Lot 2 - Enhancements

ORR

31 May 2024

Some information has been redacted from the published version of this report where its disclosure could prejudice commercial interests.'

FINAL REPORT

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EXECUTIVE SUMMARY

The Office of Rail and Road (ORR) independently monitors National Highways' management of the strategic road network (SRN) – the motorways and main A roads in England. As part of its role, the ORR advises the government on the appropriate level of funding and performance requirements for future road periods. The ORR conducts a review of National Highways' draft Strategic Business Plan (dSBP) and provides advice to the Secretary of State on the extent to which the proposed requirements for Road Investment Strategy (RIS) 3 are challenging and deliverable within the financial resources to be provided. This is known as the Efficiency Review.

The Department for Transport is yet to finalise the draft RIS. However, to ensure that planning for RIS3 continues to progress, the Department instructed National Highways to prepare an interim version of its draft SBP based on an agreed set of assumptions and requirements and invited the ORR to review those plans. This report sets out the findings of a review of the interim draft SBP. For brevity, in the remainder of this report we refer to the interim submission as the 'dSBP'.

The ORR commissioned CEPA to review the dSBP and provide case study evidence from six proposed enhancement schemes to inform ORR's overall assessment of whether the planned RIS3 enhancement programme is challenging and deliverable within the funds available for RIS3.

We reviewed National Highways' approach to cost estimation, project scheduling, and made an overall assessment of the key risks and dependencies to the successful delivery of each project. We conducted a desktop review of the dSBP, supporting materials and responses from National Highways' to Requests for Information, and clarified our understanding of the proposed approach through a challenge workshop with each of National Highways' project teams and the capital portfolio management team.

This report also provides our overall observations on the development of the sample schemes reviewed, highlighting areas where there has been a significant increase in cost or where National Highways has applied its judgement but the ORR might take a different view. We also provide recommendations for ORR, which might form the focus of ORR's challenge with regards to the proposed enhancements package in the dSBP.

Findings from the sample review

We summarise the main findings for each sample scheme below.

A46 Coventry Junctions (Walsgrave)

This is a £112.5m scheme which forms the second stage of investment in two heavily congested junctions south of Coventry in the West Midlands. There has been a 35% cost increase since the start of RIS2 because detailed design work identified that the initial scheme options was not deliverable. The latest interim cost forecast is £141m so National Highways is working to identify opportunities to bring the scheme back within the approved budget.

National Highways requires DCO consent before it can start work on construction. It has yet to submit the application, which is planned for autumn 2024. By this point National Highways has spent over £60m on completing the first stage (Binley Junction), however if the DCO application on Walsgrave fails then the outturn value for money on the overall investment will be poor.

M3 Junction 9

This is a £249m scheme to increase capacity at a congestion junction on the M3 in the South-East of England. The cost has increased by £138m (107%) since the start of RIS2 due to changes in scope and optioneering, the pause in the Smart Motorways Programme, and exceptional inflation in construction prices. There is greater confidence in the latest cost estimate but National Highways awaits the outcome of its DCO application which may introduce additional requirements.

The project schedule appears reasonable relative to a typical National Highways project. The construction period for the scheme is 35 months which means that National Highways expects to spend approximately ~£5m per month during the construction phase, compared to a RIS2 average of £8.2m.

A66 Northern Trans-Pennine

This is a [**text redacted**] billion programme in the North-West of England which consists of 11 different projects to upgrade 30km of single carriageway and improve junctions along a strategically important route. DCO consent has been granted but National Highways has received a legal challenge. It is too early to tell if this will impede progress.

The cost estimate has increased by [**text redacted**] (25%) since the start of RIS2 due to inflation in construction prices in recent years, the additional inflation and project management costs incurred during the delay to the decision on the scheme's DCO application, additional scope and the costs associated with delaying part of the schedule into RIS3. Over a similar period, the BCR has fallen from 1.8 to 1.1. Despite the 'Project Speed' initiative, National Highways is seeking ministerial approval to extend the construction phase from 5 years to 7 years.

There is greater confidence in the cost and schedule estimates as the project has matured, although National Highways plans to update the cost estimate to reflect the latest changes introduced through the DCO. The estimate includes a [**text redacted**] risk uplift. Whilst this is not unreasonable, the A66 will be a challenging scheme to deliver given the legal challenge, the complexities of project integration and the extended delivery phase. We would expect to see a risk uplift closer to [**text redacted**], or else a stronger justification for the lower provision applied by National Highways.

A428 Black Cat to Caxton Gibbet

This is a £1 billion project to construct a new 10-mile dual carriageway south of St Neots in South Cambridgeshire and support economic growth in the Oxford–Cambridge corridor. The cost has increased by ~£270m (35%) since the start of RIS2. The main drivers of this increase are the exceptional inflation in construction prices, and the additional inflation and project management costs that resulted from a legal challenge to the DCO consent.

There is greater certainty in the cost estimate now that it is contracted with the supply chain and the scheme is in construction. However, the risk provision of 6.7% is significantly below the average 20% cost overrun observed on UK road schemes at FBC stage, as set out in the research which informs DfT's WebTAG guidance. We challenge whether confidence in the cost estimate is sufficient to justify such a low risk provision. In response to our draft report, National Highways told us that subsequent project negotiations and contract price agreements resulted in a higher 11% risk provision. However, it did not set out the basis of this calculation nor does it explain why 6.7% was deemed appropriate in the production of the most recent cost estimate.

The legal challenge delayed SoW by 12 months. This milestone has since been achieved, with the project aiming for completion by March 2027. Our review found no major present concerns with the schedule. However, at the peak of construction this is a large project with a monthly expenditure 'run rate' of just over double that of an average RIS2 scheme. As this is a relatively large enhancement scheme, we suggest that ORR monitors the scheme's Earned Value metrics closely as the A428's scale might limit National Highways' ability to ramp up its activity and 'catch up' if it were to fall behind on the critical path.

A417 'Missing Link'

This is a £540m, 3.4 mile dualling scheme on the last remaining single-carriageway section of the A417 in the South-West of England. The project cost estimate has increased by ~£160m (42%) since December 2018 as a result of exceptional levels of inflation on construction prices, design changes and delays associated with the National Trust withdrawing its support from the scheme and having to replace the previous Delivery Integration Partner. The project has achieved its SoW milestone. Both internal and external assurance indicate the project is progressing to schedule and it is expected to complete in February 2027. We find that the approach to cost and schedule estimation is reasonable and more certain now that the scheme is contracted and in construction, although we recommend that ORR challenges the risk, inflation and carbon overlays which have been applied.

With regards to risk, research on reference class forecasting commissioned by DfT to inform the optimism bias uplifts used in transport appraisal finds that even at the FBC stage, for the PMean level of certainty, the average UK road project would require a risk uplift of 20% over the base cost estimate if it is to be delivered 'on budget'. The A417 has risk provision of 12.4%: whilst we acknowledge that National Highways has a reasonably high level of confidence in its cost estimates by this stage of the project lifecycle, it has not set out the evidence or justification to support the significant difference between its view of an appropriate risk uplift and the external evidence.

Lower Thames Crossing

If built, the Lower Thames Crossing (LTC) will be significantly bigger than anything National Highways has delivered before, both in cost and construction schedule. Based on the latest most likely estimate [**text redacted**], the LTC is expected to cost £8.9 billion (including portfolio risk). However, there remains substantial cost uncertainty: the P50 estimate for the scheme is [**text redacted**]. The LTC construction phase will last between 81 and 92 months and will open Q1 2033 at the earliest.

National Highways has estimated development costs in the region of £1,091m, of which £750m is included in the dSBP. This leaves a development funding gap of £341m but there is a wider ongoing discussion between National Highways, DfT and HMT on whether and how to fund the scheme given affordability constraints.

The LTC programme depends on funding certainty by spring 2025 to support a 'Go/No Go' decision in its current form. Any delay beyond this point will have much greater consequences on both costs (supplier contracts may require renegotiation and/or retendering) and Start of Works (August 2026).

Including portfolio risk, uncertainty allowance and project risk results in a [**text redacted**] risk provision [**text redacted**] against the total base cost of the scheme. For a project of this size, stage of maturity and substantial uncertainty, we would expect to see a risk provision in excess of [**text redacted**] of project costs as National Highways' existing evidence base may not be as reflective of a scheme of this scale and complexity.

The scheme has been rephased and National Highways has used this opportunity to test the robustness and elasticity of the schedule. It has also embedded a different operating model with a dedicated internal division and integrated commercial, technical and programme integration partners. But this project is of a different scale and risk profile and has more complex integration challenges which ultimately reside with National Highways.

Overall conclusions

Although the RIS3 portfolio will be challenging to deliver, there are fewer enhancement schemes than there were in RIS2. Since the focus will be on completing the 'RIS2 tail' the portfolio is also more developed than at the same point in the development of RIS2 and there has been greater opportunity for collaboration with the supply chain to ensure that both the costs and the schedule are commercially deliverable.

We find that National Highways' cost estimation process is procedurally sound. As with any process there is some need for the application of assumption and expert judgement on a case-by-case basis, particularly where National Highways has less complete information. In that context, we observe that National Highways' estimates adopt a conservative approach to forecasting inflation (the OBR's November 2023 CPI inflation forecast plus 150 basis points). If ORR is minded to reduce the forecast to CPI plus 75 basis points – which better reflects the long-run average difference between CPI growth and construction price inflation – the impact is estimated in the table below.

Table 0.1: Impact of CPI plus 75bp inflation on enhancement scheme costs in RIS3 (£m, nominal)

Scheme	2025/26	2026/27	2027/28	2028/29	2029/30	RIS3
A428	-9.07	-8.05	-1.29	-0.02	-0.02	-18.45
A417	-5.17	-3.07	-0.29	-0.08	-0.07	-8.69
A66	[**text redacted**]	[**text redacted**]	[**text redacted**]	[**text redacted**]	[**text redacted**]	[**text redacted**]
M3 Junction 9	-2.41	-0.71	-0.11	-0.04	0.00	-3.26
A46 Walsgrave	-0.29	-1.80	-3.82	-0.23	-0.15	-6.28
Scenario A	-41.78	-56.25	-37.58	-16.48	-36.24	-188.33

Source: CEPA analysis of National Highways' cost estimate forms and dSBP Financial Model

In our view, National Highways' approach implicitly embeds 'downside risk' on inflation into its central estimates. If considered in isolation, this would flow through into inefficient base cost estimates for each scheme. There is also a risk that it double counts the risk of exceptional inflation because it is (a) already captured in the base cost estimate, and (b) National Highways uses the Central Risk Reserve (CRR) as cover for all overspend, regardless of its source.

On the other hand, we are concerned that some of the sample schemes do not have an adequate provision for risk, given the residual challenges that the Company must overcome. For example, the A428 includes a risk allowance of just 6.7% despite being the second-largest project that National Highways has delivered in recent times. The A66 includes a risk allowance of [**text redacted**] compared to [**text redacted**] for schemes at a similar stage of maturity despite being the largest RIS3 scheme, the involvement of three different Delivery Integration Partners, the integration of 11 different projects, and a legal challenge to the DCO consent.

The CRR as proposed accounts for around £420m or 10% of the enhancement portfolio under Scenario A. We recommend that ORR considers National Highways' approach to inflation and the sizing of the CRR in the round, to ensure that the portfolio as a whole is appropriately funded.[1]

When we look across the sample schemes, we observe early cost estimates that have a very wide range around them and a tendency for the most likely estimate to move higher in that range as the scheme progresses. In a scenario where there are a lot of new projects in the RIS, ORR should be mindful of this trend as it considers whether the programme is deliverable within the funds available.

Although there are fewer and more developed enhancement schemes in the RIS3 portfolio, there remain several schemes which are larger and more complex than the 'typical' National Highways project. There will be four schemes which are broadly equivalent to the A14 in construction cost (A428, A66, A12 Chelmsford to A120 Widening, A303 Amesbury to Berwick Down) plus the LTC. Whilst the Company can explain how it is evolving its operating model to prepare to deliver the LTC and has tried to embed lessons learned from the delivery of the A14 more widely, the ORR needs to consider more widely whether:

- The RIS3 dSBP reflects appropriately on the organisational capabilities and capacity required, to ensure that the Company is ready and able to deliver; and
- The availability and allocation of funding (including central risk reserve) is appropriate to ensure the deliverability of the portfolio as a whole. Specifically, that the risk of overspend on the largest schemes will be appropriately managed to reduce the likelihood and impact of disruption spreading to other schemes.

Additionally, National Highways does not appear to have priced external risks to the portfolio sufficiently – although we recognise that individually these are challenging to account for. These risks include reaching agreement with DfT/HMT on funding for the LTC amidst a potential change in government and any resulting reprioritisation of capital spending; the potential for a new ministerial team at DfT to be installed at around the time of the DCO submission for the A46 Coventry Junctions (Walsgrave) scheme; and the potential delay associated with the legal challenge to the A66 DCO decision.

In conclusion, whilst the enhancements plan is more developed and the evidence base is more mature than other aspects of the dSBP that we have reviewed (e.g. environment and safety), we find that the pressures identified above indicate that the dSBP is more overprogrammed than National Highways suggests (currently £921m). This is partly offset by reducing the impact of the inflation forecast on scheme costs, assuming that it is not a one-for-one transfer from scheme estimates to the CRR.

Recommendations for the Efficiency Review

Our recommendations to ORR are as follows:

(A) **Affordability within the likely funds available.** ORR should engage with DfT and National Highways to challenge whether the current enhancement package ('Scenario A') is deliverable, and to consider whether sufficient focus has been given to the development and assessment of alternative enhancement packages (i.e. with more rephasing, deferrals or cancellations).

[1] For each case study we report the latest cost estimate, either that which has been produced by National Highways' commercial function (documented in a CE300 Form) or the latest position reported to the IPDC. We recognise that these are snapshots taken at a point in time and that the cost estimates will continue to evolve. Where possible, we report figures both *including* and *excluding* 'portfolio risk'. Portfolio risk is used by National Highways based on internally established parameters to estimate the costs that it might incur in relation to the delivery of the portfolio, but it does not directly inform the budget that is set for each scheme, or the overall size of the Central Risk Reserve (i.e. the sum of portfolio risks does not equal the Central Risk Reserve).

(B) **DCO challenges.** ORR should consider whether the assumed period between DCO submission, consent and Start of Works is sufficient on more contentious schemes, such as the A66 and Lower Thames Crossing. In that context, it should also engage with National Highways to better understand the risk of RIS3 expenditure slipping into RIS4 – noting that the main risks relate to the A66 (which may be resolved before the start of RIS3) and the main construction of the LTC (which may be funded outside the RIS3 SoFA).

(C) **Inflation risk.** ORR should consider National Highways' approach to inflation and the sizing of the CRR in the round, to ensure that the portfolio as a whole is appropriately funded.

(D) **Monitoring metrics.** ORR should consider what it would require from an improved set of Earned Value metrics, to ensure that it is better sighted on emerging risks to delivery and potential slippage during the construction phase of larger and more complex schemes.

(E) **Lessons learned from RIS2.** In the context of the less developed schemes in the RIS3 package, ORR should consider whether National Highways has fully embedded lessons learned from the experience of managing the RIS1 and RIS2 enhancement programmes. There should be a particular focus on the approach to early-stage cost estimation and subsequent cost escalation; a shared understanding of scope and scheme requirement uncertainties (including those costs which emerge through the DCO process); and how these factors influence the level at which the overall funding settlement is made.

(F) **Organisational capacity and capability.** ORR should consider whether the dSBP provides sufficient evidence to demonstrate that National Highways has the organisational capacity and capability to deliver 4 schemes of similar scale to the A14 in the same Road Period, as well as the Lower Thames Crossing, noting that under Scenario A the construction of the A66 and the A12 will be rephased and deferred until later in RIS3 which might allow for resources to be transitioned more efficiently.

(G) **Delivery of expected benefits.** Ahead of RIS3, the ORR might consider its role in gathering evidence on the evolution of early-stage cost estimates and highlighting the interdependencies with the economic case for major enhancement schemes. Whilst National Highways operates a 'value for money watchlist' and has a value for money escalation process with DfT, we observe a deteriorating trend in the BCR as costs increase over time. This calls into question whether the affected schemes should have progressed as far as they have (acknowledging that the BCR is only one factor in the overall value for money assessment).

(H) **Supply chain arrangements**. Whilst the Regional Delivery Partnerships approach is expected to deliver material efficiency savings over RP2, its application has on occasion introduced tensions between National Highways and its contractors around price and performance. ORR might also engage with National Highways to undertake an independent review of the benefits that its supply chain arrangements have delivered to ensure that the whole business gains from these experiences.

1. INTRODUCTION

1.1. CONTEXT TO THE RIS3 EFFICIENCY REVIEW

National Highways has presented an interim version of its draft Strategic Business Plan (hereafter referred to as the 'dSBP') to the Office of Rail and Road (ORR) to facilitate an Efficiency Review. In relation to the RIS3 improvement schemes ('enhancements'), ORR scrutinises the dSBP to assess whether the portfolio as whole is both efficient and deliverable within the funding available.

At the time of writing, DfT has yet to confirm the level of funding available to National Highways in RIS3 (the 'Statement of Funds Available' (or 'SoFA')). Given planned constraints on public expenditure in the coming years, National Highways proposes a package of enhancement schemes which it considers appropriate and deliverable within a funding envelope which is broadly similar to that which it received in RIS2 (~£24 billion). However, in recent years high energy prices have fed through into significant cost inflation in the prices of construction plant, equipment, materials and labour. The official ONS Construction Output Price Indices: New Work (Infrastructure) index increased by 23% between April 2020 and December 2023.

In that context, National Highways is proposing a smaller number of improvement schemes compared to RIS2, such that (in its view) the overall RIS3 package is affordable. It is proposing only to continue with the RIS2 'tail' – those enhancement schemes which started (but are yet to complete) construction in RIS2 or where the Start of Works milestone was deferred until early in RIS3 (e.g. due to delays in receiving development consent). There are several larger schemes which the Company has been developing in the expectation of starting later in RIS2 or early in RIS3 but which have been delayed, including the Lower Thames Crossing, A303 Amesbury to Berwick Down, and the A46 Newark Bypass.

At present, National Highways has costed its scaled-back 'RIS2 commitments' enhancements package at £4.2 billion (Scenario A, excluding the Lower Thames Crossing and the A303 Amesbury to Berwick Down). The dSBP as a whole sets out around £24.9 billion of investment which leaves a financial pressure of around £920m. National Highways is in continuing discussions with DfT about potentially rephasing, deferring and/or cancelling several planned schemes to ensure that the RIS remains affordable and deliverable within the funds available.

1.2. SCOPE OF THIS REPORT

The ORR commissioned CEPA to provide case study evidence from six proposed enhancement schemes to inform its overall assessment of whether the planned programme of enhancement projects is challenging and deliverable.

ORR asked us to address the following scope issues, which inform the structure of each case study:

1. **Review of the approach taken to cost estimation.** We looked at whether the approach taken to the project in question is in line with National Highways' overall stated approach. We describe and evaluate approach taken to accounting for project risks. We consider how forecast costs have changed over time and confirm that the estimates in the dSBP are up-to-date. Finally, we critically evaluate the evidence put forward to justify recent changes to forecast costs.[2]
2. **Review of the approach to project scheduling.** We looked at how key project milestones (i.e. Start of Works and Open for Traffic) have been established, how this compares with contracted commitments and how the Company has built contingencies into project schedules.
3. **An overall assessment of the key risks and dependencies to the successful delivery of the project**, focusing on whether risks and dependencies have been appropriately factored into the project's cost and schedule estimations.

[2] In relation to the Lower Thames Crossing, our scope was only to conside the proposed level of development expenditure and consider whether it is appropriate and justified.

We conducted a detailed review of each case study through a combination of desk-based review of information provided by National Highways; challenge workshops with individual project teams and the capital portfolio management team; and Requests for Information (RFIs) to clarify the justification for the Company's proposals, to which it has submitted written responses.

1.3. Structure of this report

The six case studies chosen by ORR for the review are located in the report as follows:

- Section 2 sets out our findings with respect to the **A46 Coventry Junctions (Walsgrave)** scheme. This is the second phase of an investment into two junctions around Coventry. The first phase was the Binley junction upgrades, which did not require a Development Consent Order (DCO) and so the Company was able to progress delivery much sooner: the scheme reached its Open to Traffic (OfT) milestone in November 2022. The second phase of works at the Walsgrave junction is the subject of this review and is in the preliminary design phase (PCF Stage 3) targeting Start of Works (SoW) in September 2026 and Open for Traffic (OfT) in 2028.
- Section 3 sets out our findings with respect to the **M3 Junction 9** scheme. This scheme involves several upgrades to the junction, with the aim of better linking the M3 and A34 in both directions, reducing journey times and improving road safety. The scheme was granted DCO consent in May 2024, before construction works can commence in March 2025.
- Section 4 sets out our findings with respect to the **A66 Northern Trans-Pennine** scheme. This scheme consists of 10 different projects between the M6 at Penrith and the A1(M) Scotch Corner. It involves upgrading 30km of single carriageway along 6 sections of road to dual carriageway standard and making improvements to several junctions along the route. DCO consent was achieved in March 2024 but the Final Business Case must be considered and approved by the UK government before construction starts in summer 2025.
- Section 5 sets out our findings with respect to the **A428 Black Cat to Caxton Gibbet** scheme. This involves the construction of a new 10-mile dual carriageway between the Black Cat roundabout on the A1/A421 in Bedfordshire and the Caxton Gibbet roundabout on the A428 in Cambridgeshire. The scheme began its construction phase in December 2023, following a year-long delay to its Start of Works milestone due to a judicial review application to the scheme's DCO consent. It is expected to complete in March 2027.
- Section 6 sets out our findings with respect to the **A417 'Missing Link'** scheme. This scheme is centred around 3.4 miles of new dual carriageway on the only remaining singe-carriageway section. DCO consent was granted in November 2022 and Start of Works was achieved in February 2023. The scheme is planned to OfT in February 2027.
- Section 7 sets out our findings with respect to the **Lower Thames Crossing** project (£8.9 billion). If constructed, the Lower Thames Crossing will become the longest road tunnel in the UK, stretching 2.6 miles under the River Thames. The scheme includes 14.3 miles of new road connecting the M2, A2, A13 and M25, and the construction of fifty new bridges and viaducts. The initial DCO application was withdrawn in November 2020 after the Company received early feedback from the Planning Inspectorate, and a revised DCO application was submitted in October 2022. National Highways is planning to start construction works in August 2026 and complete the scheme by Q1 2033. The scope of our review is limited to the development costs associated with the project, which accounts for £750m of funding in the RIS3 dSBP.

Finally, in section 8 we summarise our findings 'in the round', identify cross-cutting issues and make recommendations which might inform ORR's advice to the Secretary of State.

2. A46 COVENTRY JUNCTIONS (WALSGRAVE)

Key findings

- The A46 south of Coventry is the busiest section on the south midlands route. It operates at an average peak period speed for traffic of between 41mph and 50mph, dropping to between 21mph and 30mph on approaches and is in the top 10% for vehicle hours delay. Two junctions on the A46 at Coventry are being upgraded as a single investment, however this work is taking being delivered in two phases.
- The scheme was originally included in the RIS2 investment package and there has been a gradual drift upwards in the original cost range for the scheme which indicates that the 'MLE' is less meaningful in the early PCF stages given option and design uncertainties. There has also been a ~25% overspend on Binley due to a supply chain insolvency event and materials costs increases.
- Substantial expenditure (~£60m) was incurred without an awareness of the feasibility of Walsgrave designs which led to options being undeliverable and a 35% cost increase. Three preferred options were deemed undeliverable due to EA's updated flood modelling and further traffic modelling proving two options would increase congestion.
- Considered a joint investment with the Binley upgrade. By its own admission, National Highways states that if the DCO for Walsgrave is not granted, the Binley scheme did not have a standalone business case. The BCR for the joint schemes had reduced from 1.9 to 1.7, representing Medium VfM. The Binley scheme's VfM is heavily dependent on the Walsgrave scheme going ahead.
- This is a scheme where there may be further delays before the DCO is granted due to external events beyond NH's control. There is a risk that further scope and inflation may be added to the scheme creating pressure on the scheme budget and potentially contributing to wider portfolio pressures.
- The construction period for the scheme is 21 months which means that National Highways expects to spend approximately ~£5m per month during the construction phase, compared to Binley's average at £1.6m and a RIS2 average of £8.2m.
- One contractor was selected across the two schemes. This should have increased incentives on the contractor to deliver to budget and time. But the duration of time between the schemes being constructed is likely to have reduced the efficiencies which could have been achieved.
- The overall risk provision for the scheme including project risk, uncertainty allowance and portfolio risk is 21% of base costs. This risk allowance is in line with other benchmarks, for example, DfT's WebTAG guidance is for a risk provision of 23% of project costs at OBC stage.[3]

2.1. BACKGROUND TO THE SCHEME

The A46 is a strategic link between the East and West Midlands, and beyond, linking the M1 J21 and M40 J15. The route connects a number of major employment sites to the wider motorway network, forms a key element of the North-South travel to work area, and is a key freight route for HGVs. The A46 south of Coventry is the busiest section on the south midlands route. It operates at an average peak period speed for traffic of between 41mph and 50mph, dropping to between 21mph and 30mph on approaches and is in the top 10% for vehicle hours delay.

Two junctions on the A46 at Coventry are being upgraded and this work is taking being delivered in two phases. The project aims to reduce congestion and improve the operation and efficiency of the existing transport network associated with Walsgrave junction to increase capacity. The scheme also aims to maintain the A46 to a safe and serviceable condition with maintenance being considered during design. Lastly, the scheme aims to support and facilitate economic growth, generating employment and residential development opportunities.

The A46 Coventry Junctions scheme was originally included in the RIS1 investment package. The first phase of the A46 Coventry Junction upgrades was the Binley junction, which did not require a DCO to be granted. Construction commenced in March 2020 and was completed in 33 months later in November 2022. The Walsgrave junction is the second junction upgrade. At the beginning of the scheme, it was unclear whether a DCO would be required. It

[3] TAG: optimism bias workbook

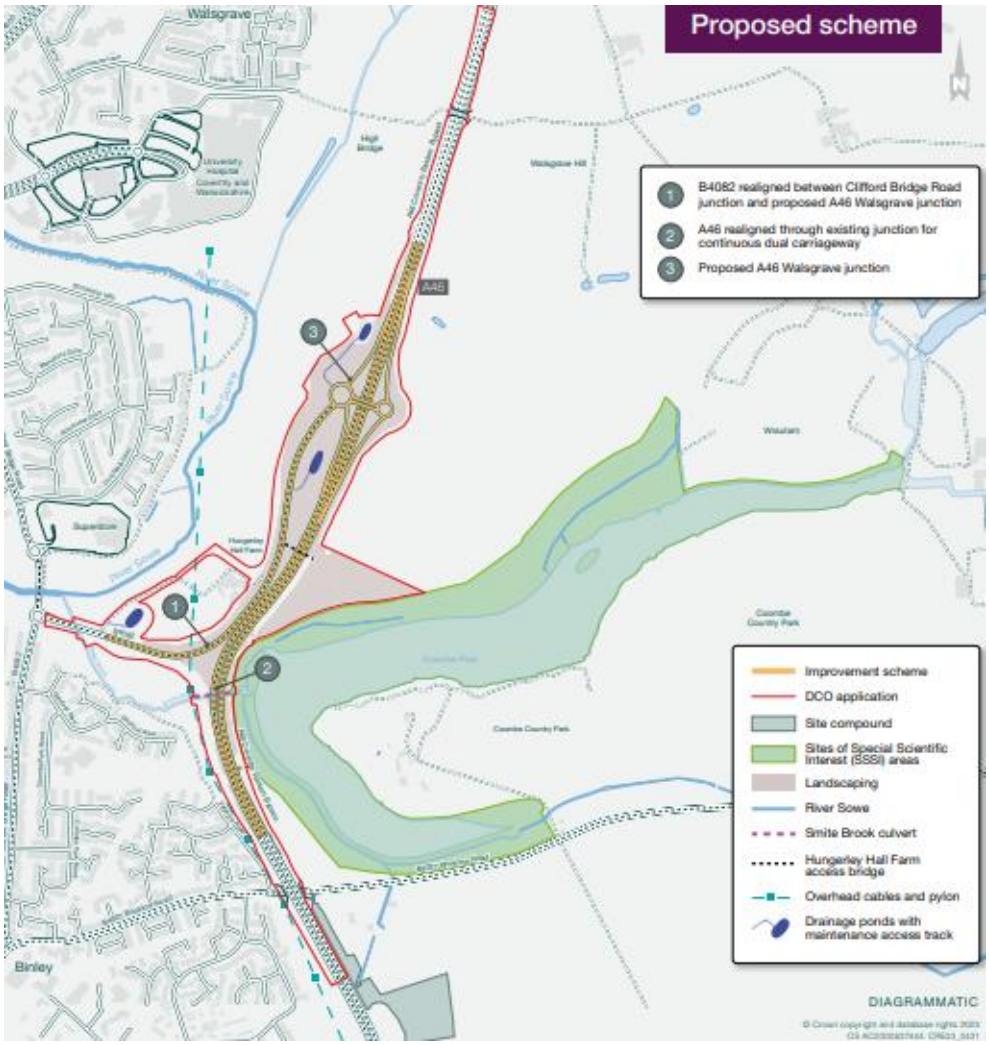
transpired that a DCO would be required due to the proximately of the Walsgrave site to a SSSI, which resulted in the junction having to move. The scheme has recently completed its statutory consultation and is preparing a report detailing the findings to be released in March 2024. The scheme will be submitting its DCO application by October 2024.

Given that the Binley and Walsgrave junction upgrades have been treated a single investment, there are a number of dependencies between the schemes. The outturn BCR of the Binley scheme is driven by whether Walsgrave goes ahead. There are a number of issues associated with the two schemes being treated as a single investment. Whilst option selection was taking place for Walsgrave, Binley (SoW March 2020) was 18 months into construction. This raises questions about the extent to which the schemes have been considered together. There are potential upsides to this approach and using a single developer across the schemes. This may provide increased incentives to the developer in order to deliver to budget and time. However, the duration of time between the schemes being constructed is likely to have reduced the efficiencies which could have been achieved.

By its own admission, National Highways states that if the DCO for Walsgrave is not granted, the Binley scheme did not have a standalone business case. The BCR for the joint schemes had reduced from 1.92 to 1.69, representing Medium VfM. The Binley scheme's VfM is heavily dependent on the Walsgrave scheme going ahead.

Octavius were appointed to deliver the construction of both the Binley and Walsgrave schemes. The contractor was appointed to deliver the Walsgrave upgrade in February 2023, following its completion of the Binley junction upgrade which was opened in November 2022.

Figure 2.1: Map of the proposed solution for the A46 Coventry Junction Walsgrave



Source: National Highways

Table 2.1 Background information to A46 Coventry Junction Walsgrave

Background information	
Cost estimation	Target outturn cost: £112.5m RIS3 Baseline: £195.5m (March 2024) (including Binley) Mid-level estimate: £141m excluding portfolio risk, £151 including portfolio risk (December 2023) Spend during RIS3: £100m (September 2023)
Current status	PCF Stage 3: Preliminary design
BCR	1.67 (Medium). This has reduced from 1.9 in May 2022.[4]
Contractual arrangements	Project awarded to Octavius Infrastructure Ltd under the Regional Delivery Partnership (RDP). This is the same contractor as the Binley junction.
Project timeline	SoW: September 2026 OfT: May 2028 Construction phase duration: 21 months
Biodiversity target	Contractual requirement of 10% biodiversity net gain
Carbon target	Corporate target of 20% carbon reduction (RIS1 Major Project tail scheme)

2.2. Cost estimation

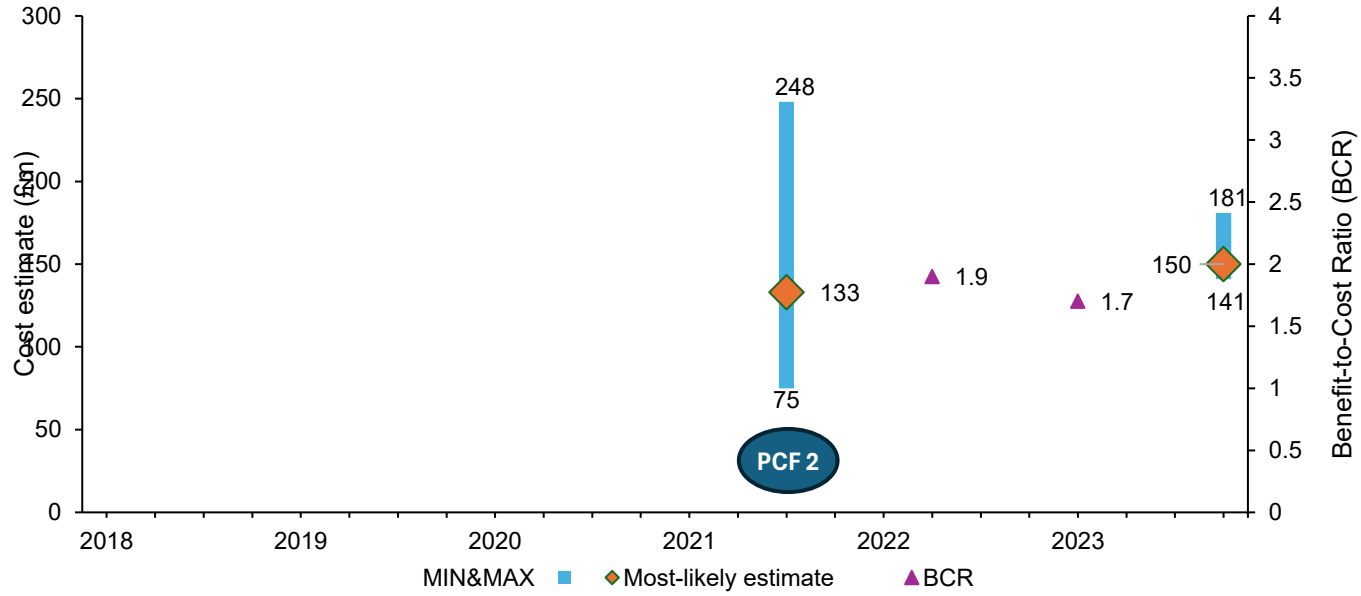
The latest interim cost estimate for the scheme is £141m (excluding portfolio risk). Highways has agreed a Target Outturn Cost ("TOC") or budget against which the agreed contractor, Octavius, is incentivised to delivery under the construction contract. We understand that there are agreed assumptions between National Highways and the contractor about the proportion of cost risks included within the TOC, and the degree to which it would be adjusted in risks materialised. Of the agreed TOC of £112.5m, £100m is included in National Highway's draft Strategic Business Plan for RIS3. In December 2023, historic costs for the scheme totalled £9.5m of the residual is historical expenditure incurred during earlier in the development phase for the scheme.

Based on the information available at the time of this review, National Highways' latest forecast shows that the scheme has remained on budget. Figure 2.2 below shows how the cost estimate for the scheme has evolved over time, noting that the scheme is on budget against its internally governed position and remains within the initial range of £75m-£248m. At PCF Stage 3, the scheme is preparing its DCO application, and as a result, there remains the risk that scope and design changes may be required, with the potential for the cost estimate to increase.

It also shows how the BCR for the two schemes has reduced from 1.9 representing medium VfM in May 2022 to the latest BCR of 1.7, continuing to represent medium VfM. The reduction in BCR is a concern particularly for this scheme because the BCR for the Binley scheme is dependent on the Walsgrave scheme going ahead and being a success. Without the Binley scheme, the BCR for Walsgrave would represent high VfM.

[4] The specified BCR is the combined BCR for both the Walsgrave and Binley schemes as presented by National Highways.

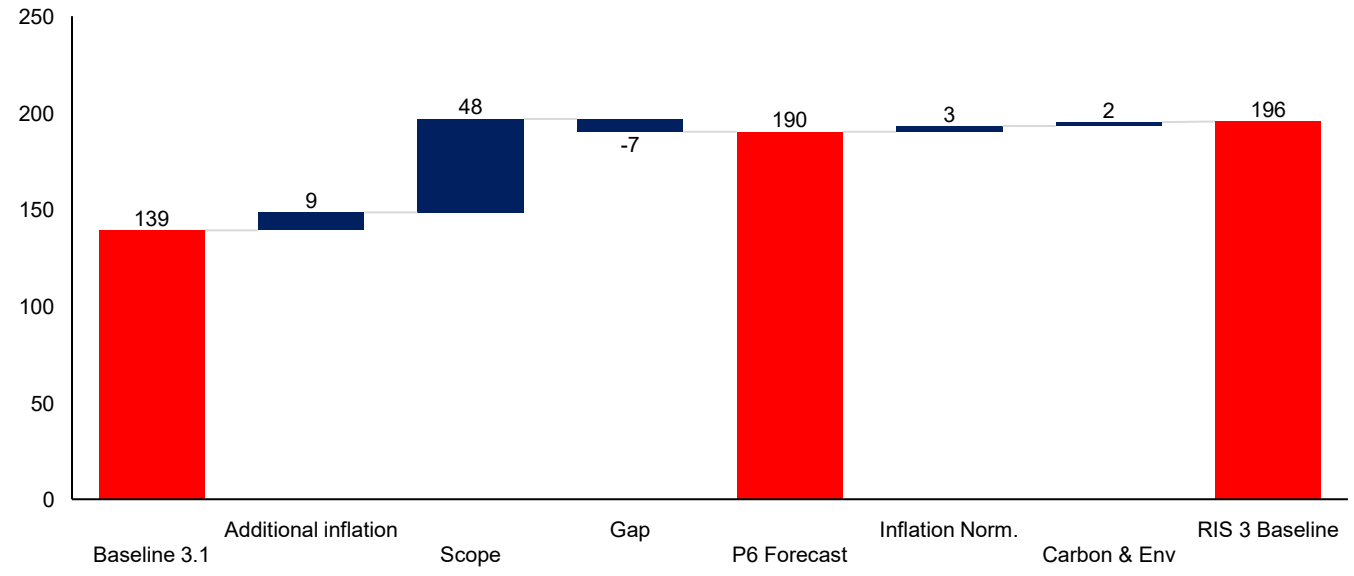
Figure 2.2 A46 Coventry Junctions Walsgrave cost estimate through PCF stages, including Portfolio Risk (nominal, £m)



Source: National Highways CE300 Form
Note: the inflation normalisation adjustment and carbon and biodiversity overlays for RIS3 are not shown in the chart above.

National Highways produced the following analysis shown in Figure 2.3 below to explain the evolution of its cost estimate between RIS2 and the estimate included in the RIS3 dSBP.

Figure 2.3 Cost evolution between RIS2 and RIS3 dSBP funding (including portfolio risk)



Source: Walsgrave-Binley ORR overview slides

The main drivers of the ~£57m (41%) cost increase were:

- The extension of PCF Stage 2 as a result of deemed options becoming unviable and further optioneering; and
- Protracted commercial tensions with the supplier, leading to a delay of 9 months entering Stage 3.

The extension of PCF Stage 2was a result of the deemed options becoming unviable and the subsequent identification, validation, and endorsement of a new option (Option 11). Updated flood modelling by the Environment Agency resulted in Option 6 being undeliverable, which remains outside of the control of National Highways.

Three further options were deemed to be unviable, for factors which are within the control of National Highways. Two options were deemed to be unviable as a result of further refined traffic modelling which determined that these Left-in/Left-out options, Options 7 and 8, created congestion impacts. A further option was acknowledged to be in excess of the budget.

It was deemed that Option 11 was deliverable. The option avoided the updated flood plain and had minimal impact on the SSSI through the 50mph speed limit and retained the existing A46 alignment. A formal solution review and validation workshop held in May 2021 deemed Option 11 to be acceptable in performance and a deliverable option. National Highways IDC endorsed Option 11 as a single viable option for progression to Stage 3.

- There were construction challenges with the Binley scheme which resulted in an additional cost of £17m for the scheme. This resulted in a challenging environment with the contractor, where the supplier experienced maximum pain on the Binley upgrade. This contributed to the extension of Walsgrave's PCF Stage 2. National Highways have stated that there is the potential for National Highways to recover further pain on Walsgrave as second part of RDP package.

National Highways has highlighted that there are more recent changes to costs. Changes in scope make up the majority of the cost increase and the additional reasons provided are explained further below.

- The Revised Development Phase Cost based on delay and additional costs led to an additional cost of £3.5m added to the forecast.
- Based on new information relating to IFT and drawings and pricing conditions, the cost of construction has increased the forecast by £32.1m.
- An upward adjustment to NRVAT from 30% to 57%.
- The price base of the works was updated to October 2023 prices and changes to inflation assumptions increased costs for Walsgrave by £3m.
- There were also changes based on Project Risk (Risk and Efficiencies) and uncertainty items.

National Highways use an 'interim forecasting tool' to enable tracking of costs against design to budget. National Highways also use this tool to provide an early warning of potential cost pressures to allow it to start value engineering work at an early stage. In February 2024, the scheme was showing to be circa. £20m higher than the budget. This increase was due to uncertainties around carbon and biodiversity. As a result, National Highways are now undertaking a 'back to budget' exercise to determine how they can work with the supplier to reduce or eliminate these uncertainties.

We understand that the latest cost estimate will be formalised prior to DCO submission.

Impact of the inflation adjustment

National Highways have assumed an annual rate of inflation of CPI[5] plus 200 basis points in 2023/24 and 2024/25 under its Deed of Variation adjustment, and from the start of RIS3 (i.e. 2025/26) it then assumes CPI plus 150 basis points. Given that its preferred measure of construction inflation (the Implied Output Price Index for New Construction: Infrastructure) has increased by between 50–75 basis points p.a. faster on average than CPI over the period 1997 to 2023, we explored the potential impact of:

[5] Based on the OBR's projections in the November 2023 Economic and Fiscal Outlook report.

- Updating the CPI forecast from 2025/26 to reflect the OBR's March 2024 EFO; and
- Reducing the rate of inflation by 75 basis points p.a.

For the A46 Coventry Junctions Walsgrave we estimate that reducing the rate of inflation by 75 basis points results in a £6.4m reduction in the cost estimate, and updating for the OBR's March 2024 CPI forecast would result in a further £2.9m cost reduction. Although there is a wider debate about the appropriate rate of inflation to apply to the RIS3 enhancement portfolio, one possible interpretation is that National Highways' relatively conservative approach results in additional base expenditure which might double-count risks provided for in the CRR.

Impact of carbon and biodiversity targets on the cost estimate

National Highways has not applied a cost overlay for biodiversity net gain[6]. The biodiversity net gain target (10%) is embedded in National Highways' contract with its Delivery Integration Partner (DIP), which is an RBP High Level Requirement. In order to meet the biodiversity target, the following measures have been applied in order to meet the biodiversity target:

- Scheme Order limits have been reduced where possible to reduce the Biodiversity baseline.
- Vegetation clearance has been minimised to reduce the required mitigation actions.
- Landscaping design to maximise gain from area available in the scheme order limits.
- Liaison with Local Authorities and OD regarding maintenance of proposed mitigation planting has commenced.
- The level of biodiversity Net Gain is currently being calculated for the Design Freeze (DF3) workshop in April 2024.

On construction carbon, the scheme has a corporate target of 20% carbon reduction which is based on Walsgrave as RIS1 Major Project tail scheme. The Carbon Management baseline has been calculated as 26,910 tonnes of CO_2 (or CO_2 equivalent) with target reduction of 5,380 tonnes of CO_2 (or CO_2 equivalent). This represents a reduction of approximately 20% against the scheme's carbon baseline. National Highways have states that this will be assured following the DCO being granted. If it is deemed that additional measured are required to achieve the carbon reduction target, the DOP will be instructed to implement measures to do so.

2.3. PROJECT SCHEDULING

The scheme is currently developing its DCO application. The latest schedule for the scheme was accepted in March 2023 and the milestones are as follows:

- DCO submission in September 2024
- DCO decision in March 2026
- SoW in September 2026
- OfT in May 2028

Our interview with the A46 Coventry Junctions Walsgrave project team did not identify any major present concerns with the schedule. It was noted that the DCO submission is expected to be delayed until October 2024, but the start of works is anticipated to be brought forward by one month to August 2026. Overall, the scheme is still expected to be open for traffic in May 2028. We note that progress on the A46 Coventry Junctions Walsgrave will depend on the outcome from its DCO submission and any judicial reviews. Six months is provisioned between DCO acceptance and SoW. As National Highways does not incorporate the probability weighted risk of the worst-case

[6] As per RFI 098 - EC Uplfits

scenario of a challenge leading to significant delay. On the basis that that National Highways has submitted a sufficiently detailed and efficient DCO, which ultimately does not lead to a judicial review, this duration would be sufficient. However we do not agree that this approach should be consistent among all schemes, and note that an appropriate length of time between DCO decision and SoW date which is appropriate for the A46 Coventry Junctions Walsgrave scheme would not necessarily be sufficient for larger, more complex schemes.

National Highways claimed that the Octavius team has learnt lessons from the Binley scheme and other DCO schemes in the region, which it will take these forward in order to de-risk the Walgrave programme, however it did not provide the detail behind this claim. National Highways told us that there has been regular engagement with regional Risk and DCO leads to ensure consistent approach with similar schemes.

The construction period for the scheme is 21 months which means that National Highways expects to spend approximately ~£5m per month during the construction phase, which remains in line with schemes during RIS2 which has a scheme-level average of ~£8m.[7]

Table 2.2 outlines how the project schedule for the A46 Walsgrave scheme has evolved over time.

Table 2.2 Project schedule evolution

Schedule	SoW	OfT	Source
May 2022 Operational Plan	October 2024	December 2025	2022-05-17 NH IDC Paper (XX) A46 Coventry Jcns Walsgrave
May 2022 Current forecast	October 2025	March 2027	2022-05-17 NH IDC Paper (XX) A46 Coventry Jcns Walsgrave
March 2024 V.3.1.9 (C131)	September 2026	May 2028	Walsgrave-Binley ORR overview slides
March 2024 Latest programme (C132)	August 2026	May 2028	Walsgrave-Binley ORR overview slides

Source: National Highways

2.4. KEY RISKS AND DEPENDENCIES

Project deliverability is assured internally through the National Highways Project Control Framework process. The latest Stage Gate Assessment Review (SGAR) and Independent Assurance Reviews (IAR) of the A46 Walsgrave scheme, carried out in May 2022, assessed the project as Amber but it was noted that there were 'modest' actions to close out which were as follows:

- The 12-month delay to Walsgrave SoW has reflected some cost impact, and Option 11 increased outturn cost which coupled with the RP2 delay has generated £70m of cost pressure for RP3.
- The difference in PCF stages makes joint analysis for the Binley and Walsgrave schemes questionable.
- The paper itself requests an increase of funding but does not specify where it will be funded from.
- The allowance for commercial management is very low (£178k) which may present challenges should there be an extended period or challenging issues during this stage.

The scheme level risk allowance is yet to be confirmed via expert-led QRA and QRSA exercises, where a group of National Highways and DIP team members reach a consensus view on the risk items which are relevant to the

[7] This calculation is based on Stage 6 Expenditure of £100.7 million divided by Stage 6 duration of 21 months.

project and remain open, develop estimates of the likelihood of occurrence, the cost and schedule impact if each individual risk were to materialise (using high, most likely and low scenario impacts) and estimate the impact of the Company's management/mitigation actions. This is then checked by the central cost estimation team to ensure that the QCRA is sufficiently complete to inform the cost estimate, and the completed risk register is then used to conduct a Monte Carlo analysis to derive P estimates for cost and schedule.

The top risks from the Company's scheme level risk register are outlined in Table 2.3 below. Due to the stage of Walsgrave, the main risks for the scheme relate to the DCO submission acceptance and any challenges raised against the scheme.

Table 2.3 National Highways top current delivery risks

Top project risks	Likelihood	Impact	Current Score & EMV	Post-mitigated score EMV
Receive 'Minded to Refuse' notice from DCO (stage 4)	High	High	£1.6m	£2.3m
Receive 'Minded to Refuse' notice from DCO (Stage 6)	High	High	£1.6m	£2.3m
Pre-application - Delay to DCO	Medium	High	£333k	£555k
WCH route imposed as condition of DCO (Stage 6)	Medium	High	£450k	£900k
Planned Construction phasing changes during Stage 6	Medium	High	£698k	£374k
As dug Materials gradings are not acceptable for use according to DMRB	Medium	High	£858k	£2.1m

Source – National Highways

The cost estimate includes a £25.8m risk provision, which comprises £6.2m for project risk, £10.2m for uncertainty and £9.4m of portfolio risk. This total risk allowance provision (including portfolio risk) equates to 21% of the base cost estimate for the scheme.[8]

Given that the scheme is currently at PCF stage 3, we need to be mindful that costs and schedules have increased levels of uncertainty prior to a scheme starting construction. By point of comparison, research on reference class forecasting approaches commissioned by DfT to inform the optimism bias uplifts used in transport appraisal finds that even at the Outline Business Case (FBC) stage, for the PMean level of certainty, the average UK road project would require a risk uplift of 21% over the base cost estimate if it is to be delivered 'on budget'.[9] We acknowledge that National Highways has the best knowledge on the cost of delivering highways projects and it now has good confidence in the cost estimate and note that the risk provision does not differ significantly from our the comparison.

[8] We note that portfolio risk is not included in the funded position for each scheme. The CRR, as proposed currently, funds a lower percentage of risk and we have reported the portfolio risk component of the scheme estimate for completeness across all schemes.

[9] Department for Transport (2021), TAG: optimism bias workbook, May. Available online at – link.

3. M3 JUNCTION 9

Key findings

- The M3 connects south Hampshire with London, the Midlands and the North. M3 junction 9 is congested and this results in significant peak time delays that impact journey times and the safety of road users caused by congestion on the main carriageway. National Highways is upgrading the M3 Junction 9 to increase the efficiency of the network by improving journey times, increasing capacity and reducing congestion.
- The scheme was originally included in the RIS2 investment package, at a cost of £129m. The cost for the scheme has evolved and is now expected to cost £249m (excluding portfolio risk), of which £213m is included in National Highway's draft Strategic Business Plan for RIS3. Based on the information available at the time of this review, National Highways' latest forecast shows that the scheme has remained on budget against its internally governed position and remains within the initial range of £110m-£400m (including portfolio risk)[10].
- The BCR for the M3 Junction 9 scheme was significantly reduced from a high to medium VfM as a result of the removal of the Smart Motorways Programme (SMP) interface from the scheme's scope. As with all schemes that have a BCR in the medium or low category, the economic case remains vulnerable to the impacts of delay and inflation.
- The project schedule for the M3 Junction 9 seems reasonable, in relation to a typical National Highways project. The construction period for the scheme is 35 months which means that National Highways expects to spend approximately ~£5m per month during the construction phase, compared to a RIS2 average of £8.2m. However, risks to schedule do remain. As with all projects that pass through the DCO process, there may be movements in the cost estimate caused by design changes. Secondly, due to the ground conditions of the scheme, further investigation may be required. As a result, we would expect an element of the risk provision to be used prior to the start of construction.
- The overall risk provision for the scheme including project risk, uncertainty allowance and portfolio risk is 15% of base costs. This risk allowance is lower than some other benchmarks, for example DfT's WebTAG guidance suggests a risk provision of 23% of project costs at OBC stage.[11] Whilst we agree that National Highways has the best knowledge on the cost of delivering highways projects, and it now has good confidence in the cost estimate, National Highways has not provided justification for the lower risk provision on this project.

3.1. BACKGROUND TO THE SCHEME

The M3 connects south Hampshire with London, the Midlands and the North. M3 junction 9 is congested and this results in significant peak time delays that impact journey times and the safety of road users caused by congestion on the main carriageway. The existing layout involves the M3 slip lanes joining a grade separated gyratory roundabout. The M3 to A34 movement is heavily trafficked and journey times are unreliable due to the interaction with the signal controlled gyratory that is also used by local traffic.

National Highways are upgrading the M3 Junction 9 in order to increase the efficiency of the network with faster more reliable journey times for long distance freight traffic and local traffic due to extra capacity and free-flowing links to the A34, adding additional capacity and reducing congestion, as shown in Figure 3.1 below. The junction upgrade aims to improve connectivity to Winchester, and between the ports of Southampton and Portsmouth and destinations in the midlands. The scheme will also provide new walking cycling and equestrian routes which improve access to the South Downs. Further objectives of the scheme are to improve the safety of the network and to create a high quality and more resilient network with reduced delay.

[10] Capital Estimate Release Form (17th May 2020, PCF Stage 3)

[11] TAG: optimism bias workbook

Figure 3.1: Map of the proposed solution for the M3 Junction 9

The scheme was originally included in the RIS2 investment package at which point the scheme was included in the M3 Junctions 9-14 scheme. The entire scheme had a forecast cost of £129m, a start of works date of March 2020, and an open for traffic target of August 2021. National Highways announced the preferred route in 2018 and submitted the DCO application in November 2022. Volker Fitzpatrick were appointed to deliver the construction of the M3 Junction 9 upgrade in December 2022.

The DCO application was submitted to the Planning Inspectorate in November 2022 and was accepted for examination in December 2022. The DCO Examination began in May 2023 and the 'Recommendation and Decision stage' was entered in November 2023 and completed in February 2024. DCO consent was granted on 17th May 2024. Detailed design is taking place in parallel with the DCO process.

Table 3.1: Background information to M3 Junction 9 scheme

Background information	
Cost estimation	Mid level estimate: £249m excluding portfolio risk, £259 including portfolio risk (March 2024) RIS3 Baseline: £267m (March 2024) Spend during RIS3: £213m (September 2023)
Current status	PCF Stage 4: Statutory Procedures and Powers, Awaiting DCO
BCR	1.8 (Medium)
Contractual arrangements	Delivery Integrations Partner: Volker Fitzpatrick Technical Partner: Arup DIP contract value £205m
Project timeline	SoW: March 2025 OfT: December 2027
Biodiversity target	4% biodiversity net gain
Carbon target	The scheme is also expected to lead to 37,070 tCO_2e emissions during scheme construction[12]

[12] M3 Junction 9 Improvement, Outline Business Case Final Stage 3 (October 2022)

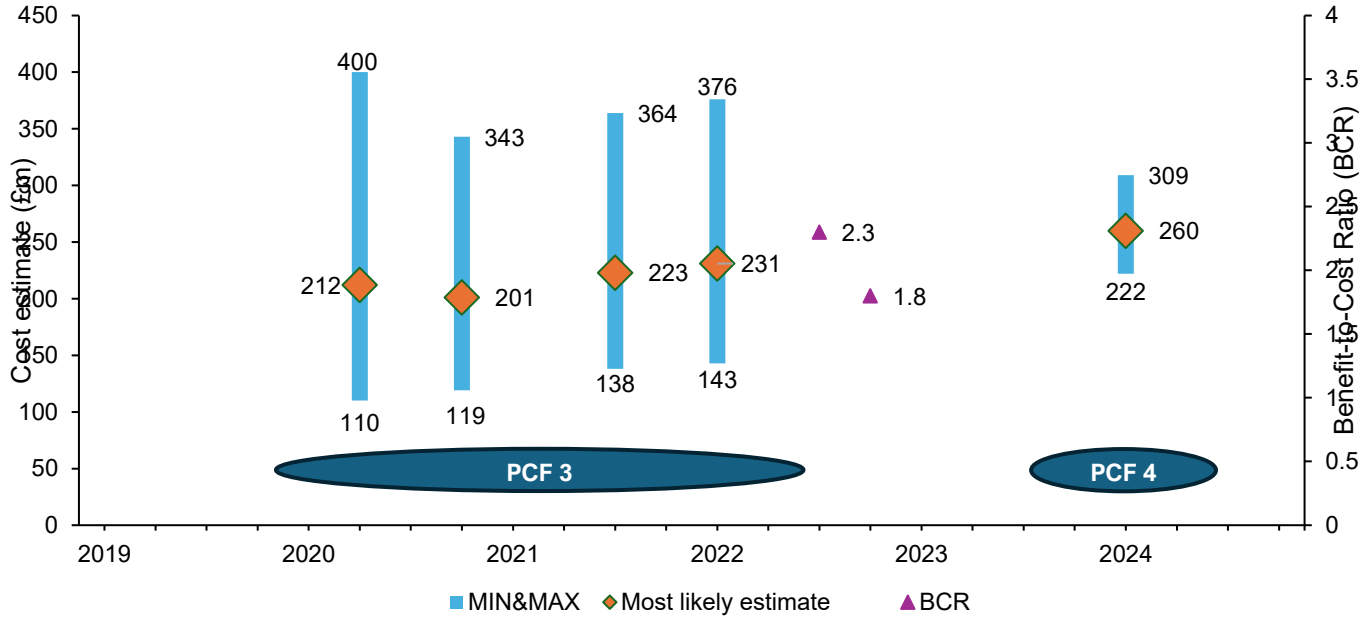
3.2. COST ESTIMATION

The latest cost estimate for the scheme is £249m (excluding portfolio risk)[13] and this is the basis of the Target Outturn Cost ("TOC") or budget against which the Delivery Integration Partner, Volker Fitzpatrick, is incentivised to deliver under the construction contract. We understand that there are agreed assumptions between National Highways and the contractor about the proportion of cost risks included within the TOC, and the degree to which it would be adjusted in risks materialised. Of the £249m total cost for the scheme, £213m is included in National Highway's draft Strategic Business Plan for RIS3. In March 2024, historic costs for the scheme totalled £34m of the residual is historical expenditure incurred during earlier in the development phase for the scheme.

Based on the information available at the time of this review, National Highways' latest forecast shows that the scheme has remained on budget. Figure 3.2 below shows how the cost estimate for the scheme has evolved over time, noting that the scheme is on budget against its internally governed position and remains within the initial range of £110m-£400m. At PCF Stage 4, DCO for the scheme has recently been granted[14], however there remains the risk that scope and design changes may be required, with the potential for the cost estimate to increase.

The BCR for the scheme has evolved over time, as shown in Figure 3.2 below. The initial BCR for the scheme of 2.3 represented high value for money. This subsequently reduced to 1.8 as a result of increases to the cost estimate and the removal of scope in relation to the pause of the Smart Motorways Programme (SMP). The latest BCR represents medium value for money. As with all schemes that have a BCR in the medium or low category, the economic case remains vulnerable to the impacts of delay and inflation.

Figure 3.2: M3 Junction 9 cost estimate through PCF stages, including Portfolio Risk (nominal, £m)

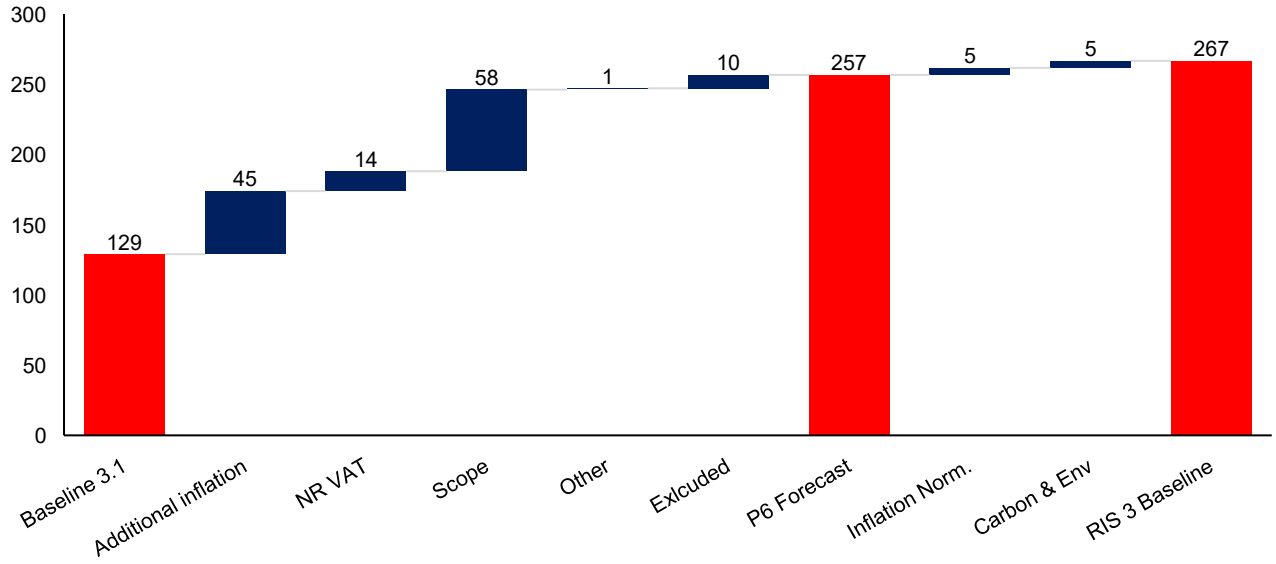


Source: National Highways CE300 Form
Note: the inflation normalisation adjustment and carbon and biodiversity overlays for RIS3 are not shown in the chart above. National Highways produced the following analysis shown in Figure 3.3 below to explain the evolution of its cost estimate between RIS2 and the estimate included in the RIS3 dSBP.

[13] National Highways provides an estimate of £260m including portfolio risk, although the process for setting portfolio risk (i.e. the Central Risk Reserve) is not a direct aggregation of portfolio risk across each individual scheme. Our understanding is that the scheme level portfolio risk estimate is more of an indicative figure used for internal financial management.

[14] Planning Inspectorate (16 May 2024) "M3 Junction 9 development consent decision announced" available at gov.uk.

Figure 3.3 Cost evolution between RIS2 and RIS3 dSBP funding



Source: M3 J9 ORR Deep Dive March 2024 FINAL

The main drivers of the £138m (107%) cost increase were:

- Scope change and optioneering as a result of traffic demand modelling and the pause of the Smart Motorways Programme (SMP);
- Additional non-refundable VAT; and
- Additional inflation.

Scope changes were required because the preliminary design was based on traffic data from the Hampshire sub-regional traffic model. The design at that time met the RIS commitment and provided value for money. National Highways subsequently released the South-East Regional Transport Model (SERTM) and this strategic model showed an increased level of demand through Junction 9 and on the A34. As a result, it was deemed that the initial baseline design no longer met demand. The junction was redesigned to provide a solution that met the safety and capacity requirements. The redesign included additional running lanes, seven new retaining walls, two new underpasses and required substantially more earthworks. These scope changes result from inherently uncertain aspect of the traffic modelling process. Whilst out of National Highways control, the Company can control its approach to setting available funding for early stage schemes where several options are being considered and therefore foresee that new traffic models might require very substantial design changes.

The initial RIS2 design complemented the SMP M3 J9-14 scheme. Following the pause of the SMP programme announced by the Secretary of State, the scheme design was deemed to be inappropriate, which resulted in a new design to provide new features including an additional concrete central reserve. As a result, the Start of Works was delayed by 12 months, which increased the scheme's cost.

Costs for 'additional inflation' led to an increase of £45m to the cost estimate, which denotes the cumulative effect of inflation on the cost estimate since the start of RIS2. This represents a large share of the cost increase in percentage terms as a direct result of the exceptional inflation rates of inflation in the IOPI index during 2022/34 that National Highways has reflected in the agreements with Volker Fitzpatrick.

Impact of the inflation adjustment

National Highways has assumed an annual rate of inflation of CPI[15] plus 200 basis points in 2023/24 and 2024/25 under its Deed of Variation adjustment, and from the start of RIS3 (i.e. 2025/26) it then assumes CPI plus 150 basis points. Given that its preferred measure of construction inflation (the Implied Output Price Index for New Construction: Infrastructure) has increased by between 50–75 basis points p.a. faster on average than CPI over the period 1997 to 2023, we explored the potential impact of:

- Updating the CPI forecast from 2025/26 to reflect the OBR's March 2024 EFO; and
- Reducing the rate of inflation by 75 basis points per year.

For the M3 Junction 9, we estimate that reducing the inflation forecast by 75 basis results in a reduction of £5m, and reflecting the OBR's March 2024 CPI forecast results in a further reduction of £4.3m. Although there is a wider debate about the appropriate rate of inflation to apply to the RIS3 enhancement portfolio, one possible interpretation is that National Highways' relatively conservative approach results in additional base expenditure where there is a risk that it is double-counted with the potential use of the CRR.

Impact of carbon and biodiversity targets on the cost estimate

For the M3 Junction 9, National Highways intend to deliver the biodiversity net gain target of 4% within the scheme cost estimate. This biodiversity net gain target is embedded in National Highways' contract with its Delivery Integration Partner (DIP). The target is lower than other enhancements schemes due to the ecology of the local area, which National Highways claims prevents a higher target being achievable. National Highways have stated that the target will be achieved by the planting of new woodland and hedgerow, including 9.6 hectares of new species rich chalk grassland.

On carbon, the scheme is also expected to lead to 37,070 tCO_2e emissions during scheme construction.[16] National Highways applies an internal carbon reduction target to each enhancement project depending on its stage of development. Committed RIS1 and RIS2 tail enhancement schemes target a 20% reduction, schemes developed in RIS2 for delivery in RIS3 target a 30% reduction, and newly announced RIS3 schemes will have a 50% reduction target. In this case, National Highways has not presented evidence or justification for any environmental overlay attributable to carbon.

3.3. PROJECT SCHEDULING

As discussed earlier, the timeline for the scheme has evolved following the SMP pause, which resulted in a 12-month delay to the SoW while the scheme was redesigned.

The scheme was granted DCO consent in May 2024. The latest schedule is based on a Start of Works in December 2024 and an Open for Traffic date during December 2027. This leaves a six month period between the DCO decision and SoW, as National Highways does not incorporate the probability weighted risk of the worst case scenario of a challenge leading to significant delay. On the basis that that National Highways has submitted a sufficiently detailed and efficient DCO, which ultimately does not lead to a judicial review, this duration would be sufficient. However we do not agree that this approach should be consistent among all schemes, and note that an appropriate length of time between DCO decision and SoW date which is appropriate for the M3 Junction 9 would not necessarily be sufficient for larger, more complex schemes.

Working in chalk and the ground conditions at the scheme's site were highlighted in National Highways' risk register. Poor ground conditions have the potential to reduce productivity and increase the works required, both of

[15] Based on the OBR's projections in the November 2023 Economic and Fiscal Outlook report.

[16] M3 Junction 9 Improvement, Outline Business Case Final Stage 3 (October 2022)

which would cause schedule delays. In the case of the M3 Junction 9, this risk is deemed to be 'Medium' following mitigating actions.

The construction period for the scheme is 35 months which means that National Highways expects to spend approximately £5m per month during the construction phase, which remains in line with schemes during RIS2 which has a scheme-level average of ~£8m. [17]

Table 3.2 outlines how the project schedule for the M3 Junction 9 scheme has evolved over time.

Table 3.2 Project schedule evolution

Schedule	SoW	OfT	Source
March 2021 – operational forecast	Jan 2024	Dec 2026	M3_Junction_9_Option_2_-_March_2024_-_Form_300
July 2022 – current forecast	Nov 2024	Oct 2027	2022-06-14 NH IDC Paper (XX) M3 J9
March 2024 – current forecast	Dec 2024	Dec 2027	M3_Junction_9_Option_2_-_March_2024_-_Form_300

Source: National Highways

3.4. KEY RISKS AND DEPENDENCIES

Project deliverability is assured internally through the National Highways Project Control Framework process. The latest interim Stage Gate Assessment Review (SGAR) from November 2023 recommended that the schedule should be accepted, based on there being no slippages against the previous submission.

The scheme level risk allowance has been determined via expert-led QCRA and QSRA exercises, where a group of National Highways and DIP team members reach a consensus view on the risk items which are relevant to the project and remain open, develop estimates of the likelihood of occurrence, the cost and schedule impact if each individual risk were to materialise (using high, most likely and low scenario impacts) and estimate the impact of the Company's management/mitigation actions. This is then checked by the central cost estimation team to ensure that the QCRA is sufficiently complete to inform the cost estimate, and the completed risk register is then used to conduct a Monte Carlo analysis to derive P estimates for cost and schedule.

Table 3.3 below shows the top project risks as detailed in the Company's risk register.

Table 3.3 Top project risks for the M3 Junction 9 scheme

Risk	Likelihood	Impact	Current Score & EMV	Post-mitigated score EMV
Design development - Design changes required that exceed cost allowance for: VRS, Lighting and Signs Communications Miscellaneous (SU Attendance) Accommodation Works Landscaping & Ecology Drainage & Ducts Earthworks Pavements Gantries Overbridges Underbridges and Footbridges	High	High	High £5.95m	High £5.89m
Site Compound location - Site compound location and/or compound layout not agreed by SDNP and the view is supported by the inspectors during the DCO examination. Compound location and/or layout change required by the Planning Inspectorate.	Medium	High	High £413k	High £383k

[17] This calculation is based on Stage 6 Expenditure of £190 million divided by Stage 6 duration of 35 months.

Risk	Likelihood	Impact	Current Score & EMV	Post-mitigated score EMV
Working in chalk - Modification of material (stabilisation) Dissolution features and or erosion is encountered in existing ground	Medium	High	High £413k	Medium £375k
DCO: Extension to / delayed Statutory DCO Timings - Delays due to objections or any other prevailing matters Statutory process periods extended through a motion in Parliament (Section 107(7) - Planning Act) or delayed. Change in Government	Medium	Medium	Medium £210k	Medium £203k
Material Availability and Price Fluctuations - Variability on material prices which may arise from market conditions, conflicts (Israel - Hamas), delays due to border closures or quarantining requirements, supply / demand of materials in the industry	Medium	High	High £405k	High £383k

Source - HE551511-VFK-COM-XXXX_XX-RE-WM-50001 (Risk Register)

The cost estimate includes a £33m risk allowance, which comprises £20.4m for project risk, £2.2m for uncertainty and £10.4m for portfolio risk. The total risk allowance provision (including portfolio risk) equates to 15% of the scheme's base cost estimate.[18] Given that the scheme is currently at PCF Stage 4, we need to be mindful that costs and schedules have increased levels of uncertainty prior to a scheme starting construction. The reasons for this are two-fold, firstly the further design work will take place and secondly, additional scope requirements may arise out of the DCO process.

By point of comparison, research on reference class forecasting approaches commissioned by DfT to inform the optimism bias uplifts used in transport appraisal finds that even at the Outline Business Case (FBC) stage, for the PMean level of certainty, the average UK road project would require a risk uplift of 23% over the base cost estimate if it is to be delivered 'on budget'.[19] We acknowledge that National Highways has the best knowledge on the cost of delivering highways projects and it now has good confidence in the cost estimate. However, the difference between a risk provision of 15% and 23% is not insignificant and we have not seen any justification for why National Highways deem this to be sufficient.

National Highways' told us that this lower risk provision is based on (in its view) a well-developed Stage 3 design, and Stages 4 and 5 being well advanced and running in parallel. The scheme currently has an Interim Final Estimate and is working towards a Final Estimate. We recognise that there is a maturity 'spectrum' between PCF stages and phases of business case development which means that a risk uplift of 23% might not be the most appropriate benchmark in this case. However, although we cannot be definitive, our view is that the risk provision applied here may not be sufficient and this finding is relatively consistent across our sample of enhancements case studies.

Due to the stage of the M3 Junction 9 scheme, one of the main risks is potential challenge to the DCO consent. We are aware, however, that float and contingency to allow for challenges is not incorporated into scheme schedules.

In conclusion, the project risk provisions of enhancements schemes are set at a relatively challenging level given the maturity of the scheme in the development lifecycle, which in turn drives a mindset that the scheme is likely to draw on the CRR at a later stage.

[18] We note that portfolio risk is not included in the funded position for each scheme. The CRR, as proposed currently, funds a lower percentage of risk and we have reported the portfolio risk component of the scheme estimate for completeness across all schemes.

[19] Department for Transport (2021), TAG: optimism bias workbook, May. Available online at – link.

4. A66 NORTHERN TRANS-PENNINE

Key findings

- Under the 'Project Speed' initiative, the project's initial 10-year construction schedule was halved to 5 years. As part of its RIS3 recommended portfolio position, National Highways is seeking ministerial approval to extend the construction phase to 7 years.
- DCO consent was granted in March 2024. National Highways has received a challenge to the decision. JR hearing timescales would place the SoW date of Summer 2025 at risk and it could be delayed by up to 18 months, although this is uncertain as there are no statutory timescales for consideration through the courts.
- The re-baselining of the construction phase will also impact on the project's MLE of £1,623m, but National Highways has not provided this cost estimate yet. Key drivers to the large increase in the scheme's cost estimate include exceptional inflation, the delay to the DCO decision, and changes in the scheme's scope see **Figure 4.3**).
- As of December 2023, the project has an estimated BCR of around 1.1 (low VfM). Further cost increases would call into question the validity of proceeding with the scheme.
- A risk provision of 16% of total project costs is below DfT-average risk uplift of 23% for road projects at the Outline Business Case (OBC) stage. We would expect to see a stronger justification for this risk allowance level given the legal challenge, the project integration challenges and the extended delivery phase.

4.1. BACKGROUND TO THE SCHEME

The A66 Northern Trans-Pennine schemes consists of 11 different projects between the M6 at Penrith and the A1(M) Scotch Corner. It involves upgrading 30km of single carriageway along 6 sections of road to dual carriageway standard, as well as making improvements to the junctions along the route.

At present, the casualties on the A66 are 50% higher than the Strategic Road Network. National Highways state that accidents cluster on the single carriageway sections along the A66, with these sections of the road currently below iRAP industry standards. National Highways consider the A66 to be a key strategic link on both the national and regional scale. The route is also a key freight route, which represents 25% of its overall traffic. There are no public transport alternatives, with limited diversionary routes by road. Thus, National Highways considers that enhancing the A66 presents an opportunity for improved access for local services, jobs, and tourism. This is in line with the Northern Powerhouse and Levelling Up agendas.

National Highways state the benefits of the scheme as delivering:

- **Union connectivity, with the project improving** connections between Cumbria, North Yorkshire as well as Tees Valley, Tyne and Wear and beyond. Connecting local communities will improve accessibility to services such as healthcare, jobs and education. Upgrading these single will improve safety, also reduce delays and queues, and improve the reliability of people's journeys between the M6 at Penrith and the A1(M) Scotch Corner and nationwide. This is important for the freight transported by Heavy Goods Vehicles on the road, which is particularly sensitive to delays.

- **Economic & environmental benefits.** An improved A66 will improve accessibility to tourist centres such as the Lake District and the Yorkshire Dales, supporting the regional and local economy. National Highways has committed to reducing the visual and environmental impact of the scheme on the North Pennines and Lake District, and believe the improvements made will minimise noise pollution for local communities.

- **Community benefits.** National Highways have committed to supporting the local economy throughout the construction process as well as providing training opportunities for local schools and community groups etc.

The scheme was originally included in the RIS2 investment package at which point it was at the 'Options' phase under the Project Control Framework. It had a forecast cost of [**text redacted**], a start of works date of 2024/2025, and an open for traffic target of 2033/34. National Highways announced the preferred route in Spring 2020 and

submitted the DCO application in Spring 2022. Balfour Beatty, Costain, Keltbray and Kier (the Delivery Integration Partners (DIPs)) were awarded the construction contract in October 2022. In June 2023, Costain was removed as a DIP on the project.

The Examination of the DCO application closed in May 2023 and the Planning Inspectorate made recommendations to the Secretary of State for Transport in August 2023. The Secretary of State delayed the decision on the DCO by 4 months in November 2023. A DCO for the A66 was approved in March 2024, with the scheme's Full Business Case awaiting approval from government. National Highways has received a legal challenge to the DCO consent although it is too early to assess what implications this will have for the project schedule. National Highways continues to undertake utilities diversions and archaeological works in preparation for the construction phase.

Figure 4.1: A map of the preferred A66 route

Source: National Highways

Table 4.1: Background information to A66

Background information	
Cost estimation (Last approved forecast at IPDC)[20]	[**text redacted**] (excluding Portfolio Risk) [**text redacted**] (including Portfolio Risk)
Current status	PCF Stage 5: Construction Preparation
BCR	1.05 (Low VfM).
Contractual arrangements	Balfour Beatty, Kier and Keltbray have been appointed as Delivery Integration Partners (DIPs).
Project timeline	FBC approval: Spring 2025

[20] The CE300 Form provided to us for this review estimates a cost of [**text redacted**]/ [**text redacted**] (Excluding/Including Portfolio Risk) in April 2022, but we included the last approved forecast at IPDC in Table 4.1 as it represents a more recent cost estimate (May 2023).

Background information	
	SoW: Summer 2025 OfT: Summer 2030 (in line with Project Speed commitments) or Summer 2032 (7-year construction phase pending ministerial approval)
Biodiversity target	Whilst a 10% Biodiversity Net Gain (BNG) legal requirement does not yet apply, DIPs are incentivised to deliver against a 10% BNG target.
Carbon target	Targeting 30% reduction in Carbon for the project through contractual commitments made with the DIPs.

4.2. Cost estimation

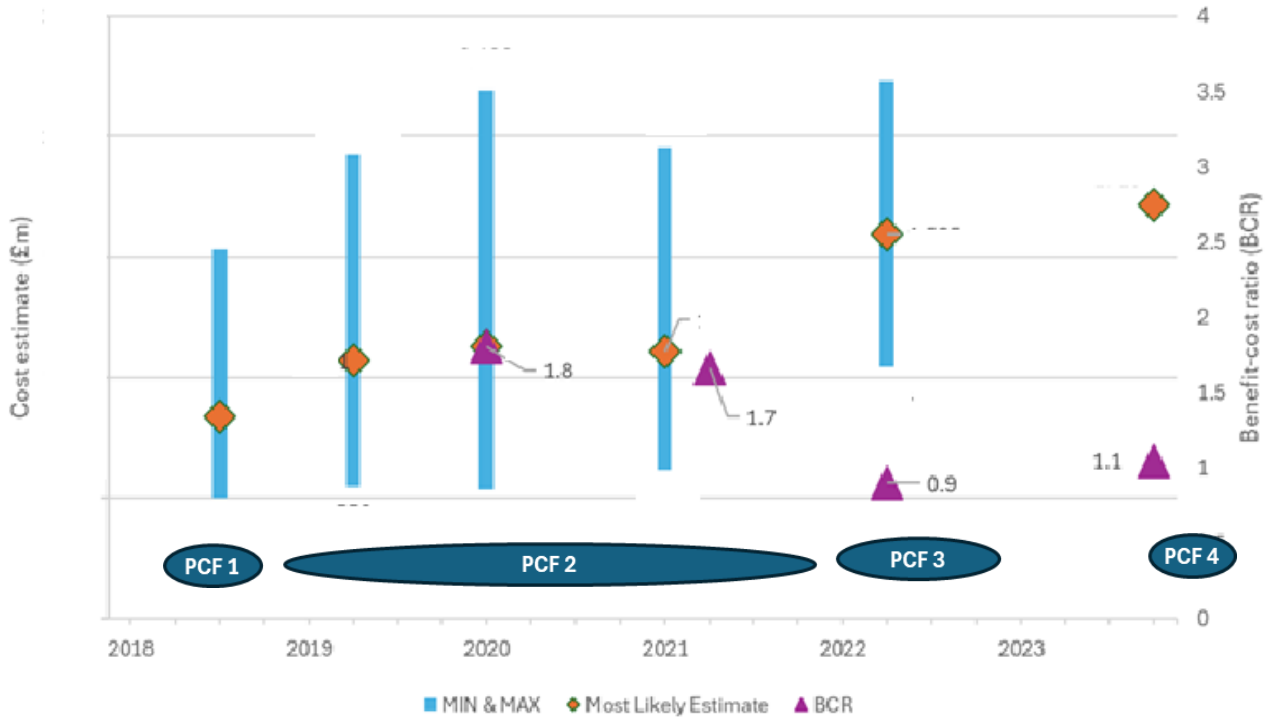
The most recent cost estimate and current Governed Position of the A66 scheme is [**text redacted**] (including portfolio risk), with the budget not yet agreed with the three DIPs - Balfour Beatty, Kier, and Keltbray. It is our understanding that this cost estimate is subject to change as the remaining detailed design work is completed, and as costs are recalculated as the project's construction phase is rephased from 5 to 7 years.

When the project was initial awarded to the DIPs, the most-likely estimate including portfolio risk was [**text redacted**]. However this most likely estimate increased by [**text redacted**] to [**text redacted**], as a result of the change to Deed of Variation 2 following the National Highways Inflation Portfolio paper in 2023. Cost evolution through the PCF stages is illustrated in Figure 4.2, with the [**text redacted**] most likely estimate in Q2 2022 plus portfolio risk being equivalent to the aforementioned [**text redacted**].

Figure 4.2 also illustrates a deterioration in the project's benefit-cost ratio (BCR) over time. During 2022, the project's BCR fell below 1, meaning at the time the scheme's costs outweighed the benefits. The February 2024 IDPC approved position represents a most likely cost estimate of [**text redacted**] (excluding portfolio risk), and an estimated BCR of around 1.1 that represents low value for money and with some uncertainty and risk still to be managed.[21]

[21] The February 2024 Investment Decision Committee paper states a forecast BCR of 1.1, based on a range of 1.05 to 1.21. We state the BCR estimate of 1.1 as it represents the DfT IPDC approved position.

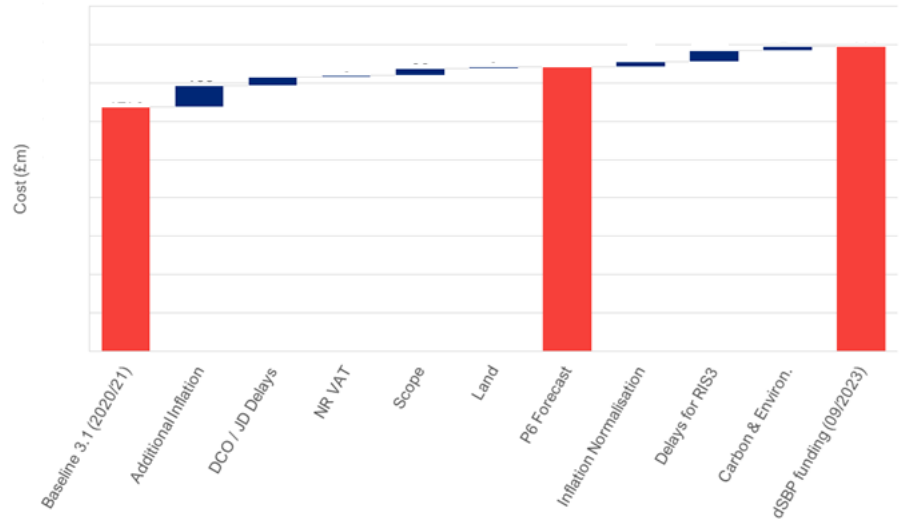
Figure 4.2: A66 cost estimate and benefit-cost ratio through PCF stages, including Portfolio Risk (£m) [**Left axis and monetary values redacted**]



Source: National Highways CE300 Form

National Highways produced the following analysis shown in Figure 4.3 below to explain the evolution of its cost estimate between the Baseline 3.1 estimate and the estimate included in the RIS3 dSBP.

Figure 4.3: Cost evolution between Capital Baseline and RIS3 dSBP funding (excluding portfolio risk)[22] [**figures and axis redacted**]



Source: Enhancement scheme cost waterfalls.xls

[22] The values shown in Figure 4.2 and Figure 4.3 are not directly comparable, as Figure 4.2 includes portfolio risk and does not include the inflation normalisation adjustment or environmental overlays. Figure 4.3 excludes portfolio risk.

The main drivers of the [**text redacted**] (25%) cost increase were:

- Inflation in construction prices over the period 2022-23 resulting from the impact of the energy price crisis on key construction materials prices, resulting in part from the Russia–Ukraine war [**text redacted**].
- Additional inflation and project management costs incurred during the delay to the decision on the scheme's DCO application [**text redacted**].
- Changes in the treatment of non-recoverable VAT incurred during the development stages – which applies across the National Highways portfolio and is not scheme-specific – but results in a cost increase of [**text redacted**].
- Increased costs of £38m following changes to design including an additional bridge structure and additional deck areas at Warcop.
- An increase in land and compulsory acquisition costs of [**text redacted**] resulting from 899 hectares of environmental mitigation and landscaping areas.
- A cost increase resulting from the normalisation of how inflation is calculated across National Highways major projects schemes [**text redacted**].
- The costs associated with delaying part of the schedule into RIS3 [**text redacted**].
- A [**text redacted**] cost overlay related to the carbon and environmental commitments and ambitions on the scheme.

We have not sought to assess the extent to which some of the smaller cost movements (e.g. due to design/scope changes (see Figure 4.3)) are 'efficient' and/or beyond National Highways' ability to control. Given the magnitude of these costs, we assume that the changes were necessary to deliver DfT's requirements and satisfy the DCO conditions. Instead, we focus on cost categories where National Highways has applied more significant judgement: the RIS3 inflation adjustment and the carbon and biodiversity overlays.

Impact of the inflation adjustment

National Highways has assumed an annual rate of inflation of CPI[23] plus 200 basis points in 2023/24 and 2024/25 under its Deed of Variation adjustment, and from the start of RIS3 (i.e. 2025/26) it then assumes CPI plus 150 basis points. Given that its preferred measure of construction inflation (the Implied Output Price Index for New Construction: Infrastructure) has increased by between 50–75 basis points p.a. faster on average than CPI over the period 1997 to 2023, we attempted to replicate the inflation adjustment included in the A66's cost estimate, and explored the potential impact of:

- Reducing the rate of inflation by 75 basis points p.a.; and
- Updating the CPI forecast from 2025/26 to reflect the OBR's March 2024 EFO

We estimate that this results in a reduction of [**text redacted**] to reflect the 75 basis point reduction and a further reduction of [**text redacted**] for the March EFO thereafter. Although there is a wider debate about the appropriate rate of inflation to apply to the RIS3 enhancement portfolio, one possible interpretation is that National Highways' relatively conservative approach results in additional base expenditure which might otherwise be provided for in the CRR. As the A66 is a large enhancement scheme in absolute terms, a more conservative approach to inflation risk will have a larger impact on the scheme's overall cost estimate.

Impact of carbon and biodiversity targets on the cost estimate

National Highways has included a Carbon & Environmental adjustment of [**text redacted**] as a RIS3 modelling input. The A66's DIPs are contractually committed to a 30% reduction in carbon, through the use of new innovative materials, products, and techniques, as well as efficient design and construction practices. Under the Partnering

[23] Based on the OBR's projections in the November 2023 Economic and Fiscal Outlook report.

Agreement, National Highways and the DIPs have agreed to the following commitments to a vehicle net zero roadmap:

- Low carbon (electric or plug in hybrid) vehicles to represent 80% of the car fleet by the 1st January 2025
- Low carbon (electric or plug in hybrid) vehicles to represent 50% of light commercial vehicles by the 1st January 2025
- 0% of the car fleet to be pure petrol or diesel powered vehicles after 1st January 2025
- A commitment to sending zero waste to landfill (excluding hazardous waste) and collaborate with the Client to develop initiatives to reduce waste generated by 25%.

Greenhouse gas emissions have been quantified as part of the Environmental Impact Assessment within the DCO application, with the most recent whole-life carbon calculation made using the stage 3 baseline design.

The DIPs are incentivised to deliver against a 10% Biodiversity Net Gain (BNG) target. Despite this, the DCO biodiversity commitment is 'no net-loss'. As the A66 is a RIS2 tail scheme, the 10% BNG target was not a legal requirement. National Highways have stated the 10% target upon which the DIPs are incentivised to deliver against represents 'best endeavour' behaviour. With a SoW date in RIS3, it is our understanding that the scheme has a 2% biodiversity cost overlay but it has not yet identified how it will achieve 10% net gain, so ORR may wish to challenge the appropriateness of the application of the overlay in this case.

4.3. Project Scheduling

A DCO was granted for the A66 on 7 March 2024. The current project baseline as per the IPDC January 2024 paper involves the following key milestones:

- FBC approval – Spring 2025
- SoW – Summer 2025
- OfT – Summer 2030

This five year construction period is in line with its 'Project Speed' commitments, which was an initiative to accelerate the timelines of key infrastructure projects. The A66 was identified by the government as a pathfinding project that is important to its 'Levelling Up' agenda in the North. Despite this, National Highways has proposed a lengthening of the construction phase from five to seven years as part of its RIS3 recommended portfolio position. This change is pending ministerial approval of the portfolio position, and represents a significant departure from it 'Project Speed' commitments.

Table 4.2 outlines how the project schedule for the A66 scheme has evolved over time. It shows that the A66 had an expected 10 year construction phase prior to being identified as a pathfinding scheme under 'Project Speed' in late 2020, with the construction duration fluctuating between just under 4 years (in April 2022) and 7 years (the current RIS3 recommended portfolio position).

Table 4.2: Project schedule evolution

Schedule	SoW	OfT	Source
PCF Stage 1 (September 2018)	April 2023	July 2028	Capital Works Estimate Release Form
PCF Stage 1 (September 2019)	April 2024	October 2030	Capital Works Estimate Release Form
PCF Stage 2 (March 2020)	November 2024	February 2035	Capital Works Estimate Release Form

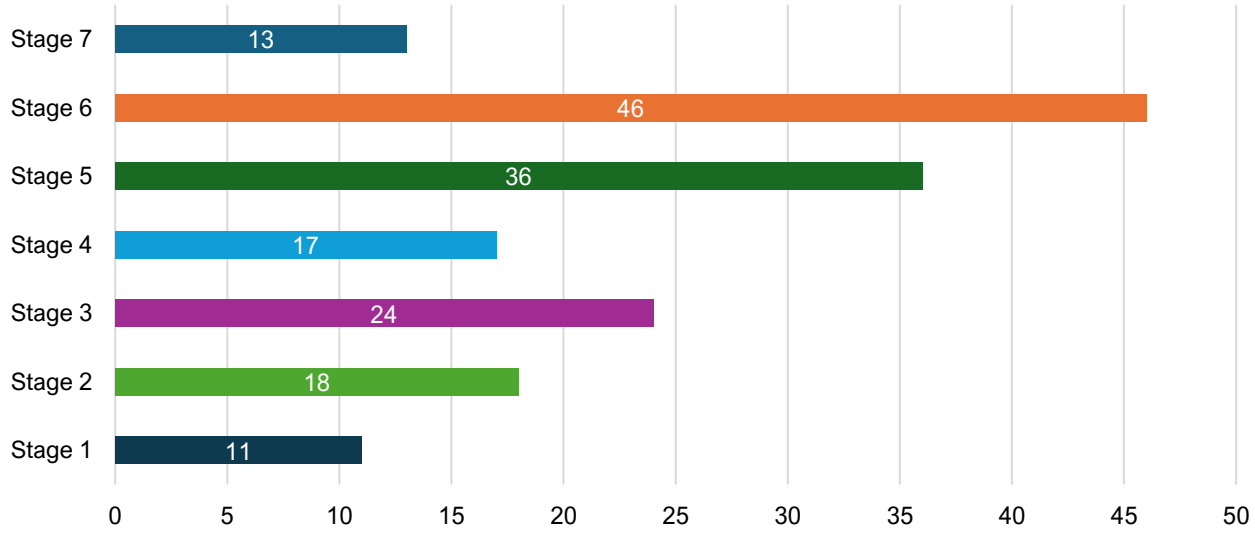
Schedule	SoW	OfT	Source
PCF Stage 2 (March 2021)	January 2024	January 2029	Capital Works Estimate Release Form
PCF Stage 3 (April 2022)	January 2024	November 2027	Capital Works Estimate Release Form
Original Baseline	Q4 2023/2024	Q4 2028/2029	IPDC June 2022
New Project Baseline	Summer 2025	Summer 2030	IPDC January 2024
RIS3 recommended portfolio position (March 2024)	Summer 2025	Summer 2032	A66 Northern-Transpennine project workshop

Source: CEPA analysis

Under any scenario, Start of Works is planned for Summer 2025. This milestone is contingent on whether the DCO consent receives a legal challenge and whether this leads to a full Judicial Review hearing. A legal challenge has been lodged, but it is too early to assess whether this will materially impact the scheme's key milestones and overall schedule. National Highways is confident that the SoW date is still achievable if any JR does not result in a hearing. With no statutory timescales for the consideration of a JR challenge through the courts, National Highways believe that any JR hearing would result in a delay to Start of Works. Precedent suggests that hearings resulting from JR could last up to 18 months, but the exact timeframe of any delay is uncertain as there are no statutory timescales for consideration through the courts.

The PCF stage durations presented in the CE300 are presented in Figure 4.4 below. The 46-month construction phase estimated in the CE300 is below the five year construction period proposed in the January 2024 IPDC paper, and the RIS3 recommended portfolio construction period of seven years.

Figure 4.4: PCF stage durations for the A66 Northern Trans-Pennine scheme



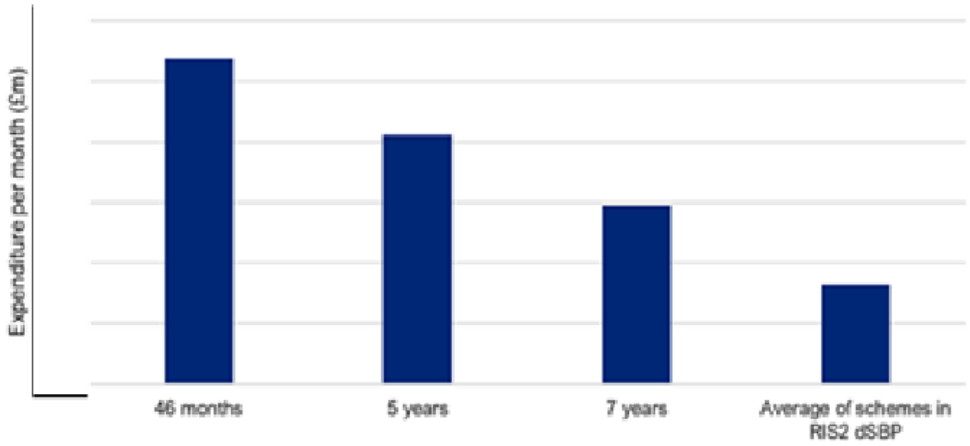
Source: National Highways CE300 Form

We recommend that the ORR monitors the A66's Earned Value metrics closely due to the scheme's large scale and cost, as opportunities to ramp up activity to 'catch up' on schedule will be limited.

The expenditure per month budgeted by National Highways within the CE300 for the construction phase under different construction phase timelines is presented in Figure 4.5 below. As a large scheme in terms of scale and expenditure, all expenditure per month estimates are above the average across schemes within the RIS2 dSBP.

Figure 4.5 shows that the proposed increase in the duration of the construction phase from 46 months to 7 years reduces pressure on expenditure per month. This in turn reduces the impact of National Highways falling behind its expected spend rate and its Earned Value metrics deteriorating, which could affect its capacity to deliver to schedule.

Figure 4.5: Expenditure per month for the A66 Northern Trans-Pennine scheme during the construction stage under different timelines (£m) [**Axis redacted**]



Source: CEPA analysis

Project deliverability is assured internally through the National Highways Project Control Framework process. The latest Stage Gate Assessment Review (SGAR) of the A66 assessed the project as 'Green'. The Infrastructure and Projects Authority assessed the project as 'Amber' in July 2023 as part of its Independent Assurance Reviews.

4.4. Key risks and dependencies

National Highways maintains a risk register for each scheme within the A66 project remit, as well as an 'Enterprise risk register' to ensure an integrated approach to risk management across all contract packages. A Strategic Risk Register for the management of wider portfolio risk is also maintained and reviewed at Major Projects level to inform National Highways on potential Portfolio Risk requirements.

The scheme level risk allowance has been determined via expert-led QCRA and QSRA exercises, where a group of National Highways and DIP team members reach a consensus view on the risk items which are relevant to the project and remain open, develop estimates of the likelihood of occurrence, the cost and schedule impact if each individual risk were to materialise (using high, most likely and low scenario impacts) and estimate the impact of the project team's management/mitigation actions. This is then checked by the central cost estimation team to ensure that the QCRA is sufficiently complete to inform the cost estimate, and the completed risk register is then used to conduct a Monte Carlo analysis to derive P estimates for cost and schedule. The current key delivery risks associated with the A66 scheme identified by National Highways are outlined in Table 4.3.

Table 4.3 Top project risks

Risk	Effect	Current Rating	Post-Mitigated Rating
Underperformance of Statutory Undertakers (SUs), with particular risk relating to NGT Gas Diversion on scheme 3a.	1. Delay to programme 2. Additional works. 3. Increased Costs from additional prelims. 4. Increased cost to SU contracts 5. Potential to miss the NGT outage, causing 12-month delay to scheme 3a	High	High

Risk	Effect	Current Rating	Post-Mitigated Rating
Excavation volumes and transportation significantly exceed those estimated	1. Additional cost against budget for Earthworks 2. Delay to programme 3. Impact on carbon performance	High	High
Materials and Resource not available to the project at the time/ level they are required .	1. More closures 2. Additional temp barriers changes to TM sequences. 3. Potential compensation payments to public transport operators. 4. Costs from reprogramming / resequencing works	High	High
Reductions to the baseline level of permanent land take through temporary acquisition are not possible	1. Reputational impact 2. Increase in land cost on on-going liability for NH	High	High
Existing Pavement condition does not meet 40 - year design life requirement	1. Programme time delay if full reconstruction required 2. Additional cost 3. TM re-design	High	High

Source: ORR A66 Deep Dive Slides.pdf

The CE300 form states that the cost estimating team reviewed a previous version of the QCRA with a pre-mitigation total of [**text redacted**] and deemed it insufficient considering the level of scheme maturity. Consequently, the central cost estimating team uplifted the project risk allowance to [**text redacted**]. National Highways since clarified that this uplift was made utilising information provided by the project and its own internal benchmarks for schemes of this maturity, with the adjustment being made where scope, schedule, and risk definition was not available at this stage of design.

The scheme's risk provision is summarised in the below table.

Table 4.4: The A66 Northern Trans-Pennine's risk provision a percentage of base costs

Risk allowance	Provision
Project risk	**[text redacted]**
Uncertainty allowance	**[text redacted]**
Portfolio risk	**[text redacted]**
Total risk provision	**[text redacted]**
Total risk provision as a percentage of base costs (inflation adjusted)	**[text redacted]**

Source: National Highways CE300 Form

The total risk provision equates to [**text redacted**] of the scheme's inflation-adjusted base cost of [**text redacted**]. [**text redacted**]. Whilst we acknowledge that National Highways has the best understanding of risks specific to its projects, it is important to acknowledge that the scheme is larger than a typical enhancement project, so if major risks identified in Table 4.3 do materialise, mitigation with the current level of risk allowance could prove challenging.

Given the above, we would expect to see a stronger justification for this risk allowance level given the legal challenge to the DCO consent, scheme integration challenges and the extended delivery phase. In particular, the

scheme consists of and 11 projects and has 3 DIPs. There is a risk that challenges experienced on one project or by one DIP could have knock-on effects that impact the wider A66 programme.

5. A428 BLACK CAT TO CAXTON GIBBET

Key findings

- The cost has increased by ~£270m (35%) since the start of RIS2. The main drivers of this increase are the exceptional inflation in construction prices over the period 2022-23 (£138m), and the additional inflation and project management costs that resulted from a legal challenge to the scheme's DCO consent.
- National Highways proposes an inflation profile that is conservative in its approach to inflation risk. We estimate that reducing the RPE uplift from 150 basis points to 75 and adjusting the inflation profile to reflect the OBR's March 2024 forecast would reduce the scheme cost estimate by approximately £44m.
- The legal challenge delayed Start of Works by 12 months. This milestone has since been achieved, with the project aiming for an Open for Traffic date of March 2027. Our review found no major present concerns with the schedule. At the peak of construction this is a large project with a monthly expenditure 'run rate' of just over double that of an average RIS2 scheme.
- We note that progress against this schedule is dependent weather conditions and its resultant influence on productivity rates in the earthworks programme. As this is a relatively large enhancement scheme, we suggest that ORR monitors the scheme's Earned Value metrics closely as the A428's scale might limit National Highways' ability to ramp up its activity and 'catch up' if it were to fall behind on the critical path.
- The scheme's risk provision of 6.71% is significantly below the average 20% cost overrun observed on UK road schemes at FBC stage, as set out in the research which informs DfT's WebTAG guidance. We challenge whether confidence in the cost estimate is sufficient to justify such a low risk provision. We would encourage ORR and National Highways to look closely at the sizing of the Central Risk Reserve overall, to ensure that the empirical evidence of optimism bias – even on relatively mature projects such as the A428 – is not overlooked.

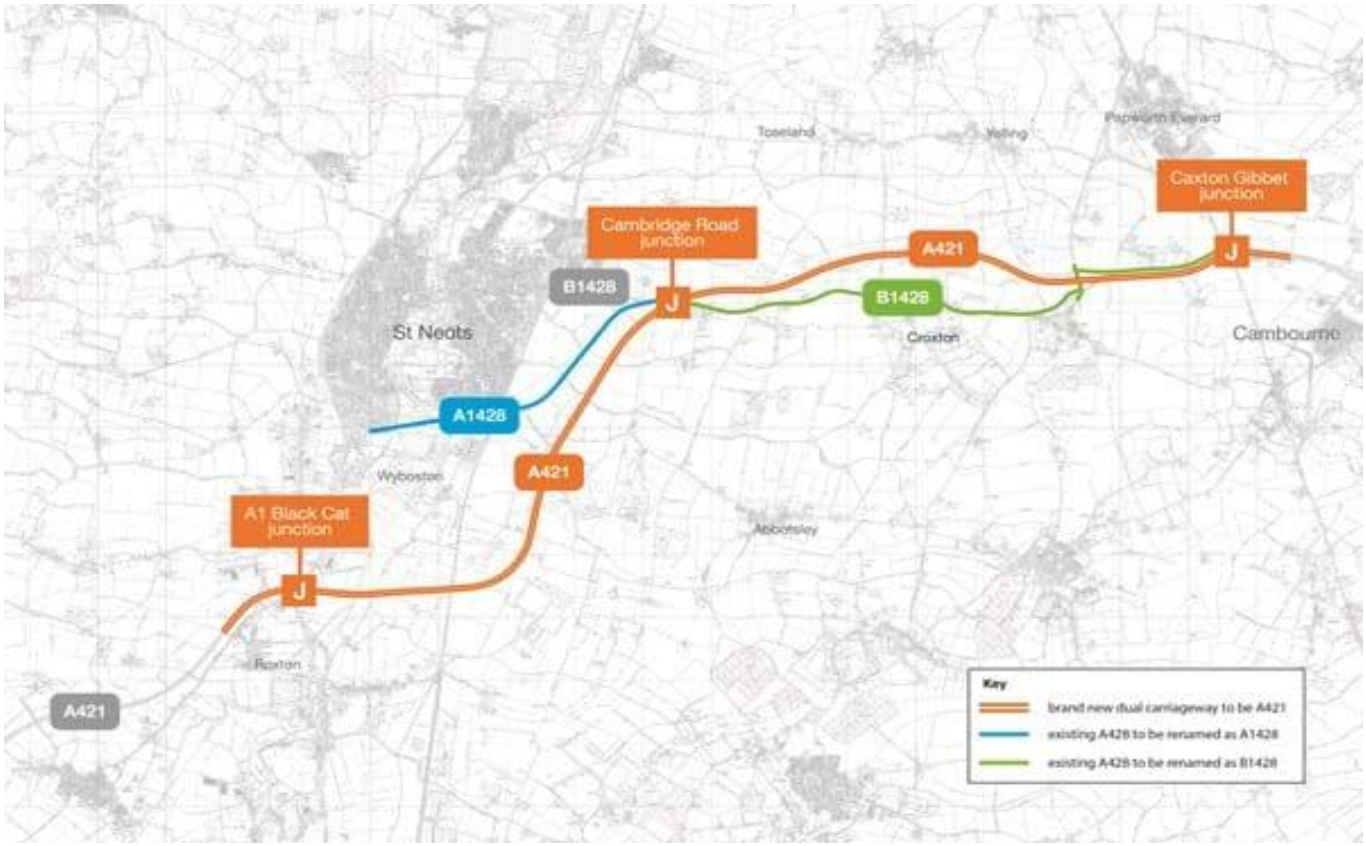
5.1. BACKGROUND TO THE SCHEME

The scheme is a £1,036m project to construct a new 10-mile dual carriageway between the Black Cat roundabout on the A1/A421 in Bedfordshire and the Caxton Gibbet roundabout on the A428 in Cambridgeshire. The project aims to support regional economic growth by improving journey times between Milton Keynes, Bedford and Cambridge. As well as the new dual carriageway, the scheme involves the construction of new junctions and bridges, and improved routes for local walkers, cyclists, and horse riders.

The A428 was originally a RIS1 scheme, with the duration of scheme delivery meaning it was also included in the RIS2 portfolio. When the scheme was originally included in the RIS2 investment package (at which point it was at PCF Stage 3),it had a forecast cost of £777m, a start of works date of July 2021, and an open for traffic target of December 2024. National Highways announced the preferred route in June 2019 and submitted the DCO application in February 2021. Skanska (the Delivery Integration Partner (DIP)) was awarded the construction contract in March 2021.

The Examination of the DCO application closed in February 2022 and the Planning Inspectorate made recommendations to the Secretary of State for Transport in May 2022. The Secretary of State granted the DCO in August 2022, but the Transport Action Network (TAN) lodged a judicial review application in October 2022 on the grounds that the government had failed to assess the climate and environmental impacts of the scheme at regional and local levels. After a second application was rejected, TAN's appeal to High Court and the Court of Appeal was rejected in May 2023. However, this judicial review application delayed start of works by 12 months from December 2022 to December 2023 the key cause of the delay being missing the start of an 'earthworks season').

Figure 5.1: Map of the new dual carriageway to be constructed under the scheme



Source: National Highways

Table 5.1 Background information for the A428 Black Cat to Caxton Gibbet

Scheme information	
Cost estimation[24]	£1,007m (Excluding Portfolio Risk) £1,027m (Including Portfolio Risk)
Current status	PCF Stage 6: Construction, commissioning and handover
BCR	1.6 (Medium VfM) 1.5 – 2.0 Low to High growth BCR sensitivity range (dBSP)
Contractual arrangements	Project awarded to Skanska under the Regional Delivery Partnership (RDP).
Project timeline	SoW December 2023 OfT March 2027
Biodiversity target	On track to achieve RIS2 target and contractual requirement of 10% net gain. Could exceed target by an additional 14% subject to detailed design finalisation.

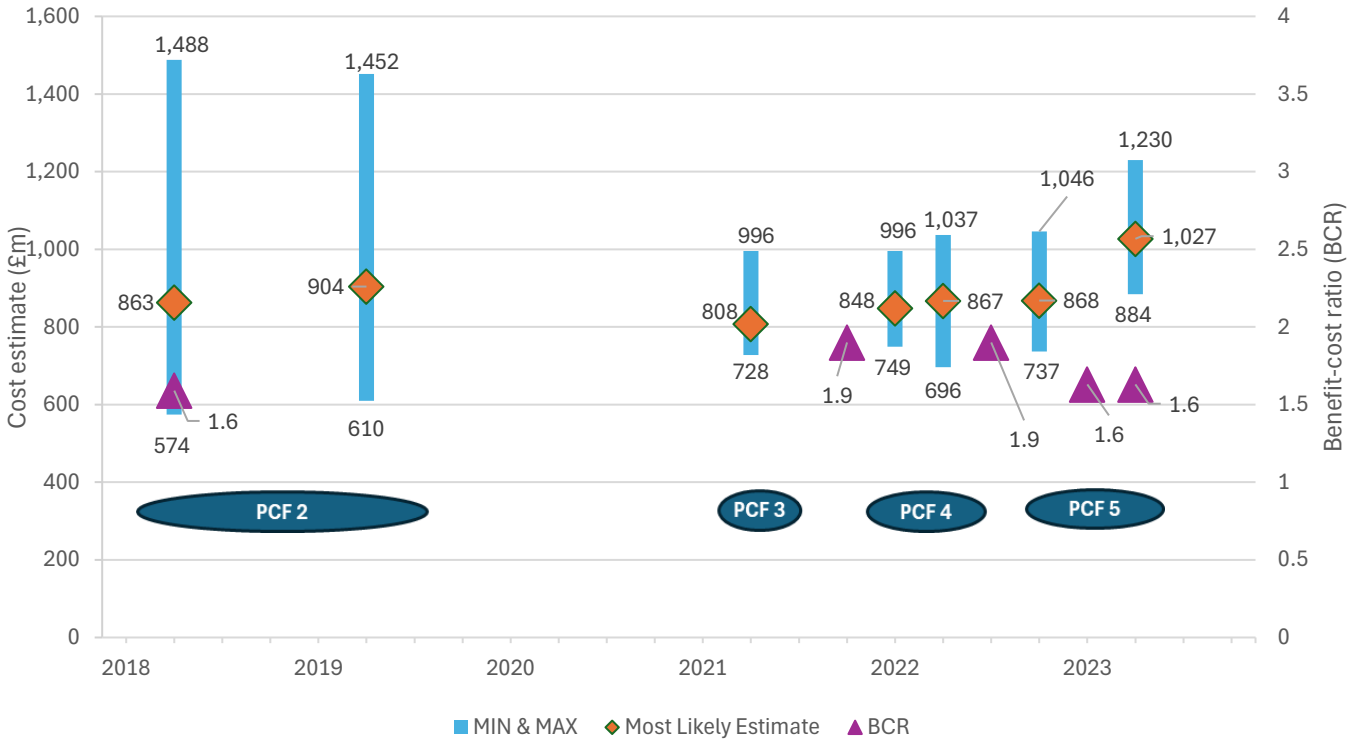
[24] For the A428 cost estimates are equivalent in both the CE300 Form and last approved forecast at IPDC.

5.2. Cost estimation

The latest cost estimate for the scheme is £1,027m (excluding portfolio risk)[25] and this is the basis of the Target Outturn Cost ("TOC") or budget against which the Delivery Integration Partner is incentivised to deliver under the construction contract. Any cost overruns against the TOC are shared 50:50 between National Highways and Skanska (up to a cap which is limited proportionate to the DIP's "management fee" for the project). This 50:50 split is predicated on Skanska delivering on all three KPIs (related to Start of Works, Open for Traffic, and Journey Time Reliability), with a split of 80:20 being applied in any other case. Of the £1,027m total, £602m is in the dSBP for RIS3.

Based on the information available at the time of this review, National Highways' latest forecast shows that the scheme remained on budget, although it remains in the early stages of the construction phase as work had not yet started on the new roads, bridges and junctions. Although the scheme is on budget against its internally governed position, the cost estimate for the scheme has evolved significantly over time, as shown in Figure 5.2 below.

Figure 5.2: Evolution of the A428 cost estimate and BCR through the PCF stages, including portfolio risk (£m, nominal prices)



Source: National Highways CE300 Form
Note: the inflation normalisation adjustment and carbon and biodiversity overlays for RIS3 are not shown in the chart above.

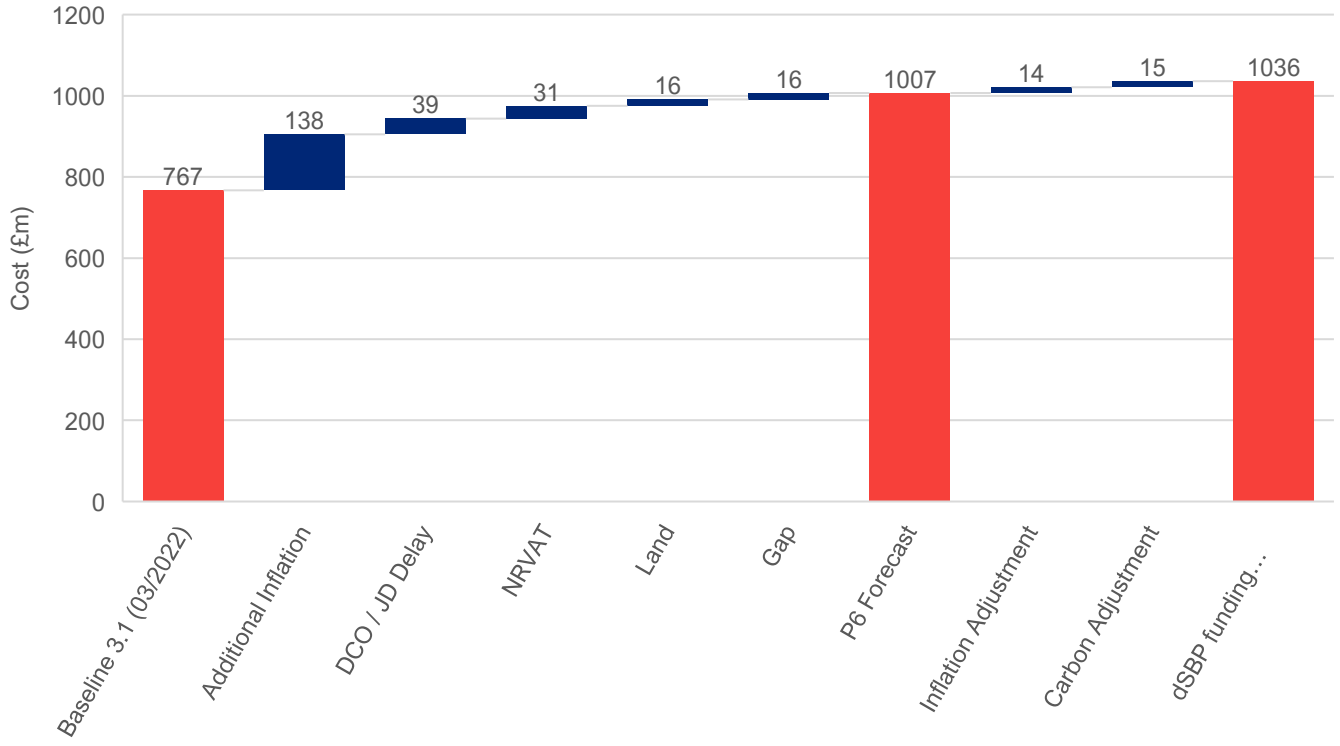
Figure 5.2 also details how the scheme's benefit-cost ratio (BCR) has evolved over time, illustrating that it has fluctuated between 1.6 and 1.9 throughout the PCF stages. All BCRs estimated represent medium 'Value for Money'. As of March 2024, the scheme's BCR is estimated to be 1.6.[26]

[25] National Highways provides an estimate of £1,055m including portfolio risk, although the process for setting portfolio risk (i.e. the Central Risk Reserve) is not a direct aggregation of portfolio risk across each individual scheme. Our understanding is that the scheme level portfolio risk estimate is more of an indicative figure used for internal financial management.

[26] The source of this latest BCR is feedback from National Highways between the Draft and Final reporting stage. National Highways previously stated to us in "A428 Black Cat - ORR overview slides.pptx" that the BCR was 1.63, but we have updated the report in line with National Highways feedback.

National Highways produced the following analysis shown in Figure 5.3 below to explain the evolution of its cost estimate between the start of RIS2 and the estimate included in the RIS3 dSBP.

Figure 5.3: Cost evolution between Capital Baseline and RIS3 dSBP funding (excluding portfolio risk)[27]



Source: A428 Black Cat - ORR overview slides.pptx

The main drivers of the ~£270m (35%) cost increase were:

- Inflation in construction prices over the period 2022-23 resulting from the impact of the energy price crisis on key construction materials prices, resulting in part from the Russia–Ukraine war (£138m)
- Additional inflation and project management costs incurred during the delay resulting from the legal challenge to the DCO application (£39m).
- Changes in the treatment of non-recoverable VAT incurred during the development stages – which applies across the National Highways portfolio and is not scheme-specific – which results in a cost increase of £31m.
- Additional land and compulsory acquisition costs of £16m due to new housing development plans and rising land values in the sub-regional area.
- A further £16m of cost increases relating to "design fix changes" and additional scope resulting from the DCO application.

We have not sought to assess the extent to which some of the smaller cost movements (e.g. due to scope changes) are 'efficient' and/or beyond National Highways' ability to control. Given the magnitude of these costs, we assume that the changes were necessary to deliver DfT's requirements and satisfy the DCO conditions. Instead, we focus on cost categories where National Highways has applied more significant judgement: the RIS3 inflation adjustment and the carbon and biodiversity overlays.

[27] The values shown in Figure 5.2 and Figure 5.3 are not directly comparable, as Figure 5.2 includes portfolio risk and does not include the inflation normalisation adjustment or environmental overlays. Figure 5.3 excludes portfolio risk.

Impact of the inflation adjustment

National Highways has assumed an annual rate of inflation of CPI[28] plus 200 basis points in 2023/24 and 2024/25 under its Deed of Variation adjustment, and from the start of RIS3 (i.e. 2025/26) it then assumes CPI plus 150 basis points. Given that its preferred measure of construction inflation (the Implied Output Price Index for New Construction: Infrastructure) has increased by between 50–75 basis points p.a. faster on average than CPI over the period 1997 to 2023, we attempted to replicate the inflation adjustment included in the A428's cost estimate, and explored the potential impact of:

- Reducing the rate of inflation by 75 basis points p.a.; and
- Updating the CPI forecast from 2025/26 to reflect the OBR's March 2024 EFO

We estimate that this results in a reduction of £25m to reflect the 75 basis point reduction and a further reduction of £19.4m for the March EFO thereafter. Although there is a wider debate about the appropriate rate of inflation to apply to the RIS3 enhancement portfolio, one possible interpretation is that National Highways' relatively conservative approach results in additional base expenditure which might otherwise be provided for in the CRR.

Impact of carbon and biodiversity targets on the cost estimate

National Highways have included a Carbon & Environmental overlay of £15m (1.5% of the total cost estimate).

The biodiversity net gain target (10%) is embedded in National Highways' contract with its Delivery Integration Partner (DIP) and the project told us that it currently expects to achieve additional biodiversity gains of around 14% – subject to the finalisation of the scheme's detailed design – and that this had been achieved within the Target Outturn Cost agreed with the DIP. National Highways told us that the 2% biodiversity cost overlay only applies to schemes with SoW in RIS3[29], so our understanding is that the Carbon & Environmental overlay for the A428 does not include a biodiversity component.

The scheme has a 20% carbon reduction target against its initial carbon baseline. The Company estimates that it has removed 28,700 tonnes of CO_2 through the design process as at the DCO submission and is targeting an approximate further 10,000 tonnes reduction during construction – which results in a combined reduction of approximately 18% to date against the scheme's carbon baseline.[30] National Highways is seeking further reductions to meet the 20% carbon reduction target within the existing budget. Should National Highways be required to exceed this 20% target through an instruction from DfT, change control would have to be triggered and additional funding would be requested, as any addition over the 20% target is not within the DIPs scope.

Construction phase reductions will be sought via opportunities to deploy an electric vehicle fleet and non-diesel HGVs. We understand that in the case of the A428, these carbon reduction targets are not embedded within the DIP contract. Rather, the DIP has agreed to collaborate with National Highways to deliver this ambition as part of its wider commercial relationship.

Noting that National Highways has applied the biodiversity and carbon overlays across the portfolio, and that ORR will want to consider the efficiency of these overlays 'in the round', we observe that in the case of the A428 the carbon overlay is not directly linked to the achievement of the Company's carbon objectives. In other words, the carbon overlay could be significantly reduced (or transferred into a portfolio risk pot), and the scheme would still expect to achieve its environmental objectives.

[28] Based on the OBR's projections in the November 2023 Economic and Fiscal Outlook report.

[29] See response to RFI098, dated 12 March 2024.

[30] National Highways applies an internal carbon reduction target to each enhancement project depending on its stage of development. Committed RIS1 and RIS2 tail enhancement schemes target a 20% reduction, schemes developed in RIS2 for delivery in RIS3 target a 30% reduction, and newly announced RIS3 schemes will have a 50% reduction target.

5.3. PROJECT SCHEDULING

As noted above, Start of Works (SoW) has been delayed by 12 months on the A428 due to the legal challenge to the DCO. The revised SoW milestone of December 2023 has been achieved, and the project is now committed to an Open for Traffic (OfT) date of March 2027.

The construction period for the scheme is 44 months which means that National Highways expects to spend approximately £18m per month during the construction phase, compared to a RIS2 scheme-level average of ~£8m and ~£15m for the A66 Northern Trans-Pennine scheme. This means that the A428 is both a relatively large scheme compared to a 'typical' enhancement project, but also more ambitious in its schedule – which may in part reflect the 'off-line' nature of much of the construction activity.

Our interview with the A428 project team did not identify any major present concerns with the schedule:

- The DIP (Skanska) was part of the joint venture which successfully delivered the £1.5bn A14 Cambridge to Huntingdon scheme in RIS2. On its side, National Highways has retained experienced project management staff from that project and has deployed them on the A428 and has incorporated lessons learnt from the A14 into its delivery plan for the A428.
- National Highways told us that it used the 12-month delay to de-risk certain activities within the project schedule, including progressing with several high value and complex utilities diversions which are now complete, as well as the commencement of archaeological investigations. This substantially de-risks both cost and schedule uncertainties.
- Although full construction works have not yet started in earnest, the scheme is currently 'on-schedule' and more than 95% of detailed design work has been completed.

We note that progress on the A428 will depend on productivity rates in the earthworks programmes, which in turn can be influenced by weather conditions. National Highways is aware that prolonged periods of bad weather may impact on construction progress There may come a point where delays on the earthworks programmes have knock on consequences for the integration of other works which would place the OfT milestone at risk. This is a risk that it has to manage across its project portfolio.

Given that the A428 is a relatively large project by National Highways' standards and that the Company's ability to ramp up activity to 'catch up' will be limited, we recommend that the ORR monitors the scheme's Earned Value metrics closely. We also suggest that it considers placing the scheme on its 'watchlist' earlier than it might do for other schemes if those Earned Value metrics slip and use that opportunity to reaffirm the Company's plan to achieve critical and near-critical activities over the following 6 to 12 months, and to understand the potential impact on the committed OfT date.

5.4. KEY RISKS AND DEPENDENCIES

The CE300 form includes a £46.6m risk allowance, of which we understand that £23.0m is reflected in the Target Outturn Cost (TOC) against which the DIP is incentivised under the pain/gain mechanism, where the contractor shares in the financial under and overperformance against the TOC up to a cap. This risk allowance equates to 4.4% of the scheme cost estimate. There is a further portfolio risk component of approximately £19m which is not held by the scheme but feeds into the wider sizing of the CRR. Including portfolio risk, the total risk allowance for the scheme equates to approximately 6.7% of the base cost estimate.

The scheme level risk allowance has been determined via expert-led QCRA and QSRA exercises, where a group of National Highways and DIP team members reach a consensus view on the risk items which are relevant to the project and remain open, develop estimates of the likelihood of occurrence, the cost and schedule impact if each individual risk were to materialise (using high, most likely and low scenario impacts) and estimate the impact of the Company's management/mitigation actions. This is then checked by the central cost estimation team to ensure that the QCRA is sufficiently complete to inform the cost estimate, and the completed risk register is then used to

conduct a Monte Carlo analysis to derive P estimates for cost and schedule. The top 5 risks from the Company's scheme level risk register are outlined in Table 5.2 below.

Table 5.2: National Highways top 5 current delivery risks

Risk	Likelihood	Impact	EMV	Post-mitigated EMV
Prolonged periods of bad weather during winter months may impact on construction earthworks and lifting works, adding to construction costs through the need to abort or repeat works.	Medium	High	£5m	£5m
Land costs could increase beyond the estimated provision, making the land budget insufficient.	Low	High	£2.5m	£2.5m
Significant level of disruption to traffic during construction using planned TM phasing could result in additional costs through the resequencing of works or compensation payments to public transport operators.	High	Medium	£3.6m	£1.7m
If National Highways is unable to agree departures for side road with local authorities, additional costs could be incurred through delayed construction activities and construction cost.	Medium	High	£2m	£1.3m
If Network Rail fails to provide agreed possessions, the resultant delay could result in deadlines being missed and additional design costs.	Medium	Medium	£2m	£1.25m

Source: A428 Black Cat - ORR overview slides.pptx

Given that the scheme design is now mature and the DIP has had extensive involvement in developing the cost and schedule estimates, the QCRA and QSRA exercises are also relatively mature and therefore more robust. However, it is worth noting that these exercises are not infallible and that National Highways finds it more challenging to accurately estimate some costs relative to others – particularly around land compensation costs and major utilities diversions / statutory undertakers works on which it has less historical cost information. Whilst we acknowledge that to some extent these cost estimates are either out of the Company's control (statutory undertakers works) or rely on external forecasts (land), National Highways should use its experience to ensure that these items are incorporated in project cost estimates with appropriate risk adjustments, especially if there is a trend of these costs being underestimated historically. For example, at the start of RIS2 National Highways estimated that it would need a risk provision of £2.8m–£10.7m for land acquisition and compensation, but its latest estimates show an increase of £16m, which is outside this range.

In that context, there is a need to be mindful of:

- Overly optimistic assumptions around the ability of the DIP to manage weather related delay and the knock-on impact on the project schedule which is relatively ambitious for a scheme of this size; and
- Residual risks which are 'unknown unknowns' and could materialise during the construction phase.

The scheme's risk provision is summarised in the below table.

Table 5.3: The A428 Black Cat to Caxton Gibbet's risk provision a percentage of base costs

Risk allowance	Provision
Project risk	£27.7m
Uncertainty allowance	£17.4m

Risk allowance	Provision
Portfolio risk	£19.5m
Total risk provision	£64.6m
Total risk provision as a percentage of base costs (inflation adjusted)	**6.7%**

Source: National Highways CE300 Form

By point of comparison, research on reference class forecasting approaches commissioned by DfT to inform the optimism bias uplifts used in transport appraisal finds that even at the Full Business Case (FBC) stage, for the PMean level of certainty, the average UK road project would require a risk uplift of 20% over the base cost estimate if it is to be delivered 'on budget'.[31] We acknowledge that National Highways has the best knowledge on the cost of delivering highways projects and it now has good confidence in the cost estimate given the maturity of the A428 scheme. However, the difference between a risk provision of 6.7% and 20% is large and given the experience of scheme costs in RIS1 and RIS2, we challenge whether confidence in the cost estimate is sufficiently high to justify such a low risk provision. In that context, we would encourage ORR and National Highways to look closely at the sizing of the CRR overall, to ensure that the empirical evidence of optimism bias – even on relatively mature projects – is appropriately considered / not overlooked. [32]

In summary, the scheme is now at a stage of maturity where there is greater confidence in the scope, cost and schedule estimates. It has been substantially de-risked through the completion of utility diversions, ground investigations and archaeological clearance. But it is worth bearing in mind that the project is larger than a typical enhancement project and as so if major risks around weather conditions and supplier performance do materialise, the scheme level risk allowance is set relatively tightly.

In response to our draft report, National Highways told us that subsequent project negotiations and contract price agreements resulted in a higher 11% risk provision. However, it did not set out the basis of this calculation nor does it explain why 6.7% was deemed appropriate in the production of the most recent cost estimate.

One further risk identified by National Highways but not included in is the project's scope at present relates to the East West Rail (EWR) scheme.[33] Whilst the relevant section of the EWR scheme is at an earlier stage of development than the A428 scheme, it could potentially lead to an increase in the A428 required scope of works. DfT's sponsors for the A428 told us that (if they materialise) DfT's current view was that if DfT instructed any change in scope, any impacts on the A428 scheme's construction scope and schedule would be mitigated through the EWR budget. The DfT project sponsors also identified inflation and stakeholder management as key risks associated with the A428 scheme's construction phase, acknowledging that the former is a risk across the portfolio and the latter is unlikely to have a financial impact, with the scope for stakeholders to affect the cost envelope is limited now the scheme is in construction phase.

[31] Department for Transport (2021), TAG: optimism bias workbook, May. Available online at – link.

[32] National Highways provided an updated project risk allowance of ~£30m and uncertainty allowance of £16.6m in "A428 Black Cat – ORR overview slides.pptx" but we opted to use the risk allowances present in the CE300 to maintain consistency across case studies within this report. We also note that updating our calculations using the updated risk allowance is immaterial to our conclusion as it increases the total risk allowance to 6.9%.

[33] Discussion with DfT sponsor for the A428 scheme on 14/02/2024.

6. A417 'MISSING LINK'

Key findings

- This is a 3.4 mile dualling scheme on the last remaining single-carriageway section of the A417.
- The scheme's cost estimate has increased by ~£160m (42%) since December 2018 resulting from exceptional levels of inflation on construction prices (£57m), design changes and delays associated with the National Trust withdrawing its support from the scheme (£57m) and replacing the Delivery Integration Partner (£32m).
- National Highways proposes an inflation profile that is conservative in its approach to inflation risk. We estimate that reducing the RPE uplift from 150 basis points to 75 and adjusting the inflation profile to reflect the OBR's March 2024 forecast would reduce the scheme cost estimate by approximately £21m.
- The project has achieved its SoW milestone. Both internal and external assurance indicate the project is progressing to schedule.
- The scheme's risk provision of 12.4% is below the 20% overrun observed on UK road schemes at FBC stage, as estimated in research underpinning DfT's WebTAG guidance. Whilst we acknowledge that National Highways has the best understanding of costs and the scheme's maturity implies a good level of confidence in its estimate, we challenge whether there is a sufficient justification for the low level of risk provision.

6.1. BACKGROUND TO THE SCHEME

The A417 'Missing Link' seeks to improve the connection between two dual carriageway sections of the A417 at Brockworth and Cowley. At present, the Missing Link is subject to frequent congestion which diverts traffic onto local roads. Accidents are frequent because of poor visibility. The scheme centres around 3.4 miles of new dual carriageway connecting the existing A417 Brockworth bypass with the existing A417 dual carriageway south of Cowley, but also includes:

- New junctions at Shab Hill and Cowley.
- The conversion of some the existing A417 between the Air Balloon and Cowley roundabouts into a walkway for walkers, cyclists, and horse riders.

National Highways states the benefits of the scheme are:

- **Creation a safer, more resilient and efficient network**, through reducing injuries and fatalities in the accident cluster sites, as well as reducing traffic problems and improving connectivity to the local road network and between the Thames Valley and West Midlands.
- **Support for economic growth** by giving people more reliable local and strategic journeys which could benefit local businesses and improve prosperity.
- **Improvements to the natural environment and heritage** by maximising opportunities for historic and environmental enhancements within the Cotswolds Area of Outstanding Natural Beauty, and minimising negative scheme impacts through the removal of Air Quality Management Area status.
- **Community and Access improvements**, with local residents benefitting from a reduction in traffic intrusion and pollution, and improved public access to the countryside.

The scheme was included in the RIS2 investment package at which point it was at PCF Stage 2. It had a forecast cost of £483m (with an estimated cost range of between £334m - £785m), a start of works date of 2021/2022, and an open for traffic target of 2024/2025. A preferred route for the scheme was announced in March 2019.

The National Trust (NT) withdrew support for the scheme in 2020 over the green bridge which led to a redesign, with the green bridge being subsequently replaced with two land crossings. These changes were taken to a supplementary consultation between the October and November 2020. National Highways submitted the DCO application in May 2021. Kier (the Delivery Integration Partner (DIP)) was awarded the construction contract in March 2022.

The Examination of the DCO application closed in February 2022 and the Planning Inspectorate made recommendations to the Secretary of State for Transport in August 2022. DCO consent was granted in November 2022, with the SoW commitment being achieved one month ahead of schedule in 2023. National Highways told us that the project is on schedule to meet the February 2027 OfT commitment.

Table 6.1 Background information for the A417 Missing Link

Background information	
Cost estimation (Last approved forecast at IPDC)[34]	£517m (Excluding Portfolio Risk) £535m (Including Portfolio Risk)
Current status	PCF Stage 6: Construction, commissioning and handover
BCR	2.0 (Medium VfM)
Contractual arrangements	Delivery Integration Partner: Kier Technical Partner: Arup
Project timeline	SoW: achieved February 2023 OfT: February 2027
Biodiversity target	The project's status as a Nationally Significant Infrastructure Project means it does not require a commitment to biodiversity net gain.
Carbon target	National Highways is targeting to reduce CO_2 emissions by 10% by 2025 and a further 40-50% between 2025 and 2030.

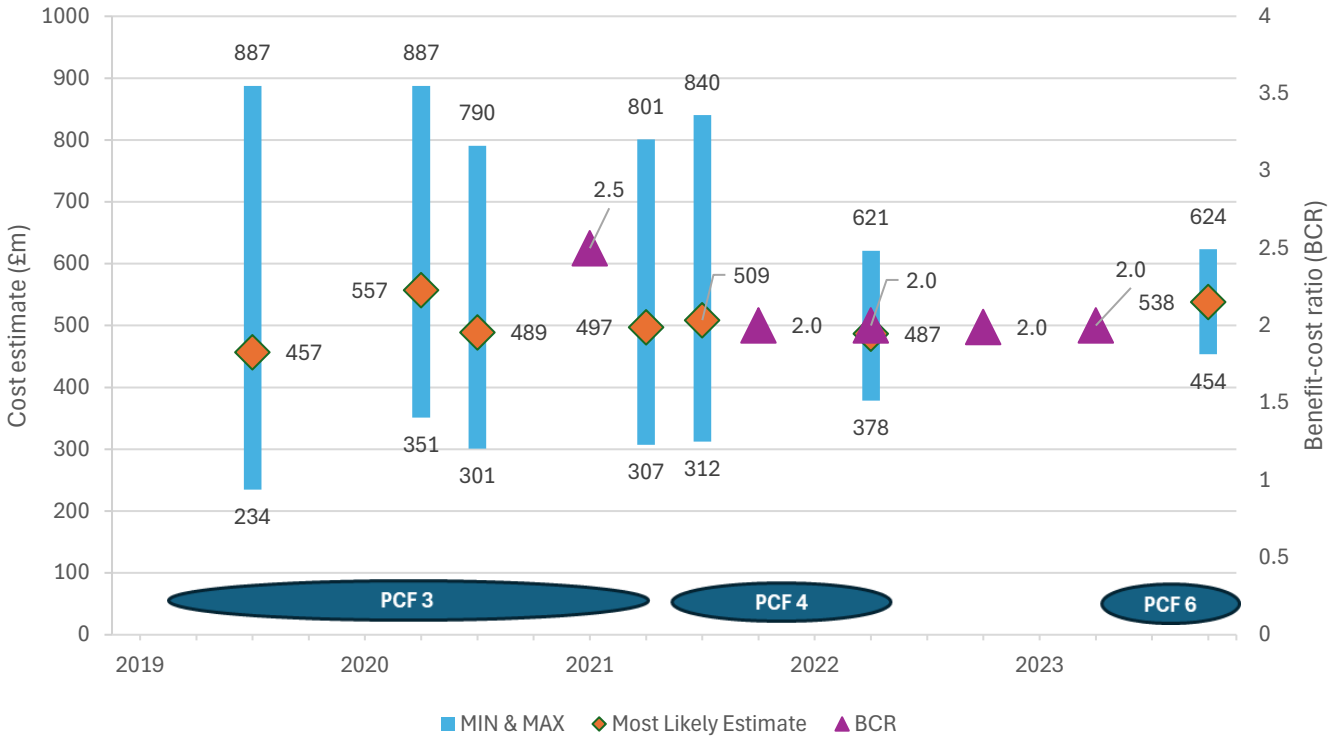
6.2. Cost estimation

The latest cost estimate for the A417 scheme as of March 2024 is £535m (including portfolio risk). This figure is the Target Outturn Cost ("TOC") against which Kier is incentivised to deliver. Under the construction contract, overruns against the TOC are split equally between National Highways and Kier. £289m of this £535m total is included within the dSBP for RIS3.

The evolution of the scheme's cost estimate and benefit-cost ratio is illustrated in Figure 6.1. The figure demonstrates that whilst the scheme's cost estimate has increased slightly as it has progressed through the PCF stages, this increase has been accompanied by a narrowing of the minimum and maximum ranges in a stable manner. Whilst the BCR fell from 2.5 to 2.0 between PCF stages 3 and 4, the scheme's BCR and its economic case has remained relatively stable since that point.

[34] The CE300 Form provided to us for this review estimates a cost of £528m / £537m (Excluding/Including Portfolio Risk) in December 2023, but we included the last approved forecast at IPDC in Table 6.1 as it was the cost estimate included onPage 2 of "A417 Missing Link Air Balloon - ORR overview slides - final.pdf" in March 2024.

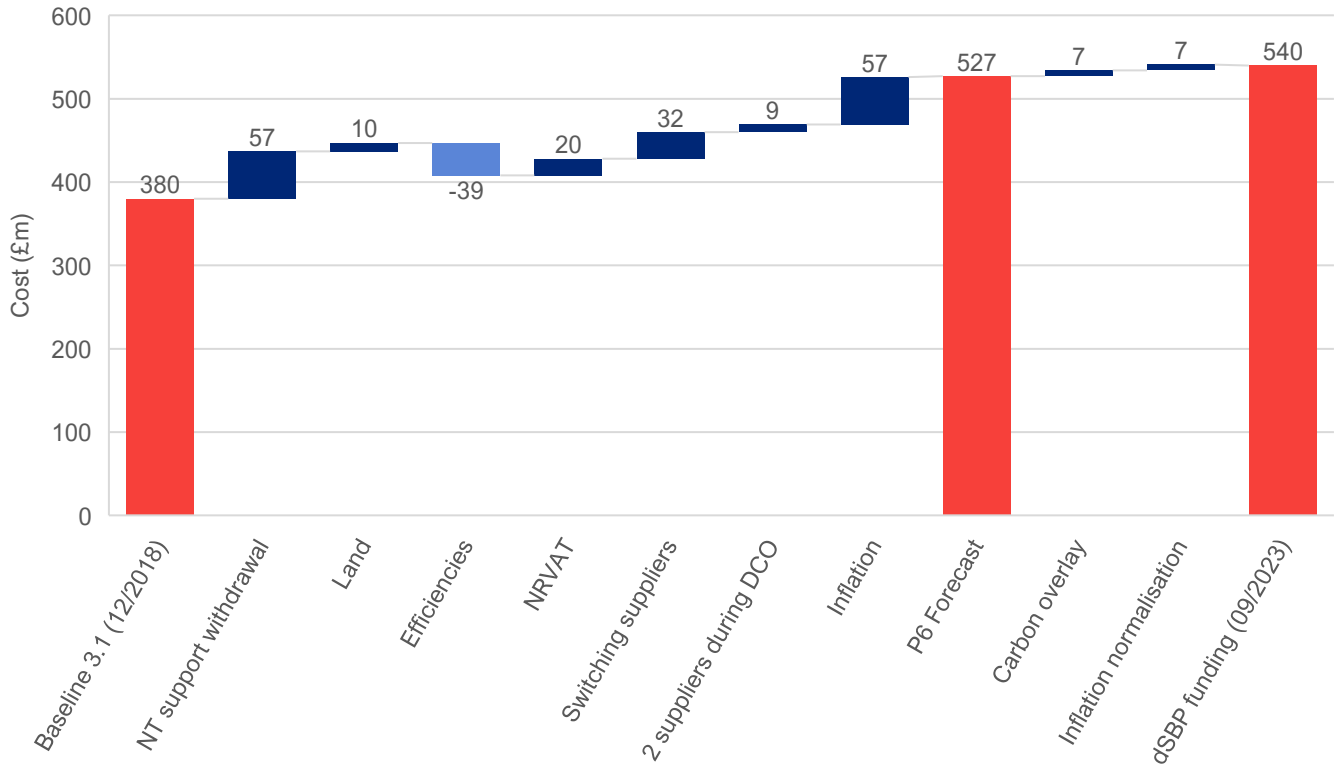
Figure 6.1: Evolution of the A417 cost estimate and BCR through the PCF stages, including portfolio risk (£m)



Source: National Highways CE300 Form

National Highways produced the following analysis shown in Figure 6.2 below to explain the evolution of its cost estimate between the Baseline 3.1 estimate and the estimate included in the RIS3 dSBP.

Figure 6.2: Cost evolution between Capital Baseline and RIS3 dSBP funding (including portfolio risk) [35]



Source: A417 Missing Link Air Balloon - ORR overview slides - final.pdf

The main drivers of the ~£160m (42%) cost increase were:

- The costs associated with the delay and redesign of the scheme, following the withdrawal of support for the scheme from the National Trust (£57m). Part of this cost results from the design costs associated with the redesign of the scheme from including a 'green bridge' over National Trust inalienable ground to include two land crossings. There was also a cost impact from the additional inflation costs incurred as a result of the 12-month delay caused by the redesign.
- Rising land costs have led to an upwards adjustment in Highways Agency Lands (HAL) forecasts, which results in an impact of £10m on the scheme's land and compulsory acquisition costs.
- A £37m efficiency saving associated with road design realignments. One design efficiency was the changing of the road from 7% to 8% gradient, which removed the need for all retaining walls, saving considerable excavation costs, HGV movements, and over 40,000 CO_2 equivalent tonnes.
- Changes in the treatment of non-recoverable VAT incurred during the development stages – which applies across the National Highways portfolio and is not scheme-specific – which results in a cost increase of £20m.
- The switching of suppliers from Taylor Woodrow to Kier following the withdrawal of Taylor Woodrow from the contract. The £32m cost increase results from Kier having higher rates than Taylor Woodrow.

[35] The values shown in Figure 6.1 and Figure 6.2 are not directly comparable, as Figure 6.1 includes portfolio risk and does not include the inflation normalisation adjustment or environmental overlays. Figure 6.2 excludes portfolio risk.

- Due to the scheme-specific knowledge and expertise it developed before it withdrew from the contract, Taylor Woodrow was retained to support the DCO application process despite its withdrawal. Retaining both Taylor Woodrow and Kier through the DCO application process resulted in a cost increase of £9m.
- Inflation in construction prices over the period 2022-23 resulting from the impact of the energy price crisis on key construction materials prices, resulting in part from the Russia–Ukraine war (£57m). The impact of the scheme's inflation adjustment is explored in greater detail below.

In addition to these cost increases, there are further planned costs that have not yet materialised. This includes a £7m cost overlay related to the carbon and environmental commitments and ambitions on the scheme, as well as an increase resulting from the normalisation of how inflation is calculated across National Highways major projects schemes (£7m).We have not sought to assess the extent to which some of the smaller cost movements (e.g. due to switching suppliers) are 'efficient' and/or beyond National Highways' ability to control. Given the magnitude of these costs, we assume that the changes were necessary to deliver DfT's requirements and satisfy the DCO conditions but there are lessons which might be learned to inform its future plans (including the efficiency savings which it assumed the Regional Delivery Partnerships model would deliver). Instead, we focus on cost categories where National Highways has applied more significant judgement: the RIS3 inflation adjustment and the carbon overlay.

Impact of the inflation adjustment

National Highways has assumed an annual rate of inflation of CPI[36] plus 200 basis points in 2023/24 and 2024/25 under its Deed of Variation adjustment, and from the start of RIS3 (i.e. 2025/26) it then assumes CPI plus 150 basis points. Given that its preferred measure of construction inflation (the Implied Output Price Index for New Construction: Infrastructure) has increased by between 50–75 basis points p.a. faster on average than CPI over the period 1997 to 2023, we attempted to replicate the inflation adjustment included in the A417's cost estimate, and explored the potential impact of:

- Reducing the rate of inflation by 75 basis points p.a.; and
- Updating the CPI forecast from 2025/26 to reflect the OBR's March 2024 EFO

We estimate that this results in a reduction of £11.9m to reflect the 75 basis point reduction and a further reduction of £9.6m for the March EFO thereafter. Although there is a wider debate about the appropriate rate of inflation to apply to the RIS3 enhancement portfolio, one possible interpretation is that National Highways' relatively conservative approach results in additional base expenditure which might otherwise be provided for in the CRR.

Impact of carbon and biodiversity targets on the cost estimate

Carbon

National Highways included a Carbon & Environmental overlay of £7m in its latest cost estimate (1.3% of the total cost estimate).[37] National Highways states that it has removed over 40,000 tonnes of CO2 in design phase, equating to a 35% carbon reduction. These carbon savings include the following initiatives:

- Saving 10,000 tonnes of CO_2 through the elimination of most retaining walls.
- 28,000 tonnes of CO_2 saved through changes to bridge designs.
- A further 2,000 tonnes of CO_2 saved due to reduced excavation and HGV movements, with HGV movements reduced by 580 movements per day.
- The elimination of over 1 million cubic metres of earthworks.

[36] Based on the OBR's projections in the November 2023 Economic and Fiscal Outlook report.

[37] A417 Missing Link Air Balloon - ORR overview slides - final.pdf

Given that National Highways has already achieved a significant reduction in carbon emissions through scheme design which is reflected in the latest cost estimate, we find that the need for the additional £7m carbon overlay is not well justified or evidenced.

Biodiversity

The scheme's status as a Nationally Significant Infrastructure Project meant that there was no provision for a mandatory biodiversity net gain target under the Environment Act 2021. As the A417 had a SoW date in RIS2, no biodiversity overlay has been applied to its cost estimate, and no provision for biodiversity net gain requirements has been allocated through Designated Funds for RIS3.[38] Even with proposed mitigations, the scheme is assessed to have a 26.5% biodiversity net loss.[39] Current biodiversity initiatives on the scheme include:

- The translocation of approximately 2,000 reptiles
- Enhancements of bat roosts and boxes in accordance with Natural England licenses.
- The construction of an artificial badger set.
- The installation of 40 bird boxes.

By May 2023, the scheme's biodiversity net loss was estimated to have fallen to 29%.[40] The CE300's December 2023 cost estimate contained no provision for biodiversity, recognising that the RIS2 biodiversity net gain requirement is at portfolio level, and not specific to individual schemes with a SoW date in RIS2.[41]

6.3. Project Scheduling

The current project schedule as of March 2024 involves the following key milestones:

- SoW – February 2023 (achieved)
- OfT – February 2027

The information available at the time of this review indicates that the project is progressing in accordance with its current schedule. Earthworks are expected to commence in Spring 2024, with the DIP targeting completion by the end of the year. This target accelerates the agreed programme, which could de-risk the structures programme and potentially facilitate early delivery of the scheme.

The evolution of the project schedule for the A417 scheme is outlined in Table 6.2 It shows the planned project schedule has remained relatively stable from September 2020 onwards, with a SoW date in February 2023 and a construction phase between 41 – 43 months. The CE300 form expected PCF Stage 6 to begin in January 2024, which represents a departure from the February 2023 SoW milestone National Highways states. We assume that for this scheme, National Highways interprets the significant archelogy and environmental mitigation works beginning in February 2023 as achieving its SoW milestone, rather than at the beginning of the full construction works under PCF Stage 6.

Table 6.2: Project schedule evolution

Schedule	SoW	OfT	Source
August 2019 (PCF Stage 3)	December 2021	July 2024 (31 month construction phase)	Capital Works Estimate Release Form (December 2023)

[38] See response to RFI098, dated 12 March 2024.

[39] The Planning Inspectorate (2022), A417 Missing Link Examining Authority's Report of Findings and Conclusions and Recommendation to the Secretary of State for Transport, August, p.67. Available at - link.

[40] 260523_A417_Missing_Link_CSR_Stage_5_post_FBC_Final_Signed_Document_PDF.pdf

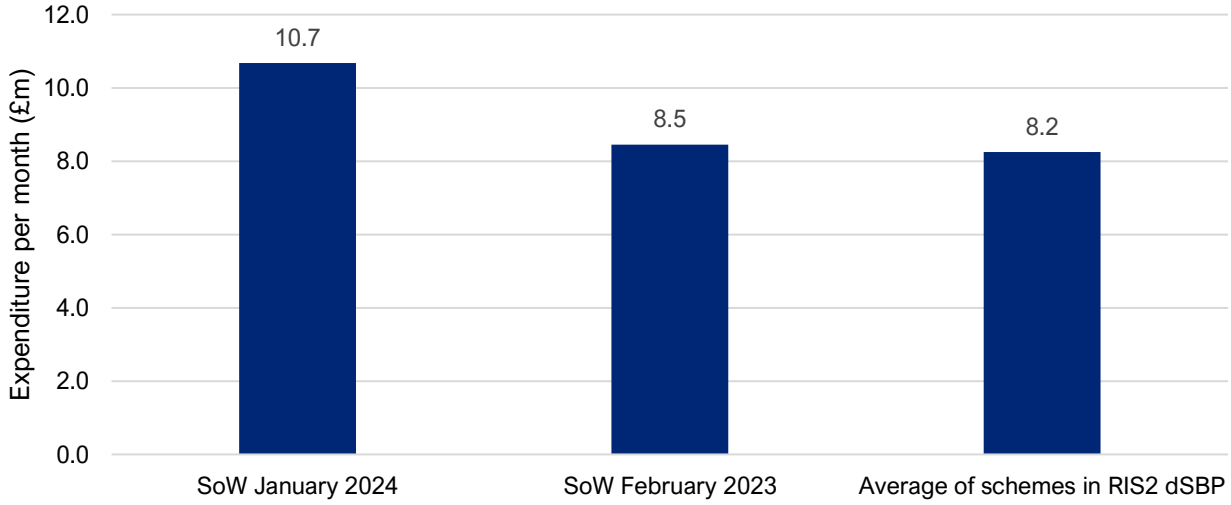
[41] A417 Missing Link Preconstruction F300.pdf

Schedule	SoW	OfT	Source
April 2020 (PCF Stage 3)	April 2022	October 2025 (42 month construction phase)	Capital Works Estimate Release Form (December 2023)
April 2021 (PCF Stage 3)	February 2023	July 2026 (41 month construction phase)	Capital Works Estimate Release Form (December 2023)
September 2021 (PCF Stage 4)	February 2023	September 2026 (43 month construction phase)	Capital Works Estimate Release Form (December 2023)
May 2022 (PCF Stage 4)	February 2023	September 2026 (43 month construction phase)	Capital Works Estimate Release Form (December 2023)
December 2023 (PCF Stage 5)	January 2024	February 2027 (38 month construction phase)	Capital Works Estimate Release Form (December 2023)
February 2024 (PCF Stage 6)	Achieved	February 2027	National Highways IDC paper (February 2024)

Source: various National Highways documentation

Expenditure per month for PCF Stage 6 is estimated at £10.7m, which is slightly above the scheme-level average of £8.2m in the RIS2 dSBP. Using the achieved SoW milestone of February 2023 as the start of the construction phase reduces expenditure per month to £8.5m, which is closer to the RIS2 dSBP average. However, given that this is a £540m scheme, we recommend that the ORR engages with National Highways to better understand the basis of the Earned Value metrics and monitor their evolution over time, as there may be more limited opportunity to 'catch up' on a scheme of this size if it falls behind schedule.

Figure 6.3: Monthly expenditure on the A417 scheme during the construction stage under different timelines (£m)



Source: CEPA analysis of National Highways CE300 Form and A417 Missing Link Air Balloon - ORR overview slides - final.pdf

Project deliverability is assured internally through Stage Gate Assessment Reviews (SGAR) as part of the National Highways Project Control Framework process, and externally through Infrastructure and Projects Authority's (IPA) Independent Assurance Reviews (IAR). Both the latest SGAR 5 review (December 2023), and IAR (March 2023) assessed the project as 'Green', providing confidence to the scheme's deliverability. Our discussions with National

Highways and DfT did not present any major concerns with the project's schedule – noting that the DIP has contractually committed to a more ambitious earthworks timetable which it is commercially incentivised to deliver.

6.4. KEY RISKS AND DEPENDENCIES

The cost estimate presented in the CE300 includes a £49.7m risk allowance, of which we understand that £22.3m is reflected in the Target Outturn Cost (TOC) against which the DIP is incentivised via the pain/gain mechanism, where the contractor shares in the financial under and overperformance against the TOC up to a cap. This risk allowance equates to 9.4% of the scheme cost estimate There is a further portfolio risk component of approximately £9.5m which is not held by the scheme but incorporated within the CRR. Including portfolio risk, the total risk allowance for the scheme equates to approximately 12.4% of the base cost estimate.

The scheme level risk allowance has been determined via expert-led QCRA and QSRA exercises, where a group of National Highways and DIP team members reach a consensus view on the risk items which are relevant to the project and remain open, develop estimates of the likelihood of occurrence, the cost and schedule impact if each individual risk were to materialise (using high, most likely and low scenario impacts) and estimate the impact of the Company's management/mitigation actions. This is then checked by the central cost estimation team to ensure that the QCRA is sufficiently complete to inform the cost estimate, and the completed risk register is then used to conduct a Monte Carlo analysis to derive P estimates for cost and schedule The top 5 risks on the Xactium risk register in terms of post-mitigated EMV are presented in Table 6.3. Within a workshop on the A417 scheme, National Highways identified harsh weather conditions, and the availability of specialist resourcing (such as drystone walling specialists) as further key risks to delivery.

Table 6.3: *National Highways top 5 current delivery risks*

Risk	Likelihood (probability %)	Impact	Current Score & EMV	Post-mitigated score EMV
If the Fuller's Earth as Class 2 fill excavated from zones D-F is deemed unsuitable for the supplier to use in embankment fill, there would be costs associated with disposal and replacement with suitable material.	55	Very High	£8.5m	£7.5m
Land costs could increase beyond the estimated provision, making the land budget insufficient.	45	Very High	£2.7m	£2.0m
If National Highways is unable to satisfy requirements to handover, there could be delay to handover and additional costs.	70	High	£2.2m	£2.0m
Detailed design changes may lead to additional construction costs or time of construction.	30	Very High	£1.9m	£1.5m
Due to incomplete drainage design to detrunking, there may be additional costs and delays realised during construction works.	75	High	£1.4m	£1.3m

Source: 2024 02 12-A417 Full Risk Register

Given that the scheme is in its construction phase, the scheme design is now mature and the DIP has had extensive involvement in developing the cost and schedule estimates. As such, the QCRA and QSRA exercises are at a relatively mature stage and should therefore be fairly robust. There is an increased difficulty in accurately estimating some costs where less historical information is available, with National Highways finding a greater challenge in measuring the cost of items such as land compensation and major utilities diversions / statutory undertakers.

In that context, there is a need to be mindful of:

- Overly optimistic assumptions around the ability of the DIP to deliver earthworks early, and the knock-on impact on the project schedule which is relatively ambitious for a scheme of this size; and
- Residual risks i.e. 'unknown unknowns' which could materialise during the construction phase.

The scheme's risk provision is summarised in the below table.

Table 6.4: The A417 Missing Link's risk provision a percentage of base costs

Risk allowance	Provision
Project risk	£28.7m
Uncertainty allowance	£21.0m
Portfolio risk	£9.5m
Total risk provision	£59.1m
Total risk provision as a percentage of base costs (inflation adjusted)	**12.4%**

Source: National Highways CE300 Form

Research on reference class forecasting approaches commissioned by DfT to inform the optimism bias uplifts used in transport appraisal finds that even at the Final Business Case (FBC) stage, for the PMean level of certainty, the average UK road project would require a risk uplift of 20% over the base cost estimate if it is to be delivered 'on budget'.[42] The scheme's risk provision at 12.4% is low in comparison to this 20% benchmark, and implies a high degree of confidence.

We acknowledge there is a balance to be struck between funding additional headroom at either the scheme and / or the portfolio level that would reduce the need to request additional funding or to defer / cancel activities as risks materialise, and tying up a larger share of public funds with National Highways which may ultimately prove not to be required. Despite this, we challenge whether confidence in its scope and cost estimate is a sufficient justification for the current level of risk provision. National Highways should consider how best it mitigates these on how major risks should they materialise, given the current level of risk provision relative to project size.

[42] Department for Transport (2021), TAG: optimism bias workbook, May. Available online at – link.

7. LOWER THAMES CROSSING

Key findings

- If built, the Lower Thames Crossing will be the longest road tunnel in the UK, stretching 2.6 miles, and will include 14.3 miles of new road connecting the M2, A2, A13 and M25. The scheme is expected to double road capacity across the Thames east of London and ease congestion on the Dartford Crossing.
- It will be the largest scheme that National Highways has ever delivered by a substantial margin, both in cost and construction schedule (81 months). But there is substantial difference in cost between P values: the latest most likely estimate is £8.9 billion (including portfolio risk) which increases to **[text redacted]** at [**text redacted**].
- National Highways has estimated development and pre-construction costs in the region of £1,091m for the first two years of RP3, of which £750m is included in the dSBP. This leaves a development funding gap of £341m but there is a wider ongoing discussion between National Highways, DfT and HMT on whether and how to fund the scheme given affordability constraints.
- The LTC programme depends on funding certainty by spring 2025 to support a 'Go/No Go' decision in its current form. Any delay beyond this point will have much greater consequences on both costs (supplier contracts may require renegotiation and/or retendering) and Start of Works (August 2026).
- Including portfolio risk, uncertainty allowance and project risk results in a [**text redacted**] risk provision [**text redacted**] against the total base cost of the scheme. For a project of this size, stage of maturity and substantial uncertainty, we would expect to see a risk provision in excess of [**text redacted**] of project costs.
- The scheme has been rephased and National Highways has used this opportunity to test the robustness and elasticity of the schedule. It has also embedded a different operating model with a dedicated internal division and integrated commercial and technical partners. However, this remains a project on a completely different scale and risk profile to other projects and has more complex integration challenges which ultimately reside with National Highways.

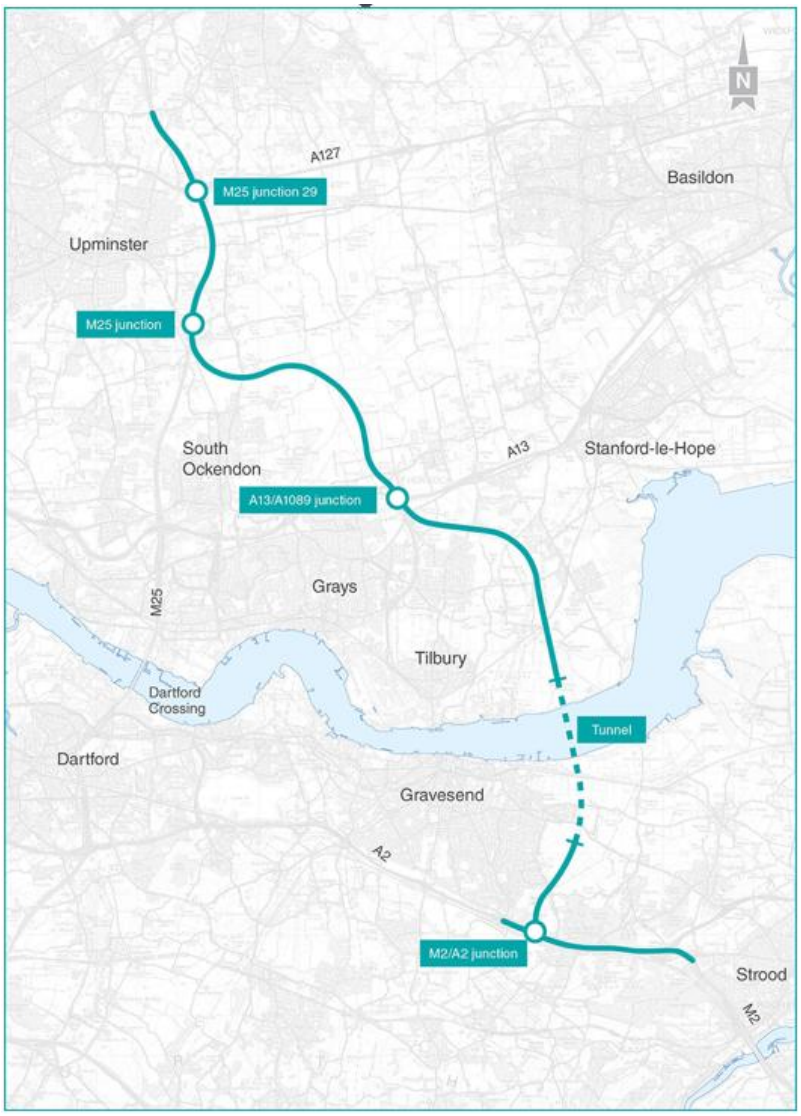
7.1. BACKGROUND TO THE SCHEME

If built, the Lower Thames Crossing (LTC) scheme will be the longest road tunnel in the UK, stretching 2.6 miles under the River Thames. The route will include 14.3 miles of new road connecting the M2, A2, A13 and M25, and fifty new bridges and viaducts. The scheme is expected to double road capacity across the Thames east of London and ease congestion on the Dartford Crossing.

This megaproject is significantly bigger than any previous National Highways scheme, both in cost and construction schedule. Based on the latest most likely estimate [**text redacted**], the LTC is expected to cost £8.9 billion (including portfolio risk). However, the latest cost estimates demonstrate that there remains substantial variation between different P values: the P50 estimate for the scheme is [**text redacted**] billion ([**text redacted**] versus the MLE) and the P70 estimate is [**text redacted**]. The difference between the most likely estimate at the [**text redacted**] estimate is slightly smaller than **[**text redacted**]**. Therefore, there is a significant affordability challenge around the LTC which means that it may not ultimately proceed despite over £800m spent on development so far.[43]

The scheme has overcome challenges to delivery so far. Firstly, the initial DCO submission was withdrawn in November 2020 following early feedback from the Planning Inspectorate. A revised DCO application was submitted in October 2022. The DCO examination phase was completed in December 2023 and the project expects a decision in 2024 (currently deferred until October 2024[44]). As with other megaprojects, National Highways has encountered opposition from groups local to the development. The scheme remains contentious amongst local authorities, including Gravesham and Thurrock, who oppose the scheme for reasons including disruption caused by construction, the additional local road investment that they believe will be required to cope with increased traffic pressures, and the environmental impact of the scheme in terms of local woodland, habitats, carbon and air quality emissions.

[43] Financial Times (January 2024) "Budget blowouts and delays: why the UK struggles with infrastructure" available at ft.com.
[44] BBC News (26 May 2024) "Election causes delay to Lower Thanes Crossing" available at bbc.co.uk.



Even if the scheme achieves DCO consent from the Secretary of State for Transport within the timescales assumed in the programme (June 2024 to March 2025), there is a high risk of legal challenge which could delay the project further. In turn, such delays would further increase the costs and may prompt a fresh evaluation of whether the project should proceed.

The BCR for the scheme has reduced from 1.5 in August 2020 to 1.2 (within a range of 0.8 to 1.7) as at May 2022[45]. Given that the central estimate BCR (at OBC stage) currently represents low value for money, its deteriorating trajectory is a concern, especially given affordability pressures.

The scheme will be split into three separate delivery contracts: the Roads North of the Thames ([**text redacted**]), Kent Roads ([**text redacted**]) and Tunnels and Approaches ([**text redacted**]). The procurement phase is complete and National Highways has let some early works contracts.

To expand on its internal programme management capabilities, National Highways has also established an Integrated Client Team with dedicated specialist technical, commercial and programme integration partners.

Background information	
Cost estimation	Development costs £1,091m Total cost estimate: £8,950m [**text redacted**] to [**text redacted**]
Current status	PCF Stage 4: Statutory Procedures and Powers, Awaiting DCO decision
BCR	1.2 (Low VfM)
Contractual arrangements	Technical Partner: COWI, Arcadis & Jacobs Commercial Partner: Turner & Townsend Integration Partner: Jacobs Delivery Partners: Balfour Beatty Civil Engineering Ltd., Bouygues Travaux Publics – Murphy Joint Venture & Skanksa Construction UK Limited
Project timeline	DCO decision: June 2024 to March 2025 SoW: August 2026 OfT: April 2033

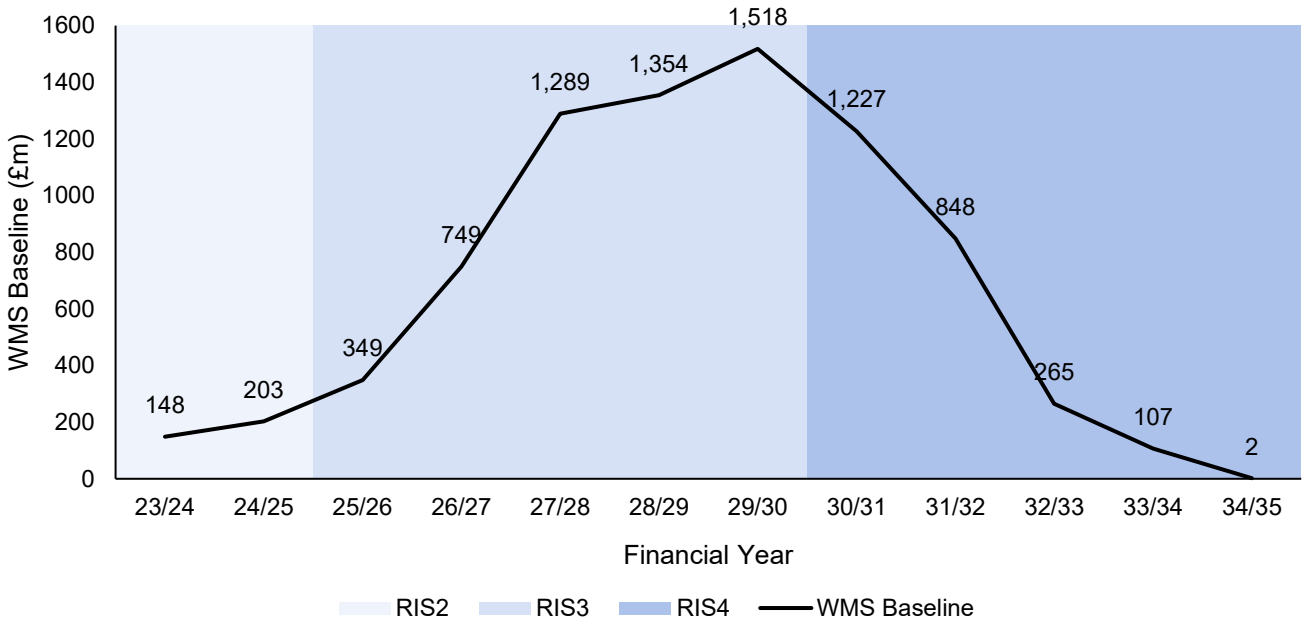
[45] DCO submission (May 2022)

Construction duration: 81 months (MLE) to [**text redacted**] months ([**text redacted**])

7.2. Cost estimation

The Lower Thames Crossing scheme is estimated to cost £8.9 billion, including portfolio risk. National Highways told us that the scheme has achieved relative cost stability over the past 18 months, aside from the impacts of exceptional construction inflation and the rephasing of the programme announced by the Secretary of State.[46] Figure 7.1 below depicts the latest baseline for the scheme over the course of RIS2, RIS3 and RIS4.

Figure 7.1 Expenditure profile associated with the WMS Baseline for the Lower Thames Crossing (£m, nominal)



Source: National Highways

The Written Ministerial Statement (WMS) had a material impact on the programme in respect of cost and schedule: there has been a cost increase of £641m against the March 2022 estimate, which breaks down as follows:

- £155m of efficiencies achieved through the procurement process and LTC's revised operating model[47].
- Increased risk opportunity and uncertainty estimation from procurement changes, programme and portfolio risk increased costs by £87m.
- Costs associated with prolongation and the rephasing of construction, delaying the scheme by 2 years, increased the estimate by £166m.
- Inflation re-profiling increased costs by £264m.
- Updating indices to September 2023 increased costs by £279m.

Development costs

The scope of our review is the scheme's development costs. National Highways estimates development and pre-construction costs of £1,091m, of which £750m are included in the dSBP (leaving a development funding gap of £341m). We understand that £750m provides sufficient funds to develop the Final Business Case and support the

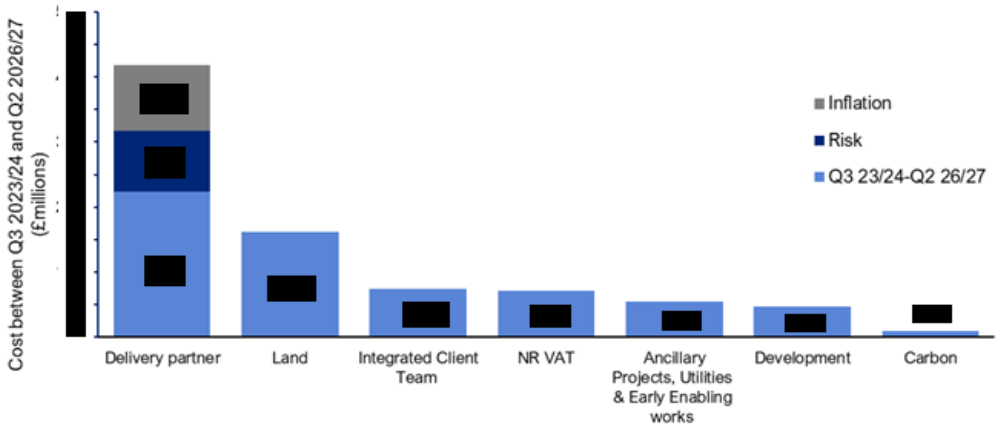
[46] DfT (March 2023) "Transport Secretary sets out record investment plans for transport network" available at gov.uk.
[47] We assume that the revised operating model refers to changes in the Integrated Client Team arrangements.

project continuation for the first 18 months of RIS3. National Highways told us that this gives it sufficient certainty to progress with critical enabling works whilst a wider agreement is sought on the £8.9 billion total cost. We understand that National Highways must issue a Notice to Proceed to its main contractors by Summer 2025, as beyond this point various contracts will need to be renegotiated or re-tendered, which would delay the schedule and create additional cost.

Benchmarking development costs on schemes of this size is challenging as there are few similar comparators. Around £1bn was reportedly spent on the enabling works for HS2 Phase One over a period of around 3–4 years (£20m–£28m per month). Assuming that the development phase on LTC lasts around 48 months (Q1 2024 to Q1 2028 as there is some overlap with the construction phase) then the rate of development expenditure is broadly comparable at £22.7m per month, although HS2 Phase One is a larger scheme with more complex interfaces.

We also considered what the LTC development costs will be used for and to what extent this expenditure may be 'sunk' (or alternatively recoverable if the project does not proceed). Using data provided by National Highways, we calculated the breakdown of costs during the development phase to be broken down as depicted in Figure 7.2.

Figure 7.2 Breakdown of development costs between Q3 2023/24 and Q2 2026/27 [**figures and axis redacted**]



Source: CEPA analysis of National Highways (Appendix D Programme Breakdown Structure)[48]

Delivery partner expenditure is the largest category, totalling [**text redacted**]. Activities included in this category includes contractor-led design work, including staff, mobilisation costs and construction activities for early enabling works, such as the provision of site access and high voltage power supply to the construction sites. We understand that most of these costs are mainly priced based on the activity rates agreed with each delivery partner through the procurement phase and that the majority of early enabling works are now contractor priced rather than National Highways' own estimates, although there are a wide range of enabling works and small projects. These are 'unrecoverable' costs in that they cannot be recovered if the scheme does not receive final investment approval. But this is necessary expenditure to enable the project to achieve SoW by August 2026 and ramp up efficiently thereafter, and once into RIS3 there appears to be minimal scope to defer this expenditure until there is greater certainty. We have allocated inflation and risk to the delivery partner costs as they are relevant to construction.

Land costs is the second largest category at £161m. Some land costs may be recoverable at a later date if the scheme does not proceed as we would expect that some lands could be sold or leased. However, National Highways has not provided any analysis of potential rates of recovery. There are other uncertainties which may affect recovery rates such as changes in local land values and the portion of costs which is rent versus purchases.

Integrated Client Team expenditure of £73.4 relates to the specialist technical, commercial and programme integration resources which National Highways has 'insourced' to help it manage the programme efficiently and

[48] We used our judgement to aggregate more granular cost categories so that the analysis is more informative. As such, the reported cost totals should be used for illustrative purposes only.

enhance its internal capabilities. This is potentially nugatory expenditure if the scheme is cancelled, but is a necessary and economic cost to ensure that progress continues whilst an agreement on funding is sought.

Ancillary projects, utilities and early enabling works costs total £54.6m. This comprises activities such as the implementation of environmental mitigation measures, construction of access routes and any necessary utility diversions. These cost activities will be unrecoverable should the project not go ahead. Whilst it would be rational to provide National Highways a degree of freedom to deliver works, there is a need to ensure appropriate governance and oversight by DfT before a decision to proceed on such works is made, to prevent unnecessary spend. We understand that a high level such governance and approval arrangements exist, but ORR may wish to engage with the Company further to understand how they will work in practice.

Additional expenditure is broken down as follows:

- **Non recoverable VAT** totals £70.2 for the period.
- **Development** expenditure relating to the DCO application process totals £47.2m.

In summary, there is a wider debate for the DfT and National Highways about if and how the LTC will be publicly funded. In our view, the £750m funding proposed in the dSBP is a substantial financial commitment in the context of a scheme which may not ultimately proceed due to affordability and value for money concerns on which the next government may take a different view in light of other capital spending priorities. Additionally, the development funding gap of £341m increases the difficulty of reaching agreement with DfT and HMT on long-term funding.

Carbon and biodiversity costs

National Highways has recognised the impact of the LTC construction programme and subsequent operation on the environment and has tried to embed carbon reduction and biodiversity improvements into the scheme design from an earlier stage. We understand that the project targets a 15% biodiversity net gain target (+1,025 biodiversity units) and that the DCO application assumes a 1,000,000 tCO_2e reduction against a 2020 baseline (-36%). National Highways told us that these targets are embedded into the contracts with its delivery partners and that it hopes to further drive a further 320,000 tCO_2e reduction through the procurement, achieving a total 50% carbon reduction.

Whilst National Highways is committed to a very ambitious carbon reduction target, it does not yet have a detailed and robust set of committed actions (a plan) to achieve this. It has initiated a procurement process to source hydrogen fuel to power on-site plant and equipment across the project, which it hopes will reduce diesel-based carbon by 33%. We understand that an additional £50m (of a £157m carbon-related cost increase) was included in the Written Ministerial Statement updated baseline which reflects National Highways estimate of the additional costs required to acquire a hydrogen supply. The Company has also established a wider carbon reduction programme to implement lessons learned from other schemes and to disseminate knowledge gained on the LTC.

National Highways shared its LTC carbon reduction and cost model[49], and we have previously reviewed the Company's approach to estimating the cost of reducing carbon in construction more broadly.[50] A detailed deep-dive into the carbon cost evidence was outside the scope of this review, but we note that the estimate carbon cost of £157m is a material sum (albeit only 1.7% of the latest cost estimate). Our understanding is that the 50% carbon reduction is now embedded into the scheme's cost estimate, such that ORR should challenge any further cost increases attributed to carbon reduction to prevent double counting.

In our 2023 carbon report we concluded that the costs of decarbonising construction materials are presently uncertain. However, we also found that (a) evidence provided to the *Infrastructure Cost Review* by Anglian Water suggests that substantial carbon reductions can be achieved through more efficient design and by eliminating waste, thereby also reducing costs; and (b) there is little evidence of a "green premium" for lower carbon construction materials at present, with the exception of electrically powered vehicles and heavy plant. We

[49] Appendix E Carbon cost forecast 27Nov23.xlsx.
[50] CEPA (2023) "Assessment of the cost and impact of National Highways' carbon reduction plans in RIS3".

acknowledge that decarbonising the LTC programme is an important but a challenging task which will require significant funding, especially to trial 'first of a kind' and/or atypical construction methods. However, given the real uncertainty around the rate at which the wider construction materials supply chain is able to decarbonise over the next 10 years (especially where the supporting technology does not yet exist or is not commercially viable), there is a risk that the 50% LTC reduction target may be undeliverable.

The Company provided no information on the cost of the LTC biodiversity commitment, but we understand it is reflected in the latest cost estimate. Based on the average cost per biodiversity unit used elsewhere in the dSBP, we estimate that any biodiversity costs should amount to around £34m or 0.4% of the LTC cost estimate.

7.3. Project Scheduling

We understand that National Highways has undertaken a bottom-up approach to scheduling for the LTC. As the construction phase of the project has been rephased, the project team has had additional time to work on planning and de-risking the construction phase. As a result, National Highways has more confidence in the achievability of the schedule, assuming that key decisions on funding and a final investment decision are in place by spring 2025.

The first phase of early mobilisation activities, critical design and consents commented in Q1 2024. There is now a gradual ramping up of early enabling works to support utilities diversions and other Statutory Undertakers works before the main Start of Works in August 2026. In total there are around 30 months between DCO consent and the SoW milestone, although this includes 9 months of DCO 'contingency' at the front end, and an expectation of overlap between critical enabling activities and full construction at the back end.

This development and mobilisation phase is substantially longer than the equivalent phases for other projects both previously and currently being undertaken by National Highways. For example, the A417 represents a more typical enhancement scheme, where PCF Stage 5 lasted for around 12 months. The scope of the LTC is much larger in terms of land take and more it is complex in terms of the enabling works being undertaken, so a more appropriate point of comparison is the early enabling works for HS2 Phase One which took just over three years.

Whilst there is some contingency in the programme early on for the supply chain to mobilise, once into RP3 the scope to defer enabling works until there is greater certainty on funding is minimal. If National Highways and its suppliers are to achieve a SoW date in August 2026, activity will need to ramp up significantly and any delayed spend will ultimately result in additional expenditure (inefficiency) and further costs pushed into RP4. Furthermore, further delays and/or rephasing of the programme would add to the risk that National Highways loses senior project leadership and internal capabilities to other high-profile projects with greater momentum.

Given the issues highlighted relating to funding certainty for the scheme, if the project is delayed beyond the Summer of 2025 at the 'Go/No Go' date for early critical works, supplier contracts may require contract renegotiation and/or retendering with new suppliers. As a result, delivering the schedule in its current form will not be possible beyond this date, which will result in further additional costs for the scheme to go ahead potentially extending into the billions of pounds. In summary, the next 18 months are crucial to the progress of the programme.

7.4. Key risks and dependencies

The LTC cost estimate includes a total risk provision of £1,459m of which [**text redacted**] is project risk, [**text redacted**] is uncertainty and [**text redacted**] is portfolio risk. This equates to a [**text redacted**] risk provision as a share of the total base cost of the scheme. For a project of this size, in the development phase of the project, we would expect to see a higher risk provision in excess of [**text redacted**] of project costs.

National Highways has conducted detailed QCRA and QSRA exercises, and it has had the opportunity to de-risk the construction phase due to the rephasing of the scheme and increase confidence in both the cost and schedule estimate compared to e.g. 18 months ago. It has also adopted a different operating model for this project including a dedicated internal division and insourced commercial and technical partners. But this remains a project on a completely different scale to anything it has delivered before, has more complex integration challenges, and is too

large to transfer risk to the supply chain in the way that National Highways might for a typical scheme under the RDP model. The typical evidence that National Highways relies on to inform its risk and optimism bias adjustments may not be sufficient here.

Based on the development phase of the scheme, we highlight the following risks:

- The main risk is that the scheme requires funding approvals to be agreed by summer 2025, and there is currently a funding gap of £341m for the scheme. If there are delays to reaching an agreement on funding beyond spring 2025, this will prevent the scheme from being delivered to the current schedule.
- Timely progress on early enabling works, installation of power supplies and land acquisitions are reliant on government approvals against the backdrop of a forthcoming General Election.
- The nature of the early enabling works are significant and relatively complex. The scheme will require large scale utilities diversions, for which National Highways may not have complete cost benchmarking information, suggesting it is an area of cost for which National Highways has less confidence.

The top LTC project risks are listed below.

Table 7.1 Top project risks

Top project risks	Description	Post mitigation rating
Necessary commitment (e.g. FBC) not granted in timely manner to reduce disruption/delays	Due to availability of public funding or private funding requirements not met of governance path not agreed.	Red
Approvals for each tranche of funding (2025/26 Enabling works)	Delays to these approvals will prevent LTC from maintaining WMS schedule.	Red
External Factors and changes delaying DCO grant (R40703)	Unforeseen external events - Government direction or policy change - Extended pre-examination approval period.	Red
Utility delays associated with a delayed start of construction (R32060)	LTC is unable to firm up windows for utility construction due to uncertainty of the DCO grant date and therefore land availability resulting in statutory undertakers unable to deliver to our programme.	Amber
Inflation exceeds forecast (R28608)	Inflation associated with delivering the programme. Impacts of Ukraine conflict and associated energy crisis.	Amber
Unable to complete necessary pre-construction works in 2025, impacting baseline schedule (R43984)	Alignment of short-term funding position with the optimised delivery requirements. - Delivering commitments to long lead items required to maintain the baseline position Scope of work delayed to NtP with a significant impact on the overall programme schedule	Amber
Review of the more onerous policy/requirements from the National Policy Statement for National Networks (NPSNN) than applied for in existing application	Environmental consenting risks impacting policy. Any tightening of policy may affect project planning balance on NPC compliance.	Amber
LTC's approach to carbon is perceived to be inadequate (R35433)	Conflicting requirements for consideration of carbon emissions within National Policy, Climate Change Act & DMRB. Potential requirement for carbon neutrality and NH's proposed Net Zero carbon plan contains some targets. May cause stakeholder objections, delays to SoS DCO decision and potential for JR.	Amber

Top project risks	Description	Post mitigation rating
	Stakeholder objections to LTC's approach to Carbon. SoS delays DCO decision by requesting further information, or rejects application - Potential judicial review of LTC's approach to Carbon	

Source - Appendix C - Post WMS Final Registers

8. CONCLUSIONS AND RECOMMENDATIONS

8.1. COST ESTIMATION ACROSS THE SAMPLE SCHEMES

Although the RIS3 portfolio will be challenging to deliver, there are fewer enhancement schemes than there were in RIS2. Since the focus will be on completing the 'RIS2 tail' the portfolio is also more developed than at the same point in the development of RIS2 and there has been greater opportunity for collaboration with the supply chain to ensure that both the costs and the schedule are commercially deliverable.

Two of the schemes we have reviewed are into the construction phase (A428, A417), so the latest cost estimates are reflected in the contracted budgets to which the supply chain must deliver and have therefore been tested by the market. There are residual construction productivity risks (related to ground and weather conditions) which may manifest in additional cost, but the financial impact of this will be shared with the supply chain.

The A66 has recently achieved DCO consent and National Highways has submitted a DCO application on two other sample schemes (M3 Junction 9, Lower Thames Crossing). In those cases, the designs are relatively well progressed, but this does not resolve uncertainty entirely because:

- National Highways is in the process of updating the A66 Northern Trans-Pennine cost estimate to reflect various changes approved as part of the DCO consent. There is also the associated inflation risk which is material on a [**text redacted**] billion scheme, and which interlinked with the decision on whether to rephase (and/or defer) construction across RP3 and RP4 to keep RIS3 affordable within DfT capital spending limits.
- The magnitude of the Lower Thames Crossing and the marginality of its economic case, combined with planned constraints on UK government capital spending plans, results in very significant uncertainty about whether and on what timescale the programme might proceed. If National Highways has not obtained certainty of funding to support a 'go/no-go' decision by spring 2025, it appears very likely that its costs will increase further. To illustrate, a further 5% increase in costs would equate to around £450m.
    - National Highways has included £750m out of £1,090m development costs in the RIS3 dSBP, broadly equivalent to 18 months of activity during RP3. Although National Highways hopes to have a final decision on funding in good time – and we agree that the project needs funding certainty to deliver efficiently – there is a risk that any incoming government does not make a final decision to the assumed timeframe. Given the risk that the scheme may not proceed, then ultimately some of the £750m may turn out to be nugatory expenditure.
- The M3 Junction 9 is of a more typical size for National Highways. Although additional requirements may yet emerge from the DCO process, the design work conducted to support the application should help to reduce most of any remaining cost uncertainty.

We find that National Highways' cost estimation process is procedurally sound. Ass with any process there is some need for the application of assumption and expert judgement on a case-by-case basis, particularly where National Highways has less complete information. In that context, we observe that National Highways' estimates adopt a conservative approach to forecasting inflation (the OBR's November 2023 CPI inflation forecast plus 150 basis points). The ORR has commissioned separate advice on the appropriate approach to dealing with forecast inflation in RIS3, but it asked us to estimate the approximate impact of reducing the inflation forecast to CPI plus 75 basis points, which is more aligned with the long-run outturn average difference between CPI and the Implied Output Price Index (IOPI). The resulting impact on RIS3 costs are shown in Table 8.1 below. In Table 8.2 we then show the incremental impact of moving from the OBR's November 2023 CPI forecast to the March 2024 CPI forecast.

Table 8.1: Impact of CPI plus 75bp inflation on reviewed enhancement scheme costs in RIS3 (£m, nominal)

Scheme	2025/26	2026/27	2027/28	2028/29	2029/30	RIS3
A428	-9.07	-8.05	-1.29	-0.02	-0.02	-18.45
A417	-5.17	-3.07	-0.29	-0.08	-0.07	-8.69
A66	**[text redacted]**	**[text redacted]**	**[text redacted]**	**[text redacted]**	**[text redacted]**	**[text redacted]**
M3 Junction 9	-2.41	-0.71	-0.11	-0.04	0.00	-3.26
A46 Walsgrave	-0.29	-1.80	-3.82	-0.23	-0.15	-6.28
Scenario A	-41.78	-56.25	-37.58	-16.48	-36.24	-188.33

Source: CEPA analysis of National Highways' cost estimate forms and dSBP Financial Model

Table 8.2: Additional impact of updating to OBR March 2024 inflation forecast on reviewed RIS3 costs (£m, nominal)

Scheme	2025/26	2026/27	2027/28	2028/29	2029/30	RIS3
A428	-7.25	-4.32	-0.50	-0.01	-0.01	-12.07
A417	-4.13	-1.65	-0.11	-0.03	-0.02	-5.93
A66	**[text redacted]**	**[text redacted]**	**[text redacted]**	**[text redacted]**	**[text redacted]**	**[text redacted]**
M3 Junction 9	-1.92	-0.38	-0.04	-0.01	0.00	-2.36
A46 Walsgrave	-0.23	-0.96	-1.47	-0.07	-0.04	-2.78
Scenario A	-33.37	-30.16	-14.47	-5.20	-9.75	-92.94

Source: CEPA analysis of National Highways' cost estimate forms and dSBP Financial Model

In our view, National Highways' approach implicitly embeds 'downside risk' on inflation into its central estimates. If considered in isolation, this would flow through into inefficient base cost estimates for each scheme. There is also a risk that it double counts the risk of exceptional inflation because it is (a) already captured in the base cost estimate, and (b) National Highways uses the Central Risk Reserve (CRR) as cover for all types of overspend, regardless of its source (i.e. the CRR is not limited only to portfolio risks). We recommend that ORR considers National Highways' approach to inflation and the sizing of the CRR in the round, to ensure that the portfolio as a whole is appropriately funded.

On the other hand, we are concerned that some of the sample schemes do not have an adequate provision for risk, given the residual challenges that the Company must overcome. Specifically:

- The A428 includes a risk allowance of 4.4% (excluding portfolio risk[51]) despite being the second-largest project that National Highways has delivered since the £1.5bn A14 Cambridge to Huntingdon scheme, to which the Company adopted a very different approach to delivery (more akin to the Integrated Client Team model which it has established for the Lower Thames Crossing).
- The A417 includes a risk allowance of 9.4% (excluding portfolio risk). Although it is a smaller scheme than the A428, we note that empirical evidence on cost overruns on UK road projects finds that the average project comes in 20% over the budget determined at the Final Business Case stage.[52]

[51] We exclude the portfolio risk estimate from each scheme's cost estimate (CE300) form as this does not feed directly into the sizing of the CRR. We note that the CRR as proposed equates to £423m over RIS3 or 10% of Scenario A costs.

[52] Oxford Global Projects (2020) "Updating the evidence behind the OB uplifts for transport appraisals" available at gov.uk.

- The A66 includes a risk allowance of [**text redacted**]. The A66 will be the largest scheme delivered in RIS3 outside of the Lower Thames Crossing and the A303 Amesbury to Berwick Down projects, involves three different Delivery Integration Partners, requires the integration of eleven different projects, and is the subject of a legal challenge to the DCO consent.
- The CRR as proposed accounts for around £420m or 10% of the enhancement portfolio (Scenario A); and
- There is a wider ongoing discussion between National Highways, DfT and HM Treasury on whether and how to fund the Lower Thames Crossing. The difference between the Most Likely Estimate (£8.9bn) and the P[**text redacted**] estimate ([**text redacted**]) is [**text redacted**] (or [**text redacted**])[53] which would be additional to the [**text redacted**] of risk already embedded in the Most Likely Estimate.

When we look across the sample schemes, we observe early cost estimates that have a very wide range around them and a tendency for the most likely estimate to move higher in that range as the scheme progresses. In a scenario where there were a lot of new projects in the RIS, ORR would need to be mindful of this trend as it considers whether the programme is deliverable within the funds available.

We acknowledge that some of the cost increase in the sample schemes is due to exceptional inflation and the impact of stakeholder requirements introduced through the DCO process. There is also a material contribution from planning delays, commercial tensions with the supply chain (more than one contractor has been replaced) and changes to the preferred route / option. Since delay is costly, we suggest that ORR might consider undertaking (or asking National Highways to undertake) an independent lessons learned review of its current procurement arrangements to ensure that the whole business benefits from the experience of operating the RDP model.

Given the uncertainties identified in the enhancement portfolio (and all else being equal), we think that the dSBP is more overprogrammed than National Highways suggests (currently £921m). This may be partly offset by reducing the impact of the inflation forecast on scheme costs, assuming that it is not a one-for-one transfer from scheme estimates to the CRR.

In relation to our sample schemes, we find that the potential for costs to slip from RP3 into RP4 is relatively low. The exception to this is the A66 scheme, where there is an ongoing discussion ahead of RIS3 about whether this scheme should be rephased to complete in RP4 (which is reflected in National Highways' dSBP). If the legal challenge to the DCO consent were successful in petitioning for a full judicial review hearing, the result would be to delay SoW and may prompt a fresh consideration of the scheme's affordability and value for money, which in turn would delay expenditure currently planned for RP3 into RP4.

There is also a risk that planned development expenditure on the Lower Thames Crossing may slip from RP2 into RP3 if, for example, there are delays in gaining approval for land purchases, early enabling works and utilities diversions. The scope for unforeseen slippage ought to be relatively limited as National Highways is now in the final year of RIS2 (2024/25).

8.2. PROJECT SCHEDULING ACROSS THE SAMPLE SCHEMES

We find that National Highways has taken a broadly sensible approach to project scheduling. As with costs, delays and/or deferrals on some schemes meant that National Highways had more time to engage with the supply chain on the project schedule to de-risk delivery (e.g. where it has completed early utilities diversions) and test the elasticity of the schedule to the potential for delays elsewhere. Where it has set the final budget for construction and work is now underway (A428, A417), the Delivery Integration Partner has influenced the schedule as part of its commercial negotiation with the Company, given that schedule delays typically result in increased costs for both

[53] If [**text redacted**] is applied to the [**text redacted**] included in the dSBP, then RIS3 development costs would increase to [**text redacted**].

contractor and client. Where there have been material changes in schedule since RIS2, this has generally been to extend the construction phase (e.g. A66 and Lower Thames Crossing, 24 month increase).

The main concerns and residual risks that we highlight are as follows:

- The A428 is a large and complex scheme with an ambitious schedule for the construction phase (44 months). It is comparable in length to the slightly larger A14 scheme (42 months) but also to the M3 Junction 9 (estimated 36 months) which is a much smaller scheme. National Highways' confidence in the schedule may reflect, in part, the off-line nature of delivery and the lessons that both client and Delivery Integration Partner have learnt from the delivery of the A14 to time and budget. However, the project is sufficiently large that if it falls behind schedule, it will be difficult to recover momentum and catch-up.
- National Highways adopts a general assumption of a 12-month window between DCO consent and SoW, to allow time for the supply chain to mobilise whilst managing the risk of legal challenge. It does not assume that there will be a legal challenge that extends to a full judicial review hearing (as there was for the A428) because (a) the length of that process is uncertain; and (b) the resulting plan for mobilisation would be inefficient. Whilst this is a reasonable assumption in respect of relatively low risk DCO applications, we are not convinced that it is appropriate in all cases. In particular, the A66 legal challenge will test this assumption although it is too early to determine whether it will impact the SoW milestone.
- National Highways has previously experienced commercial tensions with its supply chain (e.g. A417, A46) which resulted in delay. In our view, these tensions stem from the way in which early-stage cost estimates are used to inform RIS funding (which in our view results in undeliverable overprogramming) and the interaction with a procurement model which places a high value on lowest cost bids, combined with a competitive bidding environment in the supply chain. The result is an initial scheme budget (set at PCF Stage 3) which is either undeliverable (resulting in additional cost claims from the supply chain to recover its margin) or bids which are conditional on certain assumptions with respect to key risk events – and which in turn trigger further commercial negotiations closer to the start of works (PCF Stage 6).
- The Lower Thames Crossing is on a different scale to anything which National Highways has delivered before. The Company has established a new, internal LTC Division to oversee the programme, and created an Integrated Client Team which enables it to access external commercial, technical and project management expertise. However, cost, schedule and integration risks on megaprojects are too large for any individual party in the supply chain to manage, and ultimately reside with the public sector.

  At its peak, National Highways will be spending between £80m–£100m per month on construction, a very large scaling up compared to even its largest other projects, and at that rate it will be difficult to recover lost ground if the programme falls behind schedule.

8.3. Overall assessment of key risks and dependencies

Although there are fewer and more developed enhancement schemes in the RIS3 portfolio, there remain several schemes which are larger and more complex than the 'typical' National Highways project.

There will be 4 schemes which are broadly equivalent to the A14 in construction cost (A428, A66, A12 Chelmsford to A120 Widening, A303 Amesbury to Berwick Down) plus the Lower Thames Crossing. Therefore, National Highways will require a different approach to project management and access to more specialist client experience and capability in RIS3. This is not a criticism of the Company, as the same is often true of other infrastructure managers (particularly those in the public sector), because these are not routine projects. Whilst the Company can explain how it is evolving its operating model to prepare to deliver the Lower Thames Crossing and has tried to embed lessons learned from the delivery of the A14 more widely, the ORR needs to consider more widely whether:

- The RIS3 dSBP reflects appropriately on the organisational capabilities and capacity required, to ensure that the Company is ready and able to deliver; and

- The availability and allocation of funding (including central risk reserve) is appropriate to ensure the deliverability of the portfolio as a whole. Specifically, that the risk of overspend on the largest schemes will be appropriately managed to reduce the likelihood and impact of disruption spreading to other schemes.

Additionally, National Highways does not appear to have priced external risks to the portfolio sufficiently – although we recognise that individually these are challenging to account for. These risks include reaching agreement with DfT/HMT on funding for the Lower Thames Crossing following a potential change in government and any resulting reprioritisation of capital spending; the impact of a new ministerial team at DfT ahead of the DCO submission for the A46 Coventry Junctions (Walsgrave) scheme; and the potential delay associated with the legal challenge to the A66 DCO decision.

In conclusion, whilst the enhancements plan is more developed and the evidence base is more mature than other aspects of the dSBP that we have reviewed (e.g. environment and safety), we find that the pressures identified above indicate that the dSBP is more overprogrammed than National Highways suggests.

8.4. Key recommendations for the Efficiency Review

Our recommendations to ORR are as follows:

(A) **Affordability within the likely funds available.** ORR should engage with DfT and National Highways to challenge whether the current enhancement package ('Scenario A') is deliverable, and to consider whether sufficient focus has been given to the development and assessment of alternative enhancement packages (i.e. with more rephasing, deferral or cancellation).

(B) **DCO challenges.** ORR should consider whether the assumed period between DCO submission, consent and Start of Works is sufficient on more contentious schemes, such as the A66 and Lower Thames Crossing. In that context, it should also engage with National Highways to better understand the risk of RIS3 expenditure slipping into RIS4 – noting that the main risks relate to the A66 (which may be resolved before the start of RIS3) and the main construction of the LTC (which may be funded outside the RIS3 SoFA).

(C) **Inflation risk.** ORR should consider National Highways' approach to inflation and the sizing of the CRR in the round, to ensure that the portfolio as a whole is appropriately funded.

(D) **Monitoring metrics.** ORR should consider what it requires from Earned Value metrics, to ensure that it is better sighted on emerging risks to delivery and potential slippage during the construction phase of larger and more complex schemes. We understand that separate work has been commissioned on this topic.

(E) **Lessons learned from RIS2.** In the context of the less developed schemes in the RIS3 package, ORR should assess whether National Highways has fully embedded lessons learned from the experience of managing the RIS1 and RIS2 enhancement programmes. There should be a particular focus on the approach to early-stage cost estimation and subsequent cost escalation; a shared understanding of scope and scheme requirement uncertainties (including those costs which emerge through the DCO process); and how these factors influence the level at which the overall funding settlement is made.

(F) **Organisational capacity and capability.** ORR should consider whether the dSBP provides sufficient evidence to demonstrate that National Highways has the organisational capacity and capability to deliver 4 schemes of similar scale to the A14 in the same Road Period, as well as the Lower Thames Crossing, noting that under Scenario A the construction of the A66 and the A12 will be rephased and deferred until later in RIS3 which might allow for resources to be transitioned more efficiently.

(G) **Delivery of expected benefits.** Ahead of RIS3, the ORR might consider its role in gathering evidence on the evolution of early-stage cost estimates and highlighting the interdependencies with the economic case for major enhancement schemes. Whilst National Highways operates a 'value for money watchlist' and has a value for money escalation process with DfT, we observe a deteriorating trend in the BCR as costs increase over time. This calls into question whether those schemes that reach low value for money should

have progressed as far as they have (acknowledging that the BCR is only one factor in the overall value for money assessment).

(H) **Supply chain arrangements**. Whilst the Regional Delivery Partnerships approach is expected to deliver material efficiency savings over RP2, its application has on occasion introduced tensions between National Highways and its contractors around price and performance. ORR might also engage with National Highways to undertake an independent review of the benefits that its supply chain arrangements have delivered to ensure that the whole business gains from these experiences.

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