs as it puts all expenditure in the same place and makes an intrinsic link between digital signalling activities. We will discuss the allocation of these costs in our letter on SO and National Functions' costs next week.

Assuring these costs is not within the scope of this advice, however we consider that there is a strong case for including a level of funding for CP7 fleet fitment that aligns with the wider programme for signalling renewals. Further consideration needs to be given to the operational reasons for having such an extensive fleet fitment programme in CP7 and the deliverability risks this presents, especially given the existing deliverability issues with the fleet fitment programme in CP6. We will discuss the allocation of these costs between England & Wales and Scotland in our letter next week on Network Rail's SO and National Functions' costs.

Network Rail is currently developing a specification as part of its R&D programme for Optimised Train Track Operation (OTTO). The OTTO approach is a development of the Train Protection Warning System (TPWS), which offers some of the functionality of digital signalling. We consider that if OTTO is developed, tested and proven as part of Network Rail's R&D it may help to manage some of the affordability and deliverability challenges faced by Network Rail in future control periods by delivering partial solutions faster on the way to full ETCS in future.

Further detail on our views on Network Rail's digital signalling plans is attached as a supporting document ('Second supplementary advice on Network Rail's digital signalling plans').

Next Steps

We will write to you next week with our supplementary advice on SO and National Functions' costs and will continue to support you and your officials to facilitate timely decisions on funding and outputs. As set out in previous correspondence (including as part of the formal notices to commence the periodic review that we provided to you in June), we are expecting to receive the Scottish Ministers' HLOS and SoFA by the end of November.

Reflecting the need for transparency about how periodic review decisions are made, as well as our role in contributing to these, we intend to publish this letter once your HLOS and SoFA are published.

Yours sincerely

Will Godfrey

cc to Bill Reeve (Director of Rail, Transport Scotland), Alex Hynes (Managing Director, Scotland's Railway) and Stephanie Tobyn (Director Strategy, Policy and Reform, ORR)

Annex 1: Network Rail's CP6 delivery

Consistent with ORR's regular updates to funders following our review of Network Rail's delivery plan updates, this annex covers both England & Wales and Scotland and is being provided to both funders.

Background

1. This annex provides our views on Network Rail's CP6 delivery, based on its latest (June 2022) update to its CP6 plan. We are setting out our views in this area given that any risks or issues with Network Rail's delivery in CP6 will have an impact on the use of Network Rail's CP7 funding and its associated delivery.
2. Network Rail updates its OSMR delivery plan for CP6 regularly. We review these updated plans to help hold Network Rail to account against the Periodic Review 2018 (PR18) Final Determination, as well as to provide assurance to funders about Network Rail's delivery. The conclusions set out herein draw on our review of Network Rail's update of its plan in March 2022, the findings of which we set out in [our letter to the DfT and Transport Scotland on 29 March 2022](#).
3. Network Rail's latest plan sets out what it is forecasting to deliver and its income and expenditure forecasts for the remainder of 2022-23 and for 2023-24. All figures in this annex are in cash prices, which include a forecast based on the BoE May 2022 CPI forecasts.
4. Reflecting our findings from our March 2022 review, we have focused on four areas:
 - a. Network Rail's risk funding;
 - b. the impact of rising inflation on Network Rail's income and costs;
 - c. renewals profiling; and
 - d. Network Rail's workforce modernisation plans.

High-level summary of our findings

5. While we consider that Network Rail's activities in England & Wales remain on track to deliver, we have more serious concerns about Network Rail Scotland's ability to deliver against its CP6 commitments. We have identified several significant (and related) issues that could compromise Network Rail's ability to deliver on its CP6 commitments:

a) Network Rail has undertaken further deferrals of renewals from year 4 to year 5 of CP6 in its latest update of its CP6 plan (June 2022), which has increased our concerns that it will not deliver these projects in CP6.

This is particularly concerning in Scotland where Network Rail is forecasting to under-deliver on its year 4 effective volumes (which reflect how much additional life renewals activities add to assets, thus providing a view on asset sustainability) across all asset types. Network Rail has advised us that it is reporting under-delivery for several reasons, including deferrals of works and changes to the type of work (or intervention) being undertaken. There were also errors in its original year 4 budget, which has caused some of the variance.

In England & Wales, Network Rail is on track to deliver its planned volume of work in CP6, although it has deferred work into year 5 of CP6. This is mainly due to issues relating to the delivery of works, including (for example) supply-chain underperformance in signalling, labour shortages and poor reliability of specialist plant.

b) Rising inflation is expected to cost Network Rail an additional £51 million (across GB) (compared with its June submission) for the remainder of CP6.

The effect for Scotland is estimated at £2.5 million.

c) Network Rail's remaining risk fund for GB (£252m, in June 2022) will need careful management to ensure there is enough funding in CP6 to deliver its outputs.

The position is especially acute in Scotland. For example, in June 2022, Network Rail Scotland is forecasting it has only £20 million of unallocated risk funding remaining, yet it has identified £45 million of known risks, as well as several additional emerging risks that it has not yet quantified. While it is looking into options for a potential change to its budget to enable it to avoid deferrals (see above), this remains uncertain.

d) Network Rail has drawn down £55 million of risk funding (across GB) to manage the impacts of strike action. The cost for Scotland is estimated at £8 million, though we note that costs relating to recent industrial action is still being worked through.

[Redacted]

Our review of Network Rail's CP6 delivery

6. We set out below five key observations which we consider that funders should take account of in developing their CP7 HLOS and SoFA.

Further deferrals of renewals

7. In March 2022, we raised concerns about the increased backend loading of renewals. This creates risks that some of these schemes will not be completed in CP6 and/or would need to be deferred to CP7, putting additional funding pressures on CP7.
8. Network Rail remains committed to delivery of its CP6 commitments and, in England & Wales, Network Rail is on track to deliver its planned volume of work in CP6. However, Wales & Western has moved several structures and buildings renewals into year 5 of CP6. In addition, North West & Central and Wales & Western have moved some of their track renewals into year 5 of CP6.
9. Furthermore, on track renewals, we are observing a shift from full refurbishment to lower impact interventions, which is likely to mean that the next intervention will be required sooner than planned. This could result in a higher whole-life cost than would otherwise have been the case. This is especially the case in Scotland and is likely to impact on the Network Rail Scotland's ability to deliver its CP6 efficiency commitments. Failure to deliver its efficiency plans is likely to exacerbate the funding challenges highlighted above.
10. In March 2022, we asked Network Rail to provide us with assurance over its ability to deliver its planned renewals in CP6. Whilst Network Rail's Technical Authority (which provides technical assurance over the regions' activities) has undertaken a review that indicates that the volume of renewals currently being forecast for delivery in years 4 and 5 of CP6 is technically deliverable, there are some concerns that further deferrals into CP7 will occur, especially in telecoms, structures and signalling. A more in-depth review is being undertaken by Network Rail's Capital Delivery Centre of Excellence team, which will start in October

2022 and is due to conclude in January 2023. This aims to provide further insights into the preparedness of regions to deliver, to provide a basis on which to judge delivery confidence and provide the clearest forecast of the exit CP6 position.

11. The largest movement in renewals volumes has been in Scotland where Network Rail Scotland has reported that it is forecasting to under-deliver on its year 4 effective volumes budget across all asset types by between 9% and 16%. The original budget set for year 4 was incorrect, which has caused part of this variance. There are also deferrals of works and changes to the types of interventions being undertaken which further explain this variance. We consider this shortfall may be the result of poor governance and assurance and we have escalated these concerns to Network Rail Scotland's executive. We are closely engaging with Network Rail Scotland to understand how it will make improvements to ensure that future reporting accurately reflects planned delivery. We are concerned that any under-delivery in year 4 will impact on its overall CP6 delivery. It may also impact on CP7 if renewals are deferred into CP7. This potential under-delivery will further negatively impact its Composite Sustainability Index (CSI) in CP6, which shows the percentage improvement of asset sustainability compared to a baseline (the CSI value measures the cumulative change against the start of CP5).
12. In March 2022, following Network Rail Scotland's decision to defer £53 million of planned renewals, we reported that it was forecasting a CSI of 2.2% by the end of CP6 and, as of July 2022, this is now forecast to be 2.0%. This is below Network Rail Scotland's target of 2.9% and our regulatory floor of 2.4%. In practice, this means that Network Rail Scotland is not delivering sufficient renewals to achieve the levels of asset sustainability, as measured by CSI, that it agreed to in the PR18 Final Determination. This will have implications for train and freight service performance and future funding, as Network Rail Scotland's declining CSI measure will also impact on its CP7 plans as well as future control periods.
13. We have stepped up our monitoring on Network Rail Scotland's CSI measure and wrote to Network Rail Scotland about this in June 2022. This letter outlined a series of mitigations that Network Rail Scotland was undertaking, and we have further discussed these mitigations with the regional executive. It confirmed that it will continue to target its renewals in the most appropriate locations to maintain a

safe and sustainable railway. We support this approach. However, given the additional forecast under-delivery, we have requested an updated forecast for CSI at the end of CP6 to better understand the implications on long-term asset sustainability, which we expect to receive in October.

14. We consider that Network Rail Scotland's significant shortfall against its budgeted renewals for year 4 may be the result of poor governance and assurance of the CP6 re-forecasting process. We have escalated these concerns to Network Rail Scotland's executive and are closely engaging with it to understand how it will make improvements to ensure that future reporting accurately reflects planned delivery. We will provide a further update on this issue and the CSI forecast in our next review of Network Rail's plans towards the end of the year.

Rising inflation

15. Inflation is currently high – the CPI inflation rate rose by 9.9% in the 12 months to August 2022. This is a key concern for Network Rail and its forecast costs have risen by net £51 million across GB since Network Rail's update of its CP6 plan in March 2022. As of June 2022, the impact of high inflation for Network Rail over the remainder of CP6 is expected to cost a further £51 million (across GB). Network Rail's own modelling suggests that, if CPI was 1% lower than forecast, the additional cost for CP6 would (only) be £31 million (across GB). It should be noted that the impact of CPI on Network Rail's costs is not straightforward, however. For example, some of Network Rail's costs will increase in line with inflation, while other costs will be fixed.
16. The uncertainty around inflation has been included in Network Rail's risk modelling. However, as discussed below, there is very limited risk funding available to absorb any further increases in inflation (or any other cost shocks) for Network Rail, especially in Scotland.

Network Rail's remaining risk fund

17. The remaining risk fund for Network Rail in CP6 is now £252 million (across GB). This represents around 60% (or P60) of potential risks according to Network Rail's risk modelling. This is lower than the risk coverage at the start of the control period (P80). The £252 million remaining GB risk funding is for risks that could materialise in years 4 and 5 of CP6.

18. Some of the key risks for Network Rail are difficult to predict, including rising inflation (discussed above); industrial action [redacted]; its ability to deliver on workforce reform (discussed below); and issues relating to the funding of the wider rail industry (e.g. whether DfT wants Network Rail to assist with TOC financial difficulties). We are concerned that Network Rail will need to defer renewals if the risk fund is not carefully managed over the remainder of CP6. This is exacerbated by the issues discussed below.
19. We are particularly concerned about the level of remaining risk funding in Scotland, which we discussed in our June advice to Scottish Ministers. The final RF11 risk position in Scotland was £34 million. Since then, Network Rail Scotland has completed an exercise to provide more detail to us and to Transport Scotland on its use of the risk fund to date in CP6 and the risks it anticipates needing to fund with the unallocated balance remaining. The net impact is that, as of June 2022, Network Rail Scotland is forecasting it has only £20 million of unallocated risk funding remaining. This compares with £45 million of known risks, and several emerging risks, which Network Rail Scotland has not yet valued.
20. The forecast risks in Scotland are extremely uncertain given, for example, the risk fund's dependency on delivery of operational savings (identified through, for example, on-going modernisation plans) and Network Rail Scotland's poor delivery of efficiencies in year 3.
21. Network Rail Scotland has identified the renewals it will defer to increase risk funding to manage these risks. [Redacted]
22. The on-going uncertainty and limited risk funding makes effective planning more challenging for Network Rail Scotland. It is investing a lot of resource in revising its plans and, at the same time, undertaking significant work to plan for CP7. Successful management of both of these priorities will be challenging. We have previously said to Network Rail that it needs to strike a balance between using risk funding to address cost increases that have already happened, making sure there is enough risk funding to cover future risks and not leaving unused risk funding to the end of the control period. We recognise that getting this balance right is difficult and that the CP6 risk funding process has provided some stability to the planning process

Industrial action and workforce reform

23. Network Rail's CP6 plans include the cost of a pay award (which is consistent with its latest negotiating position), though this is still being negotiated and could change. Network Rail has said that any increases to the current assumption would have to be funded from additional efficiencies, which may be challenging.
[Redacted]

Next steps

24. As set out in this annex, we have significant and related issues regarding Network Rail's delivery of its CP6 commitments. We will continue to monitor Network Rail's delivery in CP6, including by way of a fuller review of Network Rail's updated CP6 plans in October/November 2022. As part of this, we will provide a formal assurance review to funders of Network Rail's update of its plans, including the areas we would expect it to focus on (or, if necessary, revise) in advance of agreeing the formal update of its plans.

Annex 2: Impact on maintenance costs at [redacted] spending levels

Background

1. In its March 2022 initial CP7 submission, Network Rail Scotland noted an expected increase in maintenance costs in CP7 of 3-5% if renewals funding was set below a funding level that reflects the optimum lowest whole life cost. As we committed to in our advice in June 2022, we requested additional information from Network Rail to evidence this potential uplift in maintenance spend.
2. We met with Network Rail to understand its assumptions and discussed the availability of data to support the proposed 3-5% uplift in maintenance spend. Network Rail advised that (because of the number of variables impacting on train performance, faults and maintenance activity) it would be difficult to robustly model a link between renewals deferrals and increased maintenance with the data available. It also argued that a degree of 'engineering judgement' and extrapolation was required given the limited data available at this stage of the planning process and the existing quality issues with Network Rail's reporting of maintenance volumes (discussed below). Furthermore, at this stage in the planning process there is still considerable uncertainty over how Network Rail Scotland will prioritise its renewals portfolio and any subsequent impacts that might then occur.
3. Reflecting the above issues, Network Rail delivered a qualitative assessment of the drivers contributing to the uplift and a set of supporting case studies. Recognising the complexity and limitations described by Network Rail, we agreed to this approach to enable delivery of this part of the supplementary advice.

High-level summary of our findings

4. Based on the information Network Rail has provided to us in August 2022 (and noting the limitations of its analysis, as discussed above), we have the following findings.
5. Although we agree with Network Rail Scotland's conclusions that there is likely to be an additional maintenance requirement under the [redacted] funding scenario, the impact is likely to be felt most in later control periods. Additionally, Network Rail Scotland is planning to defer renewals activity from CP6 which will have an impact on CP7 maintenance costs. We consider it likely that an increase

for maintenance costs will be required in CP7 because of the combined effect of CP6 and CP7 deferrals. This cost is likely to rise through CP7, potentially to the 3-5% increase Network Rail Scotland has indicated, hitting this range partway through CP7. We are concerned that Network Rail's analysis delivered in August 2022, may have unduly focussed on the areas that will increase maintenance costs and has not provided sufficient balance by exploring factors that may mitigate the impacts. These reflect, for example, that:

- The extent of assets identified for deferral in CP7, when measured against the whole breadth of network wide infrastructure, is relatively small. Furthermore, and given an expected lag in faults materialising, the impact of reduced expenditure, would only have a noticeable impact part way through CP7. It should be noted that if assets aren't renewed, the effect of the lag reduces, and the impact (i.e. a need for more maintenance) would continue to increase through CP8 and CP9. There is some existing flexibility within the maintenance operation at a working level, which suggests that Network Rail Scotland could absorb nominal increases in activity on maintenance activities within CP7. We recognise, however, that this is less likely if expenditure is significantly low or continues to remain below lowest whole-life cost in CP8 and CP9 as the volume of faults would increase.
- Network Rail Scotland has not taken due account of the anticipated improvements from adopting technologies and new working practices in CP7 in its initial plan.
- The implications of already delivered or planned works (e.g. enhancements and Lord Mair and Dame Slingso-related initiatives) on improving network resilience and hence reducing the need for maintenance activities have already been separately identified (and reflected in the proposed funding requirements).
- Scotland's rail infrastructure is currently in a relatively positive position (as measured by reference to the CSI metric) when measured against the asset condition at the end of CP4.

6. It should be noted that this advice is provided before the full extent of deferrals and the impact on the network in Scotland is known. Although the Scotland

infrastructure is currently in comparatively in a fair position (as measured by CSI), the rate of decline is accelerating and existing concerns surrounding deferrals in CP6 could lead to Scotland's infrastructure declining beyond forecasts before CP7 starts. This would indicate an increase in the risk of asset failures and the probability of an increased maintenance requirement.

7. The primary impact of deferred renewals is that maintenance costs will increase in subsequent control periods, potentially up to the £0.1 billion level detailed by Network Rail Scotland. Additional maintenance costs will continue to increase if lower expenditure (when compared with lowest whole-life cost) continues. The deeper the reduction, the bigger the impact on maintenance.
8. As per our June 2022 advice, if funding is set at a level consistent with Network Rail Scotland's [redacted] scenario, we would expect significant levels of additional funding would be required to recover asset condition in CP8 and CP9 through renewals activity. [Redacted] However, this estimate excludes the additional maintenance cost and, when the two are combined, they could provide an affordability challenge for the Scottish Government.

Review of Network Rail's updated maintenance analysis

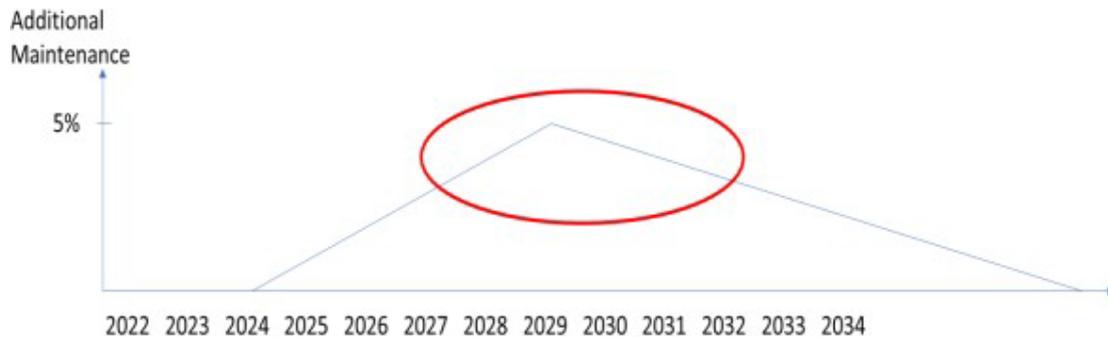
9. We have reviewed the additional evidence supplied by Network Rail Scotland and have the following observations.
10. **Data quality:** We recognise the issues Network Rail had in obtaining data to conduct this analysis. This is a known issue as it was investigated through an [Independent Reporter study into maintenance volume reporting](#), conducted in March 2022. This review identified discrepancies in how maintenance volumes are currently captured across Network Rail. These differences at route maintenance delivery unit (MDU) level in the sample make it difficult to identify overall trends that can be 'aggregated' up to a Scotland level. This may impact on the accuracy of any analysis undertaken by Network Rail. A conclusion of the review highlighted that there is further scope to improve the recording of reactive work (as opposed to planned volumes), so it provides greater clarity between preventative maintenance and reactive fault fixing. This would help to provide a greater understanding of the asset performance and support future planning against various funding scenarios. We are monitoring Network Rail's progress as

it actions the recommendations provided by the Independent Reporter to improve the accuracy of maintenance volume reporting.

11. **Renewals Expenditure** Network Rail indicated in its March 2022 initial CP7 submission that there is an additional funding requirement within its central costs of £120 million across the network. This consists of £65 million for strengthening data quality reporting and £55 million for track access plus timetabling of additional data runs. Although we recognise the merits of these on-going projects, we have concerns, as we would expect to be seeing benefits from CP6 expenditure included in Network Rail Scotland's CP7 plan. We propose to review these elements as part of the Strategic Business Plan.
12. **Qualitative vs Quantitative:** Noting the issues with Network Rail's data and methodology (as discussed above), unconscious biases (both optimistic and pessimistic) can be introduced by engineering judgement. Without data to inform opinions, there is the possibility that undue credence could be given to erroneous viewpoints.
13. **Evidence:** The 3-5% estimated increase maintenance costs Network Rail Scotland has provided is predominantly based on qualitative judgement. Its analysis has, therefore, not been able to provide the granularity required to support the range quoted. Maintenance costs are a function of labour, material and plant. However, Network Rail Scotland's submission does not explore these in sufficient detail. Furthermore, the variability of the condition of asset portfolios, local issues and variability in asset maintenance requirements have not been considered. However, our primary concern is that Network Rail Scotland has focussed exclusively on the areas which might increase maintenance and has not provided sufficient balance by exploring factors which may mitigate the impacts. Specific examples are explored below.
14. **Timing:** Network Rail Scotland's analysis demonstrates a number of drivers for increases in cost if renewals are deferred. However, the timing of these impacts is not always clearly articulated. As an example, it is recognised that assets that are reaching the end of their service life are more prone to failure. However, there is uncertainty about when failures will occur, as well as the nature of the failure and its subsequent impact. As part of its additional evidence linked to our supplementary advice on train service performance, Network Rail provided a qualitative assessment (see Figure 1 below) showing how it considers maintenance costs will increase across the GB Network over time and recover to

2024 levels of failure assuming its mitigations (such as technology / tool advances) take effect.

Figure 1: Network Rail expected additional maintenance spend due to CP7 deferrals by year across the network



15. Our view is that this analysis is overly pessimistic, and there will be a gap between the planned end of asset service life and asset failure. This 'lag' effect means that we are unlikely to see the number of asset failures increase significantly in the early years due to CP7 deferrals. Nevertheless, and in line with Network Rail Scotland's view, we would expect a steady increase in failures over time which would likely be significant in later control periods if renewals expenditure levels are not restored. [Redacted] If funding levels were reduced further with additional renewals deferred there would be an increased volume of assets nearing the end of their service life and therefore a heightened probability of failures at a system level. In this scenario, increased maintenance costs would likely be above the estimates provided [redacted]

16. **System change:** Network Rail is embarking on schemes to introduce new technologies and new working practices which will influence maintenance costs, such as Intelligent Infrastructure, R&D, efficiency initiatives and "Modernising Maintenance". The impact of these schemes has not been fully considered within Network Rail Scotland's evidence. Furthermore, examples such as the impact of improvements in drainage maintenance (which will have an unquantified improvement on the sustainability of other asset groups), and the short / long-term impact of potential future changes in asset usage (i.e. due to reduced

passenger but increased freight operations) are also excluded from Network Rail Scotland's analysis.

17. [Redacted]

18. Network Rail Scotland currently manages deferred renewals successfully between years and control periods via increased maintenance activities and minor works including meeting peaks in demand at a marginal level. Our understanding is that the ratio of time-on-tools versus non-time-on-tools in Network Rail MDUs is low, indicating an opportunity for improvement in resource capacity. With changes to working practices, for example improved planning (and noting the change to risk-based maintenance as an enabler for this), there is a possibility that some MDUs will be minimally impacted by reduced renewals spend in CP7.

19. [Redacted]

Next steps

20. In addition to progressing the recommendations associated with the March 2022 Independent Reporter study, we expect Network Rail Scotland to begin the process to instigate improvements in estimating long-term impacts on maintenance costs as part of bottom-up planning for its Strategic Business Plan.

21. We recognise the current maturity of Network Rail's maintenance modelling but expect Network Rail to work towards the development of an evidence-based approach to maintenance planning. We also expect to see evidence of best practice being regularly identified and shared within the organisation and that an appropriate governance process is instigated. We recognise that it is unlikely that this is fully achievable before CP7 and will likely be a work-in-progress for much of CP7.

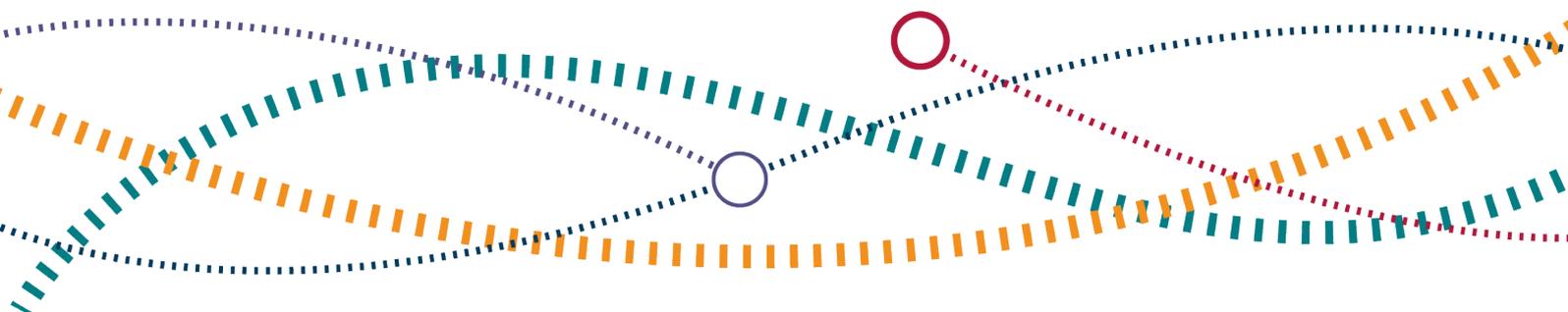
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Supporting document B: Second supplementary advice on Network Rail's digital signalling plans

Periodic Review 2023 (PR23)

16 September 2022



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1. Executive summary

Background

- 1.1 Network Rail's initial CP7 submission included proposed spend in its plans which support the deployment of digital signalling in England & Wales in CP7. In Scotland, the funding requested for digital signalling aims to support potential future digital solutions in keeping with Scotland's signalling strategy. Network Rail's funding request includes:
- (a) four digital signalling renewals in England & Wales (£690m), held in regional plans;
 - (b) fleet fitment (£1.2bn), held in Eastern and Route Services plans;
 - (c) research and development (R&D) programmes (£178m), held in Technical Authority 'other renewals' plans and separate from the wider R&D plans; and
 - (d) enabling costs (£110m), held in Eastern and Technical Authority plans.
- 1.2 We provided our initial advice to the UK and Scottish governments in May and June 2022 on the development of their High-Level Output Specifications (HLOS') and Statement of Funds Available (SoFAs). This included our views on Network Rail's digital signalling plans for CP7 including Operations, Support, Maintenance and Renewals (OSMR) costs as well enabling costs such as fleet fitment and R&D programmes.
- 1.3 We concluded that Network Rail needed to submit more information in four key areas so that we could provide additional advice on Network Rail's digital signalling plans. The four areas we agreed to provide supplementary advice on for digital signalling are set out below:
- (a) Network Rail's Network Rail's estimated digital signalling renewal project costs and Signalling Equivalent Unit (SEU) rates;
 - (b) Network Rail's plans for fleet fitment and the funding requested in CP7;
 - (c) Review of an option included by Network Rail in its initial CP7 submission to reduce passenger fleet fitment funding by c.£200m; and
 - (d) Understanding Network Rail's R&D programme for Optimised Train Track Operation (OTTO).

- 1.4 Since then, Network Rail provided us with updated project cost forecasts and additional information on SEU rates, fleet fitment and OTTO. Some of this information has changed since Network Rail's initial CP7 submission.
- 1.5 The following report sets out our supplementary advice on digital signalling to the Department for Transport (DfT) and Transport Scotland. It is based on our scrutiny of Network Rail's initial CP7 submission which was provided to ORR on 31 March 2022 and additional information provided by Network Rail between June and August 2022 in response to queries we raised.
- 1.6 We are providing the same advice to the UK and Scottish governments, reflecting our view that this report includes information relevant to both funders. We recognise that funders in Scotland are taking a different approach to the deployment of digital signalling, however our advice covers the GB network as a whole.

Scotland specific advice

Funders in Scotland may find chapters 1, 2, 4 and 6 the most useful. These chapters focus on our conclusions and recommendations, setting the context for Network Rail's digital signalling plans in CP7, our views on fleet fitment funding and OTTO which we mentioned in our initial advice to Scottish Ministers in May 2022

Although information in chapters 3 and 5 is most relevant to funders in England & Wales we are also providing it to Scottish funders. These chapters focus on project costs for the three digital signalling renewals proposed in England & Wales and an option included by Network Rail to reduce passenger fleet fitment funding.

- 1.7 All figures in this report are GB wide and shown in 2023-24 prices unless otherwise stated. Cost forecasts provided by Network Rail included some costs inflated using the November 2021 forecast and some costs are inflated using the May 2022 forecasts.

Conclusions and recommendations

Advice to funders

1.8 We have summarised the key findings from our supplementary advice to Ministers in Table 1.1 below. This provides a high-level overview of our advice in the four areas we committed providing further thinking on.

Table 1.1 Summary of advice to funders

Advice ID	Area	Summary of advice
A1	Renewals costs	There has been an average c.35% increase to digital signalling renewals cost forecasts between Network Rail's initial CP7 submission and this supplementary advice. The forecasts will continue to evolve given the early stage of development of its plan. As such we do not have full confidence in the cost forecasts provided by Network Rail in its initial CP7 submission. We also expect the cost profile to change and some costs to move into CP8.
A2	SEU rates (used to forecast and measure unit costs for signalling projects)	<p>East Coast Digital Programme (ECDP) has a lower SEU rate than the three other digital signalling renewals projects in England & Wales as it has been developed further, in collaboration with a confirmed supplier. We expect Network Rail to provide its own assurance and challenge on project costs in its SBP submission which take account of evidence from ECDP.</p> <p>The three other projects have used the same approach as each other to develop the SEU rate and we consider this method is appropriate at this stage of development.</p>
A3	Passenger fleet fitment	We consider the funding requested for passenger fleets is commensurate with the extent of renewals planned to commence in CP7 and CP8 digital signalling workbanks. We consider passenger fleet fitment could be funded via the PR23 process to ensure the delivery of this critical enabler for digital signalling.
A4	Freight fleet fitment	We consider it appropriate to include funding for freight vehicles in the PR23 process. This will safeguard existing commitments already made by funders in England & Wales for ECDP and support the future roll-out of digital signalling renewals.
A5	On Track Machine (OTM) fleet fitment	The strategy for OTM fitment is not as well developed as the freight and passenger fitment programmes. That said, it is important that funding is provided for the fitment of OTM vehicles alongside other fitment programmes in the PR23 process.
A6	Heritage & Charter	We consider funding for H&C fitment could be included within the PR23 process. However, this should be dependent on conclusions from the First in Class (FiC) (i.e., when a vehicle is the first of its

Advice ID	Area	Summary of advice
	(H&C) fleet fitment	class to be fitted with ETCS) feasibility fitment programme being carried out by ECDP.
A7	Quantitative impacts of the reduced cost option	We cannot say with any degree of certainty that the additional costs estimated by Network Rail are accurate as these have not been modelled in detail. That said, we accept the justification Network Rail has provided in developing these illustrations and conclude that additional costs much greater than the suggested £200m reduction could be incurred by industry if fleet fitment funding is reduced in CP7.
A8	Qualitative impacts of the reduced cost option	If passenger fleet fitment funding is reduced such that volumes fall below the volumes required to successfully deliver the renewals identified in CP7, it will impact the digital signalling renewals which can be delivered in CP8 and beyond.
A9	OTTO	Network Rail's initial CP7 submission included expenditure for the research and development of OTTO but no expenditure for projects which propose to use OTTO components. It is essential that the transition to full ETCS continues to progress. However, we consider OTTO may help to manage some of the affordability and deliverability challenges faced by Network Rail in future control periods by delivering partial solutions faster on the way to full ETCS in future.

Risks to delivery

1.9 We consider there are significant risks to the deliverability of Network Rail's plan. These risks are not the sole responsibility of Network Rail, but it will play a pivotal role in the management of these risks and the co-ordination of industry. Table 1.2 below summarises our view of these key risks.

Table 1.2 Key risks in the deliverability of Network Rail's plans

Risk ID	Area	Risk
R1	Direction and strategy	The Long Term Deployment Plan (LTDP) does not reflect the current deployment strategy for the roll-out of digital signalling. We consider the LTDP should be updated to reflect the current strategy across all Network Rail regions, including infrastructure renewals and fleet fitment plans to support the delivery of digital signalling.
R2	Capability and capacity to deliver the volume of signalling renewals	There is a current backlog of signalling renewals caused by a combination of a gradual build-up of delayed renewals and the cyclical nature of past infrastructure investments. A key challenge for the deployment of digital

Risk ID	Area	Risk
	(conventional and digital) in CP7	signalling is the capacity of industry to meet the increase in demand caused by approaching end-of-life renewals.
R3	Development of project costs and uncertainty in plans	There remains uncertainty in Network Rail's which will continue to be refined between now and submission of its SBP, with more accurate assumptions and detailed estimates being provided. Uncertainties such as allowances for optimism bias will need to be transparent in the build-up of Network Rail's plans.
R4	Management of fleet fitment programme	The management of the fleet fitment programme is a critical piece of work that will require co-ordination across industry. We are aware of concerns from the supply chain regarding the need for a visible pipeline of work as well as from operating companies (refers to all types of operators e.g., freight, passenger etc.) who will need to remove units from service to enable retro fitment of fleets. The level of investment in the overall deployment of digital signalling should be determined by the slower of fleet fitment or the digital signalling renewals for optimum outputs vs. spend.
R5	Optimism bias in Network Rail's plans (cost and time)	Network Rail has included a cost allowance for optimism bias in its plans which is consistent with standard allowances used for projects at this phase of their delivery. We consider there may also be some optimism bias included in its delivery programme for fleet fitment and the deployment of digital signalling renewals. This view is based on the existing delays to First in Class (FiC) fleet fitment and Network Rail's capability to deliver conventional signalling renewals in CP6.

2. Setting the context for Network Rail's deployment of digital signalling in CP7 and Beyond

Introduction

- 2.1 In previous control periods and during CP6, Network Rail has provided information that suggests the level of signalling renewals required to maintain the existing signalling network effectively could be undeliverable in terms of affordability (cost) and deliverability (volume). This is referred to by Network Rail as the signalling renewals bow-wave.
- 2.2 Evidence presented previously indicates that a change of technology from conventional signalling (line-side signals) to European Train Control System (ETCS, which refers to the wider signalling and control system for digital signalling), could alleviate the bow-wave because unit costs are anticipated to be lower, and resources can be managed more effectively by the supply chain. Other benefits, including safety and performance, are harder to quantify but should become clearly defined as deployment progresses and industry knowledge and experience is gained.

Signalling in England & Wales

- 2.3 In 2019, Network Rail, in response to a request from the Secretary of State for Transport, developed the Long Term Deployment Plan (LTDP) which sets out the strategy for the deployment of digital signalling across the rail network in England and Wales ([Digital Railway long-term deployment plan - Network Rail](#)). The latest version of the LTDP does not accurately reflect the current strategy of digital signalling due to delays in the deployment. We have recommended to Network Rail that the LTDP should be updated to reflect the current deployment strategy across all Network Rail regions, including infrastructure renewals and fleet fitment plans.
- 2.4 In England & Wales, the Department for Transport (DfT) has already committed to the replacement of conventional signalling with ETCS on a 100 mile section of the East Coast Main Line (ECML), which is part of the East Coast Digital Programme (ECDP). The Final Business Case (FBC) for ECDP was approved by the UK Government in June 2022, committing more than £1bn of funding towards this programme ([£1 billion technology investment to bring railway into 21st century -](#)

[GOV.UK \(www.gov.uk\)](http://GOV.UK (www.gov.uk)). Further renewals funding is required from the PR23 determination to complete this pathfinder programme, this was included by Network Rail in its initial CP7 submission (£382m). Funders in England & Wales are sighted on this funding requirement as it was discussed in the ECDP FBC.

Signalling in Scotland

- 2.5 In Scotland, Transport Scotland is not supportive of digital signalling as currently presented in the LTDP. It has asked for more information from Network Rail on the benefits of digital signalling as it relates to the network in Scotland, compared with renewing the network conventionally or carrying out life extension works. Transport Scotland also wants to understand if there is an alternative to ETCS which is more appropriate given its networks characteristics, e.g., renewing according to line of route characteristics.
- 2.6 Network Rail Scotland is updating its signalling strategy, called Signalling Scotland's Future (SSF, formally referred to as the Whole System Signalling Strategy (WSSS)).
- 2.7 Network Rail Scotland has told us that the development of SSF will inform the updates to the LTDP. SSF requires approval by Transport Scotland and should set out the signalling strategy across Scotland including plans for digital signalling and fleet fitment.
- 2.8 We consider digital signalling would provide benefits to the network in Scotland, through improved performance, resilience, lower renewals costs, and avoiding reliance on a conventional signalling supply chain which is downsizing across Europe due to the move to ETCS.
- 2.9 There are also some aspects of digital signalling where the opportunities are even greater in Scotland than in England & Wales. In particular, forward plans for infrastructure in Scotland are more closely integrated with plans for new rolling stock and planned rolling stock changes are clearly connected to particular lines of route, which would make the phased introduction of ETCS far simpler in Scotland than in England & Wales. It should also be noted that some areas of Scotland's network may not be suitable for the deployment of digital signalling, for example the far north.

3. Network Rail’s estimated digital signalling renewal project costs and Signalling Equivalent Unit (SEU) rate

Project costs

3.1 In Network Rail’s initial CP7 submission, it provided forecasts for CP7 and CP8 expenditure for four digital signalling renewals projects in England & Wales. Since our initial advice in May and June 2022, we have also obtained Anticipated Final Cost (AFC) figures for these projects, across all relevant control periods. Forecasts are shown in Table 3.1 below. Network Rail has requested a total of £690m in funding across these four projects in CP7.

Table 3.1 Network Rail’s digital signalling renewals forecast (2023-24 prices)

Project	Proposed CP7 spend (£m)	Proposed CP8 spend (£m)	Anticipated Final Cost (AFC) of renewal Total (£m)**
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]

[redacted]

3.2 Network Rail’s initial CP7 submission was developed on a top-down basis using standard national rates which were then applied to its regional digital signalling workbanks. We asked Network Rail for a detailed break-down of its project costs. Network Rail shared details on how costs were developed in its infrastructure cost model (RAIL BI) for application by regions. The cost model has been used to develop top-down forecasts. This is the same method used to develop forecasts

for conventional signalling and reflects the early stage of development that projects are in. Network Rail has a similar level of certainty in these costs as it would for conventional signalling projects at this stage of development. This is because the process used to develop digital signalling renewals project forecasts is similar to conventional renewals project forecasts at this early stage.

- 3.3 Network Rail also provided details on the SEU rates which are discussed further in paragraph 3.10 below. A break-down of the SEU rate was provided for each project. This included a base rate which contains components that are required for all signalling renewals schemes. There is also an inclusion for local allowances which contain components specific to each renewal and consider network characteristics. Network Rail also provided reasons for differences in rates across projects. (See Figure 3.1 for a break-down of the components of a digital SEU).
- 3.4 For projects at this stage of maturity we expect to see some variation in each iteration of cost forecasts. Network Rail has started to develop bottom-up forecasts since its initial CP7 submission. However, these forecasts were not available for our detailed review.
- 3.5 Network Rail did provide some information from its 'live' cost model. Our review of this information showed significant changes to the SEU rates and consequently the project AFCs from those submitted in Network Rail's initial CP7 submission. There is an average of c.35% increase in AFCs in the 'live' cost model being used by projects, we understand this would in-turn increase CP7 costs by c.35%.
- 3.6 Changes have occurred due to assumptions in the 'live' version of the cost model being updated between planning rounds. For example, the rate for inflation has been increased. An assumption regarding a decrease in SEU rates has also been removed. Network Rail told us this assumption was included in its initial CP7 submission in error and this cost reduction factor should have already been adjusted for. The reason an assumed decrease in SEU rates should have been removed from the cost model is partly due to delays in the deployment of digital signalling which means the SEU rate will not decrease as quickly as previously thought.
- 3.7 The magnitude of these AFC increases is greater than we would expect to see for conventional signalling projects at this stage of development. The underlying cost increase is due to a higher SEU now being used in the 'live' cost model. This points to an issue with Network Rail's cost forecasts in its initial CP7 submission. Network Rail will need to ensure its bottom-up planning is as rigorous as possible to minimise continued cost uncertainty on these projects. Planning should consider

the learning from the ECDP and verify the assumptions used to develop its plan, to avoid any further sudden cost changes in future

- 3.8 We also expect the cost profile to change, that is, how much money is spent across years 1-5 of CP7 and CP8. We recognise that these costs will continue to be refined between now and the submission of Network Rail's Strategic Business Plan (SBP), which is expected in February 2023.
- 3.9 ***Advice: Whilst Network Rail's assurance of its cost forecasts is commensurate with the projects' stage of development to date, the costs are not fully assured. There has been an average c.35% increase to digital signalling renewals cost forecasts between Network Rail's initial CP7 submission and this supplementary advice. We do not have full confidence in the CP7 forecasts provided by Network Rail in its initial CP7 submission, given the early stage of development of its plans. We also expect the cost profile to change and some costs to move into CP8.***

Signalling Equivalent Unit (SEU) rates

- 3.10 Network Rail submitted information on how it calculates SEU rates. These are the rates used to measure and forecast the unit costs of a project and forms part of its overall project costs. It provided SEU rates for different work types used by projects, and a break-down of the SEU rate for each project. It provided reasons for differences in rates across projects, for example, local allowances made by regions.
- 3.11 There are two main SEU work types associated with digital signalling, these are explained below:
- a. Work Type 20 (WT20 - Re-signalling ETCS level 2, without signals) – this is a full renewal in digital form and is the primary SEU work type associated with digital signalling.
 - b. Work Type 29 (WT29 – Re-signalling ETCS level 2 with lineside overlay signals) – this work type used in areas for driver training, in these areas an overlay will be constructed so both conventional and digital signalling will run at the same time.
- 3.12 In our initial advice we commented on the large variance between the SEU rate for ECDP and the three other digital signalling renewals projects Network Rail is proposing to commence in CP7.

- 3.13 The SEU rates have been developed by using historical data from conventional signalling renewals projects as well as including local allowances [redacted] which may be required for digital signalling renewals. The local allowances include site specific line items such as junction lighting, additional cable security etc. The application of local allowances using local knowledge and expertise causes variations between the SEU rates for each project.
- 3.14 [Redacted]

Figure 3.1 [Redacted]

3.15 We expect the SEU rates to change between now and Network Rail’s SBP submission as it continues to refine its forecasts and gain a better understanding of each project’s requirements. There are key factors for Network Rail to consider in the development of its bottom-up calculation of the SEU rate, these include:

- a. the type of digital signalling being installed e.g., WT20 or WT29;
- b. the level of local allowances used by projects;
- c. understanding and implementing the access requirements for each project; and
- d. the projected timescales to agree the engineering requirements for each project.

3.16 [Redacted]

Table 3.2 Network Rail’s forecast WT20 SEU rate for digital signalling renewals included in its initial CP7 submission (2023-24 prices)

Project	SEU rate (£m) (WT20)	Number of SEUs	Total WT20 cost (£m)
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]

Source: costing information provided by Network Rail

* Note, the costs for ECDP include CP6 spend, and additional work types identified by the programme as it has carried out more rigorous planning (see Table 3.1)

3.17 ECDP has a lower SEU rate than other projects due to the bottom-up planning that has already been carried out. We therefore have more confidence in this estimate than the forecasts for the three other projects which have only carried out top-down planning and include a level of uncertainty greater than ECDP. Based on the SEU rate for ECDP it is possible that the other projects’ rates may decrease once teams are working directly with suppliers to refine their inputs to the modelling and

provide detailed estimates. Network Rail has not relied on supplier estimates which have been provided for ECDP when developing forecasts for the other projects.

- 3.18 R&D as part of the Target 190 plus (T190) programme aims to reduce Network Rail's SEU rates down to £190,000 (i.e., spending £190k, on average, per renewal). Network Rail has said this is only likely to be achievable once it has engaged in significant 'learning by doing' during early digital signalling renewals, probably during CP8. Following discussions with Network Rail we understand that the expected reduction will not be achieved in the timelines previously anticipated and therefore these reductions are not included in the SEU rates used for projects planned to commence in CP7. Network Rail assume a reduction in SEU rates will not happen until CP8. It should be noted this is dependent on the commencement of fleet fitment and digital signalling renewals in CP7.
- 3.19 We haven't seen sufficient evidence that project costs have been challenged by Network Rail based on the learning from ECDP. We expect Network Rail to provide its own assurance on project costs in its SBP submission which take account of evidence from ECDP.
- 3.20 Table 3.3 below sets out the WT29 SEU rate for projects that are using digital signalling overlays for driver training purposes and the number of SEUs expected.

Table 3.3 Network Rail's forecast WT29 SEU rate for digital signalling renewals planned to commence in CP7

Project	Re-signalling with overlays SEU rate (WT29) (£m)	Number of SEUs	Total WT29 cost (£m)
ECDP*	[redacted]	[redacted]	[redacted]
Warrington - Wigan	[redacted]	[redacted]	[redacted]

Source: information provided by Network Rail for supplementary advice

* Note, the costs for ECDP include CP6 spend, and additional work types identified by the programme as it has carried out more rigorous planning (see Table 3.1)

- 3.21 [Redacted] Different approaches and underpinning assumptions regarding driver training and mileage accumulation are being used by different regions, particularly for the schemes anticipated to be completed earliest.
- 3.22 [Redacted]

3.23 ***Advice: ECDP has a lower SEU rate than the three other digital signalling renewals projects as it has been developed further, in collaboration with a confirmed supplier. The three other projects have used the same approach as each other to develop the SEU rate and we consider this method is appropriate at this stage of development. We expect these rates to change between now and Network Rail's submission of its SBP – and based on rates used by ECDP we expect the rates to reduce. We expect Network Rail to provide its own challenge and assurance on project costs in its SBP submission, which should take account of evidence from ECDP. Whilst overlays (Work Type 29) are necessary for driver training they significantly increase the cost of the renewal. Network Rail should review the number of overlays being proposed to ensure this is an efficient use of funding.***

4. Network Rail's plans for fleet fitment and the expenditure included in its initial CP7 submission

- 4.1 In our initial advice we said there was a strong reason to include all the costs of digital signalling within the scope of the PR23 process, i.e., to also include the non-infrastructure costs that have previously been included in operators' plans. The majority of Network Rail's digital signalling costs in CP7 are not infrastructure costs but those related to fleet fitment (c.£1.2bn). Some of these costs will also be incurred in CP8. This was due to Network Rail wanting to include all the expenditure in the same place and the intrinsic link between digital signalling activities. Following further analysis and review of the information provided by Network Rail we still consider this to be the case. That said, there remains a degree of uncertainty with both supply chain readiness to deliver the required level of fitment and operating companies' capacity to release vehicles for retro fitment in line with the fleet fitment programme.
- 4.2 We anticipate funding for fleet fitment may be confirmed at the same time as, or as part of, the SoFA decisions. In our initial advice we highlighted that clarity and certainty of fleet fitment funding was crucial to the deployment of digital signalling as it is a critical enabler for the deployment of ETCS.
- 4.3 The funding requested by Network Rail for fleet fitment is currently included in the Eastern region and Route Services plans. Funders will need to decide whether fleet fitment should be included in Network Rail's plans for CP7. This advice gives our views on Network Rail's estimate of fleet fitment expenditure and whether it should be included in Network Rail's plans.
- 4.4 It is essential that the programme of fleet fitment is aligned to the digital signalling renewals plan as there is a long lead-time for ETCS fleet fitment. It therefore needs to be delivered in advance of the infrastructure renewal to ensure trains can run on the network.
- 4.5 Network Rail has told us that the fleet fitment expenditure of £1.2bn is needed to link to the forecast digital signalling renewals volumes in CP7 and CP8 and that sufficient progress is required in CP7 to realise the full benefits of the £1.2bn expenditure. Consideration needs to be given to the operational reasons for

having such an extensive fleet fitment programme in CP7 and the deliverability risks this presents. Especially given the fleet fitment programme has existing deliverability issues in CP6.

4.6 Network Rail inclusion of £1.2bn for fleet fitment in its initial CP7 submission included fitment for multiple categories and classes of fleet, including for passenger, freight, On Track Machines (OTMs) and Heritage and Charter (H&C) trains. This split is shown in Table 4.1 below. Note, not all units cost the same amount to fit, for example FiC fleet fitment is assumed to be more expensive than subsequent fleet fitment.

Table 4.1 Fleet fitment funding request for CP7 and number of units to be fitted, split by type of vehicle (2023-24 prices)

Fleet type	Proposed expenditure (£m)	Number of units to be fitted
Passenger	[redacted]	[redacted]
Freight	[redacted]	[redacted]
On Track Machines	[redacted]	[redacted]
Heritage and Charter	[redacted]	[redacted]
Total	[redacted]	[redacted]

Source: Network Rail's supplementary advice submission

4.7 We have carried out further analysis and reviewed the information provided by Network Rail between its initial CP7 submission and our supplementary advice. We have also received information from DfT which provides its views on progress with train operating companies (TOCs) and rolling stock leasing companies (ROSCOs).

Passenger fleet fitment ([redacted])

England and Wales

4.8 The LTDP outlines when sections of the rail network in England and Wales should be converted to ETCS operation. Since passenger services operate over defined routes, it is possible to link fleets of passenger vehicles to the signalling renewal of specific track sections. This then determines when vehicles need to be fitted with ETCS.

- 4.9 Network Rail has provided us with information that details all of the vehicle fitments that need to be carried out in CP7 in order to be ready for ETCS operation. In many cases that signalling will not be introduced until CP8, but the vehicle fitment programme is lengthy and fleet fitment needs to be completed in advance of the digital signalling renewal. We have not assured the fleet fitment programme and the assumptions included within. However, we consider Network Rail is taking a reasonable approach and that the fleet fitment should be commensurate with the CP7 renewals plan and CP8 workbank.
- 4.10 For each class of vehicles affected, Network Rail has considered which re-signalling project determines when they must be fitted. Network Rail has also identified the number of vehicles and the form of fitment required depending on the relevant digital signalling renewal. We understand DfT has shared information with Network Rail which outlines the initial plans for the procurement of new fleet and Network Rail has included these assumptions in its plans.
- 4.11 While it is possible to obtain accurate details of the current fleets operating, the plan for vehicle fitment has to anticipate future expenditure on fleet upgrades for deployment ten or more years ahead. This inevitably introduces many assumptions about what will be needed. The plan should therefore be treated as the current view of the future demands for ETCS fitment. This issue also highlights some potentially critical consequences of changing the future plans for vehicle utilisation. Any change to where vehicles are used will need to consider the effect on costs and timescales for ETCS fitment. In the long-term this becomes less of an issue because all current trains should be fitted with ETCS as part of the strategy set out in the LTDP and all new trains should be ordered with ETCS already fitted.
- 4.12 Note that we would expect CP8 funding would also include costs for the remaining passenger fleet fitments and that CP7 represents the beginning of this deployment.

Scotland

- 4.13 The passenger fleet for which funding has been requested in CP7 will predominantly operate in England & Wales. It will include some vehicles which operate on cross-border routes. Transport Scotland and Network Rail Scotland are developing plans for the procurement of a new fleet of suburban trains. We anticipate this fleet would be fitted with ETCS as standard to support the transition to digital signalling in future control periods in Scotland.

- 4.14 ***Advice: We consider the funding requested for passenger fleet fitment is commensurate with the extent of renewals planned to commence in CP7 and CP8 workbanks. We consider passenger fleet fitment could be funded via the PR23 process to ensure the delivery of this critical enabler for digital signalling.***

Freight fleet fitment ([redacted])

- 4.15 Freight locomotives are often described as “go anywhere” vehicles, meaning that they need to operate over the entire GB network. Whilst this is an oversimplification, it is true that, unlike passenger operations, they are not constrained to certain routes. Network Rail previously considered that the entire freight fleet would have to be fitted with ETCS before digital signalling renewals could be carried out. However, work by ECDP in conjunction with the freight sector identified only [redacted] of the national freight fleet would need to be fitted before the start of ETCS ‘no signals’ operation on the ECML. [redacted]. Network Rail should ensure the plan is commensurate with operational requirements and the digital signalling renewals it is planning to deliver.
- 4.16 The CP7 plan includes expenditure for the fitment of most of the remaining national freight fleet with a small cost anticipated in CP8 to complete the fitment programme.
- 4.17 [Redacted]
- 4.18 ***Advice: We consider it appropriate to include funding for freight fleet fitment in the PR23 process. This will safeguard existing commitments already made by funders for ECDP and support the future roll-out of digital signalling renewals. However, not all freight vehicles will require retro fitment as some existing classes may be retired before ETCS is deployed on certain routes.***

On Track Machines (OTMs) ([redacted])

- 4.19 On Track Machines (OTMs) are vehicles which are used to help maintain the network. As such, they will be required to access parts of the network which are transitioning to ETCS. ECDP has developed a plan for the fitment of OTMs which is similar to the freight fitment programme, such that a proportion of OTMs are to be fitted as part of that programme. [Redacted]
- 4.20 The fleet will be relatively expensive to fit because there are no large fleets of similar vehicles which means retro fitment will be more complex. Network Rail's plan for OTM fleet fitment assumes that it will not be appropriate to fit vehicles that are expected to be replaced in CP7 or CP8.
- 4.21 ***Advice: The strategy for OTM fitment is not as well developed as the freight and passenger fitment programmes. That said, it is important that funding is provided for the fitment of OTM vehicles alongside other fitment programmes in the PR23 process. Network Rail should ensure it dedicates resource to developing these plans further between now and the submission of its SBP so a decision can be made.***

Heritage and Charter (H&C) ([redacted])

- 4.22 Network Rail is using learning from ECDP, which has explored the technical and financial constraints to fitting ETCS to very old locomotives. The H&C plan that is currently funded via the RNEP and sits within the ECDP budget will take three H&C locomotives through the first-in-class (FiC) process, noting that when a unit is the first of its type to undergo fitment of ETCS equipment, this is usually more expensive than other types of fitment. This should develop greater understanding of the practicability of fitment.
- 4.23 Following these initial fitments, ECDP will determine if H&C fitment is feasible [redacted]. Network Rail should ensure the plan is commensurate with operational requirements and the digital signalling renewals it is planning to deliver.
- 4.24 There remains uncertainty about H&C fitment. These vehicles have existing rights to operate on the network. That said, it is harder to justify the fitment costs of H&C

vehicles. This is why the learning from ECDP is necessary to understand the feasibility of this fitment.

- 4.25 ***Advice: We consider funding for H&C fitment should be included within the PR23 process. However, this should be dependent on conclusions from the FiC feasibility fitment programme being carried out by ECDP. If fitment is not possible, we understand compensation may need to be considered for H&C operators in the event that operation of these services is no longer possible on the GB network.***
- 4.26 Suppliers and train operators need time to develop their own strategies for the fleet fitment programme. Confidence in the pipeline of work is also required. As such, the plan should be as robust as possible. Network Rail should provide sufficient transparency in its SBP submission of assumptions used to develop its programme and budgets. We consider these assumptions should be discussed with industry and endorsed by the appropriate board, e.g., Industry Council who oversee industry matters relating to digital signalling.

5. Review of option included by Network Rail in its initial CP7 submission to reduce passenger fleet fitment funding by c.£200m

- 5.1 As discussed in section 4 of this report, Network Rail included £1.2bn of funding for fleet fitment in its initial CP7 submission. This was split across passenger, freight, OTM, and H&C fleets.
- 5.2 Network Rail also included an option to reduce passenger fleet fitment funding by c.£200m and therefore defer some aspects of passenger fleet fitment into later control periods. This was referred to as part of its 'reduced cost option'. Network Rail did not clearly define the potential impacts of this option on affordability and deliverability at the time of our initial advice to the UK and Scottish governments. We asked Network Rail to provide more information in this respect so that we could carry out further assessment of this option.
- 5.3 This option is included in Network Rail's Eastern region's plan. As mentioned previously in this report, our views here relate to the inclusion of this funding in the PR23 process and not the allocation between England and Wales and Scotland. We therefore consider it appropriate to provide this advice to both DfT and Transport Scotland.
- 5.4 In June 2022, Network Rail led a workshop which presented basic illustrations to us on the potential quantitative impacts of reducing passenger fleet fitment funding. It also discussed the qualitative impacts that could occur if the total funding request of £1.2bn is not provided for fleet fitment during CP7.
- 5.5 Network Rail included multiple assumptions and caveats in its presentation to us. Many of these were due to external factors which could affect affordability and deliverability in future control periods for example supply chain capability to meet deliverability requirements.
- 5.6 Fleet fitment should be aligned to the infrastructure renewal plans and due consideration needs to be given to the volume of fleet fitment required to successfully deliver digital signalling renewals in CP7.

- 5.7 Reducing funding in CP7 by c.£200m could mean more signalling asset renewals in CP7 and CP8 will need to be renewed conventionally due to fleet fitment not having taken place for the planned digital signalling renewals. This assumes the fleet fitment programme is not delayed by other factors e.g., supply chain capacity or Network Rail's capability to deliver the programme to the agreed timescales.
- 5.8 As already discussed in this report, the volume of digital signalling renewals which are delivered is a critical driver for expected decreases in SEU rates across projects. This is because digital signalling renewals projects are required to develop the supply chain and help it to build its capability and capacity, consequently reducing unit rates.

Quantitative impacts of reducing passenger fleet fitment funding in CP7

- 5.9 There is a rising trend in conventional signalling SEU rates. It is highly likely this rising trend will get worse. However, more competition in the supply chain should reduce this trend. We recognised this in our signalling market study ([Signalling market study – final report | Office of Rail and Road \(orr.gov.uk\)](#)). We also note that digital SEU rates require sufficient competition in order for them to fall.
- 5.10 Based on analysis of the existing supply chain, Network Rail has estimated that three major digital signalling schemes per supplier (12 major schemes in total) are required to derive consistently lower unit rates than those that Network Rail is currently delivering.
- 5.11 Network Rail presented basic illustrations for two different scenarios. The first scenario, reduced fleet fitment by c.£200m, replacing it in CP8. The second scenario, reduced fleet fitment by c.£200m, replacing it in CP9. Network Rail has suggested that the first scenario could incur additional costs to industry of c.£2.6bn, whilst the second scenario could incur additional costs of c.£6.3bn based on whole life cost forecasts.
- 5.12 These additional costs initially seem high and have not been fully assured by Network Rail or ORR. We have, however, reviewed Network Rail's rationale and assumptions and we understand the calculations it has used to arrive at these additional costs. Table 5.1 below sets out the key drivers of these additional costs.
- 5.13 The majority of Network Rail's estimated cost increases are derived from the impact of having to renew the network conventionally instead of digitally in CP7

and CP8. Network Rail has assumed industry will find it difficult to lower unit rates without an aligned, incentivised supply chain delivering digital signalling renewals.

Table 5.1 Drivers of additional costs if funding for fleet fitment is reduced in CP7

Key drivers of additional costs	First Scenario	Second Scenario
Timeline for re-introduction of funding	Funding is replaced in CP8 which means passenger fleet fitment could catch-up by CP9	Funding is replaced in CP9 which means passenger fleet fitment could catch-up by CP10
Volume of conventional vs. digital renewals	CP8: 50% renewals are conventional CP9: majority of renewals are ETCS CP10: Industry is delivering volumes and rates consistent with steady state	CP8: 50% of renewals are conventional CP9: 50% of renewals are conventional CP10: majority of renewals are ETCS CP11: Industry is delivering volumes and rates consistent with steady state
Unit rate reductions don't materialise as quickly as expected	Unit rates fall more slowly than expected due to lack of industry experience in digital signalling renewals and the requirement for conventional renewals. Conventional rates may also increase due to technology obsolescence	Unit rates fall even more slowly than in scenario one. This is due to lack of industry experience in digital signalling renewals and the requirement for conventional renewals. Conventional rates may also increase due to technology obsolescence

Source: Network Rail supplementary advice submission

5.14 **Advice: We cannot say with any degree of certainty that the additional costs estimated by Network Rail are accurate. That said, we accept that the additional costs to the industry would be much greater than the suggested £200m saving by reducing investment in fleet fitment in CP7. This is because the volume of fleet fitment is closely linked to the cost efficiency of delivering digital signalling renewals.**

Qualitative impacts of reducing passenger fleet fitment funding in CP7

5.15 The industry requires a transparent pipeline of digital signalling renewals so that the supply chain can build its capability and capacity to deliver. Linked to this, our recent signalling market study (November 2021) considered that a visible pipeline and committed funding is required so as not to inhibit potential competitors from entering the market and growing it organically.

- 5.16 The information provided by Network Rail indicated that unit rates could be higher if the transition to ETCS is delayed in CP7.
- 5.17 Network Rail estimates there are roughly five years required between funding / planning of fleet fitment programmes and the commissioning of an associated digital signalling renewal. We accept this logic given the learning from ECDP. This means fleet fitment should start as early as practicable to deliver the digital signalling renewals in Network Rail's CP7 plans.
- 5.18 We consider a reduction in passenger fleet fitment funding would slow the deployment of digital signalling renewals. This would impact on Network Rail's ability to renew the network digitally in CP7 and manage the signalling asset workbank in CP8. This in-turn leads to an impact on the cost efficiency of deploying digital signalling.
- 5.19 ***Advice: If passenger fleet fitment funding is reduced such that volumes fall below the volumes required to deliver the renewals identified for CP7 successfully, it will impact the digital signalling renewals which can be delivered in CP8 and beyond. This impact is difficult to quantify but we recognise the qualitative impacts such as supply chain readiness and the conclusions we made regarding competition in our signalling market study.***

6. Understanding OTTO

- 6.1 Network Rail has included expenditure in its initial CP7 submission for the Technical Authority’s other renewals which support the deployment of digital signalling. One of these programmes is the development of Optimised Train Track Operations (OTTO). The development of OTTO has already started in CP6 and is in its very early stages. It is not tested or proven so the effect on future control periods is uncertain. We understand Network Rail will request funding to continue this development in CP7.
- 6.2 Network Rail anticipates funding for the development of OTTO in CP7 will come from funds allocated to the Technical Authority’s ‘other renewals’ plans which is separate from R&D expenditure that is actually referred to as “R&D”. The detail of funding being considered for OTTO is not currently available. Network Rail will need to ensure funding for R&D programmes is transparent and that it provides sufficient detail in its SBP submission.
- 6.3 The OTTO concept is based on a level within ETCS referred to as Limited Supervision (LS). It includes a range of options that are being developed by Network Rail which may assist with the migration to ETCS.
- 6.4 OTTO seeks to bring expanded functionality to existing systems using current on-board equipment such as Mk IV TPWS (Mark Four, Train Protection & Warning System) or AWS (Automatic Warning System) in conjunction with additional off-the-shelf components.
- 6.5 Network Rail is considering various options for further development in CP7, these are listed in Table 6.1 below:

Table 6.1 On-board and trackside options being considered as part of OTTO concept

Systems	Options	Description
On board systems	TPWS Flex	Uses existing class B system and additional positioning to detect sensors with a smart integrator and defined communications
	TPWS Flex+	As above, but with the addition of a Driver Machine Interface (DMI) to provide movement authorities

Systems	Options	Description
Trackside systems	ISLA (Isolated Speed Limited Authority)	A set of speed limits (permanent and temporary) that can be transmitted to a Flex or Flex+ train
	RBLS (Radio Based Limited Supervision)	As above, but with the inclusion of aspect information

Source: Network Rail

- 6.6 Network Rail is still developing its detailed strategy for OTTO so we don't currently know an accurate cost or the benefits that it may bring, partly due to the level of detail available. Network Rail should make sure its strategy is clear and both England & Wales and Scotland understand the benefits it could bring across their rail networks.
- 6.7 We consider OTTO is a promising development that may deliver benefits to early ETCS track fitments, or it could provide a temporary mitigation if there are delays to digital signalling renewals or cab fitment programmes. That said, the funding required to develop OTTO should be linked to the benefits it will deliver.
- 6.8 We understand train fitment for OTTO is simpler than for full retro fitment of existing fleet. Network Rail has estimated it could take approximately 2-4 days instead of two weeks to retro fit ETCS on-board equipment. This should deliver lower costs through trains being removed from the GB network for a shorter period of time.
- 6.9 Another benefit of OTTO is its modular based design, such that the system configuration can be aligned to the business needs of a route section / train operator.
- 6.10 Network Rail considers OTTO could provide additional safety and performance benefits in OTM vehicles and possession management strategies greater than those present in vehicles without ETCS. It will not however deliver the full benefits that ETCS will. The reason for these additional safety and performance benefits is due to greater control over vehicle management in and out of possessions.
- 6.11 We are conscious that OTTO and ETCS renewals could generate numerous changes for Network Rail's workforce to manage. Network Rail should consider whether this is the most efficient way of delivering the objectives of the programme, especially as OTTO solutions may be quickly followed by ETCS renewals.

- 6.12 We can see the advantages of including funding for OTTO in the PR23 process,. This is because it can support the transition to full ETCS in some areas, although we recognise it will only deliver partial benefits.

England and Wales

- 6.13 It is important that the deployment of ETCS continues due to the complex timings of infrastructure renewals compared with the upgrading of the fleets. OTTO allows for the introduction of increased functionality sooner, allowing for the fitment of the trackside ETCS infrastructure as the fleet would already be compatible with digital signalling. This will then bring the fuller ETCS capability as and when the new ETCS fitted trains are authorised to use the digital-ready infrastructure.

Scotland

- 6.14 The fitment of OTTO may benefit the network in Scotland. Network Rail is still developing the concept so it is not clear what the benefits will be or what areas of the network will benefit. We consider the fitment of OTTO at cross-border routes may bring safety and performance benefits though track fitment where rolling stock already fitted with ETCS travel to Glasgow and Edinburgh.
- 6.15 Further detailed analysis is required to understand the benefits that may be achieved for lower traffic and rural routes.
- 6.16 ***Advice: It is essential that the transition to full ETCS continues to progress. We consider that if OTTO is developed, tested and proven as part of Network Rail's R&D it may help to manage some of the affordability and deliverability challenges faced by Network Rail in future control periods by delivering partial solutions faster on the way to full ETCS in future.***



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