A417 Missing Link

Full Business Case

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Executive summary

Introduction

This Full Business Case (FBC) sets out the case for investment, and delivery arrangements, for the 'A417 Missing Link' – a crucial link on the Strategic Road Network (SRN) which is essential to the growth, wellbeing and balance of the nation's economy.

The A417, together with the A419, connects the M4 at junction 15 (Swindon) to the M5 at junction 11a (Gloucester), passing through the Cotswolds Area of Outstanding Natural Beauty (AONB) and across the Cotswold escarpment.

The A417/A419 route is a dual carriageway all-purpose road (D2AP) with grade-separated junctions, except for a 3.4 mile (5.5km) section of single carriageway on the A417 between Cowley roundabout and the Brockworth bypass (Figure 0-1). This section is referred to as the 'A417 Missing Link' and has been a cause for concern for more than 20 years.

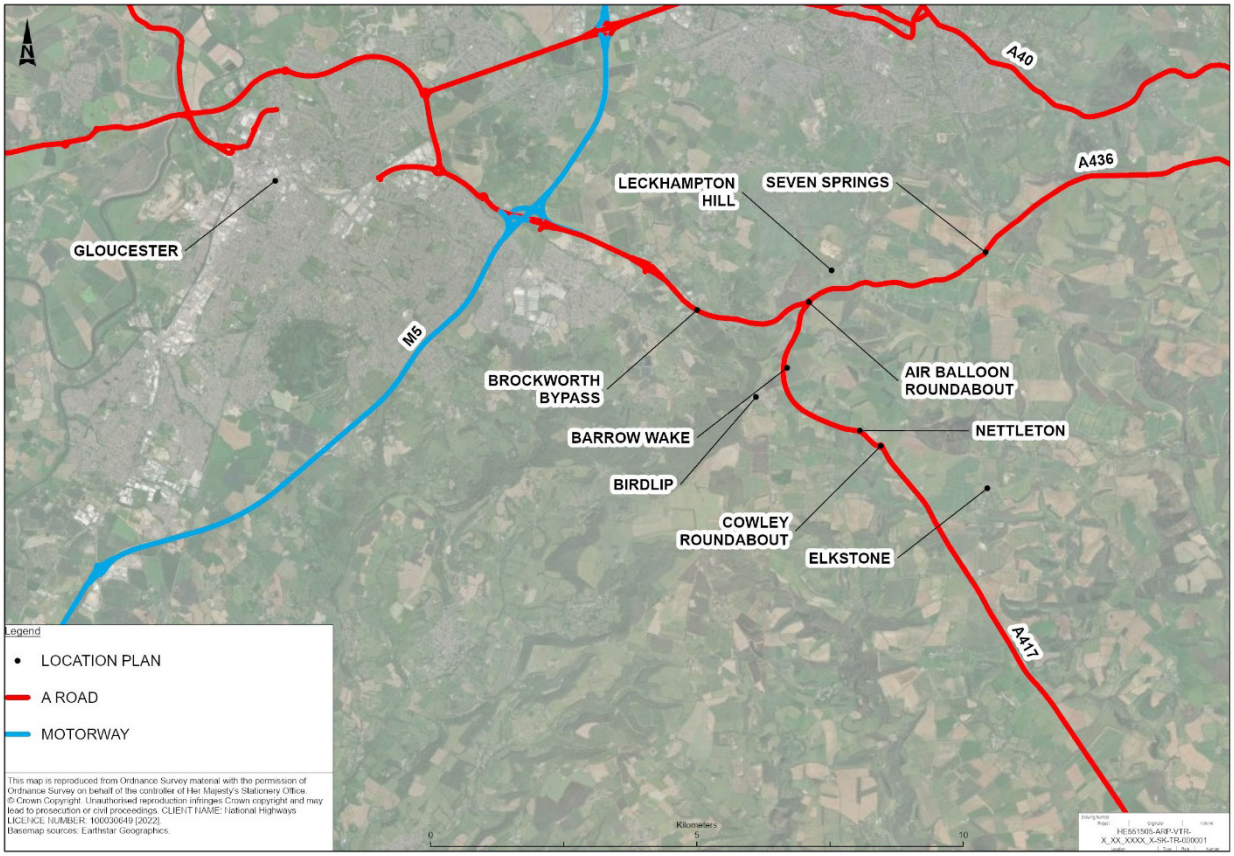


Figure 0-1 A417 Missing Link location

The case for investment has been made during previous National Highways Project Control Framework (PCF) and business case stages. On completion of the Option Selection phase of the project, option 30 was chosen as the preferred route. A Preferred Route Announcement (PRA) was made in March 2019, inclusive of three side road options for connecting the A436 to the A417. Following completion of assessments and stakeholder engagement, a decision was taken to adopt 'Alternative 2' (A436 parallel to A417) as the side road option.

The Development Consent Order (DCO) was submitted in May 2021, with the DCO examination taking place between 16 November 2021 and 16 May 2022. On 16 August 2022 the Examining Authority issued their Recommendation Report to the Secretary of State which recommended that the DCO should be granted[1]. On 16 November 2022 the Secretary of State granted development consent for the scheme as set out in the Secretary of State's Decision Letter[2].

In anticipation of the decision on the scheme, this FBC sets out the five dimensions (strategic, economic, financial, commercial and management) required to plan for successful delivery.

Strategic dimension summary

The strategic dimension provides a clear rationale for investing in the scheme, sets out a robust case for change on this part of the SRN that demonstrates how the proposal has a strong strategic fit National Highways' priorities, regional/local planning, government ambitions and the areas in scope.

Rationale for intervention

The A417 Missing Link and a three arm at-grade roundabout (Air Balloon roundabout) causes a range of problems which limit the performance of the SRN which are not to current standards:

- Fatal casualty rate ten times higher than the national average for single-carriageway roads.
- Highway alignments and junction arrangements which are not suitable for this particular section of the SRN and which are inconsistent with the rest of the A417/A419 route.
- High traffic flows which exceed the design capacity of the A417 Missing Link, and which are expected to increase.
- Reduced vehicle speeds and extended journey times as a result of congestion caused by a combination of the sub-standard road layout and high traffic flows.
- Poor journey time reliability.
- Exposure of local residents, businesses and road users to high levels of air pollution[3], as well as noise and vibration from heavy traffic.
- High traffic flows on less suitable alternative routes due to congestion on the A417.

Approximately 54,000 new homes are expected to be built across Gloucestershire and Swindon over the period up to 2031. A high proportion of these are likely to be located in strategic allocations in proximity to the southern end of the A417/A419 route at Swindon. Under a 'Do Nothing' scenario, the above problems are therefore expected to be exacerbated as the road network comes under increasing pressure from traffic growth.

The entirety of the A417 Missing Link is located within the Cotswolds AONB. A Do Nothing scenario would result in reduced visitor enjoyment of the AONB and increased exposure to high levels of air pollution surrounding the Birdlip Air Quality Management Area (AQMA), as well as increased noise and vibration.

[1] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010056/TR010056-001892-20221116_TR010056_A417_Missing_Link_Recommendation_Report.pdf, accessed 21 November 2022
[2] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010056/TR010056-001898-20221116_TR010056_A417_Missing_Link_SoS_Decision_Letter.pdf, accessed 21 November 2022
[3] The A417 Missing Link section passes through the Birdlip Air Quality Management Area (AQMA).

While the A417/A419 route between Swindon and Gloucester is only a relatively short stretch of the SRN (32 miles), it is crucial to the performance and productivity of the regional and wider economy. The route is used by long distance traffic with a wide range of origins and destinations stretching across the south-east and south-west England, the West Midlands, and South Wales, including several international gateways – Heathrow and Gatwick airports and major international ports. It connects the South-West (M5) via Gloucester to London via Swindon (A417/A4) and Oxford (A40/M40).

A series of Economic Opportunity Areas (EOAs) were identified around the SRN by National Highways, in consultation with Local Enterprise Partnerships (LEPs), which represent priority economic locations for growth. EOAs have been identified at either end of the A417/A419 route; at Cheltenham-Gloucester and Swindon.

In terms of the UK Government's Levelling Up missions, a safe and efficient SRN is critical to the balance of the nation's economy, providing access to labour markets and suppliers and encouraging trade and new investment for the region, especially prioritised areas like Gloucester which is served by poor transport links and suffers from low productivity and economic growth.

In terms of economic opportunity, Swindon, at the southern end of the A417/A419 route, is an area of major economic significance with a range of priority economic sectors, attracting major businesses and inward investment. Cheltenham and Gloucester, at the northern end of the route, are home to advanced manufacturing and engineering, as well as high value financial and business services sectors. Many businesses rely on the A417/A419 route for efficient transportation of goods and staff. Under a 'Do Nothing' scenario, the sub-optimal performance of the SRN, is not only of safety and environmental concern but also likely to increasingly limit regional productivity and economic competitiveness.

Strategic alignment

Upgrading the A417/A419 route supports the vision and business strategy of the Department for Transport (DfT) and National Highways as well as wider government ambitions, as evidenced in the following:

- Second Road Investment Strategy (RIS2[4]) 2020-2025
- National Highways Strategic Business Plan 2020-2025
- National Highways Delivery Plan 2020-2025 (August 2020)
- HM Government: Levelling Up the United Kingdom (White Paper) (February 2022)
- HM Treasury, Investing in Britain's future (2013)
- National Infrastructure Strategy (November 2020)
- Build Back Better: our plan for growth (March 2021)
- Action for roads: a network for the 21st century (Department for Transport, 2013)
- Transport Investment Strategy (July 2017)
- DfT Outcome Delivery Plan: 2021 to 2022
- DfT Decarbonising Transport: A Better, Greener Britain (July 2021)
- The Road to Growth (Highways England, now National Highways, March 2017)

[4] Department for Transport (March 2020), Road investment strategy: 2020 to 2025, Accessed 11th March 2020, https://www.gov.uk/government/publications/road-investment-strategy-2-ris2-2020-to-2025

The scheme supports the economic growth aims, visions and aspirations of the following:

- GFirst Local Enterprise Partnership – Local Industrial Strategy (2019 draft)
- Western Gateway Sub-National Transport Plan – Strategic Transport Plan 2020-2025 (February 2021)
- Gloucestershire, Cheltenham and Tewkesbury Joint Core Strategy (November 2017)
- Gloucestershire Vision 2050 Concordat (October 2018)
- Gloucestershire Local Transport Plan 2015-2031 (March 2019)
- Connecting Places Strategy – Central Severn Vale (November 2017)
- Cotswold District Council Local Plan 2011-2031

The scheme also has the support of local Members of Parliament (MPs) for the area, National Trust, together with a letter of support from the host authority, Gloucestershire County Council, and the surrounding six district authorities.

Vision & objectives

Situated within the Cotswold AONB, the area has significant environmental, heritage and landscape aspects which have been influential in the scheme's development and are reflected in the overall vision for the scheme. These include Sites of Special Scientific Interest (SSSIs), several ancient woodlands, listed buildings, scheduled monuments, inalienable land owned by National Trust, and Common Land. The route passes across the Cotswold escarpment which presents steep gradients that require engineering solutions. Other engineering constraints include sensitive groundwater sites, challenging ground conditions, and several means of local access that need to be maintained.

Taking the above into account, National Highways has worked in partnership with key stakeholders to agree the following vision for the scheme:

> *A landscape-led highways improvement scheme that will deliver a safe and resilient free-flowing road whilst conserving and enhancing the special character of the Cotswolds AONB; reconnecting landscape and ecology; bringing about landscape, wildlife and heritage benefits, including enhanced visitors' enjoyment of the area; improving local communities' quality of life; and contributing to the health of the economy and local businesses.*

This vision is supported by a series of design principles, scheme objectives and sub-objectives (see Table 2-4) which guided option development and assessment through the PCF stages.

A theory of change logic model has been developed for the scheme which presents the anticipated outputs, outcomes and impact of the scheme.

INPUTS

Investment in:

- The A417/A419 – a strategic route between Gloucester and Swindon
- The A417 Missing Link – the only section of single carriageway along this route
- The landscape within the Cotswolds Are of Outstanding Natural Beauty (AONB)
- Government funding of £479m
- National Highways Resources, Contractor Resource, Stakeholder support and Land Acquisitions

OUTPUTS

By 2027 deliver:

- 3.4 miles (5.5km) of new, rural all-purpose dal carriageway for the A417, connecting the existing A417 Brockworth bypass with the existing dual carriageway A417 south of Cowley.
- New crossing to accommodate the Cotswolds Way National Trail
- New junction to enhance connectivity towards the Thames Valley and West Midlands as well as connectivity to local destinations via the B4070.
- The detrucking of the existing A417 between 'Air Balloon Roundabout' and the 'Cowley Roundabout' with some lengths of the existing road converted into a route for walkers, cyclists and horse riders including disabled users. Other section retained as lower-class public roads, maintaining local access for residents.

OUTCOMES

Transport Outcomes:

- **Safe, resilient, and efficient network:** Avoiding approximately 72 fatal, 220 serious and 64 slight injuries over 60 years.
- **Supporting Econimic Growth:** More reliable strategic route with greater road capacity and resilience. Reduced journey times with average journey times reduced between Cirencester and the M5 by up to 27% (5 mins) westbound and 22% eastbound in 2026.
- **Improved natural environment and heritage:** Reduced noise and air pollution, specifically in the area covered by the Birdlip AQMA, with potential for this designation to be removed (subject to monitoring by Cotswolds District Council)
- **Community and access**: Localised benefit to community with reduced severance and improved local connectivity and accessibility (reduced traffic flows through Birdlip and along Birdlip Hill, Ermin Way by as much as 60% by 2026).

Immediate Outcomes:

- Local construction projects and employment bring short term economic growth.
- Alignment with National Highways Client Scheme Requirement and Strategic Priorities.

People, Business and Place Outcomes:

- Agglomeration economies in the local region especially Gloucester and Swindon
- Labour-skills matching with more productive jobs.
- Safer travel on the A417/A419 and SRN
- Improved health outcomes though better journey quality and environmental outcomes
- Improvement capacity to reduce congestion, thus reducing traffic impacts to local area near Birdlip.
- Facilitating the sustainable growth aims, vision and aspiration of the region. Providing the capacity to support housing and employment site development
- Supporting economic growth and levelling up through improved links between Cheltenham, Gloucester, and Swindon and further afield between West Midlands, Herefordshire, Wiltshire, Worcestershire and the Swindon, Berkshire, Oxford areas.

IMPACTS (Strategic Benefits)

- Economic growth and improved productivity
- Better quality of life with enhanced access to community and services
- Health and wellbeing improvements
- Larger labour pool, more employment opportunities, and more productive jobs
- Improvement in physical and social capital by restoring natural habitats and reducing environmental impacts.

Figure 0-2 A417 Theory of Change Logic Model

Overall, the strategic dimension demonstrates a strong case for investment, which is analysed further and quantified within the economic dimension.

Economic dimension summary

The economic dimension assesses the scheme in terms of economic, environmental, and social impacts, in line with the DfT Transport Analysis Guidance (TAG) and provides an overall Value for Money (VfM) assessment.

Economic appraisal

The economic appraisal has been carried out based upon a comparison of the 'with' and 'without scheme' scenarios (also referred to as 'Do-Something' and 'Do-Minimum') with benefits extrapolated for the 60-year appraisal period and benefits compared to scheme implementation costs. Initial and adjusted Benefit Cost Ratios (BCRs) have been estimated. In addition to the core assessment, sensitivity tests assessing the impact of high and low growth forecasts have been undertaken. In addition, the impact of the DfTs Transport Decarbonisation Plan (TDP) has been assessed. A summary of the Analysis of Monetised Costs and Benefits (AMCB) is provided in Table 0-1.

Table 0-1 Analysis of monetised costs and benefits

Item	Impact £000s (PV, 2010 prices)
Accidents (not assessed by TUBA)[1]	75,725
Construction (not assessed by TUBA)[2]	-17,843
Greenhouse gases (not assessed by TUBA)[3]	-60,367
Noise (not assessed by TUBA)[4]	481
Air quality (not assessed by TUBA)[5]	-6,054
Transport Economic Efficiency: consumer users (commuting)	38,215
Transport Economic Efficiency: consumer users (other)	25,344
Transport Economic Efficiency: business users and providers	151,099
Wider public finances (indirect taxation revenues)	37,054
Level 1 Present Value of Benefits **(PVB)**	243,653
Broad transport budget Present Value of Costs **(PVC)**	212,862
OVERALL IMPACTS	
Level 1 Net Present Value (NPV)	30,791
Initial Benefit Cost Ratio (BCR)	1.14
Reliability benefits	61,579
Wider economic benefits	118,350
Level 2 PVB	423,582
Level 2 NPV	210,720
Adjusted BCR	1.99
Level 3 indicative monetised impacts (landscape monetisation assessment and natural capital assessment (carbon sequestration))	-47,637

Item	Impact £000s (PV, 2010 prices)
Natural capital assessment	15 ecosystems assessed. Six are assessed as an adverse impact, one was assessed as neutral and eight are assessed as beneficial,
Level 3 non-monetised	6 out of 12 are positive, one was scoped out and five are adverse
Final VfM judgement	Medium

Notes: All monetary values are expressed in 2010 prices, discounted to 2010. 1 from COBALT, 2 from QUADRO, 3 TAG unit A3 chapter 4, 4 TAG unit A3 chapter 2, 5 TAG unit A3 chapter 3. Numbers may not sum due to rounding.

The monetised aspects of economic appraisal of the scheme are as follows:

- Substantial Transport Economic Efficiency (TEE) benefits estimated at £215 million, consisting of journey time savings of £272 million and vehicle operating costs of -£58 million (see Section 3.7 more details).
- Construction disbenefits of £18 million (see Section 3.7 for more details)
- Wider economic impacts of £118 million, with agglomeration benefits of £101.5 million, £1.7 from labour supply impact and £15 million from increased output in imperfect markets (see Section 3.7 for more details).
- Significant accident benefits of £76 million and a reduction of 292 Killed or Seriously Injured (KSI). These accident benefits reflect the fatal casualty rate being 10 times higher than the national average for a similar road (see Section 3.7 for more details).
- Journey time reliability benefits of £61 million, split between business users (£33 million) and commuting and other users (£28 million) (see Section 3.7 for more details).
- Noise benefits of £0.5 million due in part to reduction in traffic on minor roads. Overall, more households would experience a decrease in noise rather than an increase (see Section 3.8 for more details).
- Greenhouse gas disbenefits of £60 million, with road user carbon emissions increasing by 745,436 Tonnes of CO2 equivalent (CO_2e) as a result of more traffic on the A417/A419 corridor. National Highways would work to minimise carbon emissions during construction and operation of the scheme (see Section 3.8 for more details on the greenhouse gas assessment and Section 6.10 for the Carbon Management Plan for reducing carbon emissions for the scheme).
- Air quality disbenefits of £6 million with an increase in regional Nitrogen Dioxide (NO_2) and Particulate Matter ($PM_{2.5}$). But there would be improved air quality in the Birdlip Air Quality Management Area due to less vehicles travelling through (see Section 3.8 for more details).

Based on the monetised appraisal the scheme summary is as follows:

- Level 2 Present Value of Benefits (PVB) of £424 million (level 1 PVB of £244 million)
- Present Value of Costs (PVC) of £213 million
- Level 2 Net Present Value (NPV) of £211 million (level 1 NPV of £31 million)
- Adjusted BCR of 1.99 (initial BCR of 1.14)

The non-monetised environmental impacts of the scheme are:

- biodiversity – slight adverse (see Section 3.8 for more details)
- water environment – slight adverse (see Section 3.8 for more details)
- landscape - moderate adverse (see Section 3.8 for more details)
- natural capital assessment – 15 ecosystems assessed, six had adverse impacts, one was neutral and eight had beneficial impacts
- historic environment – moderate adverse (see Section 3.8 for more details)

The non-monetised social impacts of the scheme are:

- accidents - moderate beneficial (see Section 3.9 for more details)
- journey quality – moderate beneficial (see Section 3.9 for more details)
- physical activity - slight beneficial (see Section 3.9 for more details)
- security - slight beneficial (see Section 3.9 for more details)
- severance – slight beneficial (see Section 3.9 for more details)
- accessibility - slight beneficial (see Section 3.9 for more details)
- option value and non-use value – screened out
- personal affordability - moderate adverse (see Section 3.9 for more details)

In addition to the core assessment, high and low growth sensitivity tests have been undertaken More details on these are in section 3.15. The overall results from the high growth sensitivity test are as follows:

- Level 2 PVB of £453 million (level 1 PVB of £270 million)
- PVC of £213 million
- Level 2 NPV of £240 million (level 1 NPV of £57 million)
- Adjusted BCR of 2.13 (initial BCR of 1.27)

The overall results from the low growth sensitivity test are as follows:

- Level 2 PVB of £407 million (level 1 PVB of £219 million)
- PVC of £213 million
- Level 2 NPV of £194 million (level 1 NPV of £6 million)
- Adjusted BCR of 1.91 (initial BCR of 1.03)

A sensitivity test based on the DfT TPD has been included and this would reduce the amount of carbon emitted and result in a BCR of between 2.18 and 2.22 based on the upper and lower values. More details on these are in Section 3.15.

In addition to the monetised aspects included in the BCR, the impact of the scheme on the environment is indicatively monetised within the Landscape Monetisation Assessment and also within the carbon aspects of the Natural Capital Assessment. Although monetised, they are not included in the BCR figure, but instead are considered in the Value for Money assessment of the scheme.

- The Landscape Monetisation Assessment of the scheme estimates an indicative disbenefit of £38 million and the Natural Capital Assessment estimates an indicative carbon disbenefit of £10 million.

Switching analysis based on the core level 2 PVB of £424 million and PVC of £213 million has been undertaken to assess the change in PVC and PVB that would be required for the VfM assessment to change to from medium to low. More details are in Section 3.15. The outcome would be as follows:

- PVC would need to increase by £70 million (33%) or
- PVB would need to decrease by £105 million (25%).

An assessment of the P80 costs has been undertaken, and even if costs increased to that amount, the actual increase in PVC would still be within the £70 million amount and therefore the scheme, based on the BCR, would still be a 'Medium' VfM scheme. More details on this are in Section 3.15.

Based on the economic appraisal results, the high and low growth sensitivity tests, the switching analysis, the indicative monetised impacts and the non-monetised impacts, the conclusion in relation to the VfM assessment is that the scheme is a 'Medium' VfM scheme and that this is a robust medium with an adjusted BCR of 1.99.

In order for the scheme to be assessed as 'Low' VfM, benefits would need to decrease by £105 million. Therefore, based on this, when the indicative and non-monetised impacts are included, the VfM would remain 'Medium'.

Commercial dimension summary

The commercial dimension sets out the procurement approach and contract strategy that has been adopted up to PCF stage 5 – construction preparation – and the approach to future stages covering PCF stage 6 (construction, commissioning and handover) and PCF stage 7 (closeout).

The commercial dimension has been developed in accordance with UK Government guidance, taking on board learning outcomes from other large-scale infrastructure projects carried out in the UK, including the Road Investment Programme (RIP) and wider project portfolio.

Procurement strategy

A thorough assessment of viable procurement options was undertaken prior to implementing the preferred delivery strategy. A new supplier for PCF stages 5 to 7 was procured using National Highways' Routes to Market Regional Delivery Partnership (RDP).

The RDP is a £9 billion, 6-year framework with regional lots to develop, design and construct highway projects (2018-2024) which was awarded to 13 Delivery Integration Partners (DIP) in November 2018. The rationale for adopting the RDP is that it offers a ready-to-use basis for finalising the DIP contract award with more certainty and reduced risk.

A national procurement exercise was undertaken to identify a preferred contractor for the scheme. All tender submissions were sent to the National Highways' commercial team for assessment and were assessed solely on quality due to the DIP all having pre-agreed rates.

Following this process, Kier Highways Ltd (Kier) was appointed as the A417 Missing Link DIP contractor under the RDP in December 2021. The Integrated Project Team (IPT) consists of RPS, Kier Design Services (KDS), Tony Gee and Partners (TGP) and Arup.

Mace have replaced Corderoy as National Highways' independent cost consultants going forward for PCF stages 5-7, with Atkins acting as independent technical advisors to National Highways.

Contract type

The contract form is under the New Engineering Contract (NEC4) – ECC Main Option C Target Contract with Activity Schedule.

The contract length is currently estimated to be 75 months, from Kier's appointment in December 2021 to the completion of construction, currently estimated for February 2028. Further information in terms of key contract milestones is included within Section 4.3.

Social value and sourcing options

The scheme will deliver against National Highways' Equality, Diversity and Inclusion (EDI) objectives in terms of equality, diversity and inclusion. To maximise Social Value, an Employment and Skills Plan and a Community Engagement Plan is being produced and overseen by a dedicated Social Value and Sustainability Lead for the project.

National Highways and the DIP Supply Chain Manager will work with the supply chain community to understand the demands on them from across the industry, to understand potential resource requirements and to capture the appropriate risks on both a strategic and project basis. Small and Medium Enterprises (SMEs) have been identified who can complement the strategic sub-contractors. During PCF stage 5, the DIP Supply Chain Manager will work to develop an SME plan to meet a target of 43% SMEs by 2024.

Commercial risks

A number of commercial risks have been identified for the project and recorded on the Risk Register (e.g. exceptional weather, market conditions, unknown archaeology etc.). These have been identified early and a Risk Management Plan (RMP) has been produced to mitigate any potential impacts on the scheme. Further detail regarding commercial risks is outlined in Section 4.7.

Contract management

Effective contract management guidance is set out within the Sourcing Playbook (HM Government)[5] and its principles have been embedded within the contracting approach for the scheme.

Contract management will be taken forward by National Highways (i.e. the project director) through use of CEMAR, a market-leading contract management solution. Specific working areas will be set up between the relevant parties, including Kier and National Highways, which will be used to raise early warnings, compensation events, etc. The software ensures simplification of the management of contracts and ensures that commercial risk is minimised through improved contract compliance.

A technical and commercial challenge process will be in place to deal with any change in scope and resultant change/compensation events. National Highways' independent technical advisors (Atkins) and cost consultant (Mace) will review and validate each compensation event. This would then be agreed between the project manager (PM) and the contractor.

Pricing and charging mechanisms

Payment for works is made based on the price for work done to date, which varies for the development phase and the construction phase. During the development phase, payment is cost reimbursable based on the total of the amounts stated in the cash flow forecast, due on or before the assessment date. During the construction phase, payment is made

[5] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/987353/The_Sourcing_Playbook.pdf

on the total defined cost which the PM forecasts will have been paid by the Supplier before the next assessment date.

There are two types of cost saving mechanisms to incentivise the Contractor, when it beats the budget and the target cost. These are set out in more detail within Table 4-3 and Table 4-4.

The contract also contains the ability to reward the contractor for achieving targets set by National Highways through incentivisation on Key Performance Indicators (KPIs) as an additional payment through the contract. The incentive schedule for KPIs is set out in Table 4-5.

In summary, the commercial dimension demonstrates how best value is being achieved through the procurement and contract strategy, having determined the optimal terms for: risk allocation and transfer; pricing framework and charging mechanisms (with incentives linked to KPIs); social value commitments, and overall contract management approach.

Financial dimension summary

The financial dimension section presents evidence of the scheme's affordability, covering the estimated scheme outturn cost, spend profiles and funding arrangements.

Cost estimates

Cost estimates for the scheme have been prepared by National Highways' Commercial team, accounting for risk and inflation. Cost estimates are provided in Table 0-2, and are based on Q1 2022 prices but include adjustments for risk and anticipated inflation throughout scheme development and construction. Key cost assumptions are provided in Section 5.2.

Table 0-2 Capital cost estimate (£ million)

Phase	Total including approval (£m)
Options	6.5
Development	[redacted]
Construction	[redacted]
Lands	[redacted]
Sub-Total	**463.5**
Portfolio Risk	[redacted]
Total	[redacted]

Source: National Highways

Based on current estimates, the most likely total outturn cost of the scheme is £[redacted], including portfolio risk. A proportion of these costs have been incurred during the RIS1 (2015-2020) period while the scheme has been developed. The remaining development and the majority of construction costs are incurred during the RIS2 (2020-2025) period.

To help manage and mitigate the impact of rising inflation, a total £[redacted] has been allocated within the contract award value for managing inflation risk. Sensitivity tests have been carried out (see Table 5-3) demonstrating that inflation would need to increase by £[redacted] before it would be required to return to DfT/His Majesty's Treasury (HM Treasury) for additional funding. The table also shows which risk pots will be drawn down from and in which order.

Budget Arrangements

The scheme is identified in RIS2 in Part 3: Investment Plan, under the South and West section. It is referred to on pages 103 and 104 as a scheme committed in the RP2 funding period, citing the importance of the route to the local economy. RP2 provides funding for road schemes to start on site by 1 April 2025.

The budget set aside for the scheme is between £250-£500 million. The latest cost estimate provided (Table 0-2) places the scheme within the outlined budget from RIS1.

Funding arrangements

Current and future stages of the project are to be funded by National Highways with approvals given by the DfT Investment Portfolio and Delivery Committee (IPDC), HM Treasury and the Cabinet Office. This follows a decision in April 2018 to classify the scheme as Tier 1 due to its size and complexity with it being situated within an AONB. Projects subject to Tier 1 governance are typically over £500m, novel or contentious projects, and are subject to higher levels of scrutiny and oversight by the DfT and HM Treasury.

In Q2 2020/2021, the scheme entered the Government Major Projects Portfolio (GMPP). These governance changes required all project approvals to be sought from the DfT's IPDC, with additional approvals from HM Treasury's Treasury Approval Point (TAP) and the Cabinet Office. The elevation into Tier 1 governance also provided the project with the opportunity to work closely with the DfT's Centres of Excellence.

The funding arrangements for the scheme are summarised in Table 0-3.

Table 0-3 Summary of funding arrangements

Phase	Previously approved (£m)	Funding request (£m)	Total incl. approval (£m)
Options	6.5	-	6.5
Development	[redacted]	[redacted]	[redacted]
Construction	[redacted]	[redacted]	[redacted]
Lands	[redacted]	[redacted]	[redacted]
Sub-Total	**137.0**	**326.5**	**463.5**
Portfolio Risk	[redacted]	[redacted]	[redacted]
Total	[redacted]	[redacted]	[redacted]

Source: National Highways

The scheme will return to IPDC in December 2022. The only change from the previous IPDC in June 2022 is an increase of £3.3m in cost due to changes in how Non-Recoverable VAT is calculated by His Majesty's Revenue and Customs (HMRC) for the overlap of the development phase and advanced construction works.

Efficiencies

An Efficiency Register is being used to capture efficiencies, with associated reporting information, value, evidence and approval information also included. Each efficiency is supported by justification as to why the entry is considered to be efficiency. Through PCF stages 5-7, the A417 Digital Efficiency Register will capture, assess, and categorise any additional efficiencies. Each efficiency will have an owner responsible for realisation and

reporting. Efficiencies will be mapped as part of the Building Information Modelling (BIM) 'digital twin' model to analyse them in context and highlight where efficiencies can be grouped together to add further value.

Monthly workshops will be held with efficiency owners to track progress and gather evidence. Targets and KPIs will be set for each efficiency to determine whether it is delivering value, if action is required to improve value, and whether the efficiency should be shared beyond the scheme. Outputs from these workshops will be reported as part of the monthly Efficiency Register submission to National Highways.

Management dimension summary

The management dimension outlines the governance arrangements for developing and delivering the scheme, demonstrates realistic timescales, highlights risks and management procedures, and demonstrates the existence of a robust engagement and communications plan.

Key scheme milestones

The scheme is being progressed by National Highways' South-West Major Projects team, in accordance with the National Highways PCF. A Stage Gate Assessment Review (SGAR) is held at the end of each PCF stage, with Independent Assurance Reviews (IARs) at set milestones.

Table 0-4 PCF stage milestones

PCF stage	Start	End
PCF stage 1 (Option identification)	Sep-16	Jan-18
PCF stage 2 (Option selection)	Mar-18	Dec-18
PCF stage 3 (Preliminary design)	April-19	May-21
PCF stage 4 (Statutory procedures)	May-21	Nov-22
PCF stage 5 (Construction preparation)	Nov-21	Nov-22
PCF stage 6 (Construction phase)	Feb-23	RIS3
PCF stage 7 (Close-out)	RIS 3	RIS3

Key project milestones, which were/have been agreed between National Highways and DfT, include:

- Preferred route announcement: March 2019
- DCO application: May 2021
- Secretary of State Decision: 16 November 2022
- Start of Works (SoW): March 2023
- Open for Traffic (OfT): RIS 3

Project governance and organisational structure

The scheme is being progressed by National Highways' South-West Major Projects team, in accordance with the National Highways PCF.

Due to its size and complexity with it being situated within AONB, the scheme moved into Tier 1 governance and assurance structure in April 2018. As a Tier 1 project, the ultimate authority to invest is granted by the DfT's Secretary of State and the Chief Secretary to HM

Treasury. Prior to the Ministerial submission, approvals must be given at all levels of defence - the approval sequence is set out in .

National Highways has nominated Dean Sporn as the scheme's Senior Responsible Owner (SRO). The SRO is accountable to National Highways' Committee and will ensure successful project delivery.

The SRO will also be supported by the Regional Delivery Director (RPD) and Project Director (PD), who will take overall responsibility for the successful delivery of the scheme. National Highways have also nominated a Project Manager (PM) who runs the project on a day-to-day basis.

Project plan

A detailed project schedule has been produced which sets out the key project tasks and duration as well as key project milestones. The schedule is considered to be a live document with progress on planned task completion being monitored against actual progress by the PM. The PM will also report progress against the plan to the wider project team.

A range of project management reports are produced on a regular basis to record progress against schedule and cost forecasts. A detailed programme has been developed up to project completion and progress will be monitored on a monthly basis.

Stakeholder engagement and consultation

PCF stage 4 stakeholder engagement documents have been produced and published, and the contractor (Kier) will take forward responsibility for future stakeholder and communication strategies. Throughout PCF stage 5, the appointed Communications and Stakeholder Manager (C&SM) will continue to develop and update the Communications and Stakeholder Engagement Plan (CSEP).

A number of products have and will be developed to publicise the scheme including regular webpage updates, an enhanced project newsletter to showcase the project, local radio slots and provision of information to parish councils (including newsletters).

Risk management

The Risk Register has been transferred to the contractor and will be continually updated throughout the remaining stages of the project, using Xactium. The top 5 risks in terms of Expected Monetary Value (EMV) have been extracted and are listed in Table 6-6 , Section 6.6.

The risk management process adopted for the scheme aims to identify and manage all identified/foreseeable risks and opportunities in a manner which is proactive, effective and appropriate.

To enable this, risk workshops will be undertaken bi-weekly and the project risk manager will implement effective risk management through the production of a Risk Management Plan (RMP). These are intended to minimise risk and maximise benefits through use of prior experience of schemes involving National Highways and the DIP.

Change management

Change management, including contractual change, will be undertaken using CEMAR. A technical and commercial challenge process will be in place to deal with any change in scope and resultant change/compensation events. Each change event proposed will be

reviewed and assured in detail by National Highways' independent cost consultant, Mace and technical advisors, Atkins.

Benefits realisation

Benefits management for the project is being undertaken in line with the 'National Highways Benefits Management Manual' October 2018, which has been used successfully on RDP North projects and widely on Smart Motorways programmes.

A collaborative RDP Benefits Realisation and Evaluation Plan (BREP) is being used to define the RDP framework and scheme level functions, roles, accountabilities and responsibilities for benefits planning and realisation. For the scheme, this will be aligned with the project's High-Level Requirements (HLRs) and project objectives to produce an A417 BREP. The project sponsor will be accountable for benefits management and will own the Benefits Management process to ensure the benefits included in the FBC are delivered and not degraded by risk.

Carbon management

The scheme has considered the management and opportunities to reduce carbon throughout its design and development, including the decision to change the gradient from 7% to 8%, thereby reducing the amount of excess material requiring excavation. Optioneering work has also been undertaken in previous stages looking at excess material within landscaped bunds and the transportation of materials to and from site.

Kier has produced a Carbon Management Plan (CMP), see Section 6.10, setting out the approach going forward for the scheme in terms of carbon management and sets out a number of design options currently being considered at PCF stage 5 and 6.

Lessons learned

A lesson learned log has been used on the scheme to record relevant lessons from earlier stages of scheme development and from other schemes. The lessons learned log contains items covering aspects such as project planning, PCF product reviews, evidence sources, risk recording, risk workshop preparation, expert involvement, and land access enquiries. This will ensure that key risks are mitigated and will provide greater programme and cost certainty. Some of the key lessons learned during PCF stage 4 and 5 are included in .

The DIP Collaborative Performance Framework Manager will own the lessons learned process, capturing data and providing regular reports through to the Project Management Team and National Highways.

In summary, the management dimension confirms that appropriate organisational structure and processes have been put in place to ensure the successful delivery of the scheme to both cost and schedule. In addition, it confirms that the scheme can deliver against KPIs and provide the benefits identified and agreed as part of the FBC.

1 Introduction

1.1 Purpose of this document

1.1.1 This report forms the Full Business Case (FBC) report and provides justification for the financial investment over the entire lifecycle and at each stage of the scheme. It addresses the objectives, benefits, risks, costs and value for money of the scheme.

1.1.2 The FBC covers the five dimensions of a business case (strategic, economic, financial, commercial and management) and has been developed in line with the principles outlined in HMTs Green Book: appraisal and evaluation in central government[6].

1.1.3 The FBC is required as part of PCF stage 5 to prepare for construction and ensure that all plans for successful delivery are in place.

1.2 Scheme overview

1.2.1 The A417/A419 is a strategic route between Gloucester and Swindon that provides an important link between the Midlands/North and South of England. The route is an alternative to the M5/M4 route via Bristol. The section of the A417 near Birdlip, known as the 'Missing Link', forms the only section of single carriageway along the route and is located in the Cotswolds Area of Outstanding Natural Beauty (AONB).

1.2.2 In 2014, the Department for Transport (DfT) announced its five-year investment programme for making improvements to the strategic road network (SRN) across England. This scheme is one of more than 100 schemes identified as part of the first Road Investment Strategy (RIS1) 2015-2020[7]. Funding for delivery of the scheme has been confirmed within the second Road Investment Strategy (RIS2)[8], which covers the period between 2020 and 2025 and was published on 11 March 2020.

1.2.3 This scheme, to upgrade this section of the A417 in a way that is sensitive to the surrounding AONB, would help unlock Gloucestershire's potential for growth, support regional plans for more homes and jobs, and improve life in local communities.

1.3 Scheme vision and objectives

1.3.1 The vision is for a landscape-led highways improvement scheme that will deliver a safe and resilient free-flowing road whilst conserving and enhancing the special character of the Cotswolds AONB; reconnecting landscape and ecology; bringing about landscape, wildlife and heritage benefits, including enhanced visitors' enjoyment of the area; improving local communities' quality of life; and contributing to the health of the economy and local businesses.

1.3.2 In order to deliver this vision, there are four Client Scheme Requirements (CSRs):

[6] Department for Transport (March 2018), The Green Book: Central Government Guidance on Appraisal and Evaluation
[7] Department for Transport (March 2015), Road investment strategy: 2015 to 2020, accessed 29 January 2020, https://www.gov.uk/government/publications/road-investment-strategy-for-the-2015-to-2020-road-period
[8] Department for Transport (March 2020), Road investment strategy: 2020 to 2025, accessed 11 March 2020, https://www.gov.uk/government/publications/road-investment-strategy-2-ris2-2020-to-2025

- Safe, resilient and efficient network: to create a high-quality resilient route that helps to resolve traffic problems and achieves reliable journey times between the Thames Valley and West Midlands as well as providing appropriate connections to the local road network.
- Improving the natural environment and heritage: to maximise opportunities for landscape, historic and natural environment enhancement within the Cotswolds AONB and to reduce negative impacts of the proposed scheme on the surrounding environment.
- Community & access: to enhance the quality of life for local residents and visitors by reducing traffic intrusion and pollution, discouraging rat-running through villages and substantially improving public access for the enjoyment of the countryside.
- Supporting economic growth: to facilitate economic growth, benefit local businesses and improve prosperity by the provision of a free-flowing road giving people more reliable local and strategic journeys.

1.4 Scheme description

1.4.1 The scheme would provide 3.4 miles (5.5km) of new, rural all-purpose dual carriageway for the A417. The new dual carriageway would connect the existing A417 Brockworth bypass with the existing dual carriageway A417 south of Cowley. The new dual carriageway would be completed in-line with current trunk road design standards. The section to the west of the existing Air Balloon roundabout would follow the existing A417 corridor, but to the south and east of the Air Balloon roundabout, the corridor would be offline, away from the existing road corridor.

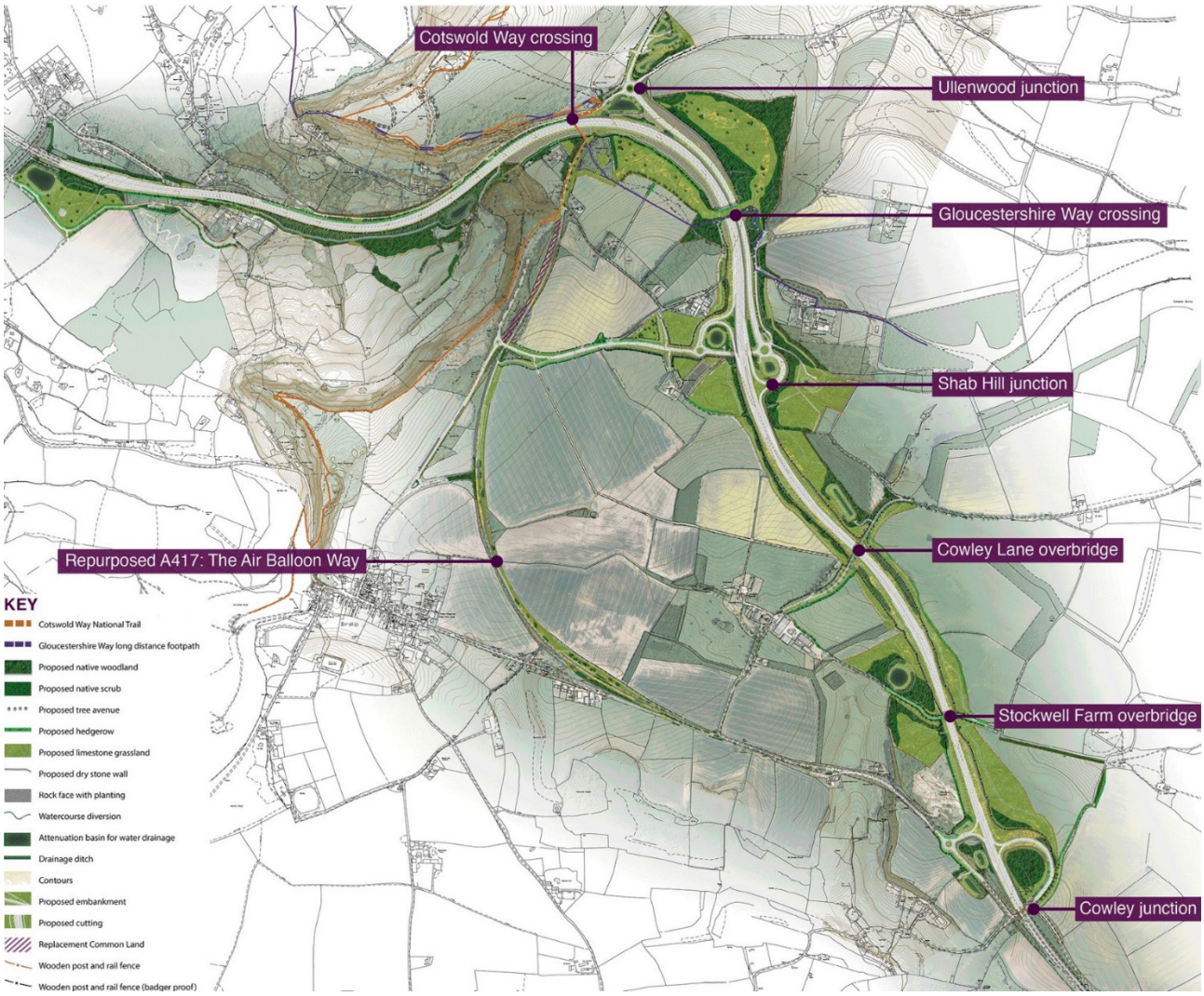


Figure 1-1 Scheme alignment

1.4.2 The scheme would include a new crossing near Emma's Grove for walkers, cyclists and horse riders including disabled users, which would accommodate the Cotswold Way National Trail. A new junction would be incorporated at Shab Hill, providing a link from the A417 to the A436 (towards the A40 and Oxford), and to the B4070 (for Birdlip and other local destinations).

1.4.3 A new 37-metre-wide multi-purpose crossing would provide essential mitigation for bats and enhancement opportunity of ecology and landscape integration. The public would also further benefit as the crossing would accommodate the Gloucestershire Way and provide an improved visitor experience.

1.4.4 A new junction would be included near Cowley, replacing the existing Cowley roundabout, making use of an existing underbridge to provide access to local destinations. The use of the existing underbridge would allow for all directions of travel to be made.

The current A417 between the existing 'Air Balloon roundabout' and 'Cowley roundabout' would be detrunked for its entire length. Some lengths of the existing road would be converted into a route for walkers, cyclists and horse riders including disabled users. Other sections would be retained as lower-class public

roads, maintaining local access for residents. Some of the route would provide Common Land.

2 Strategic dimension

2.1 Overview

2.1.1 The purpose of the strategic dimension is to provide a clear rationale for investment, demonstrating the extent to which the scheme aligns with CSR, National Highways' Business Strategy, DfT Strategic Priorities, and wider government ambitions. The scheme also sets out how the scheme contributes to local, regional and national strategic priorities and ambition.

Background

2.1.2 The A417/A419 route has been a cause for concern and subject to studies for more than 20 years. From 2001 to 2003, environmental investigations and design work was carried out by WSP on behalf of the Highways Agency (now National Highways), including public consultations, business surveys and stakeholder workshops. An economic dimension (cost benefit analysis) was subsequently prepared for a single route option in 2005, although the scheme was then put on hold in 2010 due to funding concerns.

2.1.3 The A417 did not feature as a scheme to start construction during the RIS1 period, however, the Government confirmed that the scheme would proceed in the 2014 Autumn Statement. Work has been ongoing since early 2015. The scheme was subsequently included in the second RIS2[9], announcement in April 2020 as a committed scheme for Road Period 2 (RP2), and in National Highways' Delivery Plan in August 2020 as a new major enhancement scheme to be started in RP2.

2.1.4 This strategic dimension sets out the case for change:

- Outlines the wide range of problems associated with the existing arrangements on the A417.
- Sets out the drivers for change (both internal and external).
- Explores the impact of not changing – the Do Nothing.
- Defines the scheme spending objectives (SMART objectives).
- Sets out the Theory of Change logic model and what constitutes successful delivery in terms of outputs, outcomes and impact.

2.1.5 The strategic dimension has been prepared with reference to Department for Transport's Guidance: The Levelling Up Toolkit[10]. The Toolkit replaces the Rebalancing Toolkit that was published in 2017 and is supplementary to the Transport Business Case Guidance.

2.1.6 A Levelling Up report has been used to update the strategic dimension from the updated Outline Business Case (OBC) (November 2020) to provide enhanced place-based analysis of the scheme.

[9] Department for Transport (March 2020), Road investment strategy: 2020 to 2025, Accessed 11th March 2020, https://www.gov.uk/government/publications/road-investment-strategy-2-ris2-2020-to-2025
[10] Department for Transport, February 2022, Transport Business Cases: The Levelling Up Toolkit https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/918398/supplementary-guidance-rebalancing-toolkit.pdf

2.2 Scheme development

Project stages and timeline

2.2.1 The scheme is being developed in line with National Highways' Project Control Framework (PCF), as shown in Figure 2-1. The scheme is currently in the later stages of the development phase and this Full Business Case (FBC) is being developed as part of PCF stage 5 (construction preparation).

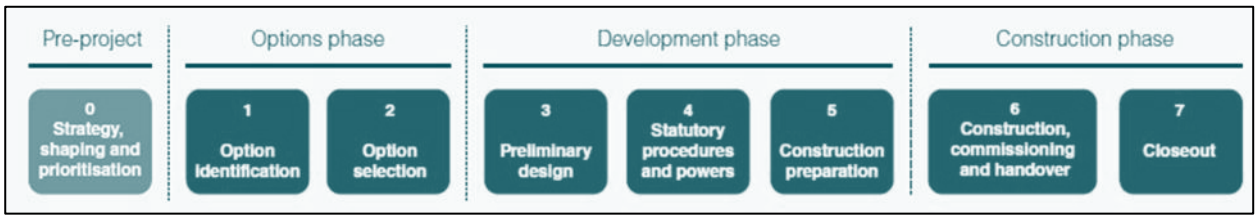


Figure 2-1 PCF stages

2.2.2 National Highways commenced detailed work on the scheme in early 2015 and the timeline since then is as follows:

- PCF stage 0 (strategy, shaping and prioritisation) in September 2015
- PCF stage 1 (option identification) in 2018
- PCF stage 2 (option selection) in March 2019
- PCF stage 3 (preliminary design) completed in May 2021 with the submission of the Development Consent Order (DCO)

2.2.3 National Highways are running PCF stage 4 (statutory procedures and processes) and PCF stage 5 (construction preparation) in parallel in order to have funding for the scheme approved in January 2023 and start construction in March 2023.

2.2.4 The original project timeline had inherent risk due to the accelerated programme limiting the survey data available to inform the preliminary design and subsequent DCO application. The delay has de-risked this by providing additional time to obtain comprehensive survey data and revise the design prior to DCO submission.

2.2.5 The delay emerged as the project was going through HM Treasury Approval Point (TAP) in April 2020, which was the conclusion of the governance round started in November 2019. As part of that submission, DfT and HM Treasury were briefed on the emerging schedule delay and the initial programme estimates. At that time, the project took the view that the cost savings would offset the cost of delay, and the schedule would be partially mitigated by construction phase savings.

2.2.6 Overall, the DCO submission was delayed from June 2020 to May 2021. Start of Works (SoW) moved by an equivalent 12 months to March 2023. Open for Traffic (OfT) was originally confirmed in the 2020-25 Delivery Plan as Q4 2025. However, subsequent survey data and buildability advice determined that the original OfT commitment was unachievable. The complex geology and environmental sensitivity, combined with complex traffic management requirements and a micro-climate high on the Cotswold escarpment which often experiences extreme weather, require a construction period of between 3.5 to 4 years. It is anticipated that the mainline would be open in February 2027 which would be part of Road Investment Programme 3 (RIP 3). There would also still be significant traffic management to accommodate on-line widening on Crickley Hill

beyond autumn 2025. The project is actively working to mitigate this and efficiencies are expected to be realised through the DIP.

2.2.7 The anticipated construction period being planned is approximately 47 months, with construction commencing in March 2023.

Background to scheme development

2.2.8 During PCF stage 3, the preferred route was further developed following comments received during the Statutory Consultation (late September to mid-November 2019, with a supplementary public consultation period between 13 October 2020 and 12 November 2020 on changes to the proposed scheme).

2.2.9 The development of the project included a proposed 'green bridge' on land owned inalienably by National Trust, to mitigate severance of the Cotswold Way and incorporate a crossing between habitats on either side of the road. The scheme presented at Statutory Consultation in 2019 was inclusive of a bridge up to 50 metre width. However, in early 2020, the National Trust's position changed, stating that they would refuse consent for any structure taking inalienable land.

2.2.10 Inalienable land requires the landowner's consent, otherwise Special Parliamentary Procedure (SPP) is invoked to compulsorily purchase it. This process could take up to two years with no guarantee of success, and pursuance of SPP is therefore considered an unacceptable risk to project delivery and National Highways' reputation. The project team intensified discussions with National Trust in early 2020 but, as the decision point on a DCO submission neared, no agreement could be found. National Trust, in their letter of 27 May 2020, confirmed that they would not support the proposed Green Bridge. With no appetite to leverage the project with the risk of SPP, the decision was taken to postpone DCO submission and find alternative mitigation for the Cotswold Way.

2.2.11 The delay has afforded the project the opportunity to incorporate design efficiencies into the 2019 scheme, namely a revised vertical alignment on Crickley Hill. This change, from 7% to 8% (still reduced from the current 10%) would reduce the surplus earthworks by nearly 1,000,000m^3 and reduce the scale of retaining structures, therefore improving environmental outcomes, construction risk and outturn costs. In addition to the change in gradient and the removal of 'green bridge', there were additional changes to the scheme following the statutory consultation in 2019. These included:

- new crossings: Cotswold Way and Gloucestershire Way crossings
- the design of Cowley junction to close off access to Cowley Village via Cowley Wood
- the rerouting of the B4070 to Birdlip via Barrow Wake
- improvements for walkers, cyclists and horse riders, including disabled users
- the replacement of Common Land, which is a type of green space

2.3 Strategic context

2.3.1 This section of the FBC report sets out the strategic context, covering the extent to which the proposed scheme would contribute to achieving the objectives of the area (place-specific objectives) as well as National Highways' and the DfTs strategic priorities and wider government and national ambitions.

Significance of A417/A149 route location

2.3.2 The A417 forms a crucial link on the Strategic Road Network (SRN) which, together with the A419, connects the M4 at junction 15 (Swindon) to the M5 at junction 11a (Gloucester).

2.3.3 As shown in Figure 2-2, the A417/A419 route provides a key connection within the region and, at 32 miles, the route is significantly shorter than the alternative M4/M5 route which is 66 miles in length. As a result of this, the route is well-used, with an Average Annual Daily Traffic (AADT) of 36,900 vehicles[11] at Crickley Hill.

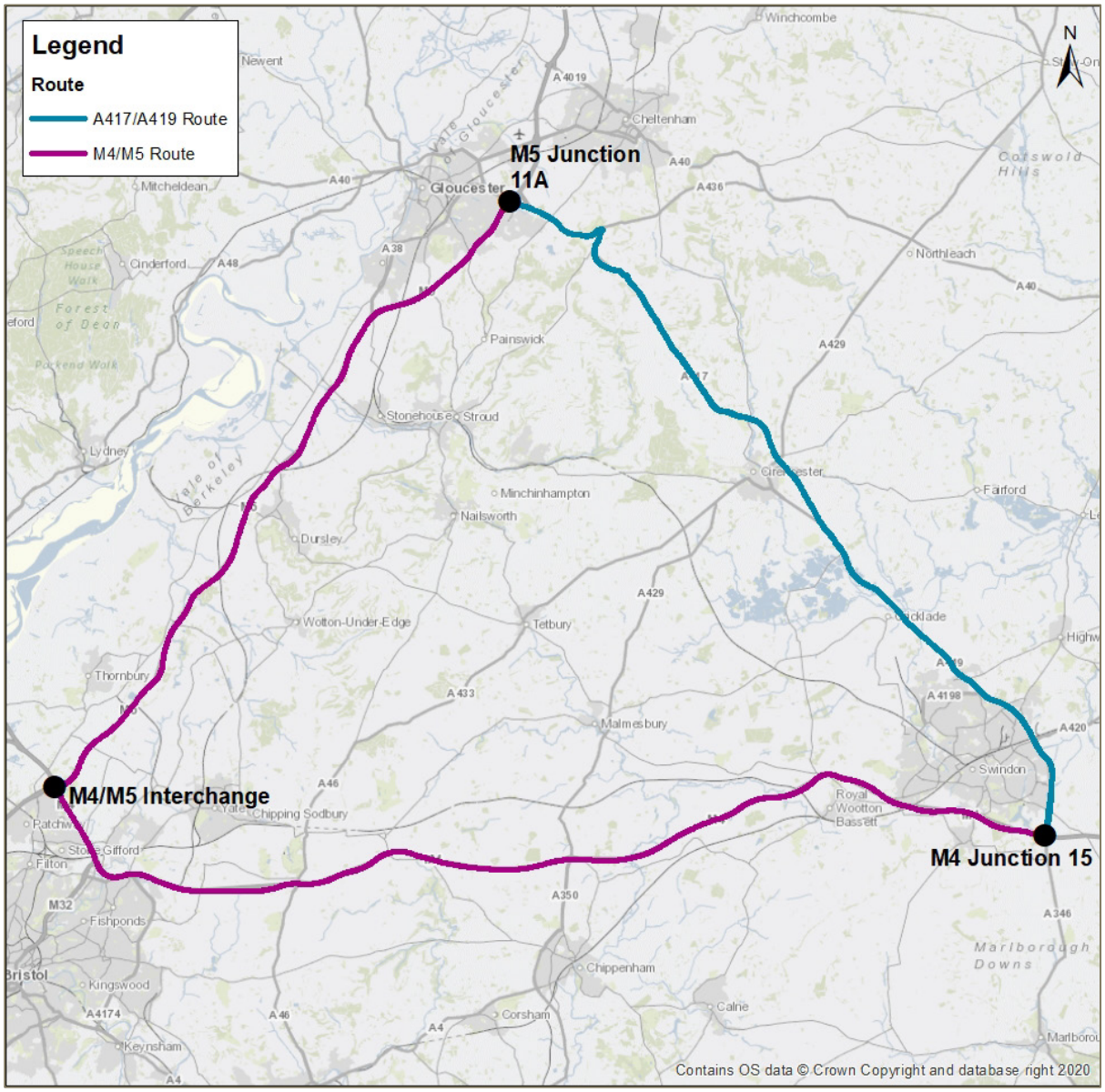


Figure 2-2 A417/A419 route length compared to M4/M5 alternative route

2.3.4 For 90% of its length, the A417/A419 route is of dual carriageway standard at the national speed limit, with grade separated junctions. The A417/A419 scheme, the location of which is shown in Figure 2-3, refers to the 3.4-mile section of the route between Cowley roundabout and the bottom of Crickley Hill.

[11] 2015 Observed Data

2.3.5 The route passes through the Cotswolds Area of Outstanding Natural Beauty (AONB) with the entirety of the A417/A419 located within it. The A417/A419 route passes across the Cotswold escarpment between Birdlip and Brockworth, with a steep gradient of up to 10% on the A417 at Crickley Hill.

2.3.6 The A417/A419 route passes through the Birdlip Air Quality Management Area (AQMA) which covers the Air Balloon roundabout and the properties on the two A417 approaches. This AQMA was declared by Cotswold District Council in 2008 as a result of high levels of nitrogen dioxide in the area originating from road traffic[12].

2.3.7 Other environmental and heritage constraints in the vicinity of the A417/A419 route include Sites of Special Scientific Interest (SSSIs), several areas of ancient woodland, listed buildings, inalienable land owned by the National Trust at Crickley Hill, and Common Land.

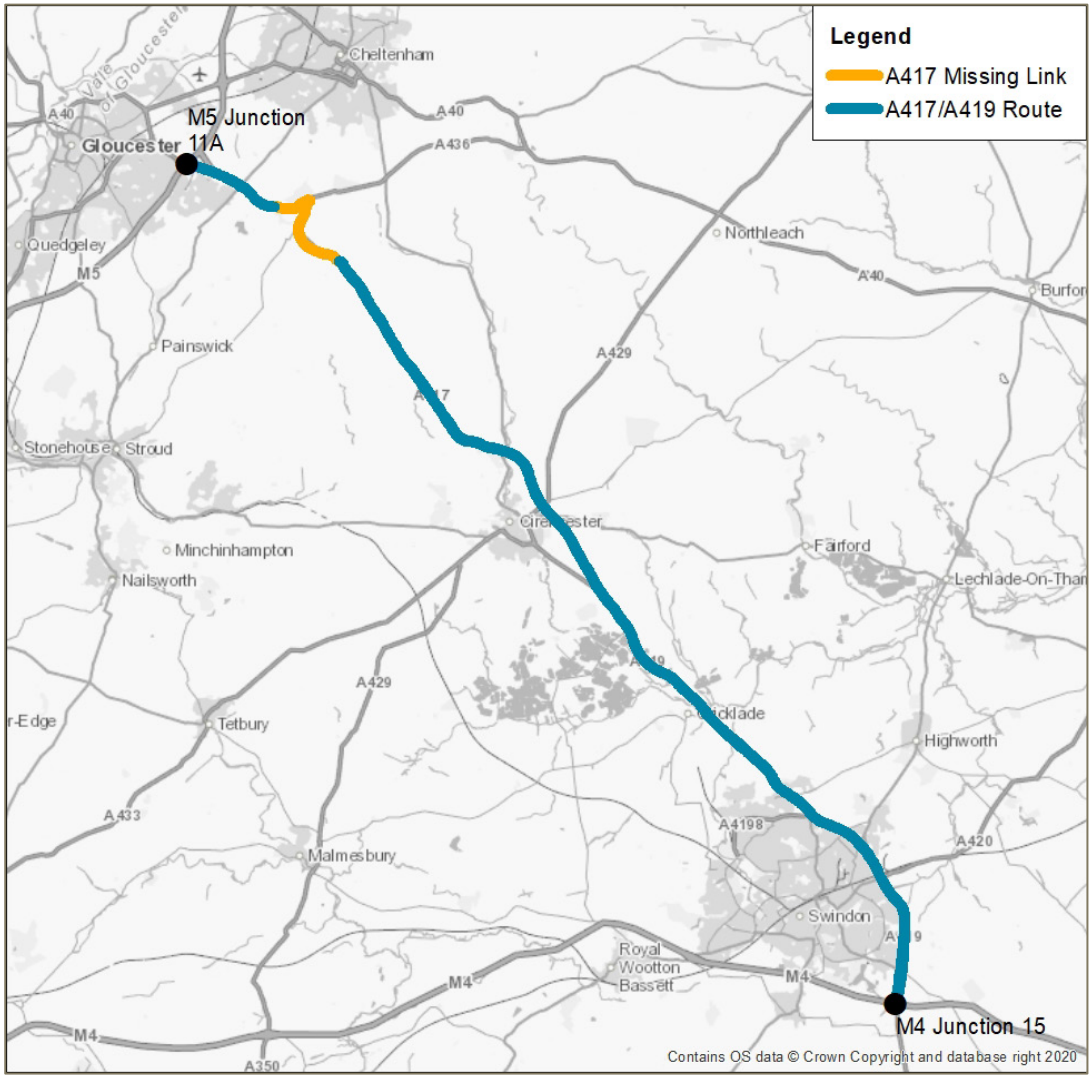


Figure 2-3 Location of the A417/A419 route

[12] Department for Environment, Food & Rural Affairs (DEFRA) website - https://uk- air.defra.gov.uk/aqma/details?aqma_id=39

Route purpose and users

2.3.8 The A417/A419 route is used by both local and strategic traffic, for a range of journey purposes including strategic traffic and freight use, supply chain connections, and local traffic.

2.3.9 Strategic traffic and freight use: the full A417/A419 route serves a range of origins and destinations across the country as shown in Figure 2-4. The route serves an essential role, connecting the ports and airports of the south-east to the west Midlands, mid and north Wales, and north-west England.

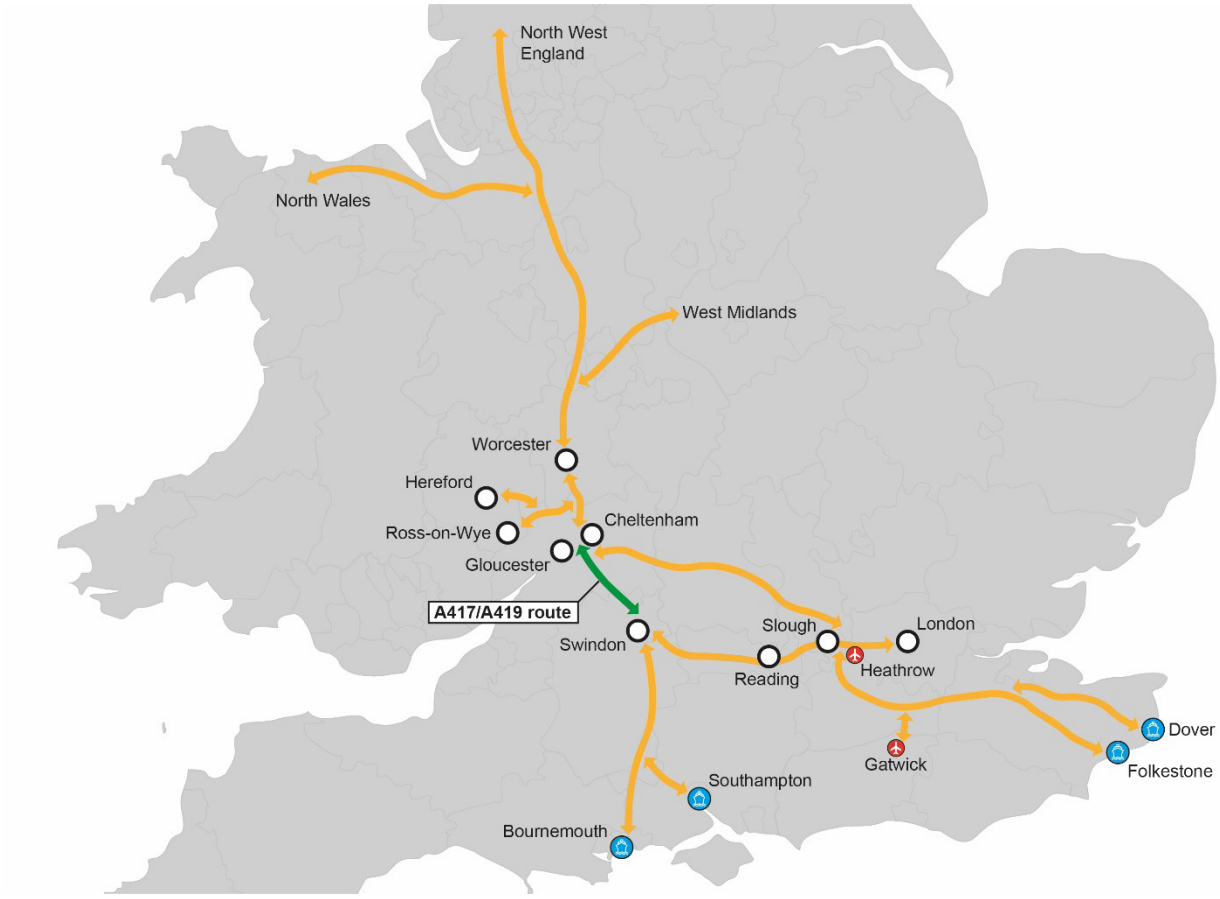


Figure 2-4 A417/A419 route strategic origins and destinations

2.3.10 The A436, which joins the A417 at the Air Balloon roundabout, is part of the Primary Route Network and part of the designated Freight Network[13] in Gloucestershire and provides direct connection between Swindon/Cirencester and Oxford/Cheltenham. It is the signed primary route between south Oxfordshire and Gloucester via M5 Junction 11a. The majority of traffic on the A436 would therefore also use the western part of the A417/A419 route between the Air Balloon roundabout and the bottom of Crickley Hill.

2.3.11 Supply chains connect businesses along the Gloucester – Swindon corridor, with businesses in Gloucester supplying industries in Swindon. The route also plays a key role as a direct connection between the south-east and south coast to the Midlands and north England.

[13] Gloucestershire's Local Transport Plan 2015-2013 sets out the roads that form part of Gloucestershire's Freight Network.

2.3.12 The A417 is an important route for local traffic travelling between Cirencester in the south and between Cheltenham and Gloucester in the north.

Overview of local economic and development priorities

2.3.13 The A417/A419 route lies across two counties, Gloucestershire and Wiltshire, where extensive growth in both housing and employment is planned. Approximately 54,000 new homes are expected to be built across Gloucestershire and Swindon during the period up to 2031[14].

National Highways organisational overview and strategic aims

2.3.14 In 2014, the Government reformed the way that England's strategic roads were funded and managed. While safety remained the number one focus, the arrangements also gave new emphasis on customer service and delivery. Highways England (now National Highways) was established as the steward of the Strategic Road Network, with a remit to operate, maintain, renew and enhance motorways and main 'A' roads to the benefit of road users, people who live next to or depend on the network, and the natural, built and historic environment.

Road Investment Strategy 2: 2020-2025

2.3.15 Following the establishment of National Highways, Government committed to a second five-year funding settlement Road Investment Strategy (RIS2), published in March 2020. This sets a long-term strategic vision for the network, not only in upgrades but in maintenance and measures to address the effects that old roads have on nearby communities. With that vision in mind, it then specifies the performance standards required; lists planned enhancement schemes which are expected to be built; and states the funding that will be made available during the second Road Period (RP2), covering the financial years 2020/21 to 2024/25 and providing funding of £24.5 billion for highway schemes.

2.3.16 The RIS2 document presents:

- The strategic vision for what the strategic road network should look like in 2050, and the steps to help realise this.
- The performance specification, setting out the expectations for National Highways and the SRN, including metrics and indicators measuring the performance of both National Highways and the network against outcomes.
- The investment plan of how money will be invested in operations, maintenance, renewals and enhancements of the road areas affected.
- A statement of funds confirming that £27.4 billion will be provided over the period to National Highways to undertake this work.

2.3.17 RIS2 sets out National Highways' vision for the SRN in 2050. This comprises:

- a network that supports the economy
- a greener network

[14] Based on information contained in Bronze TEAM Assessment for PCF stage 1 (2017), Stroud District Local Plan (November 2015), and Swindon Borough Council Local Plan (March 2015). Note that the number of houses to be delivered in the Tewkesbury Borough Council area will be higher, due to overspill from Gloucester City Council and Cheltenham Borough Council's allocations (which in turn will be lower). These three authorities have worked together to produce a Joint Core Strategy. Swindon Borough Council's planned housing growth is up to 2026, when the current Local Plan period ends, based on an assumed 1,625 dwellings per annum over 10 years (page 26 in the Local Plan).

- a safer and more reliable network
- a more integrated network
- a smarter network

2.3.18 RIS2 committed to “connecting the two dual carriageway sections of the A417 near Birdlip in Gloucestershire, taking account of both the environmental sensitivity of the site and the importance of the route to the local economy.”

National Highways Strategic Business Plan 2020-2025

2.3.19 The Strategic Business Plan confirms National Highways’ plan to open 25 schemes stated in the first road period and begin construction on 12 new schemes, covering different parts of the country, that would improve connectivity and enable safe reliable and timely journeys. The scheme represents one of the so-called “road hot spots" in need of a solution to tackle long-standing congestion and safety issues.

2.3.20 The plan sets out the performance framework which brings together all of National Highways’ delivery aims for the second Road Period, underpinned by National Highways’ three imperatives: safety, customer service, and delivery. It is organised around six performance outcomes from the performance framework, as agreed by the DfT, Transport Focus and Office of Rail and Road (ORR). These are as follows:

- improving safety for all
- providing fast and reliable journeys
- a well-maintained and resilient network
- delivering better environmental outcomes
- meeting the needs of all users
- achieving efficient delivery

2.3.21 The plan was published on the same day as the government’s second RIS2 and emphasised the importance of the SRN to the economy, social wellbeing and connecting the country where roads are considered a fully integrated system and a part of the broader UK transport network.

2.3.22 The document also sets out, for each performance outcome, the KPIs by which the service that National Highways provides will be measured. The scheme objectives and impacts as well as National Highways’ RP2 KPIs are mapped in Table 2-5 in Section 2.9.

National Highways Delivery Plan 2020-2025 (August 2020)

2.3.23 This document, which supports National Highways’ Strategic Business Plan, covers core activities in operations, maintenance and renewals. It details different categories of schemes for delivery in the plan timeframe and lists the schemes for capital investment.

2.3.24 As one of the key enhancement schemes, the scheme would generate £424 million of benefits across England, reducing accidents and journey times, bringing new opportunities for the regional economy and at the same time protecting the environment and natural capital as far as possible.

Summary of strategic context: business strategy

Signficance of the A417/A149 route location

- The A417/A419 route forms a crucial link connecting the M4 at Junction 15 to the M5 at Junction 11A. It is approximately half the distance of the alternative route which uses the M4 and M5.
- The 'A417 Missing Link' is a short, 3.4-mile section of single carriageway which comprises 10% of the route.

Route purpose and users

- The route is used by both local and strategic traffic for a range of journey purposes.
- A key function of the route is to connect the ports and airports of the south-east to north Wales, the north-west of England, and the West Midlands.

National Highways' strategy

- As part of it's second Road Investment Strategy (RIS2), National Highways has set out its vision (to 2050) for the Strategic Road Network, of which the A417/A419 route is a part. These comprise:
  - a network that supports the economy
  - a greener network
  - a safer and more reliable network
  - a more integrated network
  - a smarter network
- National Highways' Strategic Business Plan provides the high level direction for every part of the organisation for RP2, setting the outcomes which National Highways aim to deliver and the strategic priorities for the business.

Contribution to wider strategy

2.3.25 This section considers the contribution of the scheme to national, regional and local/place-specific priorities.

National strategy

HM Government: Levelling Up the United Kingdom (White Paper) (February 2022)

2.3.26 The Levelling Up White Paper sets out how the Government plans to spread opportunity more equally across the UK. It comprises a programme of systems change, including 12 UK-wide missions to anchor the agenda to 2030, alongside specific policy interventions that build on the 2021 Spending Review to deliver immediate change.

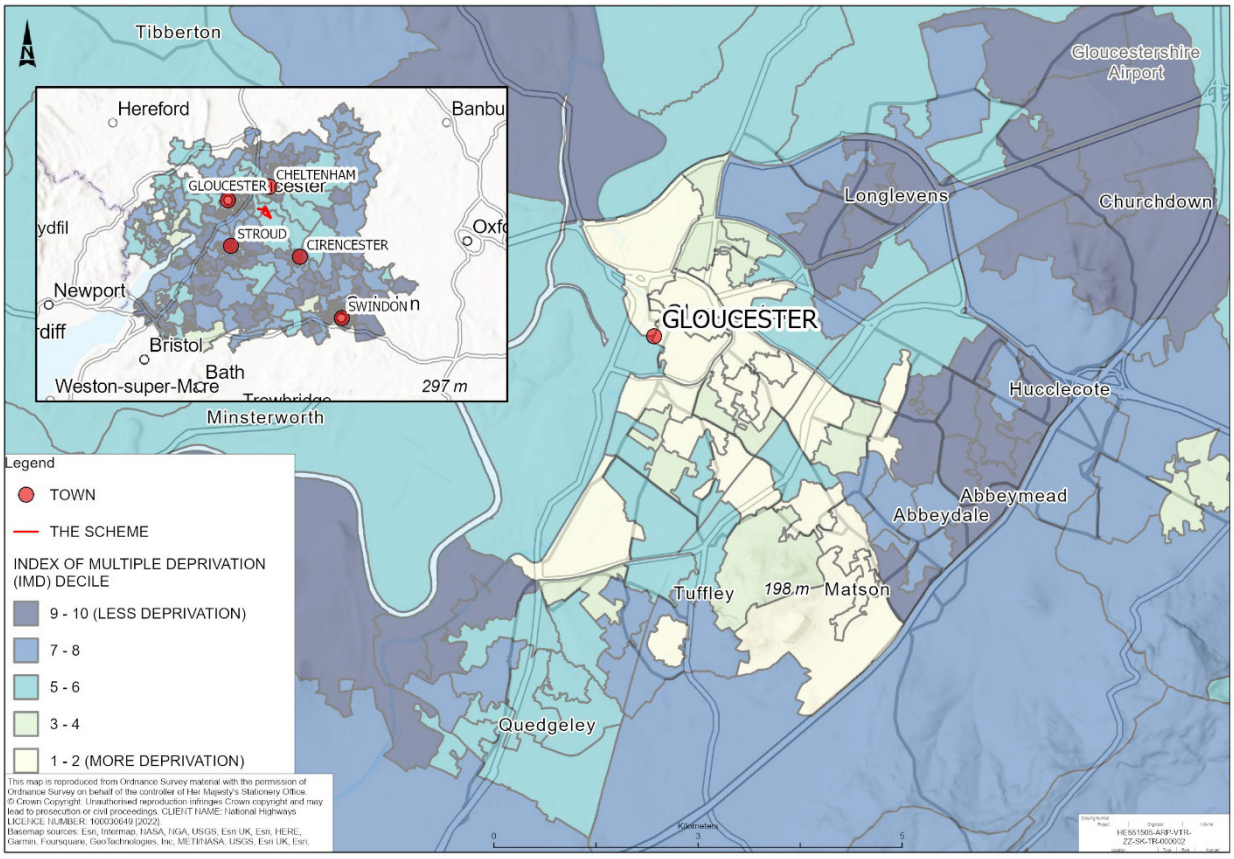
2.3.27 Transport infrastructure is an important form of physical capital which can act to reduce effective distances between places and provide increased market access and employment opportunity. In levelling up terms, the scheme represents investment in physical capital which can help to close the productivity gap, supporting those areas lagging behind.

2.3.28 The A417/A419 scheme study area covers six key local authority districts; each of which has a different level of priority in the levelling up fund categories, as shown in Table 2-1. Priority category 1 is the highest priority whereas priority category 3 is the lowest.

Table 2-1 Local Authorities and Priority Categories (Round 1 and 2)

Local Authority	Levelling Up Fund prioritisation category
Cheltenham	3
Cotswold	3
Gloucester	1 (High Priority)
Stroud	2
Swindon	3
Tewkesbury	3

2.3.29 Gloucester is a high priority area for levelling up investment being prioritisation category 1 and also having the most deprived neighbourhood in the region. The town centre is deprived and where it was surrounded by some of the least deprived neighbourhood in the country. The Index of Multiple Deprivation (IMD) is presented in Figure 2-5.



Source: National Statistics – English indices of deprivation 2019

Figure 2-5 Index of Multiple Deprivation (2019) - overall

2.3.30 The scheme would support levelling up in Gloucester, with better connectivity and connection to employment, housing, and social services as well as linking

businesses in the region, especially to the concentration of business activity in Swindon.

HM Treasury, Investing in Britain's future (2013)

2.3.31 Within Government, HM Treasury has a renewed long-term commitment to improve Britain's transport infrastructure, to help rebalance the economy, enhance productivity, create jobs and address the challenges associated with population growth. HM Treasury's 'Investing in Britain's future' paper (2013) stated that: "The Government will treble annual investment in major road schemes by 2020-21, compared to today's levels, by: identifying and funding solutions to tackle some of the most notorious and longstanding road hot spots in the country [and] upgrading the national non-motorway network with a large proportion moved to dual lane and grade-separated road standard to ensure free-flowing traffic nationwide."

National Infrastructure Strategy (November 2020)

2.3.32 Infrastructure underpins the economy and transport and is vital for a healthy job market, businesses and economic growth but also has a profound impact on people's daily lives. The strategy seeks to address the long-term issues that have held back UK infrastructure, including insufficient funding for regions outside of London and the 'stop-start' nature of public investment, so that infrastructure will be built back fairer, faster and greener.

2.3.33 The strategy emphasises how the government will boost growth and productivity across the whole of the UK, levelling up and strengthening the Union. Infrastructure investment will help unite and level up the UK, create thriving regions, support cities in living up to their full potential and help revitalise towns and communities, leaving no community or business behind. Regional cities like Gloucester are not as productive or as connected as they should be, in part due to poor local transport links. Strengthened infrastructure would bring support to improve productivity through enhanced connectivity and agglomeration economies.

Build Back Better: our plan for growth (March 2021)

2.3.34 The UK Government has set out the plan to build back better: a transformational approach, tackling long-term problems to deliver growth that creates high-quality jobs across the UK and focuses on achieving the people's priorities: levelling up the whole of the UK.

2.3.35 Infrastructure, like roads, is one of the three core pillars of growth that will drive long-term productivity improvements via record investment and capital spending plans. The new UK Infrastructure Bank will invest in local authority infrastructure projects with £4.2 billion for intra-city transport settlements and deliver infrastructure projects better, greener and faster. Transport connectivity will support individuals across the country to access jobs and opportunities.

2.3.36 The government is committed to transforming the UK's infrastructure and investment in the transport network is required to underpin economic recovery and growth, with connectivity being a key factor in determining where firms choose to locate and grow, and people's ability to access resources and employment.

2.3.37 Regional economic growth relies on infrastructure investment. Intra-city transport settlements have committed to invest £4.2 billion from 2022-23, including West of England and other large city regions that will help drive productivity.

Transport strategy

Action for roads: a network for the 21st century (Department for Transport, 2013)

2.3.38 The DfT set out its vision to transform England's road network in 'Action for Roads: A network for the 21st century' (July 2013). The publication of this document coincided with the DfT announcing the 'biggest-ever upgrade of our motorways and key A-roads – our strategic road network'. The document also announced that 'by 2021, spending on road enhancements will have tripled from today's levels', to counter the effects of past underinvestment.

Transport Investment Strategy (July 2017)

2.3.39 The Transport Investment Strategy sets out plans to create a more reliable, less congested, and better-connected transport network. The investment would help build a stronger, more balanced economy by enhancing productivity and responding to local growth priorities.

2.3.40 The nationally managed SRN supports the easy movement of people and goods around and between regional economies. The A417/A419 is part of the SRN and connects Major Road Network (MRN) A38, A436, and A430.

2.3.41 The investment aims to provide better quality infrastructure, a reliable, well-managed and safe network that provides smooth, fast and comfortable journeys. At a local level, people need to access employment centres, such as Swindon, and vital services.

DfT Outcome Delivery Plan: 2021 to 2022

2.3.42 In July 2021, the DfT published this corporate report which addresses the rising challenges in the transport industry posed by the COVID-19 pandemic. It outlines priority outcomes over the next year, including improving connectivity across the UK and growing the economy by enhancing the transport network.

2.3.43 The plan will help drive forward and deliver transport improvements with greater speed and efficiency. The improved connectivity will increase the productivity of cities and towns by supporting the regeneration of high-priority locations. Investment in local transport will increase interconnectivity and drive greater local investment. More effective regional networks ensure quality transport connections to enable these areas to function as economic clusters, thereby reducing the cost of doing business.

2.3.44 Improving the experience for road users means promoting efficiency and innovation in the maintenance and management of the roads. The plan targets improvements for longer term resilience.

DfT Decarbonising Transport: A Better, Greener Britain (July 2021)

2.3.45 National Highways are committed to deliver better environmental outcomes and it shares the responsibility to tackle climate change and achieve Net Zero UK Carbon emissions by 2050. National Highways will take responsibility to design schemes and services that are carbon and energy efficient. Initiatives to reduce

carbon footprint such as energy-saving measures for maintenance depot and using low-energy lighting and control systems for motorways.

2.3.46 Economic growth will not be delivered at the expense of sustainability. National Highways will use resources more efficiently, minimise demands to protect the environment and improve quality of life locally and nationally.

2.3.47 The SRN has a key role in net zero Britain. Roads today are seen to work against the ambitions of a zero-carbon economy. However, Britain still relies heavily on roads, with 80% of families owning a car. Road travel will decarbonise fast with the ban of new petrol and diesel car sales by 2030. The future of road travel is zero carbon powered by renewable electricity, hydrogen and biofuels and so a net zero Britain will still travel by road in 2050. The investment in Britain's roads therefore supports a thriving net zero economy, employing 7.4 million people in the UK and bring £314 billion in Gross Value Added (GVA) to the economy.

The Road to Growth (Highways England, now National Highways, March 2017)

2.3.48 The Road to Growth[15], National Highways' strategic economic growth plan, was published in March 2017. In the document, National Highways identified four economic roles:

- Economic role 1 – Supporting business productivity and competitiveness and enabling the performance of SRN-reliant sectors.
- Economic role 2 – Providing efficient routes to global markets through international gateways.
- Economic role 3 – Stimulating and supporting the sustainable development of homes and employment spaces.
- Economic role 4 – Providing employment, skills, and business opportunities within our sector.

2.3.49 Economic roles 1 and 3 are of particular relevance to the scheme, with a direct relationship between these roles and issues identified in relation to journey times and journey time reliability. Further specific analysis undertaken by National Highways, using the Economy Assessment Tool (EAT), has shown that overall, the local authority areas along the A417/A419 route[16] have a high level of reliance on the SRN. The SRN is highly significant to these areas in supporting business productivity/competitiveness (economic role 1) and in stimulating sustainable development (economic role 3).

2.3.50 While developing The Road to Growth, a series of Economic Opportunity Areas (EOAs) were identified by National Highways in consultation with Local Enterprise Partnerships (LEPs). EOAs are priority economic locations and growth opportunities that exist around the SRN. EOAs have been identified at either end of the A417/A419 route, at Cheltenham-Gloucester and Swindon. Therefore, a safe and reliable route between these key growth areas is vital if they are to achieve their aims.

2.3.51 The above analysis also supports the case for the scheme in terms of the Levelling Up agenda and the role of transport in boosting productivity and enabling sustainable economic growth.

[15] The Road to Growth: Our Strategic Economic Growth Plan (2017), National Highways
[16] The local authority areas included in the EAT analysis are Cotswold District, Gloucester City, Swindon Borough, Tewkesbury Borough, and Wiltshire.

Regional and local strategy

2.3.52 Upgrading the A417/A419 route supports the economic, housing and employment growth aims, visions and aspirations of the region, covering the GFirst LEP, Swindon and Wiltshire LEP, Gloucestershire County Council as the local transport authority for the area, and Cotswold District Council as the local planning authority.

2.3.53 This section outlines key policies which have been produced by these organisations, and the significance of the scheme in its potential impact or contribution to their objectives.

GFirst Local Enterprise Partnership

Local Industrial Strategy (2019 draft)[17]

2.3.54 The Draft Local Industrial Strategy, produced by the GFirst LEP, aims to enhance the lives of those living and/or working within Gloucestershire and to tackle and address future challenges.

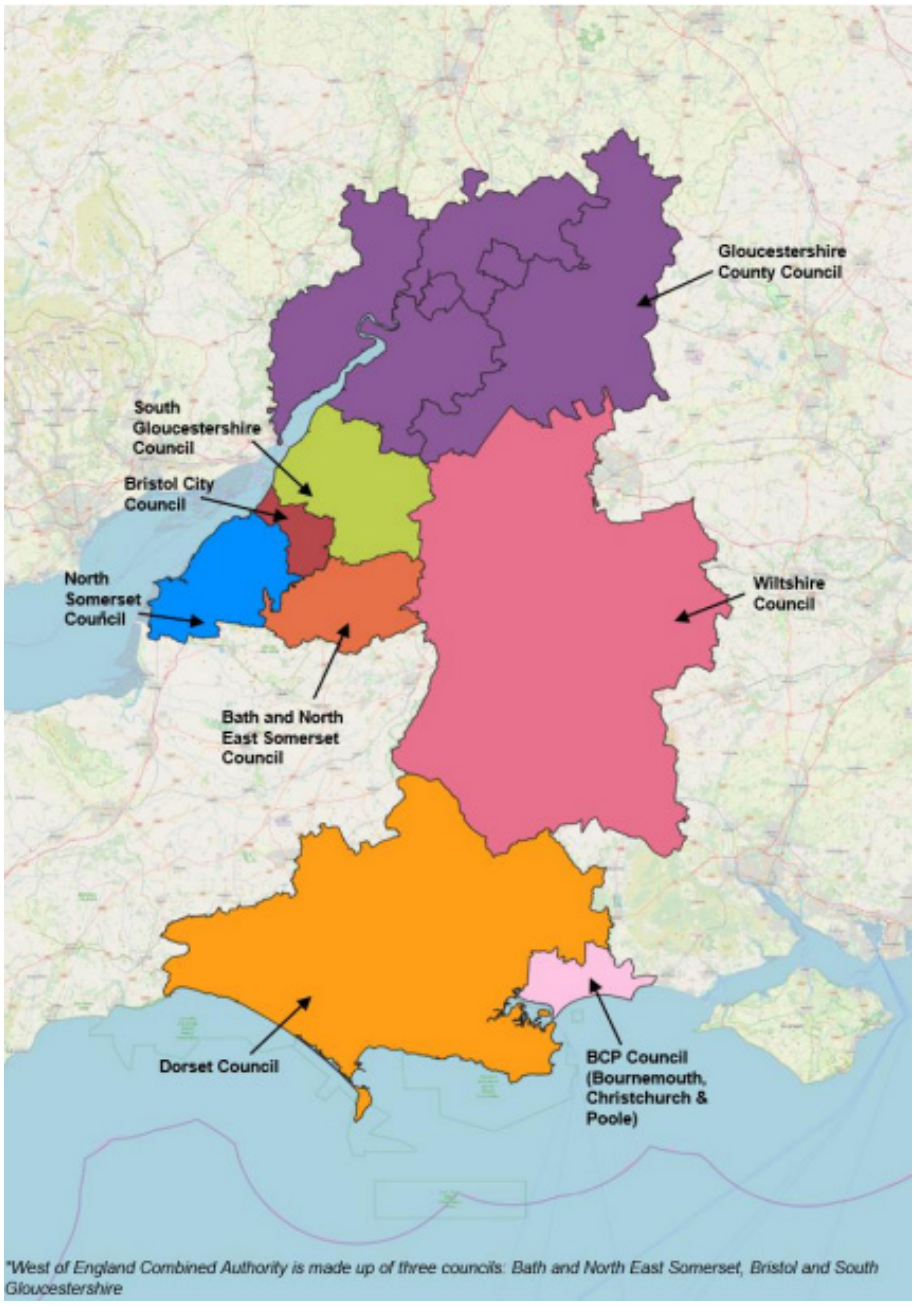
2.3.55 The document sets out two 'Seizing Opportunities' in the areas of 'cyber-tech' and 'green'. In identifying the former, Gloucestershire aims to promote its position as the 'cradle of cyber-tech and innovation in the UK'. The document highlights Gloucestershire's strength as an 'innovative active' county, with 70.3% of the businesses contributing to innovation compared to 55.1% national average. Government Communication Headquarters (GCHQ, the UK's intelligence, security and cyber agency), located in Cheltenham, encourages talent into the area and is promoting expansion and growth beyond 2030. Increasing congestion on the surrounding roads and motorways leads to increased emissions and an unhealthier and less attractive place to live.

2.3.56 The Gloucestershire Local Transport Plan sets out how it will manage increased transport demand from increased housing and economic growth. This includes the A417/A419 route with £435 million investment by National Highways.

Western Gateway Sub-National Transport Plan

Strategic Transport Plan 2020-2025 (February 2021)[18]

[17] gloucestershire_draft_local-industrial-strategy_2019-updated.pdf (gfirstlep.com)
[18] Western Gateway Sub-National Transport Body Draft Strategic Transport Plan, accessed 09/10/20



Source: Western-Gateway-Rail-Strategy-Final-Technical-Report-v3.00-Signed.pdf

Figure 2-6 Local Authority boundaries in the Western Gateway

2.3.57 The Western Gateway Sub-National Transport Body covers Gloucestershire, Bristol, Wiltshire and Dorset.

2.3.58 The Strategic Transport Plan 2020-2025 highlights the function of transport to support economic growth, by enabling key employment sectors to thrive, both by ensuring the transport network enables employees to get to work, and that goods can be transported to facilitate supply chains. It also notes that as well as certain areas in the Western Gateway lagging behind others with respect to productivity, that this 'productivity gap' has been widening over time.

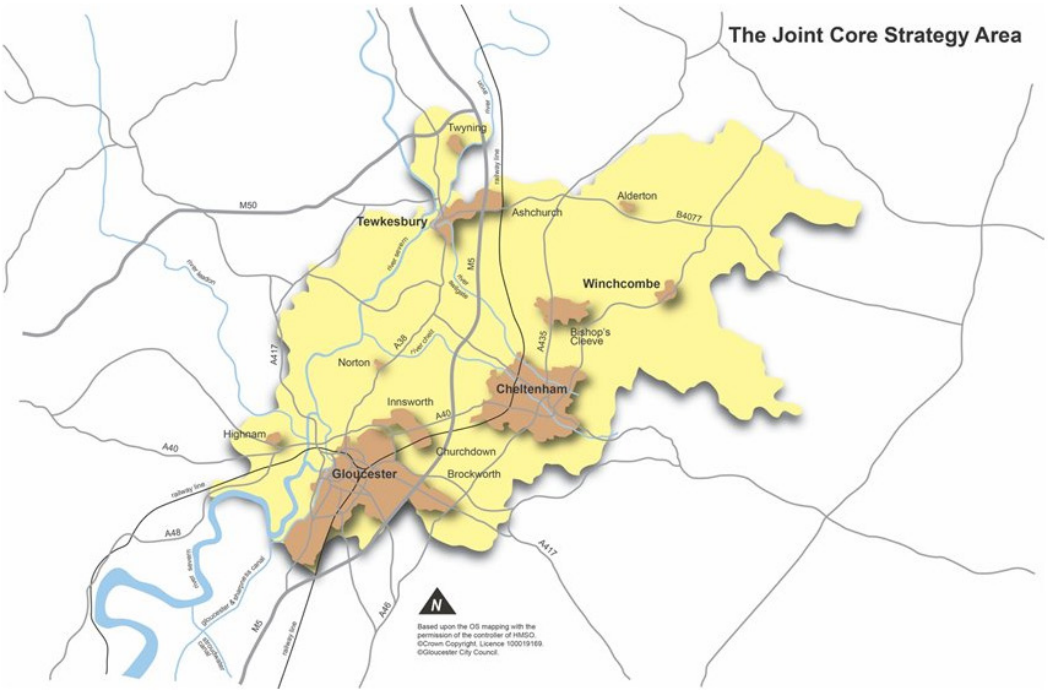
2.3.59 The M5 corridor and wider SRN, which includes the A417, need to provide connectivity within the hub and to other hubs within the Western Gateway. The

plan notes that all routes are subject to severe delays and seasonal peaks of traffic which impacts the local network, business market and growth potential.

Gloucestershi*re, Cheltenham and Tewkesbury Joint Core Strategy (November 2017)*

Joint Core Strategy (JCS) Transport Strategy

2.3.60 The JCS was adopted by all three councils (Gloucestershire, Cheltenham and Tewkesbury) in December 2017 and is now undergoing a review.



Source: https://www.jointcorestrategy.org/jcs-map

Figure 2-7 The Joint Core Strategy area map

2.3.61 The JCS Transport Strategy, for the period 2011-2031, outlines the transport strategy for the three council areas shown in Figure 2-7. The strategy lays out the required actions and investments to provide 30,500 new houses, 28,000 new jobs and the infrastructure to support this to meet 2031 planning targets. It also sets out how this will be managed and delivered whilst protecting the surrounding environment. Development in the region will increase the need for improved connectivity links in this area, with sustainable transport links being a key focus to ensure negative impacts, such as those on air quality and noise, are reduced.

2.3.62 The JCS aims to work towards improving economic, environmental and community objectives. Providing multimodal transport links can help achieve sustainable development, creating a more desirable place to live or locate a business.

2.3.63 The A417/A419 route is near several key strategic allocation housing and employment sites, including the South Churchdown and North Brockworth sites.

Gloucestershire Vision 2050 Concordat (October 2018)

2.3.64 The Gloucestershire Vision 2050 Concordat is intended to capture recent thinking and set out a mandate to take forward a Gloucestershire Vision for 2050.

2.3.65 Gloucestershire county recognises the challenges of its ageing population, with a loss of 400 young people every year compared to Bristol attracting 4,000 young people every year. In the next 20 years, Gloucestershire aims to have a demand of up to 100,000 new jobs, with only 7,000 more people to fill them. The region also faces issues such as significant impacts from climate change (increased frequency and severity of flood events) and social exclusion.

2.3.66 The document states that the approach to transport will include improved connectivity within, and to and from the area.

Local Transport Plan 2015-2031 (March 2019)

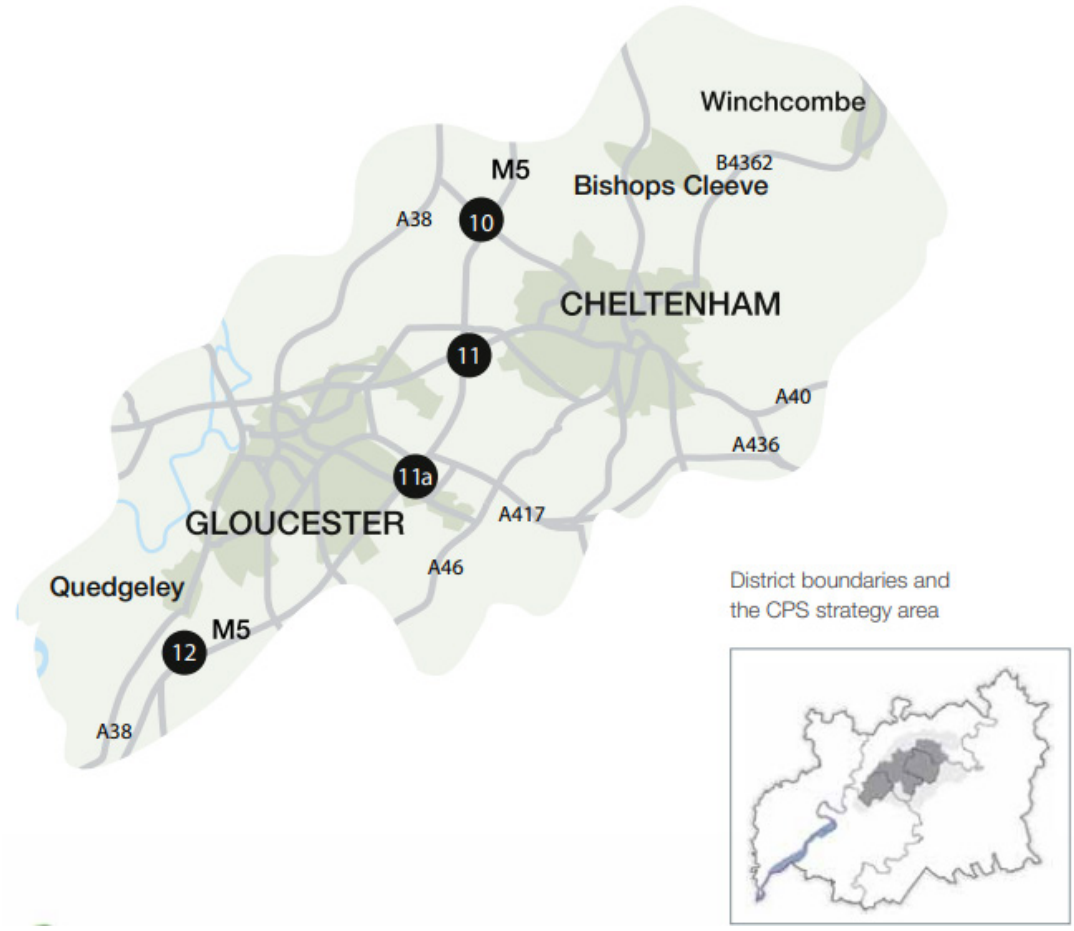
2.3.67 Gloucestershire County Council sets out its priorities regarding transport as a critical enabler of economic growth in the county in its Local Transport Plan 2015-2031. It is essential for Gloucestershire County Council that its transport network is able to cope with the challenges and pressures of the future as well as keeping up with the rate of growth and modernisation in the national economy. Gloucestershire County Council has identified the A417/A419 route as a priority location for improvement in the 2021-2031 period[19].

Connecting Places Strategy – Central Severn Vale (November 2017)

2.3.68 Central Severn Vale is one of Gloucestershire's key urban areas with approximately half of the area's population living there. There is a high amount of congestion in the surrounding area, with the strategy identifying the A417/A419 as a key strategic pinch point.

2.3.69 Central Severn Vale is leading within the cyber technology market, which will attract employment to these areas, resulting in a benefit to Gloucestershire's economy. The strategy aims to support sustainable economic growth, enable community connectivity, conserve the environment and improve community health and wellbeing. It highlights the importance of strong transport links to London, Birmingham and Swindon, among other locations, as well as managing congestion to provide greater certainty of journey times.

[19] Gloucestershire's Local Transport Plan 2015-2031 – Policy Document PD4 – Highways.



Source: 2-ltp-csv-cps-nov-2017.pdf (gloucestershire.gov.uk)

Figure 2-8 Map of Gloucester's Local Transport Plan – Central Severn Vale Area

2.3.70 The connecting places strategy notes "The A417 holds up movement on the key corridor connecting Cheltenham and Gloucester with the South-East and economic development"; with significant forecast development, these issues are likely to be exacerbated.

Cotswold District Council Local Plan 2011-2031

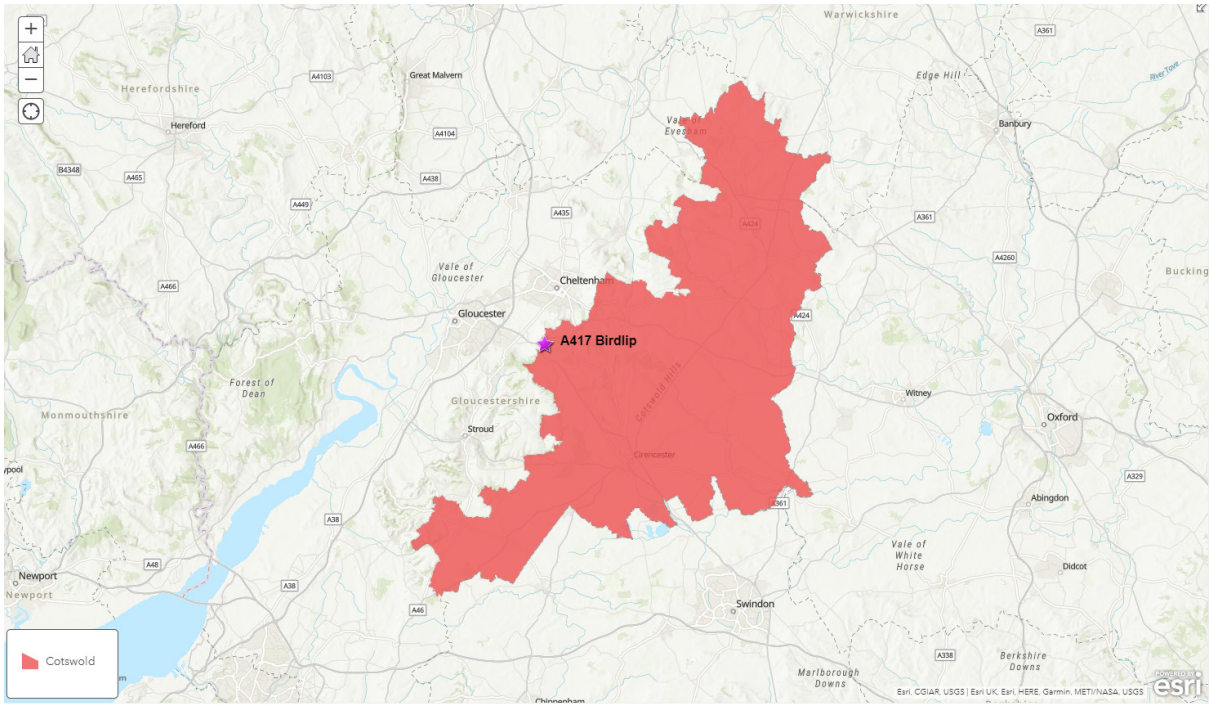


Figure 2-9 Cotswold District Council

2.3.71 The A417/A419 route is located within the Cotswold District Council area (see Figure 2-10), close to the border with Tewkesbury Borough Council. Both local planning authorities have prepared, or contributed to, Local Plans that set out the housing and jobs requirements for their respective planning areas. Cotswold District Council has set out a clear vision in its emerging Local Plan for 2011-2031. By 2031 the Local Plan will have:

- Contributed to enabling a strong, competitive and innovative local economy.
- Supported the delivery of a range of housing that helps to meet the requirements of all sections of the community.
- Further capitalised on the district's key strengths, notably its high quality historic and natural environment.
- Helped to create more healthy, sustainable, mixed communities.

2.3.72 Cotswold District Council's Local Plan 2011-2031 confirms that the transport priorities for Gloucestershire County Council include improvements to the A417 /A419 route. The vision set by Cotswold District Council suggests that the scheme would need to support housing and employment growth within the district, while acknowledging the importance of the natural environment through which the road passes.

Summary of strategic context: alignment with wider strategy

National Strategy

- The Levelling Up White Paper, published in February 2022, has set out the vision to level up the UK, closing geographical disparities through investment in physical infrastructure and other capitals. Investment in the A417 represents investment in strategic transport infrastructure, a key element of physical capital required to enhance economic growth prospects.

Transport Strategy

- On 11th March 2020, the Department for Transport announced its Road Investment Strategy 2 (RIS2). This document sets out the strategic vision for the Strategic Road Network 2050, and the steps needed alongside this. It also sets out the performance specification for National Highways and the SRN, alongside an investment plan of how money will be invested in operations, maintenance, renewals and enhancements of the road network.
- National Highways' strategic economic growth plan, 'The Road to Growth', has identified four economic roles for the Strategic Road Network. These include supporting business productivity and supporting the sustainable development of homes and employment spaces, two areas of particular relevance to the issues relating to the scheme. Economic Opportunity Areas have been identified at either end of the A417/A419 route, at Cheltenham-Gloucester and Swindon.

Regional and Local Strategy

- Upgrading the A417 Missing Link supports the economic, housing and employment growth aims, visions and aspirations of GFirst LEP, Swindon and Wiltshire LEP, Gloucestershire County Council as the local transport authority for the area, and Cotswold District Council as the local planning authority.

2.4 The Case for change

2.4.1 This section of the strategic dimension outlines the current situation, issues with the existing arrangement, and the rationale for intervention. It explains how the scheme proposal would directly address the problems identified and the opportunities to contribute to wider economic, environmental and social objectives.

Existing arrangements

2.4.2 There are a number of key issues with the existing arrangements on the A417/A419 route. The primary issue is that the existing highway alignment is not to current Design Manual for Roads and Bridges (DMRB) standards and is therefore unsuitable for the high traffic flows traversing the route. The scheme is designed to relieve the issues by completing the dual carriageway link with grade-separated junctions.

Highway alignment and junction arrangements

2.4.3 As shown in Figure 2-10, the current route includes 1.4 miles (2.3 kilometres) of single carriageway between Cowley Roundabout and an at-grade priority junction with the B4070 at Birdlip, and 2 miles (3.2 kilometres) of single-carriageway with an additional eastbound climbing lane. These sections of single-carriageway are referred to as the ‘A417 Missing Link’.

2.4.4 The majority of the A417/A419 route is covered by the national speed limit, with a 0.5 mile (0.8 kilometres) section of 40mph limit through Nettleton Bottom, to the north of the Cowley roundabout.

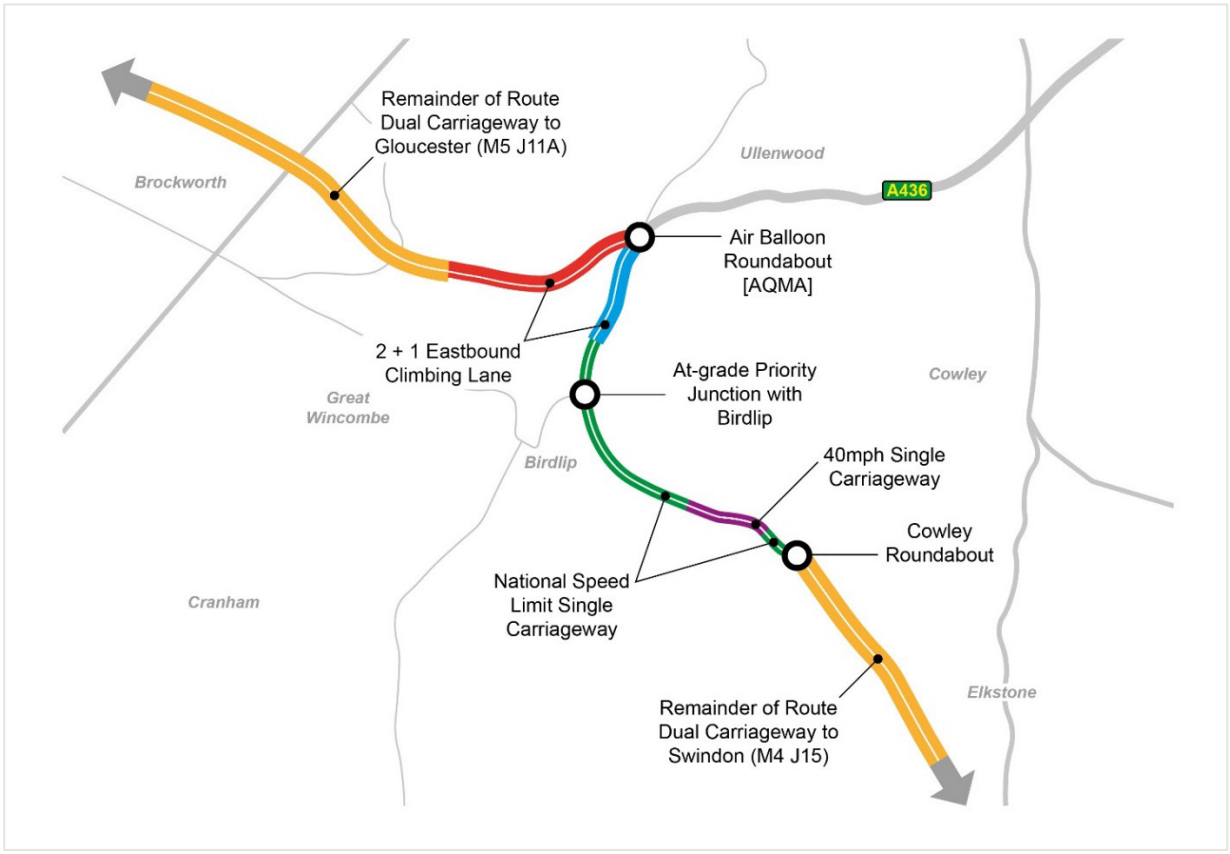


Figure 2-10 A417/A419 route

2.4.5 The standard of the A417 Missing Link is highly inconsistent with the rest of the A417/A419 route. While the remainder of the route provides grade separation and priority to SRN traffic, there are a number of issues with the A417 Missing Link which limit the effectiveness of the whole route.

- single carriageway layouts
- at-grade junctions, including the Cowley and Air Balloon roundabouts where traffic on the SRN may be required to give way
- a section subject to a 40mph speed limit

2.4.6 This section of the route includes long sections with gradients exceeding the desirable maximum gradient of 6% for all purpose single carriageway roads[20].

2.4.7 Steep gradients on the SRN can lead to significant problems, including frustration for drivers following slow moving heavy vehicles, breakdowns and bottlenecks which can lead to traffic congestion. On the 2+1[21] sections, such as Crickley Hill, bottlenecks form due to inefficient lane usage.

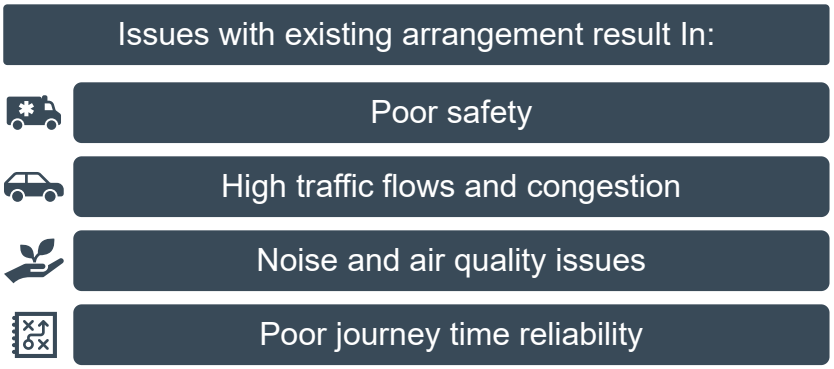
2.4.8 For the majority of the A417/A419 route, stopping sight distances are below the desirable minimum of 215 metres for a 60mph (100kph) single carriageway road[22], and at some points are as low as 120 metres. This visibility can be further

[20] The desirable maximum gradients are in DMRB Volume 6 Section 1, Chapter 4 Vertical Alignment (Part 1 TD9/93). 6% is considered to be the desirable maximum, while 8% is allowable within design standards
[21] 2+1 road is a specific category of three-lane road, consisting of two lanes in one direction and one lane in the other
[22] The desirable minimum stopping sight distances are in DMRB Volume 6 Section 1 Part 1, Chapter 1 Design Speed (TD9/93).

limited by oncoming HGV traffic. These stretches of reduced stopping sight distances result in an increased risk of accidents.

2.4.9 There are four priority junctions and 11 private property accesses directly along the A417/A419 route. All of these junctions and access points are unrestricted, which means that all turning movements are allowed, including right turns off and on to the A417.

2.4.10 Overall, these issues with the existing alignment result in a range of wider issues on the A417/A419 route.



Safety

2.4.11 The A417/A419 route is an accident cluster site, with 42 collisions involving personal injury of 82 people over the 5-year period between July 2014 and June 2019 (inclusive)[23] and the 42 collisions are categorised by their seriousness as shown in Figure 2-11:

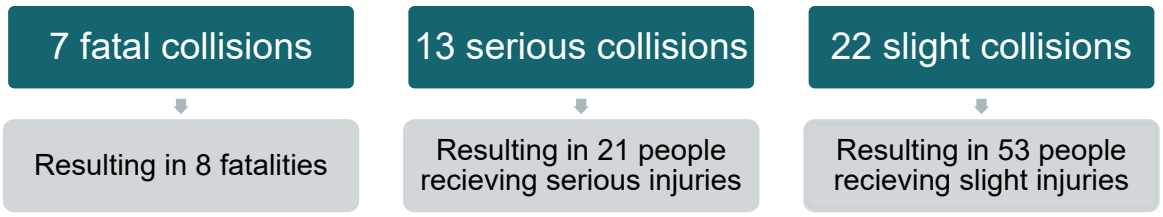


Figure 2-11 A417/A419 Accidents (July 2014 to June 2019)

2.4.12 The casualty rates observed on the A417/A419 route are significantly higher than the national averages for single-carriageway roads for fatal and serious casualties[24] i.e., accidents that occur on the A417 are more severe with more fatal and seriously injured casualties. This comparison is presented in Figure 2-12 which presents the observed casualty rates per PIA (Personal Injury Accident) on the A417 Missing Link against the national average for equivalent road types.

[23] Information on the causes of accidents is not readily available for this period.
[24] Compared to the national average 'Link and Junction Combined Casualty Rates' for 'Older S2 A Road' road type – TAG Databook May 2022 v1.18 Table COBALT 5, published by DfT.

Figure 2-12 Local A417 and national average casualty rate (Casualties per PIA)

2.4.13 If the national average casualty rate per PIA in Figure 2-13 is applied to the 42 PIAs recorded on the A417 Missing Link for the period July 2014 to June 2019, then this would result in the number of causalities as per Table 2-2. Based on the national average, the number of slight casualties would be close to the number observed in the period July 2014-2019 and the overall number of accidents is only 25% higher. However, the number of serious casualties observed on the A417 Missing Link is 100% higher than the national average while the number of observed fatalities is 300% higher.

Table 2-2 Casualty rates per PIA by severity – local and national comparison

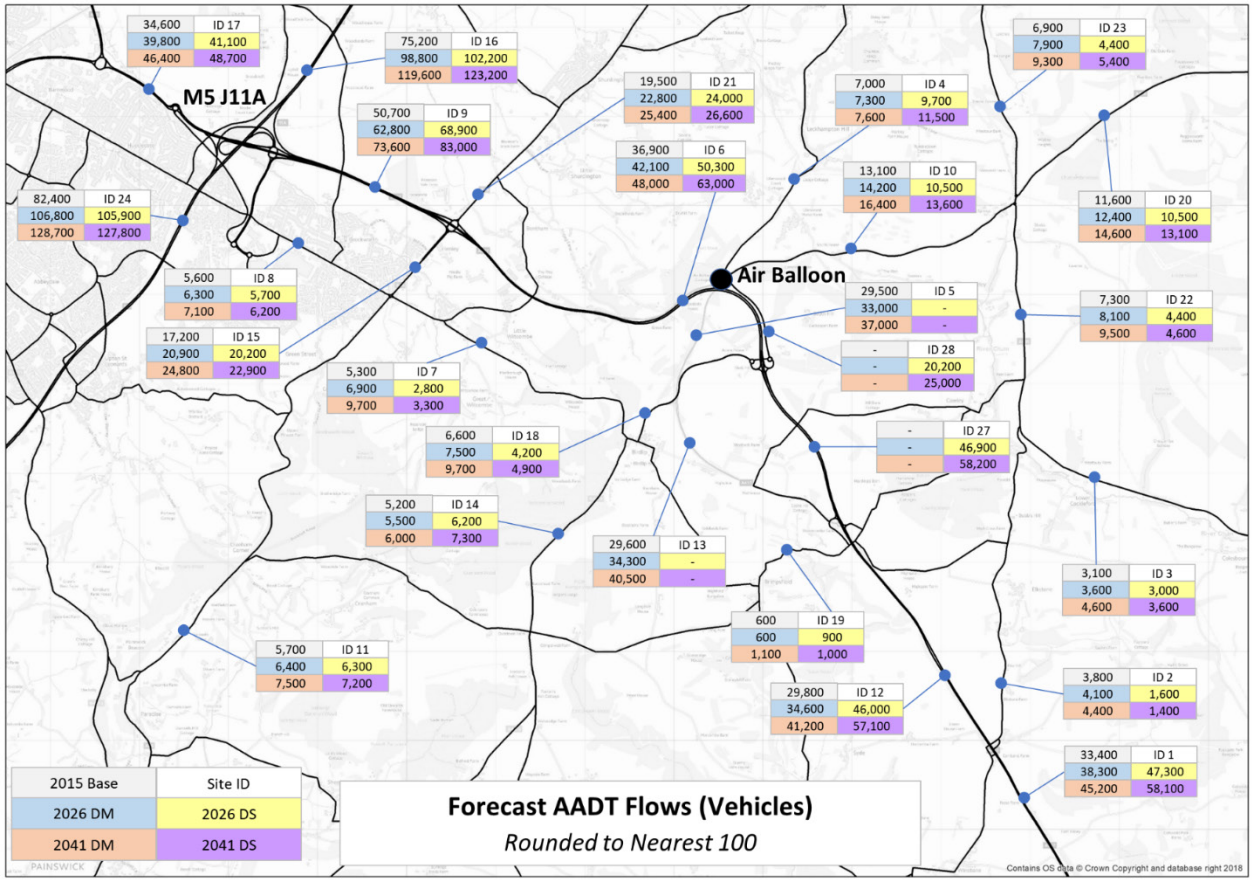
	Total PIAs	Casualties			
		Fatal	Serious	Slight	Total
Observations (July 2014 – June 2019)	42	8	21	53	82
National Average	42	2	10	55	66

Source: Department for Transport

2.4.14 More detailed analysis, previously undertaken as part of PCF stage 1, shows that over 50% of the PIAs could be attributed to specific problems associated with the A417/A419 route. The high Killed or Seriously Injured (KSI) rate is due to scheme alignment, the gradient, accessibility to roads, and vehicle crossings lacking central reservations, especially on the escarpment and Air Balloon roundabout.

Highway traffic flows

2.4.15 Figure 2-13 shows forecast traffic levels on the A417/A419 route for 2026 and 2041, where Do-Minimum (DM) shows the traffic flows without the scheme intervention and the Do-Something (DS) shows the traffic volume with the scheme.



Source: HE551505-ARP-HGN-X_XX_XXXX_X-RP-TR-000007

Figure 2-13 Forecast AADT (Annual Average Daily Traffic)

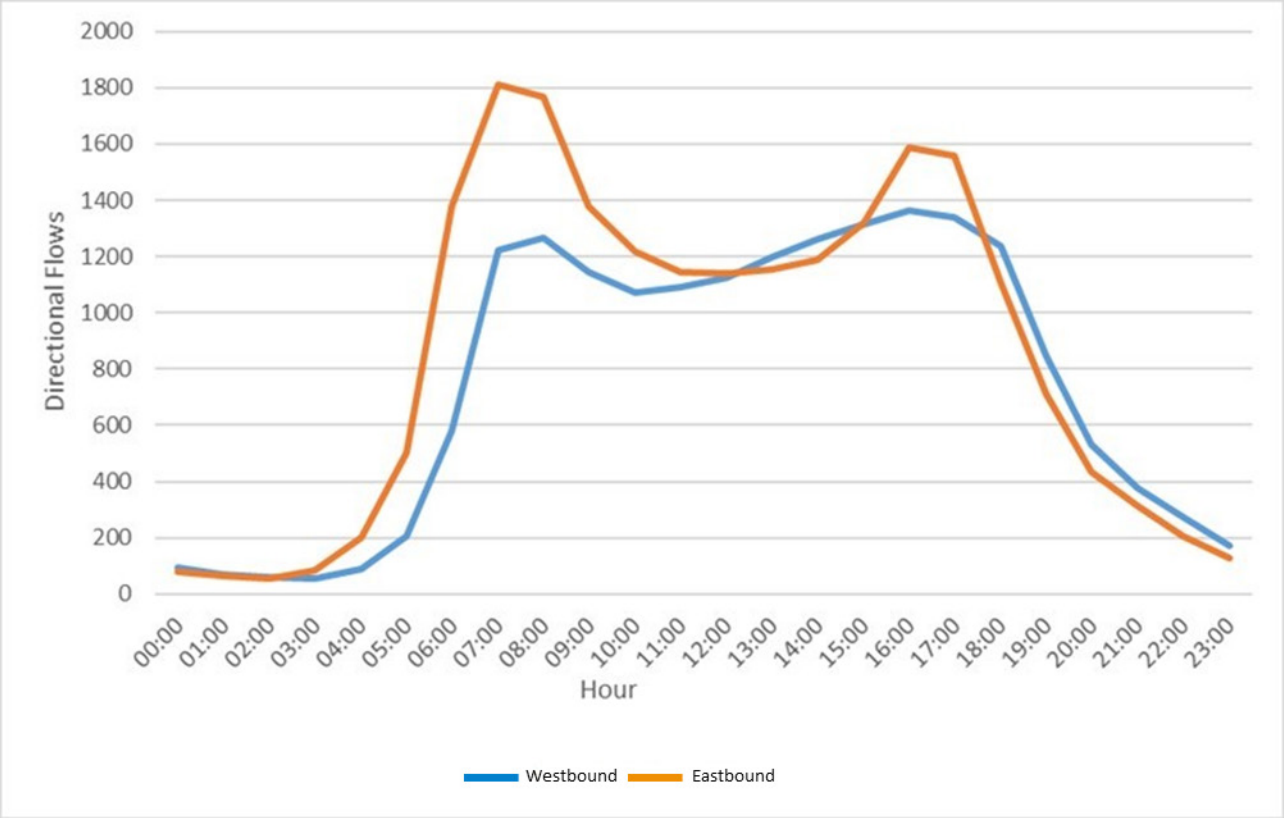
2.4.16 As shown in Figure 2-14, the current flows are more than twice the recommended maximum opening year AADT for a new rural single carriageway (13,000), and within the flow range for justifying either a dual 2 or 3 lane all-purpose road[25]. These high traffic flows result in an increased likelihood of congestion and delay.

2.4.17 As shown in Figure 2-14, the DM AADT on the A417/A419 route west of Air Balloon roundabout (ID6) is forecast to increase from 36,400 in 2015 to 42,100 in 2026, a 16% increase. A total of 33% increase from 2015 to 2041 to 48,000 without the scheme. This will place even greater pressure on a section of road which is already operating above capacity[26].

2.4.18 Traffic flows throughout the day are highly variable. Figure 2-15 shows the recorded hourly weekday traffic flows, by direction, in February 2016 on the A417 Crickley Hill.

[25] Recommended flow ranges are provided in DMRB Volume 5 Section 1 Part 3, Chapter 2 Economic Assessment and Recommended Flow Ranges for New Rural Road Links (TA 46/97). The recommended maximum opening year AADT for a new single carriageway road (S2) is 13,000. For D2AP the recommended opening year AADT range is 11,000 to 39,000

[26] AADT forecasts, without improvements to the A417, are presented as the Do-Minimum scenario in the stage 5 ComMA Report.



Source: PCF stage 5 ComMA

Figure 2-14 A417 Crickley Hill hourly traffic flows, by direction (February 2016)

2.4.19 In the eastbound (Gloucester to Swindon) direction, traffic flows are highest during the morning and evening peak period. However, in the westbound direction (Swindon to Gloucester) peak periods are less pronounced, with relatively little variation in daytime flows. This is reflective of a lack of capacity in this direction restricting traffic flow, particularly at the Air Balloon roundabout.

2.4.20 Heavy Goods Vehicles (HGVs) account for approximately 9% of AADT on the A417/A419 route[27], which is typical for the SRN. However, due to the steep gradients of up to 10% on Crickley Hill, HGVs have a greater impact on traffic flow and capacity than would be the case in other locations.

Journey times and vehicle speeds

2.4.21 The majority of the A417/A419 route between the M5 J11A and Cirencester is a dual carriageway with the national speed limit of 70mph. However, as shown in Table 2-3, the average speeds in 2041 for peak time are well below 46 mph (2/3 of the speed limit) except eastbound PM peak, 51 mph. The Interpeak average speed in 2015 is 59 mph shows the possible travel speed on A417 also considerably low compared to other motorway and highways on strategic road networks. Given the high standard of the majority of the route, it is clear that the A417 Missing Link section is the source of prolonged journey times.

[27] Department for Transport traffic counts, count point ID 57116, A417 Crickley Hill.

Table 2-3 Actual and modelled average journey times on the A417 between Cirencester and M5 J11a[28]

Year	AM peak		Inter-peak		PM peak	
	Time (mm:ss)	Average speed (mph)	Time (mm:ss)	Average speed (mph)	Time (mm:ss)	Average speed (mph)
Cirencester (A417/A429 junction) to M5 Junction 11a [westbound]						
2015	17:33	49	17:12	50	18:25	47
2026	18:18	47	17:53	48	18:52	46
2041	19:33	44	19:08	45	20:17	43
M5 Junction 11a to Cirencester (A417/A429 junction) [eastbound]						
2015	15:38	56	14:42	59	15:03	58
2026	16:58	51	15:07	58	15:37	56
2041	18:45	46	16:09	54	17:13	51

Journey time reliability

2.4.22 Reliable journey times are essential to a functioning road network. It is important to both businesses and freight providers to know how long specific journeys will take so that they can plan efficiently and economically.

2.4.23 Average 2015 journey time reliability statistics, collected by the Highways Agency (now National Highways), indicate the percentage of journey times on each section of the SRN that are considered to be completed ‘on time’. The statistics for the A417 between Cirencester and M5 Junction 11a for the period April 2014 to March 2015 are presented, by section, in Figure 2-16.

[28] Journey time forecasts extracted from the stage 5 ComMA Report

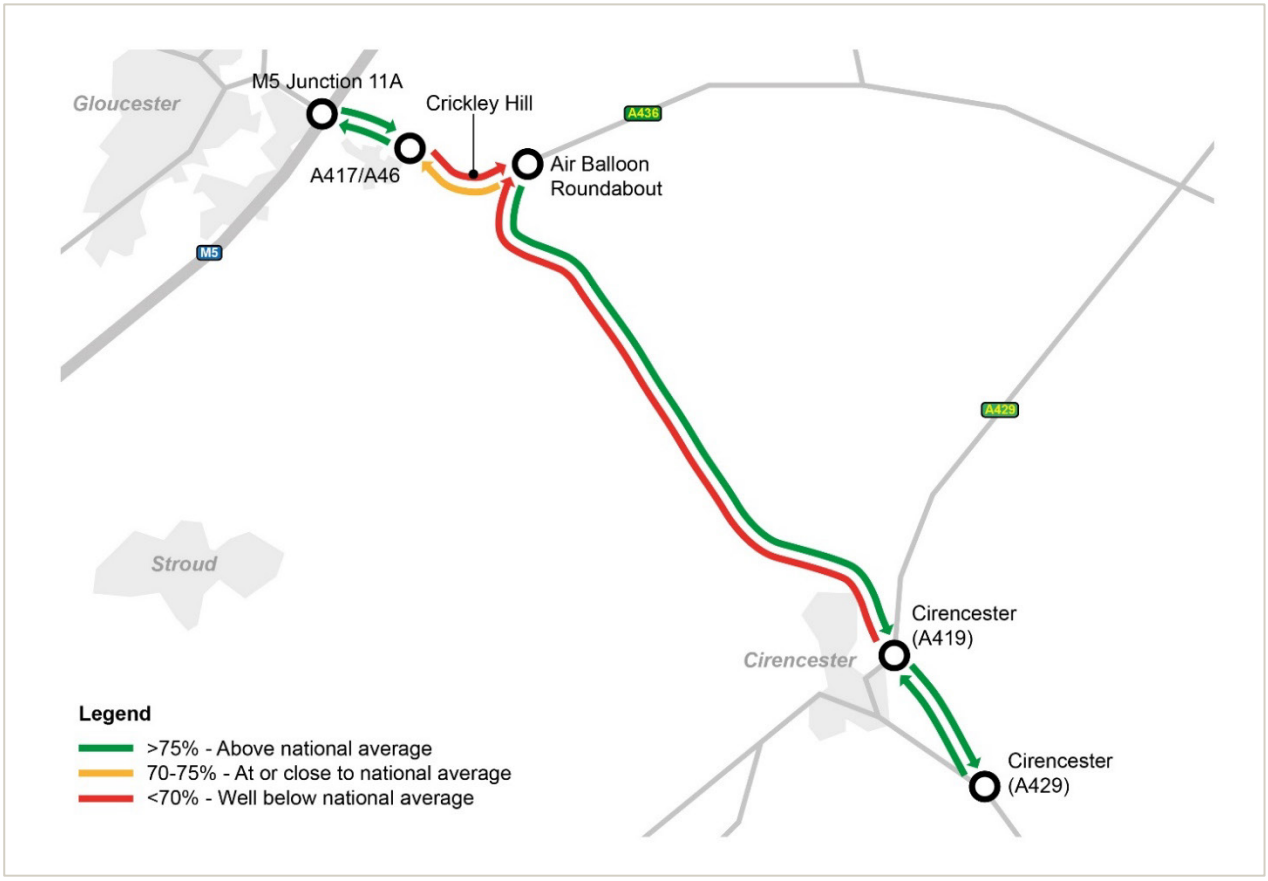


Figure 2-15 A417 Journey time reliability

2.4.24 As shown in Figure 2-16, journey time reliability on key sections of the A417 is below 70%. The average reliability for the full A417/A419 route was 77% during the same period, while the average for all A roads on the SRN in England was 75%. An explanation of the approach used to appraise the reliability benefits and full results from this analysis can be found in Sections 12 and 13 of the PCF stage 5 ComMA Report.

2.4.25 Poor journey time reliability is an issue throughout the year and does not vary seasonally. The Air Balloon roundabout and Crickley Hill are considered to be two major causes of the issue. Eastbound (uphill) journey time reliability on Crickley Hill is considerably worse than the reverse direction; 67.8% of 'uphill' journeys compared to 74.0% of 'downhill' journeys are completed on time. This is reflective of the impact of slow-moving vehicles ascending Crickley Hill and delays approaching the Air Balloon roundabout.

2.4.26 The eastbound section of the A417 approaching the Air Balloon roundabout ranks in the bottom 8% of SRN sections for journey time reliability.

Air quality

2.4.27 The Birdlip Air Quality Management Area (AQMA) covers the A417/A436 Air Balloon roundabout and A417 approaches, along with adjacent residential and business properties. The Birdlip AQMA was declared in April 2008 as the result of high levels of Nitrogen Dioxide (NO_2) caused by vehicle emissions.

2.4.28 Cotswold District Council produced an Air Quality Action Plan (2011) to set out strategies to mitigate the impact of air pollution in the area and to consider the cost effectiveness of several options. The Air Quality Action Plan includes results of a 2010 assessment which identified high levels of HGV traffic (>10%) and slow traffic speeds due to congestion at the roundabout as significant sources of NO_2 pollution. The Air Quality Action Plan suggested that a 52.4% reduction in HGV road traffic would be required to achieve compliance with annual nitrogen dioxide objectives. Section 3.8 provides detail of the scheme impacts and how the scheme contributes to improving the air quality in the area.

Impact on local residents

2.4.29 The issues described above also have a significant impact on local residents. Local residents and businesses experience high levels of air pollution, as well as noise and vibration from heavy traffic, as detailed in Section 3.8 environmental impacts. High traffic levels on the A417 result in traffic rerouting to use unsuitable alternatives, such as local roads. These issues also result in severance of the public rights of way which cross the existing A417 alignment, including the Cotswold Way National Trail.

Summary of issues with existing arrangement

Safety

- The A417 Missing Link is an accident cluster site.
- On this section, fatal and serious casualty rates are significantly higher than national averages.

High Traffic Flows and Congestion

- Current traffic flows are more than twice the recommended AADT for roads of the current standard.
- AADT on the A417 Missing Link is forecast to increase 30% between 2015 and 2041 without the scheme.
- HGV traffic has a significant impact on traffic flow and capacity due to the steep gradients on the route.
- Average travel time between Cirencester and M5 Junction 11A is up to 20% higher without scheme during peak periods.

Air Quality

- The A417/A436 Air Balloon roundabout and A417 approaches, along with adjacent residential and business properties, are covered by the Birdlip Air Quality Management Area.
- The Birdlip AQMA was declared in April 2008 as a result of high levels of NO_2, caused by vehicle emissions.

Journey Time Reliability

- Journey time reliability for sections of the route is below 70%.
- This is significantly lower than the national average of 77% for the full A417/A419 route, and 75% for all A roads on the SRN.
- Slow moving HGVs and delays appraoching Air Balloon Roundabout are key factors which have a significant impact on journey time reliability.

2.4.30 It is recognised that the issues with the existing arrangement have adverse consequences for the local and regional economy; significant for a region that already lags behind in productivity terms. Four of the six local authorities in the region have lower than UK average productivity. The A417 Missing Link represents a key transport barrier in the area that hinders connectivity and accessibility.

2.5 Place based analysis

2.5.1 This section covers place-based analysis as set out in the Department for Transport's Levelling Up Toolkit guidance (2022). Its purpose is to assess how the scheme would contribute towards delivering the DfT's strategic priority to 'Grow and Level Up the Economy'.

2.5.2 A separate Levelling Up report provides a fuller assessment of key economic and socio-economic indicators for the study area. The analysis helps to identify spatial economic disparities across the scheme area, comparing levelling up metrics / indicators with the UK and England as a whole.

2.5.3 The place-based analysis covers the study area, defined by the six local authority boundary areas of Cheltenham Borough Council, Cotswold District Council, Gloucestershire County Council, Stroud District Council, Swindon Borough Council and Tewkesbury Borough Council.

Summary of the Levelling Up Analysis

2.5.4 The scheme objectives are centred largely on the safety and reliability of the SRN – the SRN representing critical physical infrastructure that contributes to UK productivity through efficiently connecting people and places. The A417/A419 route represents a sub-standard section of SRN infrastructure which limits capacity, reliability, and compromises safety.

2.5.5 The A417 cuts across an area where there is significant economic disparity across six local authorities, with evidence that Gloucestershire, in particular, is performing below its economic potential. Investment in physical infrastructure, with a wider remit to also protect and enhance the natural environment, represents one step towards levelling up the region.

2.5.6 The scheme would bring places closer together through enhanced connectivity which should generate agglomeration economies through enabling businesses to have better access to a broader labour market pool; a wider range of markets; and better connected supply chains.

2.5.7 The scheme would provide the enhanced infrastructure required to support sustainable development in the region, helping to increase the supply of quality housing (including affordable housing) that would help attract and retain the working age population required for a prosperous regional economy.

2.5.8 The A417/A419 route connects a number of areas of major economic significance, namely the urban areas of Cheltenham and Gloucester at the northern end of the route, and Swindon at the southern end of the route.

2.5.9 According to the Strategic Economic Plan for Gloucestershire 2.0 (2018), the county has a 'prosperous and resilient economy set within a highly attractive natural environment'. There are a number of sectors with high growth potential,

however, there is evidence that growth has slowed in recent years, relative to the rest of the UK. The Strategic Economic Plan set out ambitious targets for growth, of which transport was a key element. This included a range of transport projects identified as 'enablers for growth'. The A417/A419 route was identified as a 'congestion pinch point' and 'a major accident blackspot' and has become a 'Tier 1' scheme for National Highways.

2.5.10 The scheme would increase the capacity of the SRN, supporting forecast population and employment growth as well as the efficient movement of freight traffic. This is achieved working with the natural environment, with investment in landscape and nature recovery interventions as well as improved access to the natural environment for the recreational and wellbeing benefit of local communities and visitors.

2.5.11 By effectively bringing places closer together, the scheme has the potential to also support commercial site development, attracting in private investment through enhanced connectivity and a more attractive business location with access to a greater pool of human capital and skills.

2.5.12 The scheme by itself would not level up opportunity across the region, but a no investment scenario, with no upgrade, would almost certainly hold back the economic prospects of the region as a whole, acting as a barrier to sustainable development and future prosperity.

2.6 Impact of do nothing

2.6.1 Combining the analysis of existing problems (Section 2.4) with place based analysis and strategic alignment (Section 2.5 and Section 2.6), the impacts of not changing (a Do Nothing scenario) have been identified.

Impact of traffic growth

2.6.2 The forecast increase in demand on the A417/A419 route, based on the scheme traffic model, without any improvement to the existing road network, would be 9-12% between 2015 and 2026, and 24-34% between 2015 and 2041.

2.6.3 This will result in increased congestion on the A417, with some traffic likely to re-route and use alternative routes which are unsuitable, such as Birdlip Hill/Ermin Way.

2.6.4 In the absence of any improvements on the A417, the AADT flow on Birdlip Hill/Ermin Way (ID7 on Figure 2-14) is forecast to increase by 1,600 vehicles (30%) between 2015 and 2026, and by 4,500 vehicles (85%) between 2015 and 2041.

2.6.5 The rise in traffic levels on the route is likely to result in increased congestion, further reductions in vehicle speeds, and further increases in journey times. This would result in the A417 operating in a manner that is well below the standard expected by the SRN. As the current configuration of the road is single carriageway, maintenance works also have a significant impact on traffic.

2.6.6 Given the predicted rise in demand on the route, it is also likely that no action will result in an increased risk of fatal or serious injury. Given that fatal and serious casualty rates on the A417/A419 route are significantly higher than the national average, and half of accidents are attributable to problems associated with the

road, it is highly likely that this pattern will be exacerbated. The increase in accidents and traffic incidents, such as rear end shunts, is also likely to result in unplanned closures, reducing the resilience of the road.

2.6.7 Both increases in congestion and accident numbers are likely to contribute to peak spreading – to avoid congestion – and further reduced journey time reliability.

Limiting economic and housing growth

2.6.8 The inadequate highway capacity of the A417/A419 route and the resultant congestion means that the route cannot suitably support and facilitate the economic growth aspirations of the region.

2.6.9 Sustainable economic growth in the region will be reliant on the A417 serving new housing and employment development and visitor access. However, surveys have shown that the performance of the road is already viewed as a constraint on business operations, where a total of 54,000 houses are planned in the area surrounding the A417 corridor for the period 2016 to 2031.

2.6.10 Gloucester is one of the few local authorities that has UK Government levelling up prioritisation category of 1[29], meaning that it is classed as higher priority due to lower performance across the levelling up economic and socio-economic metrics.

2.6.11 Lack of good quality transport infrastructure would constrain the opportunity for economic growth; areas that are short of physical capital are more likely to fall into a vicious cycle whereby businesses struggle to attract investment (financial capital). The lack of financial capital may reduce labour (human capital) and without sufficient tax receipts, local government becomes weaker with less ability to provide social welfare (institutional capital). Without proper social services, the residents are less socially connected and therefore there is a less active and engaged community (social capital).

2.6.12 The A417 directly connects Gloucester and Swindon; the A417 infrastructure enhancement will act to bring these places and their respective local authorities (with significant levelling up challenges) closer together. The physical infrastructure will drive the growth in the local economy and help attract other capital and investments to the region.

Environmental impacts

2.6.13 Increased exposure to high levels of air pollution surrounding the Birdlip AQMA, as well as increased noise and vibration associated with high traffic flows, are likely to occur, which would affect local residents, businesses, and road users.

2.6.14 Under the Do-Nothing scenario, it is likely that severance will increase for local residents and non-motorised users, who may find that it becomes more difficult, dangerous and time consuming to make local journeys on the A417. Increased flows on local roads will increase this issue.

[29] Source: Levelling Up Fund: Prioritisation of places methodology note - GOV.UK https://www.gov.uk/government/publications/levelling-up-fund-additional-documents/levelling-up-fund-prioritisation-of-places-methodology-note

2.6.15 Visitor enjoyment of the Cotswolds AONB surrounding Birdlip will reduce, both due to the intrusion caused by high traffic flows and the difficulty in accessing the area.

Summary of impact of Do Nothing

2.6.16 Figure 2-15 summarises the likely 'Impact of Do Nothing' for both the A417/A419 route and wider region.

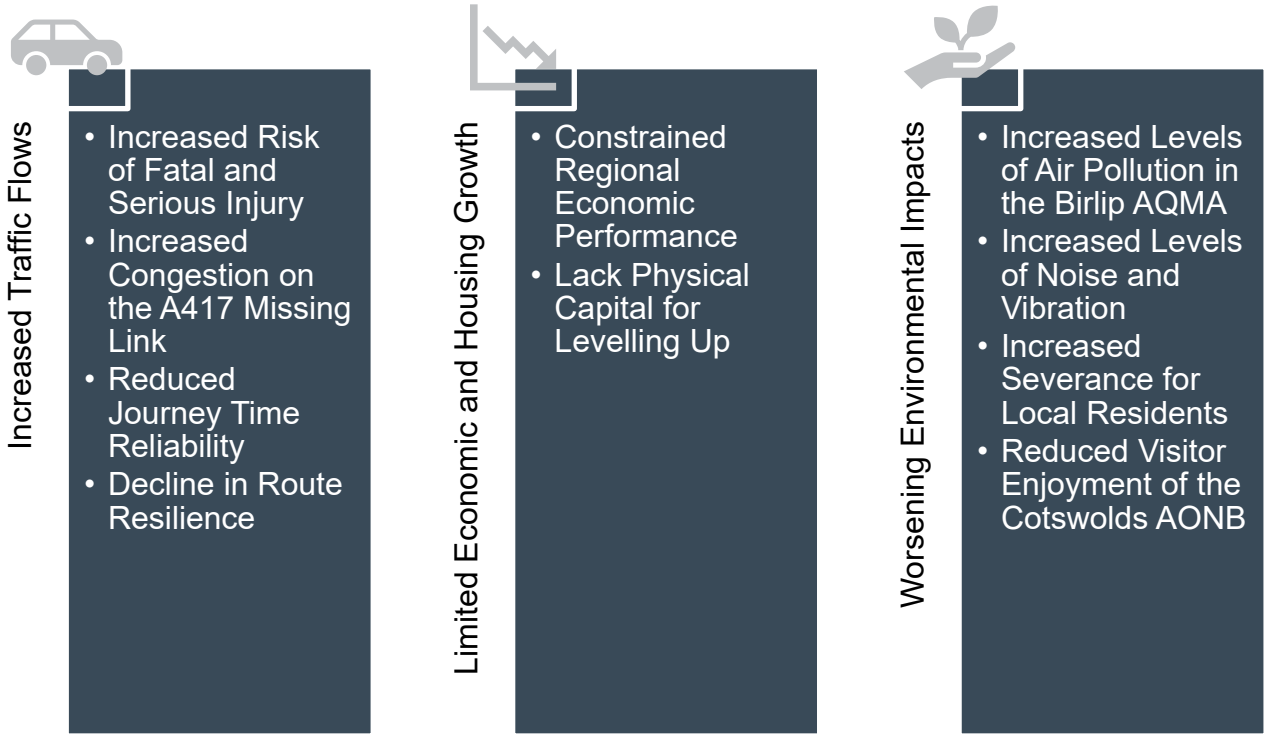


Figure 2-16 Summary of the impact of doing nothing

2.7 Scheme objectives

Scheme objectives and strategic benefits

2.7.1 To guide option design and assessment, National Highways has established a vision for the scheme and set out a series of design principles and objectives.

2.7.2 The following vision has been agreed in consultation with key stakeholders:

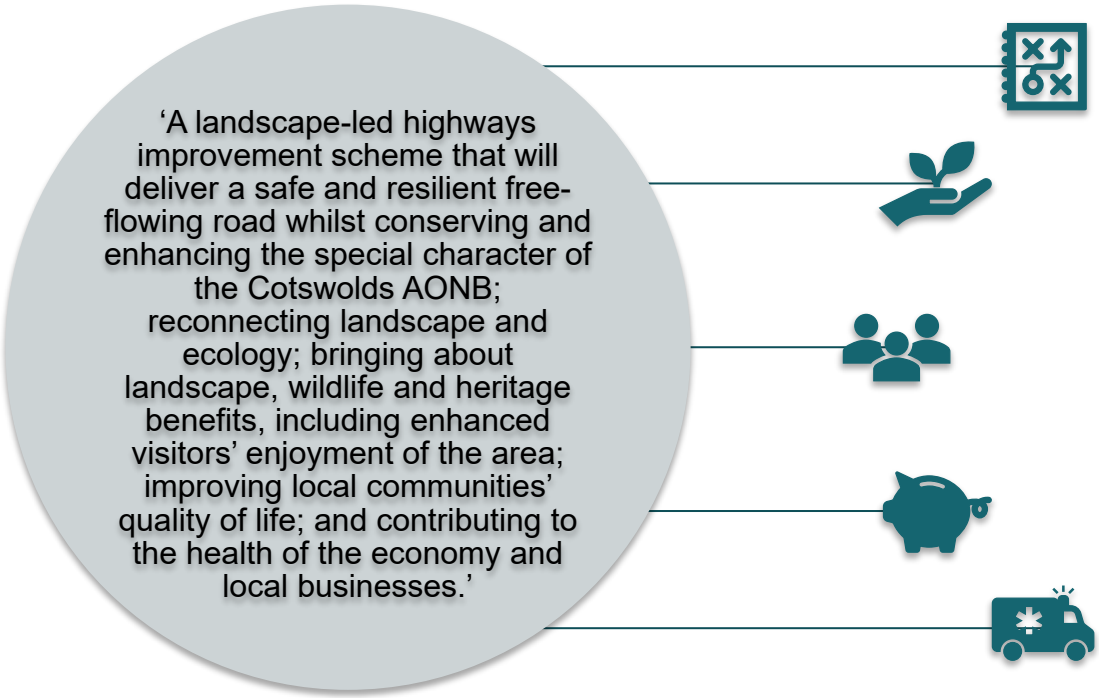


Figure 2-17 Scheme Vision

2.7.3 The vision, design principles and objectives are agreed through proactive engagement with a number of groups and organisations at the start of this scheme. set out in full in the 2020 public consultation document[30]. The scheme objectives and sub-objectives are summarised in Table 2-4.

[30] A417 Missing Link Moving forward: response to public consultation in 2020 and next steps. A417_Responding_to_feedback+2020.pdf (highwaysengland.co.uk)

Table 2-4 Scheme objectives and sub-objectives

Scheme Objective	Sub-objective
Safe, resilient and efficient network: to create a high-quality resilient route that helps to resolve traffic problems and achieves reliable journey times between the Thames Valley and west Midlands as well as providing appropriate connections to the local road network.	Road safety would be improved by designing to current standards and better separation of strategic and local traffic.
	The scheme would be designed to provide greater road traffic capacity, improved network resilience and better journey time reliability for strategic and local journeys.
	The scheme would enhance operational efficiency, improve maintenance safety and support best value whole-life cost benefits.
	The scheme would consider appropriate relaxations or departures from highways standards to minimise the environmental impact of the road without compromising safety.
Improving the natural environment and heritage: to maximise opportunities for landscape, historic and natural environment enhancement within the Cotswolds AONB and to minimise negative impacts of the scheme on the surrounding environment.	The scheme would have an identity which reflects, conserves and enhances the character of the local landscape.
	The scheme would improve landscape and ecological connectivity through landscape and habitat restoration and creation.
	The horizontal and vertical alignments of the scheme would pay due regard to the nature of the local landform.
	The siting and form of structures, cuttings, embankments and landscape mounding would reflect local topography and landform.
	The design of structures would be of lasting architectural quality.
	The scheme would avoid significant interruption to groundwater flows or negative impacts on the aquifer, springs and watercourses.
	The scheme would avoid loss of land or, where absolutely necessary, minimise intrusion upon designated nature conservation sites, National Trust land, open access land and country parks.

Scheme Objective	Sub-objective
	The scheme would enable enhanced preservation of heritage assets and their settings and adopt designs that reflect and enhance the historic character of the area.
Community & Access: to enhance the quality of life for local residents and visitors by reducing traffic intrusion and pollution, discouraging rat- running through villages and substantially improving public access for the enjoyment of the countryside.	The scheme would enhance community cohesion by improving local connectivity and accessibility by helping to separate strategic and local traffic.
	The scheme would reduce rat-running on local roads through provision of a more reliable strategic route with improved capacity, thereby enhancing the amenity of local settlements.
	The scheme would contribute towards community and recreational opportunities through improved provision for motorised and non-motorised users.
	The scheme would minimise road noise by applying sensitive noise mitigation measures where required.
	The scheme would minimise light pollution through sensitive structural, junction, and lighting design and sign illumination.
	The scheme would improve air quality by reducing pollution from traffic congestion.
	The scheme would improve continuity of access to the Public Rights of Way network, the Cotswold Way National Trail and the Gloucestershire Way.
Supporting economic growth: To facilitate economic growth, benefit local businesses and improve prosperity by the provision of a free-flowing road giving people more reliable local and strategic journeys.	The scheme would contribute towards national transport policies that support economic growth.
	The scheme would complement Development Plans published by local authorities in the region to support regional and local economic growth and prosperity.
	The scheme would contribute to the health of the local visitor economy through improved access and visitor experience of the Cotswolds AONB.
	The scheme would minimise disruption to local economic interests and businesses during both construction and operation.
	The scheme would restore redundant highways land to agricultural, public access, community or nature benefit uses where appropriate.
	The scheme would support the development and employment of local skills in its construction.
	The scheme would seek sustainable opportunities to use locally sourced construction materials to support the local economy.

2.8 Scope

The scheme

2.8.1 The scheme would provide 3.4 miles (5.5km) of new, rural all-purpose dual carriageway for the A417. The new dual carriageway would connect the existing A417 Brockworth bypass with the existing dual carriageway A417 south of Cowley. The new dual carriageway would be completed in-line with current trunk road design standards. The section to the west of the existing Air Balloon roundabout would follow the existing A417 corridor, but to the south and east of the Air Balloon roundabout, the corridor would be offline, away from the existing road corridor.

2.8.2 The scheme would include a new crossing near Emma's Grove for walkers, cyclists and horse riders including disabled users, which would accommodate the Cotswold Way National Trail. A new junction would be incorporated at Shab Hill, providing a link from the A417 to the A436 (towards the A40 and Oxford), and to the B4070 (for Birdlip and other local destinations). Neither of these are located on National Trust land and therefore there are no objections from National Trust.

2.8.3 A new 37-metre-wide multi-purpose crossing would provide essential mitigation for bats and enhancement opportunity of ecology and landscape integration. This bridge was widened from the 25-metre wide crossing at the time of the updated Outline Business Case following the supplementary public consultation. The public would also further benefit as the crossing would accommodate the Gloucestershire Way and provide an improved visitor experience.

2.8.4 A new junction would be included near Cowley, replacing the existing Cowley roundabout, making use of an existing underbridge to provide access to local destinations. The use of the existing underbridge would allow for all directions of travel to be made.

2.8.5 The current A417 between the existing Air Balloon roundabout and Cowley roundabout would be detrunked for its entire length. Some lengths of the existing road would be converted into a route for walkers, cyclists and horse riders including disabled users. Other sections would be retained as lower-class public roads, maintaining local access for residents. Some of the route would provide Common Land.

2.8.6 The scheme is shown in Figure 2-18.

Figure 2-18 The scheme

Scheme design and health and safety

2.8.7 At PCF stage 5, the scheme alignments are being designed to, and assessed against, a 120kph design speed to provide an indicative level of safety based on the Design Manual for Roads and Bridges (DMRB). Although the scheme is progressing, other design decisions have been made to improve safety compared to the existing A417 alignment:

- Wherever possible, in accordance with standards, structures would be designed with integral abutments and piers which removes the need to inspect and maintain bearings at height and adjacent to the carriageway.
- Where suitable, the scheme would cross existing side roads on underbridges, enabling the majority of inspection work to take place from local roads, reducing the time needed to be on the SRN.
- Junctions, where provided, would be grade-separated to reduce the risk to traffic using the strategic network over the current at grade junction arrangements. Gaps in the central reserve would not be provided, reducing the risk of traffic crossing the carriageway. Any minor side roads would access the trunk road via left-in/left-out junctions only.
- Existing WCH routes would be improved where possible along the route, specifically at locations where existing routes cross the scheme. Opportunities would be developed to improve the safety of users within the study area.

Timescales

2.8.8 The DCO submission was May 2021. National Highways are running PCF stage 4 (statutory procedures and processes) and PCF stage 5 (construction preparation) in parallel to have funding for the scheme approved in January 2023. The Secretary of State granted DCO consent for the scheme on 16 November 2022. Start of Works (SoW) has moved to March 2023 with an anticipated construction period of 47 months. Open for Traffic (OfT) will part of Road Investment Strategy 3 2025-2030 (RIS 3). There would also still be significant traffic management to accommodate on-line widening on Crickley Hill beyond autumn 2025.

2.9 Strategic benefits

2.9.1 The outputs, outcomes and impact of the scheme are summarised in the theory of change logic map in Figure 2-19. A theory of change process shows how the scheme will deliver the intended outcomes and lead to the strategic benefits (impacts).

INPUTS

Investment in:

- The A417/A419 – a strategic route between Gloucester and Swindon
- The A417 Missing Link – the only section of single carriageway along this route
- The landscape within the Cotswolds Are of Outstanding Natural Beauty (AONB)
- Government funding of £479m
- National Highways Resources, Contractor Resource, Stakeholder support and Land Acquisitions

OUTPUTS

By 2027 deliver:

- 3.4 miles (5.5km) of new, rural all-purpose dal carriageway for the A417, connecting the existing A417 Brockworth bypass with the existing dual carriageway A417 south of Cowley.
- New crossing to accommodate the Cotswolds Way National Trail
- New junction to enhance connectivity towards the Thames Valley and West Midlands as well as connectivity to local destinations via the B4070.
- The detrucking of the existing A417 between 'Air Balloon Roundabout' and the 'Cowley Roundabout' with some lengths of the existing road converted into a route for walkers, cyclists and horse riders including disabled users. Other section retained as lower-class public roads, maintaining local access for residents.

OUTCOMES

Transport Outcomes:

- **Safe, resilient, and efficient network:** Avoiding approximately 72 fatal, 220 serious and 64 slight injuries over 60 years.
- **Supporting Econimic Growth:** More reliable strategic route with greater road capacity and resilience. Reduced journey times with average journey times reduced between Cirencester and the M5 by up to 27% (5 mins) westbound and 22% eastbound in 2026.
- **Improved natural environment and heritage:** Reduced noise and air pollution, specifically in the area covered by the Birdlip AQMA, with potential for this designation to be removed (subject to monitoring by Cotswolds District Council)
- **Community and access**: Localised benefit to community with reduced severance and improved local connectivity and accessibility (reduced traffic flows through Birdlip and along Birdlip Hill, Ermin Way by as much as 60% by 2026).

Immediate Outcomes:

- Local construction projects and employment bring short term economic growth.
- Alignment with National Highways Client Scheme Requirement and Strategic Priorities.

People, Business and Place Outcomes:

- Agglomeration economies in the local region especially Gloucester and Swindon
- Labour-skills matching with more productive jobs.
- Safer travel on the A417/A419 and SRN
- Improved health outcomes though better journey quality and environmental outcomes
- Improvement capacity to reduce congestion, thus reducing traffic impacts to local area near Birdlip.
- Facilitating the sustainable growth aims, vision and aspiration of the region. Providing the capacity to support housing and employment site development
- Supporting economic growth and levelling up through improved links between Cheltenham, Gloucester, and Swindon and further afield between West Midlands, Herefordshire, Wiltshire, Worcestershire and the Swindon, Berkshire, Oxford areas.

IMPACTS (Strategic Benefits)

- Economic growth and improved productivity
- Better quality of life with enhanced access to community and services
- Health and wellbeing improvements
- Larger labour pool, more employment opportunities, and more productive jobs
- Improvement in physical and social capital by restoring natural habitats and reducing environmental impacts.

Figure 2-19 Theory of Change

2.9.2 Investment in the scheme would need to contribute directly to improved performance for National Highways against the Key Performance Indicators (KPIs) for the RIS2 period post 2020.

2.9.3 The National Highways RP2 Key Performance Indicator (KPI) contributions define what constitutes a successful outcome. The scheme has been compared against the KPIs to identify what the scheme would deliver in terms of anticipated scheme outcomes and impact (see Table 2-5).

Table 2-5 Scheme key outcomes & impact

RP2 Outcome[31]	Key Performance Indicator	Scheme Outcomes & Impact
1. Improving safety for all	At least a 50% reduction in the number of people killed or seriously injured on the SRN by the end of 2025, compared with the 2005-09 average baseline.	The scheme is forecast to reduce significantly the number of fatal and serious accidents at the A417/A419 route. Accident reduction benefits valued at up to £76 million are forecast, with reductions of 72 fatal and 220 serious casualties over 60 years. The scheme is also forecast to reduce traffic flows on unsuitable 'rat-runs' in the area, which is expected to reduce accident numbers in the area. Repurposing the existing A417 between the Air Balloon roundabout and Cowley roundabout would provide a new route for walkers, cyclists and horse riders.
2. Providing fast and reliable journeys	Ambition that average delay per mile driven will be no worse by the end of RP2 compared to the end of RP1.	The scheme is forecast to significantly reduce delay on the A417/A419 route, reducing average journey times from Cirencester to the M5 in both the westbound and eastbound directions. In the opening year westbound journey times would decrease by up to 27% (five minutes) and eastbound by up to 22% (three minutes). Average journey times westbound on the A436 would reduce by up to 10% (over 90 seconds). Total monetised journey time savings of up to £272 million.
	97.5% of lanes free from closures caused by roadworks in 2020-21. Revised metric and target for remaining years of RP2.	This KPI refers to the period before scheme construction.
	Achieve 86% of motorway incidents cleared within one hour, based on 24-hour coverage	Incident clearance would be enhanced by upgrading the single-carriageway sections of the route to dual-carriageway standard.
3. A well-maintained and resilient network	95% of road surface in a condition that requires no further investigation for maintenance for years 1 and 2 of Road Period 2.	This KPI refers to the period before scheme construction. The scheme would enhance operational efficiency, improve maintenance safety and support best value whole-life cost benefits.
4. Delivering better	Road noise mitigation for 7,500 households in 'noise important	The scheme would reduce traffic flow through the Birdlip area, reducing noise impacts on local residents. With the scheme in place there would remain five Noise Impact Areas which lie

[31] Highways England Operational Metrics Manual July 2021 ris2-operational-metrics-manual-july-2021-1.pdf (nationalhighways.co.uk)

RP2 Outcome[31]	Key Performance Indicator	Scheme Outcomes & Impact
environmental outcomes	areas', funded through designated funds.	within the affected route of the scheme. Four of these would benefit from noise reductions and one would be removed as part of the scheme proposals
	No net loss of biodiversity across all National Highways activities by the end of RP2.	The scheme would have a slight biodiversity and water impact following mitigation. The scheme would have significant landscape character, visual amenity and historic environment impacts.
	Bring agreed sections of the SRN into compliance with legal NO_2 limit values as soon as possible.	The scheme would reduce traffic flow through the area covered by the Birdlip AQMA, improving ambient air quality.
	Reduce carbon emissions resulting from National Highways electricity consumption, fuel use and other day-to-day operational activities during RP2.	The scheme has been designed to minimise the requirement for energy consuming operational equipment such as street lighting or intelligent transport systems where possible. Where lighting may be potentially required, for example at Grove Farm underpass, low lux demand sensitive lighting is proposed to reduce greenhouse gas emissions associated with operating the scheme. The scheme would contribute to the overall net zero strategy.
5. Meeting the needs of all users	82% road user satisfaction score for first two years of RP2 with year-on-year increases in the following years.	The scheme would reduce delay and both accident numbers and severity, resulting in improved journey times and safety, and hence improved road user satisfaction. Signage would be in line with current standards.
	By 2024-25, 90% of overnight road closures information accurately issued seven days in advance of work starting.	A Traffic Management Plan for the scheme would be produced following the key areas outlined in the major project dynamic roadworks vision statement. This includes 'the appropriate use of full closures and associated diversions' and 'explaining clearly what activities are or are not taking place'.
6. Achieving efficient delivery	Achieve efficiency target of £2.23 billion on capital and operational expenditure by the end of RP2.	As of October 2020, the RP1 carry-over efficiencies for the scheme are Level 2 Assured as £4.8 million with the scheme target for RP2 generated efficiencies being £37 million.

2.9.4 A summary of the high-level strategic benefits of the scheme is provided in 2-10. Further detail on benefits is covered under Benefits Realisation, set out in Section 6-9 of the Management Dimension. This moves from assessment of strategic high-level benefits to detailed plans around managing benefits realisation and associated monitoring and evaluation plans.

2.10 Summary of scheme high level strategic and operational benefits

Safe, resilient, and efficient network	•The scheme is forecast to reduce the number of fatal and serious accidents at the A417 Missing Link. Significant accident reduction benefits valued at up to £76 million are forecast, with reductions of 72 fatal and 220 serious casualties over 60 years. •In the opening year the scheme would reduce average journey times from Cirencester to the M5 by up to 26% (five minutes) westbound and 22% (three minutes) eastbound. Average journey times westbound on the A436 would reduce by up to 10% (over 90 seconds). Total monetised journey time savings of up to £272 million.
Improving the natural environment and heritage	•The scheme would have significant landscape character, visual amenity and historic environment, biodiversity and water environment impacts. •The scheme would have a slight biodiversity and water impact following mitigation. •Scheme designs would seek opportunities to enhance the landscape, historic and natural environment.
Community & Access	•The scheme would reduce traffic flows through Birdlip village and along Birdlip Hill/Ermin Way by as much as 59% in the opening year (comparing 'with scheme' and 'without scheme' scenarios). •The scheme would reduce traffic flow through the area covered by the Birdlip AQMA, improving ambient air quality, and reducing noise impacts (valued at up to £0.5 million).
Supporting economic growth	•The scheme would facilitate development and economic growth in Cheltenham, Gloucester and Swindon and potentially further afield in Herefordshire, Wiltshire and Worcestershire. The A417 will serve the needs of new housing developments across the sub-region. •The scheme would improve journey time reliability, with total monetised benefits of up to £62 million (all users). •Welfare value of increased business outputs in imperfectly competitive markets valued at up to £15 million and agglomeration benefits of total £102 million.

Figure 2-20 Client Scheme Requirements and operational benefits

2.11 Stakeholder engagement

2.11.1 National Highways has a strong customer focus and expects to engage with stakeholders in a way that builds confidence, support and trust. A detailed Communication and Engagement Plan was therefore developed for the scheme to support PCF stages 1 and 2, setting out the framework for communications and engagement. A Communications and Engagement Plan for PCF stage 3 was developed to set the framework for communications and engagement following the Preferred Route Announcement (PRA).

2.11.2 National Highways has established an A417 Strategic Stakeholder Panel (SSP), comprising key stakeholders and members of the integrated project team, held every two months throughout the planning process where regular advice from Local Planning Authorities and the Cotswold Conservation Board has been considered in the development of the scheme proposals. The SSP has engaged the users in the design phase (Design Summary Report) and showed potential benefits of the favoured option. Various technical working groups (TWGs) have also been established to cover particular topic areas. The two main working groups are the Heritage, Landscape and Environmental TWG and the Walking, Cycling and Horse-riding (WCH) TWG.

2.11.3 A Statutory Consultation Strategy was prepared to support PCF stage 3, to set out how National Highways would fulfil the statutory requirement to consult on the proposed scheme as per the Planning Act 2008. The statutory consultation carried out between 27 September 2019 and 8 November 2019 sought the views of the general public, land interests and stakeholders on the preferred scheme and the three side road alternatives for connecting the A436. There were 903 responses to the statutory consultation. The feedback received has been taken into account during the design development of the scheme and this has been reported in the Consultation Report submitted with the DCO application in May 2021.

2.11.4 A supplementary public consultation took place from 13 October 2020 to 12 November 2020 to provide individuals and organisations an opportunity to respond to the scheme changes since the Statutory Consultation in September to November 2019. The change reflected the design which was subject to the DCO Application. Since the supplementary public consultation closed on 12th November 2020, National Highways has continued to engage with stakeholders to provide updates on the progress of the scheme and discuss any technical matters relevant to the preparation of the scheme design.

2.12 Risks

2.12.1 This section identifies the risks of delivering the investment and also proposed mitigations. Risk management strategy is covered in greater detail in Section 6.8. A risk register has been produced as part of the PCF stage 5 and risk allocation is detailed in Section 4.7.

Business risks

2.12.2 The original project timeline had an accelerated programme which would bring inherent risk by limiting the survey data to inform the preliminary design and subsequent DCO application. The programme timeline has been delayed allowing for additional time to obtain comprehensive data.

2.12.3 However, the delay in the early stages has set back the programme considerably and might affect the final delivery and construction phase. The implication of the delayed timeline could be very significant: increased costs, brought about by high inflation since the second half of 2021, along with lower welfare benefits, including journey time savings and accident savings, would cause further downward pressure on the Benefit Cost Ratio (BCR) and overall scheme value for money.

2.12.4 Separate documents, including the Risk Management Plan (RMP) and Risk Register, have been prepared to identify how risks and opportunities will be managed, monitored and reported and are an integral part of the management dimension in this FBC.

2.12.5 A risk manager was appointed in September 2022 for the project and will work with the Integrated Project Team (IPT) to implement effective risk management through the project. Using a robust risk management framework aligned to ISO31000, the risk manager will work with the Project Management Team and develop a RMP. A single integrated team for PCF stages 5-7 will build on the collaborative working foundation already established in PCF stages 3 and 4 between National Highways and its suppliers and bring lessons learned from other projects.

2.12.6 A detailed risk register has been produced as part of the wider project up to PCF stage 5, in order to identify and assess the risks to the project's success. The project team have assessed the probability and impact of each risk and agreed risk mitigation strategies. Risk allocation and ownership has also been identified within the register.

2.12.7 A benefits prioritisation workshop with National Highways will be held in early 2023 to identify owners and risks associated with delivering benefits, to understand dependency and relative importance of key factors e.g., cost, programme, customers and High-Level Requirements (HLRs), so benefits are prioritised and protected effectively.

2.12.8 The lesson learnt log is prepared as part of an assurance review covering aspects such as project planning, PCF product reviews, evidence sources, risk recording, risk workshop preparation, expert involvement, and land access enquiries.

Service risks

2.12.9 During the construction phase, where an on-line improvement is to be completed, the steep gradient and high traffic flows would be likely to cause delay in the construction phase and eventually affect the delivery. Furthermore, the road characteristics would increase the risks of accidents to both road users, construction workforce and other users (cyclists, pedestrians, horse riders and potentially animals in the neighbouring areas) especially when the road spaces are restrained, and the impacts would also be distributed to nearby roads and links.

2.12.10 The scheme design has gone through rigorous health and safety impact assessments, where risks are mitigated to as low as reasonably practicable, as required in the Construction (Design Management) Regulations 2015 and all relevant Health and Safety legislation.

2.12.11 The Regional Development Partnership (RDP) framework offers a ready to use basis for finalising the Delivery Integration Partner (DIP) contract award with more certainty that reduces the risks.

2.12.12 National Highways continues to engage with the supply chain community to understand the demand across the industry to identify the risks of procuring necessary material and resources. Placing early orders and long-term programme visibility could help reduce the procurement risks. National Highways will undertake periodic reviews of the marketplace and National Highways risk registers and will stay in constant communication with suppliers.

External Risks

2.12.13 The allowance for inflation needs to be frequently updated and monitored due to recent high inflation since the second half of 2021 that could affect the scheme affordability and value for money.

2.12.14 The Equality Impact Assessment (EqIA) has identified risks during construction and operation including pollution and disruption to the community. The Full EqIA was undertaken for the scheme at PCF stage 3 where mitigation measures were provided along with recommendations and detailed in Section 6.4.

2.12.15 On 16 November 2022 the Secretary of State (SoS) granted DCO consent for the scheme. Following the DCO approval there is a six-week period for third parties to raise an objection to the Secretary of State (SoS) granting consent. During this period third parties can raise a pre-application protocol letter as an opportunity to resolve and differences ahead of a formal objection. If no agreement is reached with the SoS and the application for Judicial Review is made, the courts will consider if there is sufficient merit in the challenge, either on the papers or at a hearing. (This process can take up to several months, and the claimant can request a hearing if permission is refused on the papers). If the judge decides that there is merit in the challenge this will be taken forward to a Judicial Review hearing. The courts will set the hearing date between six months and 12 months in the future.

2.13 Interdependencies and constraints

2.13.1 The scheme can be undertaken as a stand-alone project, delivering against the objectives and sub-objectives, without direct dependency on any other project.

2.13.2 Improvement schemes are required along the A419 at Swindon (at M4 junction 15 and the A419/A420 White Hart junction) to mitigate for the impacts of strategic allocations and to prevent new pinch-points along the route. These schemes are being progressed by Swindon Borough Council. Delivery timing of these schemes will need to be considered alongside the programme for the scheme, to avoid multiple sets of roadworks along the same route.

2.13.3 There are a number of physical and environmental constraints in the area surrounding the scheme that will continue to require detailed consideration as the scheme is developed, including environmental and engineering constraints.

Environmental constraints

2.13.4 The scheme lies entirely within the Cotswolds AONB. Cultural heritage, water pollution and flooding, landscape, ecological, visual, noise, and air pollution impacts would all need to be reduced. Consultation and collaboration will continue

to be required with the Statutory Environmental Bodies (SEBs) to ensure that environmental constraints are considered fully and where possible mitigated. In addition to the Cotswolds AONB, key environmental constraints close to the A417 are:

- Air Quality Management Area (AQMA) at the Air Balloon roundabout
- five Scheduled Monuments, including Emma's Grove and Crickley Hill Fort, within 1.6 miles (1km) of the existing road
- known and expected archaeological sites within close proximity
- designated Greenbelt on the area directly north and abutting the A417
- Cotswold Beechwoods Special Area of Conservation (SAC) located west of the A417
- four Sites of Special Scientific Interest (SSSIs) located within 1.6 miles (1km) of the existing alignment
- two Gloucestershire Wildlife Trust Reserves, at Crickley Hill Country Park and Barrow Wake
- Noise Important Areas (NIAs) along the A417 at Crickley Hill and on the A436
- the majority of the area is located on a major aquifer with high groundwater vulnerability
- the eastern and south-eastern extent of the area is within a groundwater source protection zone
- Cotswold Way National Path crosses the A417 close to the Air Balloon roundabout, and numerous Public Rights of Way are within 500 metres of the A417
- Regionally Important Geological Sites (RIGS) 300 metres from the existing A417 alignment
- listed buildings including Golden Heart Inn (Nettleton Bottom) and Mile Stone on the existing A417 alignment and in several locations within the study area
- areas of historical and authorised landfill located north of the A417 at Crickley Hill

Engineering constraints

2.13.5 The most significant physical constraint is the Cotswold escarpment which rises steeply from west to east and across which the A417/A419 route passes. It is likely that departures from standards would be required. Key engineering constraints identified at this stage include:

- Steep gradients and high traffic flows would make construction of an on-line improvement slow and present a number of risks to both the customer (road users), construction workforce and Walkers, Cyclists and Horse Riders (WCHs).
- There are a several small side roads and private means of access along the existing route which would need to be maintained throughout construction and in the permanent solution.
- Walking, cycling and horse-riding provision – the area includes a number of popular Public Rights of Way (PRoW) and bridleways including Gloucestershire Way and Cotswolds Way.
- Statutory undertakers' apparatus including Openreach and electrical high voltage supplies cross the area.
- Potential impacts on the aquifer and groundwater protection zone.

- Challenging ground conditions, including an area of recorded landslips to the west of the Cotswold escarpment.
- Inalienable land owned and leased by National Trust at Crickley Hill and Common Land at Barrow Wake and Crickley Hill.

2.14 Key Assumptions

2.14.1 In assessing the congestion reduction benefits of the scheme, a number of assumptions have been made as detailed in the economic dimension section . The assumptions are largely built into the scheme traffic model, which was developed from the South-West Regional Traffic Model (SWRTM). Full details of the scheme traffic model are provided in the PCF stage 5 Combined Modelling and Appraisal (ComMA) Report.

3 Economic dimension

3.1 Introduction

3.1.1 The economic dimension outlines the economic, environmental, and social impacts, and provides a Value for Money (VfM) assessment of the scheme.

3.1.2 The assessments presented in this economic dimension have been prepared in line with the Transport Analysis Guidance (TAG) (the Department for Transport's online appraisal guidance). The full range of economic, environmental, and social impacts are presented in a separate Benefits Register.

3.1.3 The VfM assessment and option appraisal have considered the full range of costs and benefits of the scheme. Costs and benefits have been quantified or 'monetised', as part of a cost benefit analysis, wherever possible. Other impacts, including many of the environmental and social impacts, have been assessed qualitatively.

3.1.4 The economic, environmental and social impact assessments, and the underpinning analyses, provide a means of establishing how the scheme objectives and sub-objectives are supported. The relationship between the VfM appraisal and scheme objectives is set out in Table 3-1.

Table 3-1 Relationship between value for money appraisal and scheme objectives

Objective	Value for money appraisal	Business case sections
Safe, resilient and efficient network	Accident savings Journey time changes	**3.7 Transport user benefits** Business users, commuting & other users travel time benefits, reliability benefits and accident benefits
Maximise opportunities for landscape, historic and natural environment enhancement and minimise negative impacts of the scheme	Landscape impact monetised Natural capital assessment carbon sequestration monetised Qualitative environmental assessments of impact on: - Landscape - Natural capital assessment - Heritage - Biodiversity - Water environment	**3.8 Environmental impacts**– Table 3-14
Community and access (enhance the quality of life for local residents and visitors)	Noise impacts Air quality impacts Qualitative assessment of social impacts	**3.8 Environmental impacts** - Table 3-14 **3.9 Social impacts** - Table 3-18
Support economic growth	Journey time reliability improvements Increased business outputs in terms of investment, employment and productivity	**3.7 Transport user benefits** – Business user travel time benefits, reliability benefits and wider economic impacts

3.1.5 The scheme costs, used to inform the Benefit Cost Ratio (BCR) and VfM appraisal in this FBC, have been prepared by National Highways Commercial Services. These costs are based on the scheme design submitted for the DCO.

3.2 Current economic appraisal situation

3.2.1 This section provides an update on the economic appraisal of the scheme since the updated Outline Business Case (OBC) was developed in October/November 2020.

3.2.2 The current economic appraisal results in the following changes since the updated OBC:

- Level 1 Present Value of Benefits (PVB) is £244 million, a decrease from £303 million reported in the updated OBC
- Present Value of Costs (PVC) is £213 million, an increase from £206 million reported in the updated OBC
- Initial Net Present Value (NPV) is £31 million, a decrease from £98 million reported in the updated OBC
- Initial BCR is 1.14, a decrease from the 1.47 reported in the updated OBC
- Level 2 PVB is £424 million, a decrease from the £516 million reported in the updated OBC
- Adjusted BCR is 1.99, a decrease from the 2.51 reported in the updated OBC.

3.2.3 The economic appraisal, which estimates BCRs for the scheme, has been undertaken in line with DfT TAG. The benefits expected to arise from the scheme are substantial, with forecast PVB (including level 2 benefits) of £424 million, compared to level 2 PVB of £516 million reported in the updated OBC. For the initial BCR the VfM would be a robust 'low' and for the adjusted BCR the VfM would be a robust 'medium'.

3.2.4 In addition to the core scenario, high and low growth sensitivity tests have been undertaken and a test on the impact of the Transport Decarbonisation Plan (TDP) on the carbon appraisal. These are high and low growth scenarios to provide a range of BCR values.

- The high growth sensitivity test has a level 2 PVB of £453 million and an adjusted BCR of 2.13.
- The low growth sensitivity test has a level 2 PVB of £407 million and an adjusted BCR of 1.91.
- The TDP would reduce the monetised carbon assessment to between £19 million and £11 million and therefore the adjusted BCR would be between 2.18 and 2.22.

3.2.5 In addition to those monetised benefits that are factored into the BCR, there are significant non-monetised benefits arising as a result of the scheme improving transport links in the area and this acting as an enabler of economic growth. The scheme would provide the enhanced infrastructure and improve capacity of the SRN that would support the forecast population and employment growth as well as the efficient movement of freight traffic. This would be achieved working with the natural environment and providing improved access to the natural environment for the recreational and wellbeing benefit of local communities and visitors. These non-monetised benefits need to be balanced against disbenefits which similarly have not been included in the adjusted BCR, such as the effect on

landscape. Evidence for this can be found in the Monetised Landscape Assessment which returns dis-benefits of £72 million.

3.2.6 The VfM assessment is a key component of the appraisal of the scheme as this assessment takes into consideration the non-monetised benefits/disbenefits and those monetised benefits/disbenefits that do not have a rigorous methodology, such as landscape monetisation. Overall, for the scheme these large 'intangible' disbenefits outweigh any 'intangible' benefits and therefore temper the overall value for money rating, with the scheme offering 'Medium' value overall.

3.3 Changes in assumptions since updated Outline Business Case

3.3.1 Since the updated OBC was developed there have been a number of changes to the traffic model and the assumptions used in the traffic model and economic appraisal of the scheme.

3.3.2 The key changes to the traffic model and appraisal since the updated OBC was developed are as follows:

- Opening year has been updated from 2024 in the updated OBC to RIS3 in the FBC to account for the impact of the delay in the DCO submission following design changes in relation to the removal of the Green Bridge and change in gradient from 7% to 8%. (Note – the current anticipated Open for Traffic (OfT) date is RIS3, but the traffic modelling retained RIS3 as the year of opening). Section 2.8 contains details on the scheme.
- Design year has been updated from 2039 in the updated OBC to 2041 in the FBC to account for the delay in the opening year of the scheme.
- Construction costs have been updated to reflect changes in design following the supplementary consultation, improved knowledge of mitigation and inflation pressures. Section 2.8 contains details on the scheme and changes since the updated OBC.
- Use of TAG databook 1.17 (November 2021) for the FBC. TAG databook 1.13 (July 2020) was used for the updated OBC and a significant change between them is a reduction in the forecast Gross Domestic Product (GDP), i.e. a reduction in economic growth compared to that forecast in the July 2020 TAG databook.
- Increase in the department for Business, Energy and Industrial Strategy (BEIS) carbon values used in the greenhouse gas appraisal of the scheme for the FBC, issued September 2021.
- Emissions Factor Toolkit (EFT) 11 which accounts for a greater uptake of electric vehicles from 2031 onwards.

3.3.3 In July 2021, the DfT released the Transport Decarbonisation Plan (TDP) which sets outs DfTs pathway to net zero transport in the UK, the wider benefits net zero transport can deliver and the principles that underline DfTs' approach to delivering net zero transport. Following the release of the TDP, National Highways, in consultation with the DfT, created a sensitivity test to assess the impact that the TDP would have on carbon emissions and therefore the impact on the BCR of the scheme.

3.3.4 In addition to the TDP, National Highways have produced the Chief Analyst Carbon Valuation Toolkit v1.4 which has been developed to obtain an estimate of the disbenefit associated with traded greenhouse gas emissions. In addition, this toolkit will estimate the value of non-traded emissions, as per the TAG

greenhouse gases workbook, and accounts for greenhouse gas emissions in relation to construction. The results from this toolkit are presented in Section 3.7.

3.4 Economic appraisal methodology

3.4.1 The economic appraisal, which estimates BCRs for the scheme, is based primarily on calculations of monetised user benefits in terms of time savings, changes in fuel and vehicle operating costs, and reduced road accidents.

3.4.2 Forecast trip and cost information has been extracted from the PCF stage 5 scheme traffic model for the expected opening year and 15 years after opening, as well as for an intermediate year (2031) and a final forecast year (2051). The DfT Transport User Benefits Appraisal (TUBA) software (version 1.9.17, with economics file 1.9.18, based on TAG workbook 1.18) has then been used to monetise the user benefits.

3.4.3 The scheme traffic model has been developed using SATURN software to represent three weekday time periods that are consistent with the South-West Regional Traffic Model time periods. These are an average AM peak period hour (07:00-10:00), an average hour in the inter-peak (10:00-16:00) and an average PM peak period hour (16:00-19:00) for an average Monday to Friday weekday in March 2015 (excluding school holidays and bank holidays).

3.4.4 In addition to the validated time periods, an off-peak average hour (19:00-07:00) is represented for the purposes of appraisal.

3.4.5 Table 3-2 identifies the approach adopted to appraise the economic impacts of the scheme for the updated OBC and the FBC.

Table 3-2 Overview of economic assessments

Element	Updated OBC approach	FBC approach
Transport user benefits - TUBA (Transport Users Benefit Appraisal)	TUBA 1.9.14	V 1.9.17 (economics file 1.9.18, based on TAG data book 1.18)
Accidents - COBALT (COst and Benefit to Accidents – Light Touch)	COBALT Version 2013.02	Version 2.2, March 2022, TAG databook 1.17
Journey time reliability	Comparison of observed journey time reliability (using journey time standard deviations derived from TrafficMaster data)	Comparison of observed journey time reliability (using journey time standard deviations derived from TrafficMaster data)
Construction impacts - QUADRO (QUeues And Delays at Roadworks)	QUADRO version 2019 version 4.17.0.1	Quadro version 2021 V4.20.0.1
Air quality	Emissions Factor Toolkit 9, TAG workbook June 2019	Emissions Factor Toolkit 11, TAG workbook 1.9.17 (November 2021))
Noise impacts	TAG workbook May 2019	TAG workbook 1.17 (November 2021)
Greenhouse gas emissions	Emissions Factor Toolkit 9, TAG workbook June 2019	Emissions Factor Toolkit 11, TAG workbook 1.9.17 (November 2021))

Element	Updated OBC approach	FBC approach
Wider economic impacts - WITA (Wider Impacts in Transport Appraisal)	WITA version 2.0 Beta, May 2019 Wider Economic Impact dataset	WITA version 2.2, July 2021 Wider Economic Impact dataset

3.4.6 The overall appraisal is based on a comparison between the 'With' and 'Without Scheme' scenarios, referred to as the 'Do-Something' and 'Do-Minimum' respectively in the PCF stage 5 Combined Modelling and Appraisal (ComMA) Report, with benefits extrapolated for the full 60-year appraisal period. The scheme benefits are then compared to the scheme implementation costs to estimate the BCR for each option.

3.4.7 Further detail on the modelling tools, appraisal software, and methods used is provided in the PCF stage 5 ComMA Report.

3.4.8 Key assumptions for the economic appraisal are:

- Background traffic growth is based on the Road Traffic Forecasts 2018 (RTF18), adjusted according to local National Trip End Model (NTEM) 7.2 growth factors and specific local development assumptions.
- Economic benefits are estimated for all hours and days of a full calendar year, derived from the weekday scheme traffic models, with off-peak benefits derived from an additional non-validated model scenario (rather than simple factoring), and weekend benefits derived by a process of factoring.
- The standard economic parameters in TUBA, COBALT and QUADRO, taking account of the November 2021 TAG updates, apply to this scheme, with the TUBA assessment using the economics file based on TAG workbook 1.18.
- The scheme opening year has been modelled as RIS3, with benefits appraised over a 60-year period from the year of opening.
- Two additional scheme traffic model forecast years, consisting of an intermediate year of 2031 and a final forecast year of 2051, have also been used to support the economic appraisal of the scheme.
- Scheme costs have been provided by National Highways Commercial team as an Order of Magnitude Estimate.
- In line with TAG, all economic appraisal costs and benefits are reported in 2010 prices, with future costs and benefits discounted to 2010 using HM Treasury standard discount rates.

3.4.9 Full economic appraisal results and further details on the assumptions used are provided in the PCF stage 5 ComMA Report.

3.5 Economic impacts

Summary of economic appraisal outputs

3.5.1 The Present Value of Benefits (PVBs) for the scheme are substantial, with level 1 PVB estimated at £244 million (2010 prices discounted to 2010)[32]. The greatest portion of the level 1 monetised benefit would be expected to arise for business users, followed by benefits associated with accident savings. When reliability and

[32] The monetised values presented in this business case are Present Values, in 2010 prices (the Department for Transport's current preferred price base), with a discount rate applied to costs and benefits in all future years in line with HM Treasury guidance.

wider economic benefits, level 2 benefits, are included the PVB increases to £424 million.

3.5.2 The dis-benefits associated with delays to road users during the construction period are relatively minor and are more than offset by the benefits that are expected following scheme opening. The disbenefit during construction is approximately £18 million.

3.5.3 The Present Value of Costs (PVC) for the scheme have been calculated based on the Order of Magnitude Estimates, adjusted to 2010 prices and discounted to 2010. The PVC is estimated at £213 million for the scheme.

3.5.4 The Net Present Value (NPV) has been calculated by subtracting the PVC from the PVB. The level 1 NPV for the scheme is £31 million and the level 2 NPV is £211 million.

3.5.5 The initial BCR (level 1) for the scheme is shown in Table 3-3, estimated at 1.14. The adjusted BCR (level 2) has been calculated, to include monetised journey time reliability and wider economic benefits. The adjusted BCR is 1.99 for the scheme.

3.5.6 Economic appraisal outputs are summarised in the Analysis of Monetised Costs and Benefits (AMCB) in Table 3-3.

Table 3-3 Analysis of Monetised Costs and Benefits (£000s)

Item	Updated Outline Business Case values	Full Business Case values	% change in benefits	Reason for change
Accidents (not assessed by TUBA)[1]	67,026	75,725	13	
Construction (not assessed by TUBA)[2]	-16,829	-17,843	6	
Greenhouse gases (not assessed by TUBA)[3]	-42,594	-60,367	42	Increase in carbon values
Noise (not assessed by TUBA)[4]	417	481	15	
Air quality (not assessed by TUBA)[5]	-4,569	-6,054	33	Change in road type in TAG workbook
Transport Economic Efficiency: consumer users (commuting)	44,588	38,215	-14	Reduction in forecast GDP
Transport Economic Efficiency: consumer users (other)	33,098	25,344	-23	Reduction in forecast GDP
Transport Economic Efficiency: business users and providers	175,173	151,099	-14	Reduction in forecast GDP
Wider public finances (indirect taxation revenues)	46,842	37,054	-21	Reduction in forecast GDP
Level 1 Present Value of Benefits **(PVB)**	303,151	243,653	-20	

Item	Updated Outline Business Case values	Full Business Case values	% change in benefits	Reason for change
Broad transport budget Present Value of Costs **(PVC)**	205,635	212,862	4	Increase in costs and inflation
OVERALL IMPACTS			4	
Level 1 Net Present Value (NPV)	97,516	30,791	-68	
Initial benefit cost ratio (BCR)	**1.47**	**1.14**	**-22**	
Reliability benefits	71,843	61,579	-14	Changes in values of reliability
Wider economic benefits	140,657	118,350	-16	Reduction in total employment and GDP per worker
Level 2 PVB	515,651	423,582	-18	
Level 2 NPV	310,016	210,720	-32	
Adjusted BCR	**2.51**	**1.99**	**-21**	

Notes: All monetary values are expressed in 2010 prices, discounted to 2010. 1 from COBALT, 2 from QUADRO, 3 TAG unit A3 chapter 4, 4 TAG unit A3 chapter 2, 5 TAG unit A3 chapter 3. Numbers may not sum due to rounding.

3.5.7 The following can be seen in Table 3-3:

- The greatest benefits of the scheme are those related to transport user benefits, in particular business users, accidents, and the wider economic benefits.
- The greatest disbenefits of the scheme are greenhouse gases and construction impacts.

Key changes in monetised benefits since updated OBC

Changes in Transport User Benefits

3.5.8 In relation to the transport user benefits, these have decreased in comparison to those in the updated OBC. These changes are due to a forecast reduction in GDP growth in TUBA 1.9.17 in comparison to that used in the TUBA 1.9.14 for the updated OBC. Overall, as shown in Table 3-3, the transport user benefits for the scheme have decreased from £253 million to £215 million; a 15% decrease in benefits. The greatest change occurs for 'other users', these being those travelling for leisure purposes, where benefits have decreased from £33 million to £25 million (23% decrease). 'Other users' see the greatest change in user benefits as they are the user class most susceptible to changes in GDP growth.

3.5.9 To demonstrate the impact that the forecast reduction in GDP growth has, the outputs from the traffic model used for the FBC have been run through TUBA 1.9.14, which was used for the updated OBC, to assess the impact that the forecast reduction in GDP growth has on transport user benefits. Table 3-4 shows the results of this test.

Table 3-4 Comparison of TUBA version results (£000s)

Item	Updated OBC (TUBA 1.9.14)	TUBA 1.9.14 for FBC	Difference (%) (Updated OBC v FBC 1.9.14)	FBC TUBA	Difference (%) (FBC TUBA 1.9.14 v 1.9.17)
Commuting	£44,588	£44,609	0.05%	£38,215	-14%
Other	£33,098	£35,106	6%	£25,344	-28%
Business users	£175,173	£170,270	-2.8%	£151,099	-11%
Wider public finances	£46,842	£44,291	-5%	£37,054	-28%
PVC	£205,635	£212,862	3.5%	£212,862	0%

Notes: All monetary values are expressed in 2010 prices, discounted to 2010

3.5.10 As can be seen from Table 3-4 running the FBC traffic model through TUBA 1.9.14 the outcomes are very similar with differences of less than 6% when compared to the updated OBC. Whereas, comparing the results of running the FBC traffic model through TUBA 1.9.14 and 1.9.17 the differences are much greater and are all decreases, as would be expected as a result of the reduction in forecast GDP growth.

Changes in Transport Economic Efficiencies user benefits

3.5.11 A breakdown of the transport user benefits are shown as Transport Economic Efficiency (TEE) in Table 3-5. The TEE table shows that the scheme achieves substantial transport economic efficiency benefits (journey time and vehicle operating costs), estimated at £215 million, down from £256 million reported in the updated OBC. The results of the TEE assessment show benefits for all trip purposes (Table 3-5).

Table 3-5 Transport Economic Efficiency (TEE) – benefits (£000s)

Item	Updated Outline Business Case values	Full Business Case values
Consumer transport – commuting user benefits	**ALL MODES**	**ALL MODES**
Travel time	57,720	50,508
Vehicle operating costs	-13,132	-12,293
User charges	0	0
During Construction & Maintenance	-3,223	-4,028
NET CONSUMER – COMMUTING BENEFITS	**41,365**	**34,187**
Consumer transport – other user benefits	**ALL MODES**	**ALL MODES**
Travel time	86,546	74,741
Vehicle operating costs	-53,451	-49,399
User charges	4	2
During construction & maintenance	-6,877	-6,361
NET CONSUMER – OTHER BENEFITS	**26,221**	**18,983**
Business impacts	**ALL MODES**	**ALL MODES**
Travel time	167,735	147,089
Vehicle operating costs	7,422	4,001

Item	Updated Outline Business Case values	Full Business Case values
User charges	15	9
During construction & maintenance	-5,813	-7,180
Sub Total	**169,360**	**143,919**
Private sector provider impacts	0	
Revenue	0	0
Operating costs	0	0
Investment costs	0	0
Grant/subsidy	0	0
Sub Total	**0**	**0**
Other business impacts		
Developer contributions	0	0
NET BUSINESS IMPACT	**169,360**	**143,919**
TOTAL		
Present value of transport economic efficiency benefits (TEE)	**236,946**	**197,089**

Notes: All monetary values are expressed in 2010 prices, discounted to 2010.

3.5.12 In relation to changes in transport user benefits (including construction and maintenance costs), these have decreased in comparison to those in the updated OBC. These changes are due to a forecast reduction in GPD growth in TUBA 1.9.17 in comparison to that used in the transport user benefit assessment (TUBA 1.9.14) for the updated OBC. Overall, as shown in Table 3-5, the transport user benefits for the scheme have decreased from £237 million to £197 million; a 17% decrease in benefits. The greatest change occurs for 'other users' where benefits have decreased from £33 million to £25 million (28% decrease).

Changes in wider economic benefits and reliability benefits

3.5.13 The other main decreases in benefits are the wider economic benefits that have decreased from £141 million to £118 million (14% decrease) and the reliability benefits which have decreased from £72 million to £62 million (14% decrease).

3.5.14 Between the May 2019 Wider Economic (WEI) dataset used for the updated OBC and the July 2021 WEI used for the FBC there have been changes in the values within the WEI dataset. The changes in the WEI dataset as:

- decrease in local GDP by worker in the study area
- post 2056, a decrease in total employment in the study area and by sector
- decrease in average workplace earning
- post 2019, a decrease in GDP per worker
- no change in productivity per worker.

3.5.15 In addition, the reduced forecast GDP growth in TUBA would also be included in WITA2.2 and thus would also impact on the wider economic benefits forecast for the scheme.

3.5.16 All of these have reduced the wider economic benefits from the scheme between the updated OBC and the FBC.

3.5.17 The reliability benefits have decreased due to updates to the TAG databook between that used for the updated OBC (TAG databook 1.13) and the FBC (TAG databook 1.17).

Changes in greenhouse gas disbenefits

3.5.18 The greenhouse gas disbenefits from the scheme have increased from £43 million to £60 million.

3.5.19 Since the updated OBC there have been two changes to the assumptions behind the greenhouse gas assessment. These are Emissions Factor Toolkit (EFT) 11 which was released in November 2021 and new carbon values were issued by BEIS in September 2021. Both of these have impacted on the greenhouse gas assessment with the greenhouse gas disbenefit increasing from £43 million in the updated OBC to £60 million in the FBC.

3.5.20 The greenhouse gas assessment for the updated OBC was based on EFT 9, whereas that for the FBC is based on the EFT 11. The main difference between these is that EFT 11 accounts for a greater uptake of electric vehicles post 2031. This results in lower emissions in comparison to those forecast for the updated OBC. Table 3-6 provides the forecast carbon emissions for the DM and DS scenarios for the updated OBC and the FBC.

Table 3-6 Carbon emissions for the updated OBC and FBC (tCO_2e)

Scenario	Updated Outline Business Case	Full Business Case	Difference
Do-Minimum	12,277,978	8,857,347	-3,420,631
Do-Something	13,239,782	9,520,034	-3,719,748
Difference	961,804	662,687	-299,117

3.5.21 As can be seen from Table 3-6, the use of EFT 11 results in a decrease in the forecast carbon emissions when compared to the forecast emissions for the updated OBC. Overall, the application of EFT 11 would result in approximately 300,000 Tonnes of Carbon Dioxide equivalent (tCO_2e) being saved.

3.5.22 Although there is a reduction in carbon emissions compared to those forecast for the updated OBC, the reduction in carbon emissions does not follow through to the monetised values as it is offset by the increase in carbon values. Table 3-7 provides the monetised carbon values for the updated OBC and the FBC based on the emissions in Table 3-6.

Table 3-7 Monetised carbon values for the updated OBC and FBC (£000s)

Scenario	Updated Outline Business Case	Full Business Case	Difference
Do-Minimum	£547,477	£690,135	£148,658
Do-Something	£584,071	£740,711	£156,640
Difference	-£42,594	-£50,576	£7,982

Notes: All monetary values are expressed in 2010 prices, discounted to 2010.

3.5.23 As shown in Table 3-7, the greenhouse gas disbenefit for road users has increased from £43 million in the updated OBC to £51 million for the FBC, even though the emissions have decreased as a result of applying EFT 11 (see Table 3-6). The difference is approximately £8 million.

3.5.24 In addition, the greenhouse gas assessment for the FBC includes embedded (construction carbon) and traded carbon. The embedded carbon is a disbenefit of £9 million and the traded carbon is a disbenefit of £0.5 million.

3.5.25 Overall, the greenhouse gas disbenefits are driven by road user emissions and these account for approximately 84% of the greenhouse gas disbenefit.

Changes in Present Value of Costs (PVC)

3.5.26 The PVC is estimated at £213 million for the scheme (expressed in 2010 prices and discounted to 2010), up from the PVC of £206 million in the updated OBC. This increase in PVC is due to a slight increase in costs. The costs used in the economic appraisal of the scheme have increased from the £275 million used for the updated OBC economic appraisal to £287 million for the FBC economic appraisal, which is based on the scheme submitted for the DCO.

3.5.27 This increase in PVC would be due to changes in the design of the scheme, such as the multi-purpose crossing increasing from 25m to 37m wide following the 2020 supplementary consultation, further refinement of the scheme design in particular the structures, more defined mitigation and rising inflation pressures. Section 2.8 provides more details on the scheme design for this FBC, with Section 2.2 providing details on the scheme timeline and the scheme changes incorporated into the design for the updated OBC.

3.6 Costs

3.6.1 The outturn costs for the scheme are £[redacted] and this includes portfolio risk, these are based on 2021/2022 prices and are the cost for constructing the scheme. These costs are based on the Order of Magnitude Estimates.

3.6.2 More details in relation to the cost estimates submitted for previous Investment Portfolio and Delivery Committee (IPDCs) and the impact of rising inflation are provided in Section 5.2.

3.6.3 For the economic appraisal these costs are rebased to a 2010 price using GDP deflator values in the November 2021 (v1.17) TAG workbook. The costs used in the economic appraisal of the scheme are £287 million in a 2010 price base. More details on the outturn costs are contained in Section 5. The PVC of £213 million is the cost in 2010 base and discounted to 2010 to be consistent with the benefits of the scheme and to allow calculation of the BCR.

3.6.4 In addition to the capital cost of £287 million, the costs used in the economic appraisal of the scheme include £8.3 million for major maintenance of the scheme only. As per the capital costs these are rebased to 2010. These costs are included in the PVC of the scheme. The maintenance costs have been calculated using values included within Part 2, Chapter 9 of the COBA manual (July 2017). If these are converted to 2022 costs, then the maintenance costs are £10.6 million. Over the 60-year appraisal period, the maintenance costs would be approximately £24 million based on GDP deflator values in TAG workbook 1.17 (November 2021).

3.6.5 The pre-efficient Official Journal of the European Union (OJEU) have produced risk assessed cost estimates for the scheme. Table 3-8 shows these cost estimates at different P-values from P30 to P80. The P-value represents the level of certainty associated with a particular level of cost. For the scheme the current cost estimate would represent a P-value of [redacted].

Table 3-8 OJEU estimate P-Values

	P30 (£m)	P40 (£m)	P50 (£m)	P60 (£m)	P70 (£m)	P80 (£m)
Exl. PR	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Inc. PR	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Source: National Highways

3.6.6 No specific sensitivity tests have been undertaken in relation to the P-values in Table 3-8. A switching analysis has been undertaken to determine the change in costs or benefits that would need to occur in order for the scheme to change its VfM category. The results of this switching analysis are reported in Table 3-22. Based on the switching analysis even the P80 cost would not result in a change of VfM assessment once the costs have been rebased to 2010 and discounted.

3.7 Transport user benefits

Business users

3.7.1 Journey time benefits are expected to arise as a result of capacity improvements along the A417/A419 route. By dualling the A417, providing grade separation at Cowley roundabout and diverting A417 traffic away from the Ullenwood junction (formerly Air Balloon roundabout) to alleviate the congestion pinch-point, traffic flows are improved on the A417 and the A436 and journey times on the A417 are reduced. The benefits to business users (Table 3-9) have been estimated separately from commuting and other users. Journey time benefits to business users are expected to be £147 million, down from the £168 million reported in the updated OBC.

3.7.2 A net decrease in vehicle operating costs for business users, due to the decreased congestion, means that the NPV is higher than the value of journey time changes.

Table 3-9 Benefits for business users (£ million)

	Net journey time changes			Value of journey time changes	Vehicle operating costs	Net Present Value (NPV)
	0 to 2 min	2 to 5 min	> 5 min			
The scheme	-8	125	31	147	4	151

Notes: All monetary values are expressed in 2010 prices, discounted to 2010.

Commuting and other user benefits

3.7.3 As with business users, journey time benefits are expected to rise for commuting and other users as a result of capacity improvements along the A417/A419 route. By dualling the A417, providing grade separation at Cowley roundabout and diverting A417 traffic away from the Ullenwood junction (formerly Air Balloon roundabout) to alleviate the congestion pinch-point, traffic flows are improved on the A417 and the A436 and journey times are reduced. Table 3-10 shows the

forecast journey time benefits for commuting and other users for the scheme and these are forecast to be £125 million.

3.7.4 An increase in vehicle operating costs, associated with the longer distances that would be travelled by some 'commuting and other' users following scheme implementation means that the NPV of benefits is approximately 49% lower than the monetised value of journey time changes. Scheme traffic model forecasts show that an improved A417 is expected to attract some traffic from shorter, but more congested, routes between the south and Birmingham. This is particularly expected to be the case for 'other' users on long distance journeys.

Table 3-10 Benefits for commuting and other users (£ million)

	Net journey time changes			Value of journey time changes	Vehicle operating costs	Net Present Value (NPV)
	0 to 2 min	2 to 5 min	> 5 min			
The scheme	-11	110	26	125	-61	64

Notes: All monetary values are expressed in 2010 prices, discounted to 2010.

3.7.5 As noted in Section 2.9, and detailed in Table 2-4, there are a number of scheme objectives and their equivalent RP2 outcome that define what constitutes a successful delivery of the objectives.

3.7.6 The second scheme objective is 'supporting economic growth' and the equivalent RP2 outcome is 'providing fast and reliable journeys'. Figure 2-16 provides the Theory of Change and in the outcomes section of this it can be seen that the scheme would be forecast to reduce average journey times on the A417 between Cirencester and the M5 in the opening year and beyond. These and other improvements in journey times are reflected in the value of journey time changes in Table 3-10 and Table 3-10 that forecast journey time benefits as a result of the scheme would be approximately £276 million.

3.7.7 Therefore, based on the journey time benefits of approximately £276 million the scheme would provide faster journeys between destinations.

3.7.8 Journey time benefits for the scheme over the 60-year appraisal period at a sector level are shown in Figure 3-1.

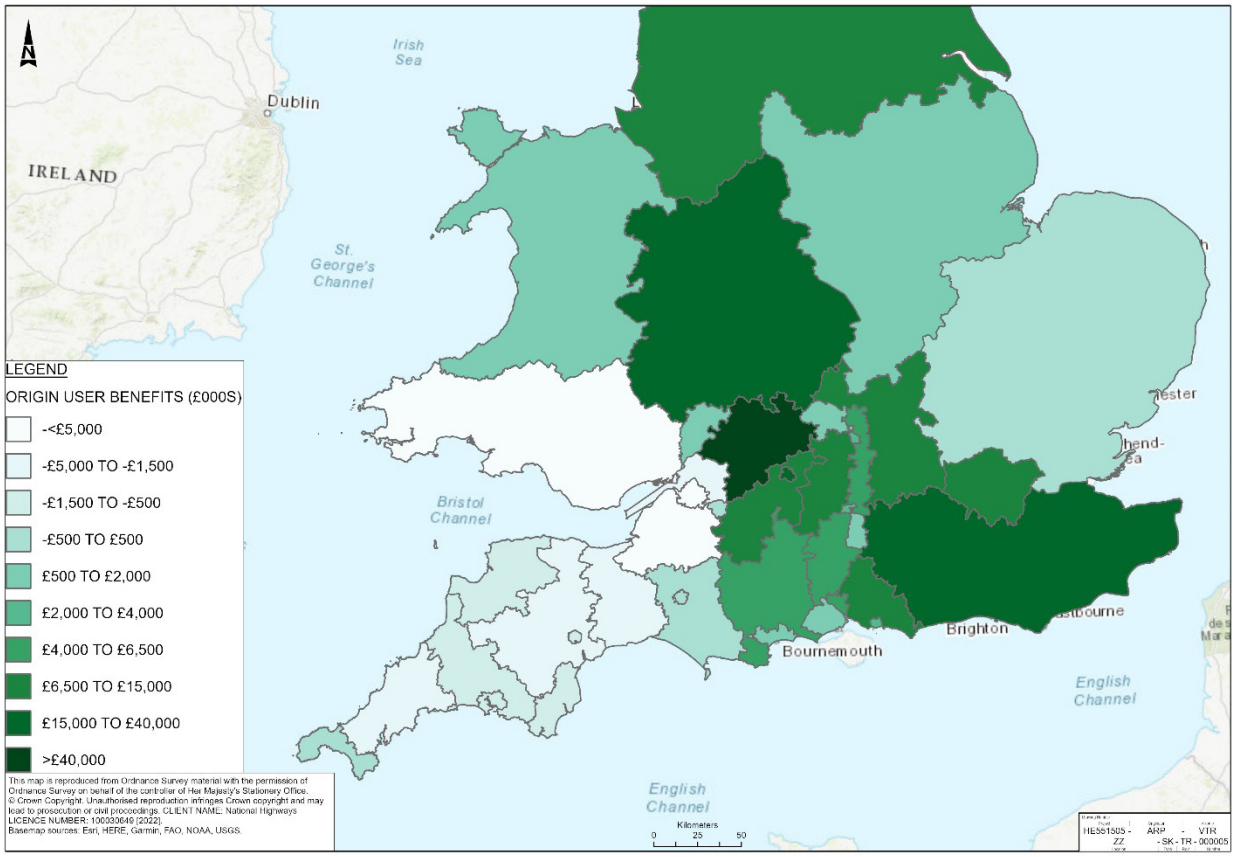


Figure 3-1 Origin journey time benefits for the scheme

3.7.9 As shown in Figure 3-1 the scheme delivers benefits to most geographical sectors of England. The greatest benefits from the scheme occur in the main impact area of the scheme with forecast benefits of than £40 million. Journey time benefits from the scheme are distributed along the M4/M5 corridor to the north and along the south coast.

3.7.10 London, the south-east and the north would have significant benefits from the scheme of between £6 million and £23 million. East Midlands and North Wales gain benefits from the scheme as well, but these would be lower than those along the M4/M5 and the south and would be between £1.5 million and £2 million.

3.7.11 The benefits seen across the model are a result of journey time improvements along the A417/A419 route as a result of the scheme.

3.7.12 Cornwall, Devon, and West Dorset would have disbenefits of less than £2 million. South Wales, Somerset and Bristol would have disbenefits of more than £5 million. These sectors would have a disbenefit as vehicles from these areas are unlikely to use the scheme and would potentially be impacted by increases in traffic on the M4 (east of Swindon) and the M5 (north of Gloucester).

Accidents

3.7.13 An accident analysis has been undertaken using Cost and Benefits to Accidents – Light Touch (COBALT), comparing the forecast accident impacts in the 'With scheme' scenario to the expected situation in the 'Without scheme' scenario. Collisions for the 5-year period July 2014 to June 2019 have been entered into

the COBALT network along with the existing and future annual average daily traffic flows from the scheme traffic model. Collision data for the 5-year period May 2013 to June 2019 was obtained from Gloucestershire, South Gloucestershire, Swindon, and Wiltshire highway authorities and the DfT. Outside of the area covered by these authorities, collision data was obtained from the DfT Road Safety Data website. More recent data has not been covered due to the impact of COVID-19 on traffic flows from 2020 onwards.

3.7.14 An analysis of traffic flows on the A417 between Cowley roundabout and the B4070 Birdlip junction for the period 2015-2022 has been undertaken. This utilised a permanent count site located on this section of the A417. From this the monthly averages for the period January 2015 to August 2022 were calculated and plotted for eastbound and westbound traffic in Figure 3-2 and Figure 3-3. These graphs show the average monthly traffic flow for the period January 2015 to August 2022 and compare with the 2015 to 2019 average traffic flow.

3.7.15 As shown in Figure 3-2 and Figure 3-3 the following are noted

- the impact of the COVID-19 lockdown in March 2020 is clearly visible with traffic flows decreasing from approximately 13,000-14,000 vehicles to approximately 4,000 vehicles.
- Traffic flows then started to increase from May 2020 onwards to approximately 12,000 to 12,500 vehicles for the period August 2020 to October 2020.
- Then with the announcement of the second lockdown at the beginning of November 2020 there is a second decrease in traffic on the A417, although not as large as the decrease associated with the first national lockdown in March/April 2020
- Traffic flows then increased during 2021, but still remained lower than the 2015 to 2019 average. From June to November 2021 traffic flows were more than 90% of the 2015 to 2019 average.
- During 2022 traffic flows have continued to increase and are approximately 90% of pre-COVID levels

3.7.16 Based on the analysis of the traffic data and the significant decrease in traffic flows in 2020 due to the national lockdowns, collecting and using accident data from this period would not reflect the reality of the accident issues experienced on the A417.

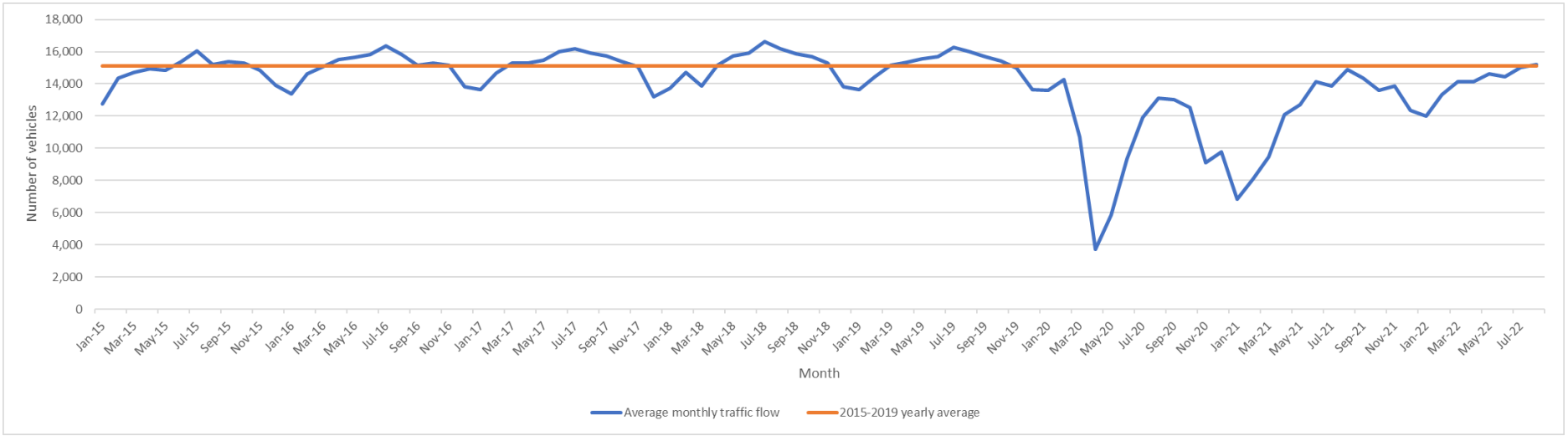


Figure 3-2 A417 eastbound average monthly traffic flow from January 2015 to August 2022

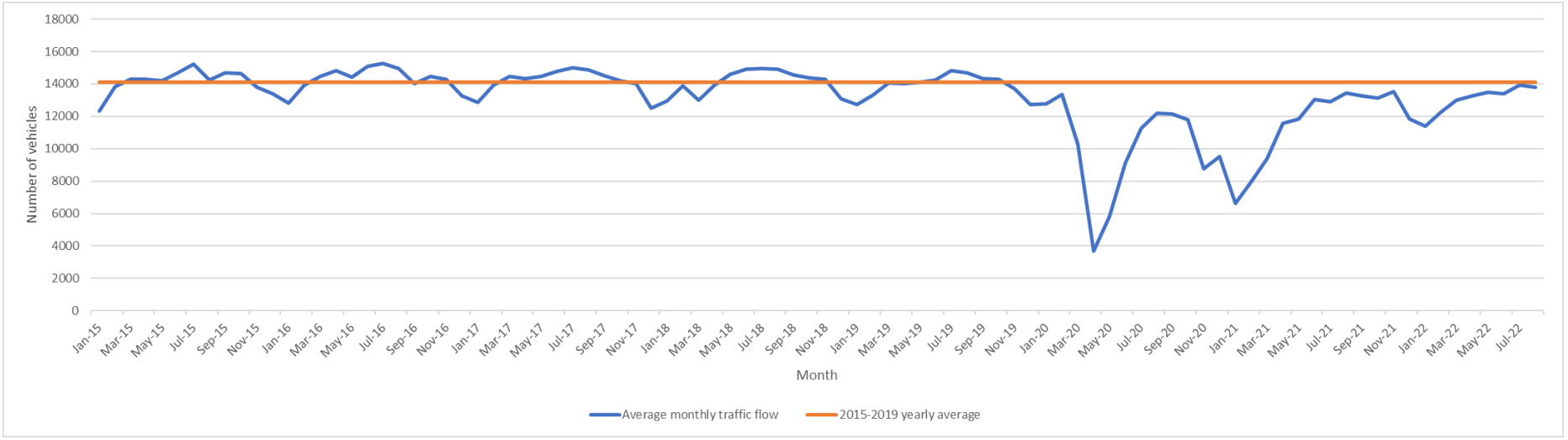


Figure 3-3 A417 westbound average monthly traffic flow from January 2015 to August 2022

3.7.17 To account for the high proportion of fatal and seriously injured casualties on the existing single carriageway sections of the A417, the assessment applied observed collision severity splits and casualty rates (rather than national average splits and rates based on road type) to this part of the network.

3.7.18 The result of the accident assessment for the scheme is shown in Table 3-11. The forecast monetised benefits are substantial at £76 million for the scheme, The scheme is forecast to reduce fatal, serious and slight casualties substantially with KSI savings of 292 casualties.

3.7.19 The scheme is forecast to avoid around 72 fatalities occurring over the 60-year appraisal period. This improvement is primarily due to traffic shifting from the poorer quality existing road to a new higher quality road, removal of vehicles crossing the A417 and removal of high traffic flows from the Ullenwood junction (formerly Air Balloon roundabout).

Table 3-11 Casualty savings

60-year appraisal period		The scheme
No. of casualties saved	Fatal	72
	Serious	220
	Slight	64
	Total	356
Accident Savings (£ million in 2010 prices discounted to 2010)		75.7

3.7.20 As stated in Section 2.4.13, the KSI rate is significantly greater than the national average with the observed seriously injured 100% higher than the national average and observed fatalities 300% higher than the national average. Therefore, the number of KSIs that would be saved by the scheme is significant and this is shown in Table 3-11.

3.7.21 As noted in Section 2.9,and detailed in Table 2-4, there are a number of scheme objectives and their equivalent RP2 outcomes that define what constitutes a successful delivery of the objectives.

3.7.22 The first scheme objective is a ‘safe, resilient and efficient network’, the equivalent RP2 outcome is ‘improving safety for all’ and as shown in Table 3-11 the scheme would result in accident savings of approximately £76 million, or a reduction in the KSI of 292 over the 60-year appraisal period.

3.7.23 In addition to improving the A417, the scheme would remove conflicts between vehicles and Walkers, Cyclists and Horse Riders (WCHs) as crossing points for Public Rights of Way (PRoW) would be grade separated from the A417.

3.7.24 Therefore, based on this assessment the scheme would improve safety for all users by improving the road for vehicles and removing conflict points between vehicles and WCHs.

Wider economic impacts

3.7.25 Within the strategic dimension, a detailed qualitative analysis of the wider economic need for the scheme has been provided. In addition to this, an assessment of the wider economic impacts of the scheme has been undertaken using the DfT’s Wider Impacts in Transport Appraisal (WITA) software (version 2.2).

3.7.26 Table 3-12 summarises the wider economic impacts for the scheme. Impacts around agglomeration and labour supply have been calculated for the scheme traffic model simulation area. Impacts around increased output, which is based on an estimated 10% uplift to business user benefits, cover the wider model. The appraisal indicates the scheme is forecast to provide significant wider economic benefits, totalling £118.4 million.

Table 3-12 Estimated wider economic benefits (£000s)

Wider Impact	The scheme
Agglomeration – manufacturing	9,336
Agglomeration – construction	7,002
Agglomeration – consumer services	20,824
Agglomeration – producer services	64,367
Agglomeration – Total	**101,530**
Labour supply impact	1,710
Increased output in imperfect competitive market	15,110
Total Wider Economic Impacts	**118,350**

Notes: All monetary values are expressed in 2010 prices, discounted to 2010

3.7.27 Figure 3-4 shows the distribution of agglomeration impacts, which account for approximately 86% of the total wider economic impacts for the scheme.

3.7.28 The wider economic benefits account for approximately 49% of the initial PVBs of £244 million and 28% of the adjusted PVB of £424 million.

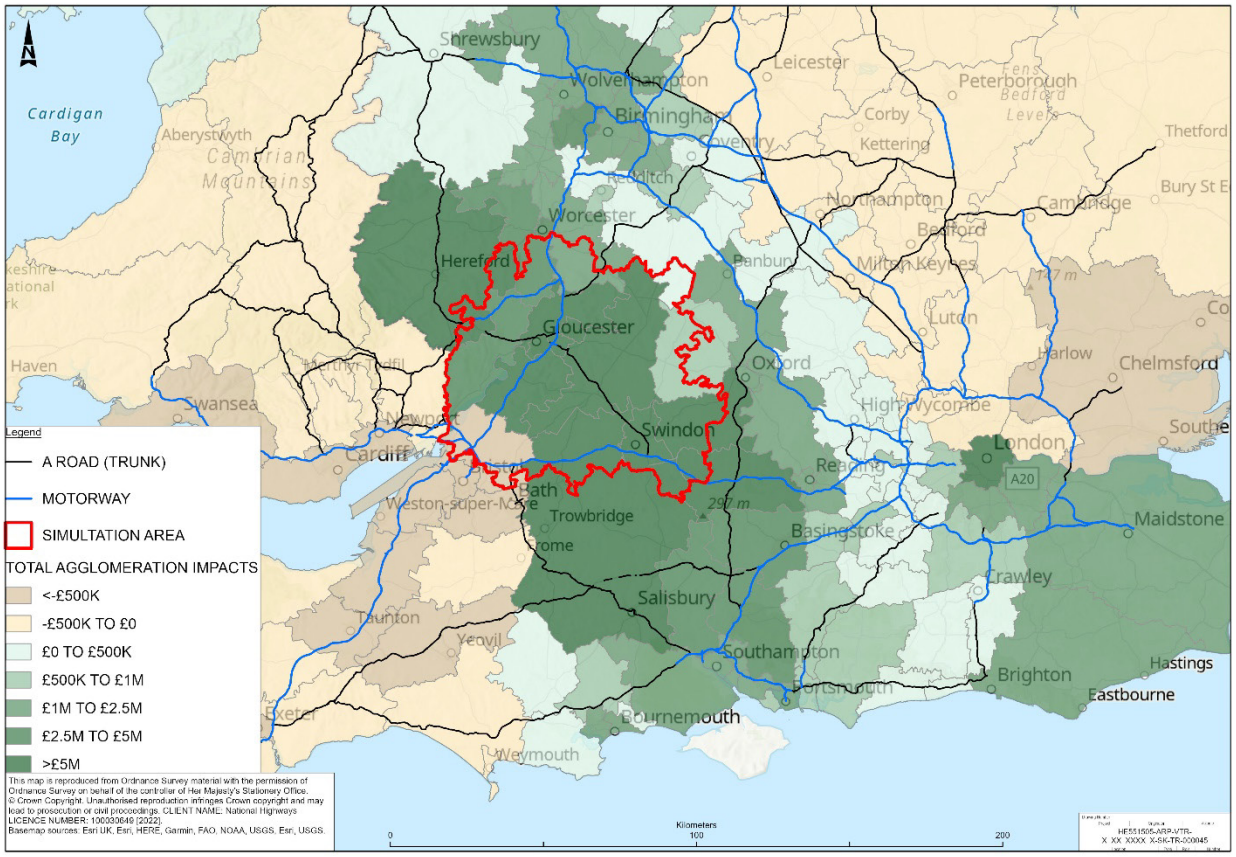


Figure 3-4 Agglomeration impacts (from WITA appraisal)

3.7.29 Figure 3-4 shows that transport user and agglomeration benefits are aligned with the A417/A419 corridor. The scheme would significantly improve journey time and reliability between the Functional Economic Areas of Cheltenham and Gloucester on the M5 and Swindon on the M4. But improvements also continue along the M4 through Reading and onto London. Whilst the benefits decay rapidly once journey times exceed 45 minutes, London and Reading have such large economic mass they still influence the traffic model results and gain benefits from the scheme.

3.7.30 Conversely, but to a less marked extent, there are disbenefits for those areas to the east and west of the scheme. These disbenefits are due to the scheme requiring those travelling east-west on the A40/A436 to travel an extra 1.5 miles (2.5 km) in comparison to without the scheme. Even though congestion at the existing Air Balloon roundabout is removed with the scheme, the additional distance would result in an increase in journey times in most instances. This extra distance results in extra costs for vehicles travelling east and west on the A40/A436 and therefore results in wider economic disbenefits for these areas. Overall, the wider economic impact of the scheme is a benefit.

3.7.31 In relation to the wider benefits of the scheme in Figure 3-4 and the Index of Multiple Deprivation (IMD) income shown in Figure 3-5 it can be seen that the scheme would have a beneficial impact in the most deprived areas in Gloucester, Cheltenham and Swindon. The agglomeration benefits in the least deprived areas of Gloucester, Cheltenham and Swindon would be in excess of £5 million.

3.7.32 With Gloucester being a level 1 prioritisation category in relation to the governments levelling up fund, the wider economic impact of the scheme would assist in relation to levelling up Gloucester.

3.7.33 There are areas of Bristol that are within the study area with that are in the bottom two quintiles for income deprivation that would have a disbenefit of more than £500,000 as a result of the scheme.

3.7.34 As noted in Section 2.9 and detailed in Table 2-4 there are a number of RP2 outcomes that define what constitutes a successful delivery of the objectives.

3.7.35 The second scheme objective is 'supporting economic growth' and the equivalent RP2 outcome is 'providing fast and reliable journeys'. The wider economic impact of the scheme is a result of the scheme improving journey times and journey time reliability on the A417. The reduced journey time and improved journey time reliability between the Functional Economic Areas of Cheltenham and Gloucester and Swindon on the M4 result in wider economic benefits of £118.4 million. Therefore, based on this the scheme would support economic growth.

Journey time reliability benefits

3.7.36 Journey time reliability benefits represent the improved certainty of journey time that customers are forecast to enjoy when using the new road. For business users, improved journey time reliability can translate into an improved ability to plan business journeys and for transport providers, an improved ability to schedule business operations. For commuters and other users, improved journey time reliability can translate into an improved ability to arrive at work on time, and to keep appointment times, which has knock-on economic benefits.

3.7.37 As shown in Figure 2-15, this section of the A417 suffers from poor journey time reliability with the journey time reliability being below 70% in comparison to the national average of 75% and 77% for the full A417/A419 route.

3.7.38 Based on an analysis of journey time standard deviation (using TrafficMaster data covering the period September 2014 to August 2015), a large beneficial journey time reliability benefit is expected for all users. An explanation of the method used and full results from this analysis can be found in Sections 12 and 13 of the PCF stage 5 ComMA Report.

3.7.39 Journey time reliability benefits for the scheme have been calculated at the all-user level and then split into 'business users' and 'commuting and other' based on the proportion of travel time benefits that accrue to these users. Table 3-13 provides the reliability benefits for 'business users' and 'commuting and other'.

Table 3-13 Journey time reliability benefits (£ million)

	Business users	Commuting and other	Total
The scheme	33	28	61

Notes: All monetary values are expressed in 2010 prices, discounted to 2010.

3.7.40 As can be seen from Table 3-13, the journey time reliability benefits of the scheme are £61 million. For business users this equates to £33 million (54%) and for commuting and other this equates to £28 million (46%). These journey time reliability benefits are due to the scheme removing the congestion issue at the Air Balloon roundabout

3.7.41 As noted in Section 2.9 and detailed in Table 2-4 there are a number of RP2 outcomes that define what constitutes a successful delivery of the objectives.

3.7.42 The second scheme objective is 'supporting economic growth' and the equivalent RP2 outcome is 'providing fast and reliable journeys'. The scheme would increase capacity on the A417, traffic on the A417 no longer passes through any at grade junctions and the Ullenwood junction, formerly Air Balloon roundabout, has been designed to accommodate the forecast traffic. All of this improves journey time reliability and the scheme would provide reliable journeys.

3.8 Environmental impacts

3.8.1 Quantitative and monetised assessments have been undertaken for noise, air quality and greenhouse gas impacts, informed by forecasts from the scheme traffic model.

3.8.2 A Landscape Monetisation Assessment has been undertaken to provide an indicative monetisation value for the VfM assessment. The calculation has been undertaken in line with the methodology set out within the Department for Transport's 'Value for Money Supplementary Guidance on Landscape[33].

3.8.3 In addition, a Natural Capital Assessment has been undertaken to provide a quantitative assessment of the impact of the scheme on carbon storage and sequestration.

3.8.4 Both the Landscape Impact Assessment and carbon sequestration assessment in the Natural Capital Assessment provide monetised values that should be viewed as indicative based on Box 4.4 of VfM guidance[34]. As these are indicative, they are not included in the BCR but are factored into the VfM assessment.

3.8.5 Qualitative assessments have been undertaken for landscape, historic environment, biodiversity, and water environment impact. A summary of the environmental assessment, in line with TAG requirements, is provided in Table 3-14.

[33] Department for Transport (2021), Value for Money Supplementary Guidance on Landscape, accessed August 2022 Value for Money Supplementary Guidance on Landscape (publishing.service.gov.uk)
[34] Department for Transport (2021), Value for Money Framework July 2017, accessed August 2022 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/918479/value-for-money-framework.pdf

Table 3-14 Summary of expected environmental impacts

Environmental Impact Area	The scheme
	Monetised impacts
Greenhouse Gases	-£60.4 million (NPV) indicating an increase in regional emissions.
Air Quality	-£6 million (NPV) indicating a net deterioration in regional air quality Improvement at properties within the Birdlip AQMA.
Noise	£0.5 million (NPV) indicating a net benefit to households.
	Indicative impacts
Landscape	-£38 million (NPV)
Natural capital assessment (carbon sequestration)	-£10 million for carbon sequestration
	Non-monetised impacts
Landscape	Moderate adverse
Natural capital assessment	15 ecosystems assessed. Six were assessed as an adverse impact, one was assessed as neutral and eight were assessed as beneficial.
Historic Environment	Moderate adverse
Biodiversity	Slight adverse.
Water Environment	Slight adverse

Notes: All monetary values are expressed in 2010 prices, discounted to 2010.

Greenhouse Gases

3.8.6 Table 3-15 shows the greenhouse gas emissions by type and for up to 2037 by the Carbon Budget (CB) periods. As the CB periods only go up to 2037, carbon data is presented by CB, but the total emissions have been calculated for the Whole Life Costs of the scheme which is the standard 60 year appraisal period.

Table 3-15 Greenhouse gas emissions by type

Source of Emissions	Change in type of emissions (tCO2e)	Total (60 year appraisal period)	CB3 (2018-2022)	CB4 (2023-2027)	CB5 (2028-2032)	CB6 (2033-2037)
Road User Emissions	Traded	8,635	-	126	430	593
	Non-traded	662,687	-	23,246	58,834	59,860
	Total	671,322	-	23,372	59,263	60,452
Construction Emissions	Traded		-	-	-	-
	Non-traded	74,114		74,114	-	-
	Total	74,114	-	74,114	-	-
Renewals and Maintenance Emissions	Traded		-	-	-	-
	Non-traded		-	-	-	-
	Total		-	-	-	-
Operational Emissions	Traded		-	-	-	-
	Non-traded		-	-	-	-

Source of Emissions	Change in type of emissions (tCO2e)	Total (60 year appraisal period)	CB3 (2018-2022)	CB4 (2023-2027)	CB5 (2028-2032)	CB6 (2033-2037)
	Total		-	-	-	-
Total across all sources	Total	745,436	-	97,486	59,263	60,452

3.8.7 As shown in Table 3-15, the majority of the greenhouse gas emissions arise from the road user emissions, with the majority of these being the non-traded emissions, which are tailpipe emissions.

3.8.8 Table 3-16 provides the Whole Life Costs (60-year appraisal period) of the monetised carbon disbenefits for tailpipe emissions, construction and maintenance and operating emissions. As can be seen from Table 3-16 the majority of emissions are the tailpipe emissions and these account for approximately 84% of the monetised carbon emissions.

Table 3-16 Value of greenhouse gas emissions over 60 years (£000s)

Value of emissions over 60 years (£2010 present values)	Tailpipe Emissions	Construction & Maintenance Emissions	Operating Emissions	Total
Traded	£458	£-	£-	£458
Non-traded	£50,576	£9,333	£-	£59,909
Total	£51,034	£9,333	£-	£60,367

Notes: All monetary values are expressed in 2010 prices, discounted to 2010.

3.8.9 As noted in Section 2.9 and detailed in Table 2-4 there are a number of RP2 outcomes that define what constitutes a successful delivery of the objectives.

3.8.10 The fourth scheme objective is ‘improved natural environment and heritage’ and the equivalent RP2 outcome is ‘delivering better environmental outcomes’. In relation to greenhouse gases the scheme has been designed to minimise the requirement for energy consuming operational equipment such as street lighting. In addition, the scheme has been designed to reduce carbon emissions during construction.

3.8.11 A Carbon Management Plan (CMP) has been developed and this sets out the current projected carbon emissions, proposed targets for carbon reduction, current and planned actions to achieve those targets, and the approach to implementation and communication.

Air quality

3.8.12 The quantitative and monetised assessment for air quality has concluded that, due to decreased congestion, there would be an overall improvement of local ambient air quality within the Birdlip AQMA with respect to Nitrogen Dioxide (NO_2) and Particulate Matter ($PM_{2.5}$). However, the scheme is forecast to increase regional emissions of NO_2 and $PM_{2.5}$, as well as greenhouse gas emissions (which would form a small proportion of the overall UK carbon budget), due to traffic re-routeing impacts and increased overall journey distances. This is expected to lead to a worsening of air quality across the study area.

3.8.13 As noted in Section 2.9 and detailed in Table 2-4 there are a number of RP2 outcomes that define what constitutes a successful delivery of the objectives.

3.8.14 The fourth scheme objective is ‘improved natural environment and heritage’ and the equivalent RP2 outcome is ‘delivering better environmental outcomes’. In relation to air quality the scheme would reduce NO_2 emissions at the Birdlip AQMA, improving ambient air quality and would help in improving the natural environment and heritage.

Noise assessment

3.8.15 The quantitative and monetised assessment for noise impacts has predicted a benefit of approximately £0.5 million for the scheme. The noise assessment forecasts a net decrease of 80 houses experiencing daytime noise and a net decrease of 22 houses experiencing night-time noise in the forecast year.

3.8.16 With the scheme in place, there would remain five Noise Important Areas (NIAs) which lie within the affected route of the A417 scheme. Two of these NIAs would benefit from noise reductions of between 11dB (No.1 & 2 Air Balloon Cottages) and 26dB (Castle Hill Cottage) in 2041, as a direct result of the new scheme alignment. Two further NIAs (Fernbank and Crickley Court) would benefit from noise reductions of between 3dB and 8dB in 2041 as a direct result of the inclusion of proposed noise mitigation (noise barriers). NIA (Woodside House) would be removed as part of the scheme proposals. There would be three dwellings that would be eligible for noise insulation under the Noise Insulation Regulations.

3.8.17 The benefit is due in part to a reduction in traffic on minor roads caused by expected traffic reassignment to the new A417 alignment and the removal of the existing A417/A419 route between Air Balloon roundabout and Cowley roundabout. Overall, a greater number of households would experience a decrease in traffic noise compared to the number of households that would experience an increase.

3.8.18 As noted in Section 2.9 and detailed in Table 2-4 there are a number of RP2 outcomes that define what constitutes a successful delivery of the objectives.

3.8.19 The fourth scheme objective is ‘improved natural environment and heritage’ and the equivalent RP2 outcome is ‘delivering better environmental outcomes’. In relation to noise the scheme would reduce noise impacts for a number of residential units in the area and Noise Impact Areas in the study area. The scheme would help to improve the natural environment in relation to noise quality in the area.

Landscape assessment

<u>Landscape monetisation assessment</u>

3.8.20 A landscape monetisation assessment has been undertaken for the scheme.

3.8.21 The landscape monetisation assessment was undertaken in line with seven-step procedure set out within the DfTs 'Value for Money Supplementary Guidance on Landscape' (DfT 2021)[35].

3.8.22 The scheme has been split into nine segments based on landscape character and land types. The buffer applied to each section to calculate the area impacted by the scheme is dependent on whether the scheme follows the alignment of the existing highway (online) or sections away from the existing highway (offline). Where the scheme is online a 50m buffer has been applied to account for the fact that the existing A417 is already in-situ and therefore already has an impact on the landscape. Where the scheme is offline a 125m buffer has been applied. In addition, the section of the existing A417 that would be detrunked and become a recreational route has been factored into the assessment and this would be identified as a benefit, whereas the new road would be classed as a disbenefit.

3.8.23 For the scheme assessment central values and central appraisal period has been used. This equates to an assessment period of 100 years.

3.8.24 The landscape monetisation assessment undertaken estimates the landscape disbenefit arising from the scheme would be £45 million and that the landscape benefit (arising from the detrunked section) would be £7 million. This gives a total valuation of the landscape as a net disbenefit of £38 million.

Non-monetised landscape assessment

3.8.25 The non-monetised landscape assessment is moderate adverse.

3.8.26 As a result of the scheme at year 15, there would be adverse permanent significant effects experienced by the following visual receptors:

- recreational users on the Cotswold Way National Trail
- visitors to the Crickley Hill Country Park and Barrow Wake

3.8.27 Non-significant beneficial effects would be experienced at the following receptors:

- communities at Birdlip and Nettleton Bottom.

3.8.28 The operation of the scheme would have beneficial and adverse permanent effects on the special qualities of the AONB within the study area.

3.8.29 Permanent adverse effects on the special qualities of the AONB include:

- Cotswold escarpment, including views from and to the AONB – with the increased depth and width of cutting and additional carriageway width
- River valleys – due to infilling the head of the valley at Coldwell Bottom and the presence of the Shab Hill junction.

3.8.30 Permanent beneficial effects on the special qualities of the Cotswold AONB include:

- Unifying nature of the limestone geology – increasing its visible presence in the landscape through the cutting and use as a building material on the structure and extensive stone walling

[35] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1007603/value-for-money-supplementary-guidance-on-landscape.pdf accessed 14 June 2022

- High Wold long distance views – reducing the visual dominance of road infrastructure through the repurposing of the A417 and setting the scheme into the landscape, enclosing it with landscape bunding and Cotswold stone walling
- Distinctive dry-stone walls – provision of extensive, additional new sections of dry stones walling across the scheme
- Internationally important flower-rich grasslands, particularly limestone grasslands – provision of large areas of calcareous grassland
- Internationally important ancient broadleaved woodland, particularly along the crest of the escarpment – provision on additional areas of broadleaved woodland
- Variations in the colour of the stone from one part of the AONB to another which add a vital element of local distinctiveness – positively contributing to local distinctiveness with the use of the Cotswold stone walling and cladding on structures
- Tranquillity of the area – with the removal of lit junctions and better integrated carriageway to reduce noise and visual disturbance
- Extensive dark sky area – removal of lit junction and better integrated carriageway to reduce light spill from vehicle headlights
- Accessible landscape for quiet recreation – improved recreational access with the provision and upgrading of ProWs, traffic free WCH crossings via the Cotswold Way and Gloucestershire Way crossings.

3.8.31 This assessment result incorporates the implementation of the Environmental Masterplan and other mitigation principles that would be applied to detailed design and construction, and form commitments upon the Design Agent and Delivery Partner to secure their implementation.

Natural Capital Assessment results

3.8.32 A natural capital assessment was undertaken and identified a range of ecosystem services considered material to decision making as follows:

- Biodiversity
- Food production
- Water supply
- Flood regulation
- Erosion protection
- Water quality regulation
- Carbon sequestration
- Cooling and shading
- Pollination
- Pest control
- Recreation
- Aesthetic value
- Education
- Interaction with nature
- Sense of place

3.8.33 Of all of the ecosystems listed above, only the impacts on carbon sequestration and loss of carbon storage as a result of construction could be quantified and monetised using a reliable and appropriate method, therefore these are included in the indicative monetised impacts. The total net monetary impact in the ability of

the scheme area to store and sequester carbon is a disbenefit of approximately £10 million (2010 price base, discounted to 2010). The majority of the disbenefit relates to the loss of stored carbon through habitat loss during construction. However, it is important to note, that particularly with carbon stored in existing habitats, there is a high level of uncertainty and high degree of influence from habitat condition and local climate that reduce the level of confidence in these figures.

3.8.34 More details on the natural capital assessment methodology and results are provided in Table 3-17.

Table 3-17 A summary of the key findings of the natural capital assessment

Type	Ecosystem Service	Change	Assessment Findings
Biodiversity		↓	There is an anticipated loss of biodiversity anticipated as a result of the scheme. Key adverse impacts include the loss of semi-natural broadleaved woodland, loss of veteran trees, hedgerows, species-rich neutral grassland and Annex 1 tufa formation habitat, as well as habitat degradation of ancient woodland from nitrogen deposition.
Provisioning	Food production	↓	As part of the scheme, approximately 15ha of cropland and 86ha of modified grassland will be lost and replaced by a mosaic of habitats that do not contribute to food production. The majority of cropland that will be lost is good to moderate quality agricultural land.
	Water supply	↓	Water supply may decrease as a result of the scheme due to the increase (16ha) in impermeable surfaces post-construction. This impacts the natural hydrological cycle by increasing stormwater runoff and reducing groundwater recharge. This can lower water table levels as well as result in higher peak flows and more frequent flooding.
Regulating	Flood regulation	↓	The 16ha increase in sealed surfaces at the expense of, most notably, modified grassland increases the area of impermeable surfaces and subsequent surface water run off into rivers. Furthermore, the loss of 18ha of mature and semi-mature woodlands during construction reduces the ability of woodlands to regulate flood risk, despite an overall increase in woodland area post-construction.
	Erosion protection	↑	Loss of farming land and increase in calcareous grasslands and woodland.
	Water quality regulation	↑	There is an anticipated increase in water quality regulation resulting from the loss of farming land and enhancement/creation of calcareous grassland and woodlands.
	Carbon storage	↓	There is an anticipated decrease in carbon storage as a result of the loss of stored carbon in habitats during construction. The greatest impact would be the loss of approximately 86ha of modified grassland. Over the appraisal period of 60 years, the net increase in carbon sequestration compared to the baseline is estimated to sequester less carbon than the carbon that would be lost from existing stores during construction.
	Cooling and shading	→	There is an anticipated decrease in the cooling and shading ability of habitats within the study area. This is driven by the

Type	Ecosystem Service	Change	Assessment Findings
			loss of approximately 18ha of semi-mature to mature woodland during construction.
	Pollination	↑	Creation and enhancement of calcareous grasslands supporting a diverse assemblage of insects
	Pest control	↑	
Cultural	Recreation	↑	As a result of the scheme there would be a resultant increased in recreational opportunities for WCH compared to the current situation as a result of the scheme. This would consist of improvements to the PRoW network and the existing A417 being detrunked and becoming Air Balloon Way.
	Aesthetic value	↓	There is anticipated to be permanent impacts on the AONB as a result of the scheme, but conversely permanent beneficial impacts on the AONB, these being reducing the visual dominance of road infrastructure with detrunking the existing A417 and creating flower rich calcareous grasslands. On balance, it is considered that the overall impact is adverse on the aesthetic value of the scheme area given the impacts on the AONB.
	Education	↑	There is an anticipated minor increase in education from nature post-construction. The improvements proposed for the PRoW network will improve the connectivity of the area and encourage visitation, which will allow for a greater number of informal educational opportunities.
	Interaction with nature	↑	There is an anticipated increase in opportunities for the public to interact with nature. This is driven by the replacement of farming land with large areas of calcareous grassland, lowland mixed deciduous woodland and a mosaic of other habitats.
	Sense of place	↑	There is an anticipated increase in the sense of place provided by the study area post-construction. The replacement of farmland with diverse calcareous grasslands and woodland contributes towards this sense of place. This will be enhanced by the use of native species and reflection of landscape character of the local area.

Historic environment

3.8.35 The proposed scheme would result in moderate adverse impacts to the form, condition and survival, of known non-designated heritage assets and archaeological potential, and minor adverse impacts to a Scheduled Monument within the boundary of the proposed scheme. However, the impact of the proposed scheme would also result in beneficial impacts to the context of buried archaeological remains by furthering understanding of the archaeology of the area. The scheme would result in changes to the settings of some designated assets resulting in minor adverse effects to their contexts, though the majority of assets outside of the proposed scheme boundary would experience neutral effects.

3.8.36 As noted in Section 2.9 and detailed in Table 2-4 there are a number of RP2 outcomes that define what constitutes a successful delivery of the objectives.

3.8.37 The fourth scheme objective is ‘improved natural environment and heritage’ and the equivalent RP2 outcome is ‘delivering better environmental outcomes’. In relation to the historic environment the scheme would have a slight impact on the historic environment, but in some instances the scheme would have a beneficial impact.

Biodiversity

3.8.38 Very large adverse effects are predicted for one veteran beech tree (Ref 196380) and on Ullen Wood Local Wildlife Site (LWS) and Ancient Woodland Inventory (AWI) due to nitrogen deposition.

3.8.39 Moderate adverse effects are anticipated on barn owl from injury/mortality.

3.8.40 Slight adverse effects are anticipated on foraging/commuting bat assemblages, breeding birds and wintering birds from disturbance and road mortality, and barn owl from disturbance.

3.8.41 Some beneficial effects are expected for badgers, other Section 41 Species, the Haroldstone Fields LWS, Hartley Wood LWS, Chatcombe Wood and Lineover Wood and Crickley Hill and Barrow Wake SSSI.

3.8.42 With the implementation of mitigation, effects on other species are considered to be neutral and not significant.

3.8.43 Overall, most effects on biodiversity would be mitigated through the scheme however, impacts upon veteran trees/ancient woodland cannot be mitigated for due to their irreplaceable nature.

3.8.44 As noted in Section 2.9 and detailed in Table 2-4 there are a number of RP2 outcomes that define what constitutes a successful delivery of the objectives.

3.8.45 The fourth scheme objective is ‘improved natural environment and heritage’ and the equivalent RP2 outcome is ‘delivering better environmental outcomes’. In relation to biodiversity the scheme would have a slight impact on biodiversity following mitigation.

Water environment

3.8.46 The scheme is expected to have no change or a negligible impact on most areas assessed.

3.8.47 However, minor impacts are anticipated on the baseflow of Normans Brook during construction as a result of cuttings and associated changes to groundwater level and flow and minor impacts to the baseflow of springs associated with Norman’s Brook during construction and operation as a result of realignment of Norman’s Brook and construction of an embankment. Moderate impacts are anticipated to Norman’s Brook through temporary lose and changes to baseflow through changes to groundwater levels as a result of stabilisation measures in the Crickley Hill landslide materials.

3.8.48 Moderate impacts are also expected to impact groundwater flow paths towards groundwater dependent features in Crickley Hill escarpment as a result of intercepting fissures and gills. Although Minor and Moderate impacts have been

identified, it is considered that the mitigation measures to be applied would reduce the overall impact on water features to slight adverse.

3.8.49 As noted in Section 2.9 and detailed in Table 2-4 there are a number of RP2 outcomes that define what constitutes a successful delivery of the objectives.

3.8.50 The fourth scheme objective is 'improved natural environment and heritage' and the equivalent RP2 outcome is 'delivering better environmental outcomes'. In relation to water the scheme would have a slight impact on water following mitigation.

3.9 Social impacts

3.9.1 TAG requires scheme promoters to consider a wide range of potential social impacts that result from a scheme. This includes impacts on physical activity, journey quality, personal security, accessibility, affordability, severance, and transport option availability (option values). The expected impacts for the scheme are summarised in Table 3-18.

Table 3-18 Summary of the social impacts assessment

Indicator	Assessment	Summary
Accidents	Moderate beneficial	Upgrading the single carriage way section of A417 to dual carriage way is anticipated to bring significant safety benefits. A COBALT analysis has been carried out to evaluate the impacts of the scheme on road safety. The assessment is based on a comparison of accidents by severity and associated costs across the impact area for the 'with' and 'without' scheme scenarios. The scheme is forecast to reduce collision rates overall and deliver significant benefits (£75.7 million). In particular, the intervention would result in a significant reduction in casualties of serious severity over the 60-year assessment period.
Journey Quality	Moderate beneficial	The scheme is expected to positively change the travel conditions and decrease traveller stress associated with improvements in journey time reliability and more comfortable driving conditions. As crossings and linear connections have been proposed to retain connectivity and access for WCH along the network, the general transport environment is expected to be improved walkers, cyclists and horse riders, including disable users. These measures are expected to result in a better user experience while enhancing people's recreational enjoyment of the area. The overall assessment for journey quality is likely to be moderate beneficial.
Physical Activity	Slight beneficial	Suitable alternatives for PRoW affected by the scheme would be provided. The scheme also proposes safe WCH crossing points on a number of key locations. This is anticipated to result in a reduction of the barriers to walking and cycling in the scheme area and thus would positively impact of physical activity levels.
Security	Slight beneficial	The scheme would impact on security through certain improvements to lighting and visibility and other indicators such as formal surveillance. Landscaping features are also expected to contribute to adequate visibility and deter intruders. Effective CCTV and ERT provision would encourage staff surveillance and group passengers. The analysis indicates slight beneficial impacts on most security indicators.
Severance	Slight beneficial	The scheme would improve the crossing opportunities on a number of key locations. Special consideration is given to the west of Air Balloon roundabout, where there are no formal road crossings. The

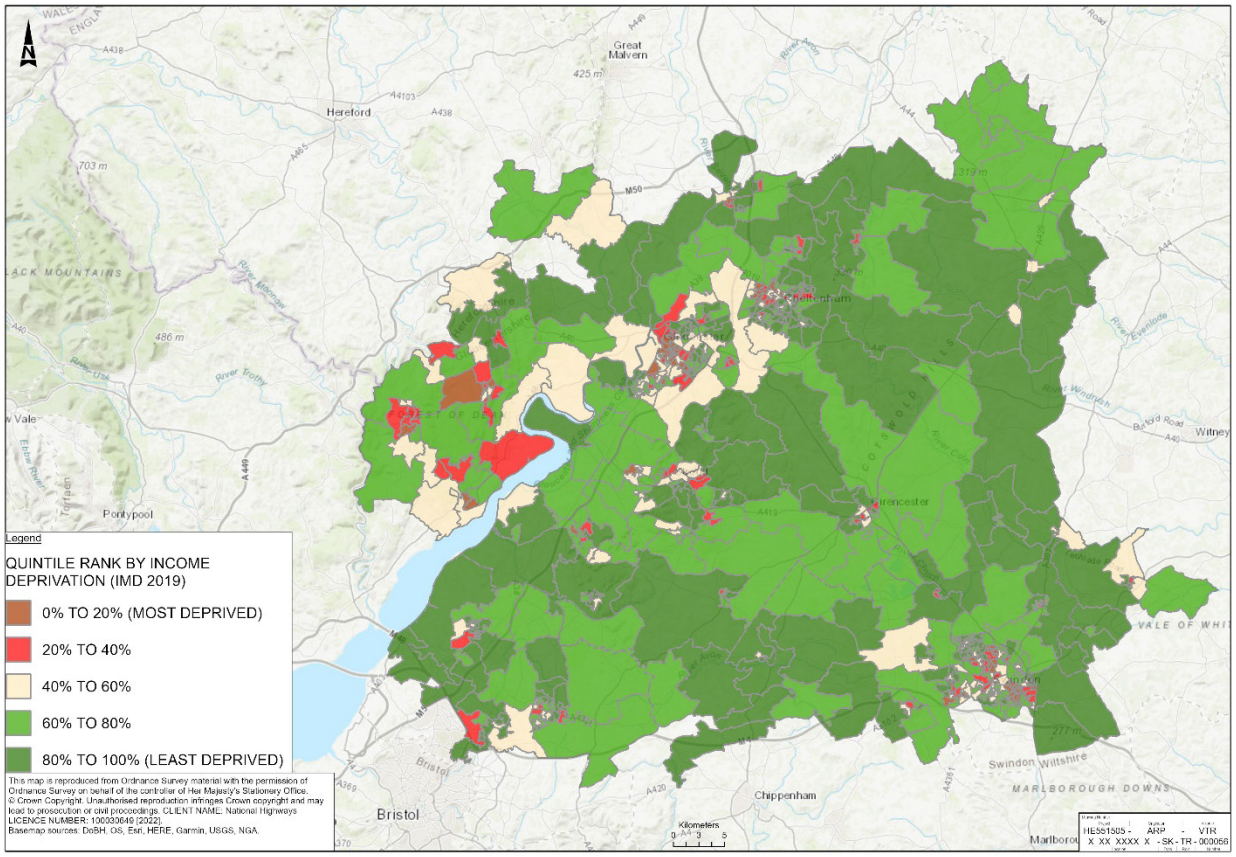
Indicator	Assessment	Summary
		scheme would increase traffic on the A417 but reduce traffic flows on many minor roads, which would be beneficial for WCHs. In any case, the impacts of road traffic from the scheme are not anticipated to interfere with people's mobility. The overall assessment on severance is considered to be slight beneficial.
Accessibility	Slight beneficial	The qualitative assessment based on the five key barriers impacting on accessibility indicates that the scheme is expected to deliver a positive net impact on accessibility, mainly from improved travel time reliability and time savings owing to the provision of a high-quality dual carriageway with associated improvements. Therefore, the scheme accessibility impact has been assessed as slight beneficial.
Option Value and Non-Use Value	Scoped out of appraisal	Screened out as the scheme does not involve the provision or loss of transport services.
Personal Affordability	Moderate adverse	TUBA outputs indicate adverse impacts to personal affordability derived from the A417 Missing Link. These disbenefits are likely to result from re-routing journeys using faster but longer routes in the transport model and from some increase in traffic outside the model area. Building on this conclusion and on the scale of the disbenefits, a moderate adverse impact to affordability is considered appropriate from the social viewpoint.

3.10 Distributional Impacts

3.10.1 A Distributional Impacts (DI) appraisal has been to undertaken to determine any differences in impacts of a transport intervention across different social groups, with particular reference to the impact upon equality through identifying the effects upon those who are disadvantaged compared to the population as a whole.

3.10.2 This appraisal has been prepared in line with current DfT TAG Unit A4.2. The eight indicators considered within the DI appraisal are: user benefits, noise, air quality, accidents, security, severance, accessibility and personal affordability

3.10.3 For this appraisal the study area has been taken as the simulation area, which covers the entirety of Cheltenham, Cotswold, Gloucester, Stroud and Tewkesbury local authorities, as well as parts of Forest of Dean, Herefordshire, South Gloucestershire, Swindon, Vale of White Horse and Wiltshire. For the DI appraisal the data required is based on Lower Super Output Areas (LSOA) and the main indicator is the income Index of Multiple Deprivation (IMD). Figure 3-5 shows the IMD income for the various LSOAs that constitute the study area.



Source: National Statistics – English indices of deprivation 2019

Figure 3-5 IMD income by LSOA for the scheme study area

3.10.4 Some assessments, such as noise and severance cover the immediate are of the scheme rather than the area in Figure 3-5. This is due to their impacts being much more localised.

3.10.5 Within the study area the majority of LSOAs within the study area are in the 60-80% and 80-100% quintiles. There are 55 LSOAs that are within the most deprived quintile and these areas are mainly within Cheltenham, Gloucester and Swindon.

3.10.6 The detailed findings from the DI appraisal can be found in the Distributional Impacts Assessment report and included as part of the ASTs. A summary of the DI appraisal can be found in Table 3-19.

Table 3-19 Summary of the Distributional Impacts assessment

Indicator	Assessment	Conclusion
User benefits	All income groups within the study area are forecast to experience benefits as a result of the scheme. However, the scheme is most beneficial to those in the least deprived (80-100%) communities. The scheme is least beneficial to those in the most deprived (0%-20%) communities. The greatest share of the benefits (63%) is found in the least deprived communities (60%-80% (28% share) and 80%-100% (35% share). Figure 3-6 shows the distribution of user benefits across the study area at LSOA level	Given the proportionate spread of benefits, which is representative of the population, the scheme is assessed as overall moderate beneficial.
Noise	The scheme is anticipated to reduce noise levels experienced by residents of Birdlip which is in least deprived income band. Witcombe and Little Witcombe experience a decrease in noise and are in 40%-60% income band. Cowley and Coberley village would experience a mix of results with some properties experiencing a decrease in noise and others an increase, both of these villages are in the least deprived income band. In relation to sensitive receptors Birdlip Primary School and Birdlip Village Hall would be subject to major beneficial impacts in the opening and design years due to reductions in noise. Birdlip Church (St Marys) would be subject to major beneficial impacts in the opening year and a moderate beneficial impact in the design year. National Star College would be subject to noise increases, but these are assessed as not significant.	The noise assessment forecasts a slight beneficial effect for the 40%-60% IMD band, a moderate beneficial effect for the 60%-80% band and a large beneficial effect for the 80%-100% band. The largest share of the population that would experience a benefit are in the least deprived income band. There are no LSOAs in the most deprived band in the noise assessment. Overall, the noise assessment would be moderate beneficial.
Air quality	The scheme is anticipated to improve/no change to NO_2 and $PM_{2.5}$ for Birdlip, Cowley, Coberley and Elkstone all of which are in the least deprived income band. Witcombe and Little Witcombe would have an improvement/no change in NO_2 and $PM_{2.5}$ and are in the 40%-60% income band. The biggest concentration where there is a worsening of NO_2 is in Cheltenham around the B4075 and this is the 60%-80% income band. The scheme is forecast to have a beneficial impact on the Birdlip Air Quality Management Area. In relation to sensitive receptors, Birdlip Cricket Club, Ullenwood and Bharat Cricket Club and Witcombe Cricket Club all show there would be	For $PM_{2.5}$ the 40%-60% and 60%-80% income bands would both have a slight beneficial impact, the 80%-100% band would a large beneficial impact. For NO_2 the 40-60% income band would have a moderate beneficial effect, the 60%-80% income band a slight beneficial effect and the 80%-100% income band a large beneficial effect. Overall, the air quality impacts are considered moderate beneficial, this assessment takes into

Indicator	Assessment	Conclusion
	an improvement in NO_2 and either an improvement or no change for $PM_{2.5}$. For the various schools and care homes, all forecast either an improvement or no change in NO_2 and $PM_{2.5}$.	consideration the impact of the scheme on the Birdlip AQMA.
Accidents	There is a broad spread of accidents across the study area, but as shown in Section 2.4, the A417 Missing Link has a higher than average KSI rate. The analysis of accident data shows that young males are shown to suffer more accidents when compared to other vulnerable social groups. Additionally, the proportion of accidents for young males is higher than the representation in the total population of the area. Overall	The majority of links are shown to have a neutral impact on most of the vulnerable social groups identified. Therefore, the scheme is assessed as having an overall neutral impact.
Security	The scheme would include CCTV and ERTs that would assist in security matters. In addition, the scheme would seek to address concerns over anti-social behaviours at Barrow Wake through increased surveillance with a new public right of way and junction arrangement serving Birdlip and Shab Hill.	Overall, the impact on security is assumed to be negligible.
Severance	The proposed alignment offers several new WCH alternatives and safe crossing points along the scheme in comparison to the existing situation. For this reason, it has been decided that severance score should be ‘none’ for the majority of locations. The only case where there is ‘slight’ severance is Bentham. This is due to the new route via Grove Farm underpass and Cotswold Way crossing representing a significant detour when trying to access the Flyup A417 Bike Park.	Overall, the scheme seeks to enhance the rights of way network and create improved accessibility, reduced severance and enhanced user experience. Therefore, the overall impact across all vulnerable groups is ‘slight beneficial’.
Accessibility	The scheme does not include any changes to public transport provision. Therefore, the accessibility has been scored as ‘neutral’.	This has been assessed as ‘neutral’.
Personal affordability	The scheme results in increased speed along the route and in turn vehicle operating costs would increase. Those groups that that benefit most from the scheme in terms of journey times savings are also the groups that incur the largest disbenefits in terms of increases to vehicle operating costs. Figure 3-7 shows the distribution of affordability across the study area at LSOA level	The proportionate spread of disbenefits is broadly representative of the population. The scheme overall has a ‘moderate adverse’ effect on affordability.

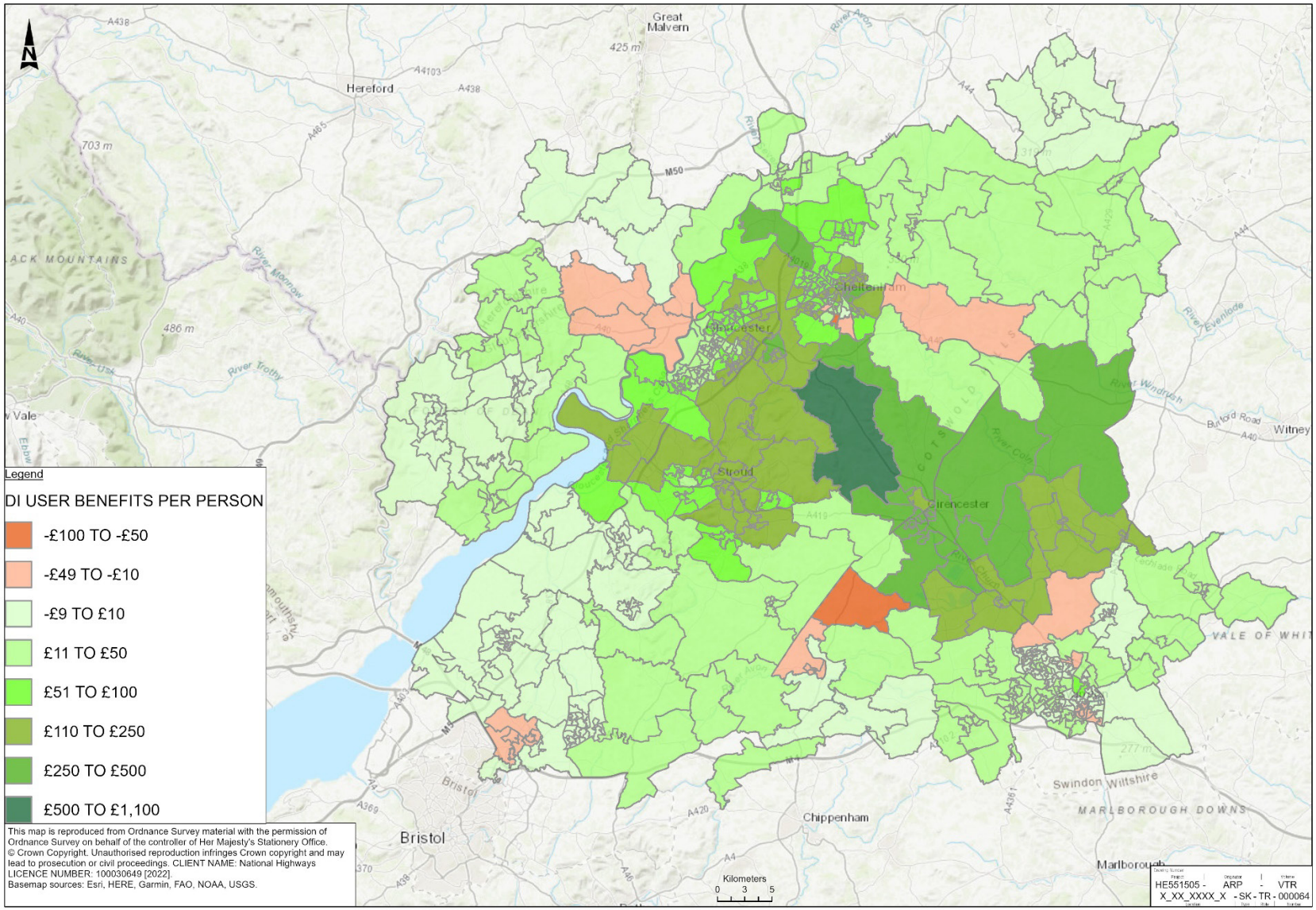


Figure 3-6 Distributional impact user benefits

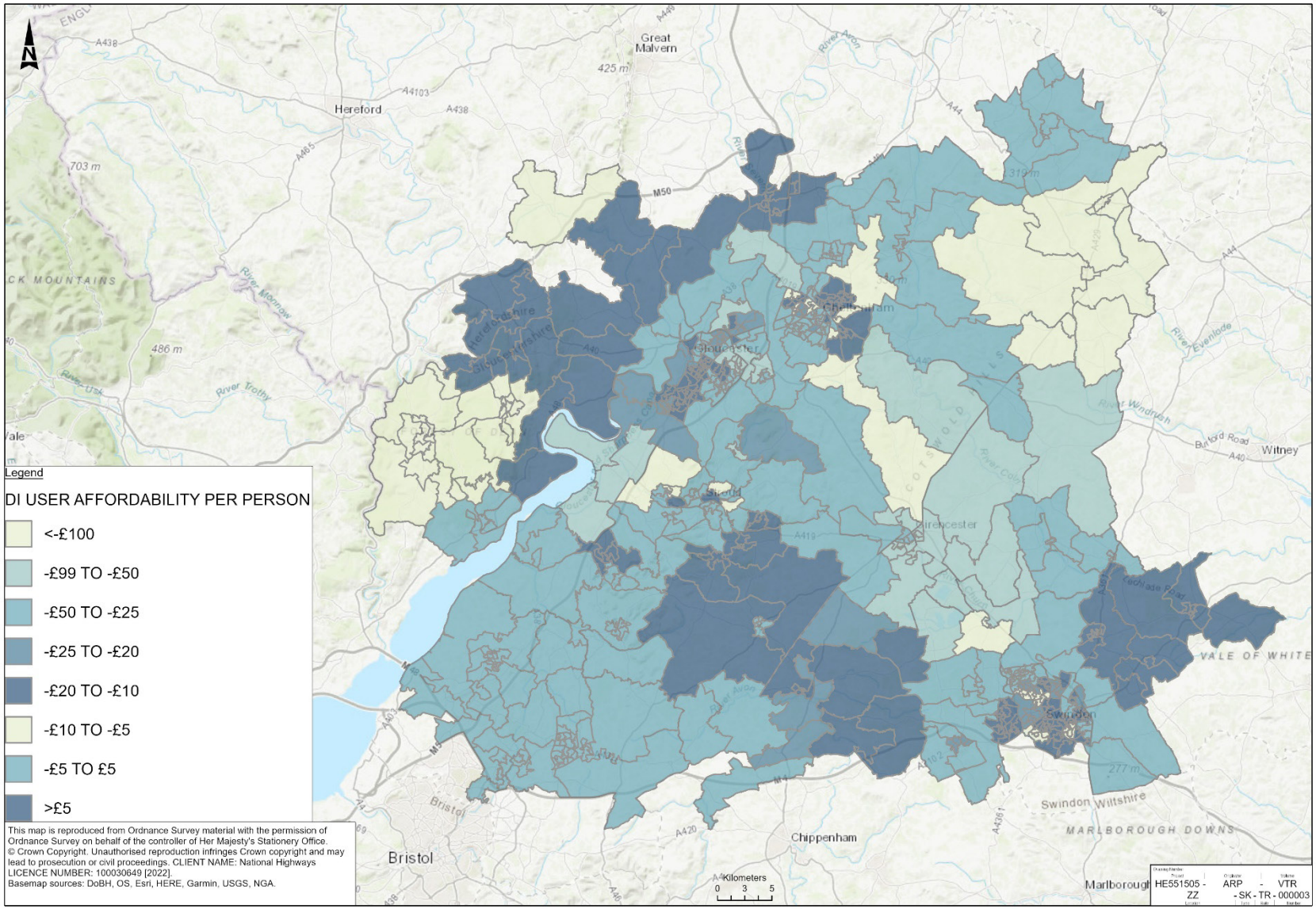


Figure 3-7 Distributional impact user affordability

3.11 Sensitivity tests

High and low growth sensitivity tests

3.11.1 As per TAG Unit M4, uncertainty around the core scenario was tested using low and high growth sensitivity tests. These scenarios are included to test the impact on the scheme with either higher and lower background traffic growth than the core scenario.

3.11.2 The low growth scenario can be used to provide an indication of the impact of lower than expected traffic growth on the scheme that could be due to an economic downturn, lower demographic growth or other unusual event (such as a pandemic). The high growth scenario tests the impact if higher than expected demand growth were to occur.

3.11.3 High and low growth sensitivity tests have been undertaken for the TUBA and WITA appraisal as these account for £370 million of the £424 million level 2 PVBs, this is approximately 87% of the level 2 PVBs. Therefore, running the accidents, construction, greenhouses gases, noise, air quality and reliability through high and low growth sensitivity tests would not be proportionate for the impact on the BCR they would have, and these are based on the core scenario for the scheme.

3.11.4 The results are reported in Table 3-20.

Table 3-20 AMCB – high and low growth

Item	Benefits (£000s)		
	Low	Core	High
Accidents (not assessed by TUBA)[1]	75,725		
Construction (not assessed by TUBA)[2]	-17,843		
Greenhouse gases (not assessed by TUBA)[3]	-60,367		
Noise (not assessed by TUBA)[4]	481		
Air quality (not assessed by TUBA)[5]	-6,054		
Transport Economic Efficiency: consumer users (commuting)	34,074	38,215	42,687
Transport Economic Efficiency: consumer users (other)	22,623	25,344	27,908
Transport Economic Efficiency: business users and providers	134,883	151,099	168,783
Wider public finances (indirect taxation revenues)	35,265	37,054	38,402
Level 1 Present Value of Benefits **(PVB)**	218,777	243,653	269,721
Broad transport budget Present Value of Costs **(PVC)**	212,862		
OVERALL IMPACTS			
Level 1 Net Present Value (NPV)	5,915	30,791	56,859
Initial Benefit Cost Ratio (BCR)	**1.03**	**1.14**	**1.27**
Reliability benefits	£61,579		

Item	Benefits (£000s)		
	Low	Core	High
Wider economic benefits	£126,165	118,350	121,689
Level 2 PVB	406,521	423,582	452,959
Level 2 NPV	193,659	210,720	240,097
Adjusted BCR	**1.91**	**1.99**	**2.13**

Notes: All monetary values are expressed in 2010 prices, discounted to 2010.

3.11.5 The level 2 PVB, over the 60-year appraisal period, is £407 million for the low growth scenario and £453 million for the high growth scenario. The adjusted BCR for the low growth scenario is 1.91 and for the high growth scenario is 2.13.

3.11.6 As with the core scenario, the level 2 PVBs and BCR have decreased in comparison to those reported in the updated OBC. The reason for these decreases is as per the decrease for the core scenario.

3.11.7 Based on the initial BCRs in Table 3-20, the VfM for all three scenarios would be 'Low'. When the level 2 benefits are included in the adjusted BCR the VfM for the scheme across all three sensitivity tests would be 'Medium'.

3.11.8 When the level 3 benefits/disbenefits are accounted for in the VfM assessment then the scheme would be a 'Medium' value for money scheme for the low and high growth sensitivity tests.

3.11.9 With the current economic situation looking uncertain, the low growth situation could be used to provide an indication as to the VfM of the scheme if GDP growth is lower than forecast. If this were to occur, then the adjusted BCR would be 1.91 and even with level 3 benefits/disbenefits included in the VfM assessment the scheme would still be classed as a 'Medium' VfM scheme.

Transport decarbonisation sensitivity test

3.11.10 As stated in Section 3.1, following the release of DfTs' TDP, National Highways developed a sensitivity test to assess the impact that the TDP would have on carbon emissions and therefore the BCR. In addition, National Highways developed the Chief Analyst Carbon Valuation Toolkit v1.4; this includes the TDP sensitivity tests.

3.11.11 Table 3-21 provides the results from the TDP sensitivity test.

Table 3-21 Transport decarbonisation plan sensitivity test results

Assessment	Item	Total	CB3 (2018-2022)	CB4 (2023-2027)	CB5 (2028-2032)	CB6 (2033-2037)
Core Assessment	Net Carbon Impact (tCO2e)	671,322		23,372	59,263	60,452
	Net Present Value of Carbon Impacts (£2010 present values)	-£51,033,954				
	Upper TDP: Net Carbon Impact (tCO2e)	194,072	-	23,151	54,258	41,717

Assessment	Item	Total	CB3 (2018-2022)	CB4 (2023-2027)	CB5 (2028-2032)	CB6 (2033-2037)
Transport Decarbonisation Sensitivity Test	Upper TDP: Net Present Value of Carbon Impacts (£2010 present values)	-£18,856,808				
	Lower TDP: Net Carbon Impact (tCO2e)	103,566	-	20,490	37,422	21,736
	Lower TDP: Net Present Value of Carbon Impacts (£2010 present values)	-£10,756,680				

Notes: All monetary values are expressed in 2010 prices, discounted to 2010.

3.11.12 As shown in Table 3-21 the core road user greenhouse gas emissions have a disbenefit of £51 million. If the TDP is taken into consideration, then the greenhouse gas emissions decrease and therefore the disbenefits reduce to between £19 million and £11 million. This reduction in greenhouse gas emissions would have a positive impact on the BCR of the scheme. For both the upper and lower TDP values, the adjusted BCR would be between 2.18 and 2.22.

Switching analysis

3.11.13 Switching analysis assesses the increase/decrease in costs, in terms of PVC, or PVB that would be required for a scheme to be move into a higher or lower VfM category. This assessment is based on the level 2 PVBs.

3.11.14 For this scheme the switching analysis assesses what increase/decrease in costs or benefits would be required to improve the VfM assessment from 'Medium' to 'High' or from 'Medium' to 'Low'.

3.11.15 For the scheme the PVBs are £424 million and the PVC is £213 million.

Table 3-22 Switching value analysis

Value for Money	Low (adjusted BCR <1.5)	High (adjusted BCR >2.0)
Costs	Costs rise by £70m (33%)	Costs fall by £1m (1%)
Benefits	Benefits fall by £105m (25%)	Benefits rise by £2m (1%)

Notes: If disbenefits from landscape impact are considered, then the BCR needed for high would to be 2.25 and for low would need to be 1.75
Notes: All monetary values are expressed in 2010 prices, discounted to 2010.

3.11.16 As shown in Table 3-22 if a BCR of 2 is considered for the scheme to be assessed as a high VfM scheme, then the PVC would need to decrease by 1% or PVB would need to increase by 1%.

3.11.17 As shown in Table 3-22 if a BCR of 1.5 is considered for the scheme to be assessed as a low VfM scheme, the PVC would need to increase by 33% or PVB would need to decrease by 25%.

3.12 Economic dimension conclusion

3.12.1 The value for money assessment has been prepared by National Highways, in consultation with the DfT, and is in line with TAG and has considered the full range of economic, environmental, social and public accounts impacts of the

scheme. Costs and benefits have been quantified, or 'monetised' as part of a cost benefit analysis, wherever possible.

3.12.2 The economic, environmental and social impact assessments, and the underpinning analysis, provide a means of establishing how the scheme supports the project objectives and sub-objectives.

3.12.3 An analysis of the expected monetised benefits of the scheme shows an initial BCR of 1.14. Inclusion of wider economic impacts and reliability benefits produces an adjusted BCR of 1.99.

3.12.4 Indicative monetised impacts from landscape and carbon storage of -£40.4 million would also have the potential to impact on the BCR of the scheme.

3.12.5 The Natural Capital Assessment assessed 15 ecosystems, six were assessed as adverse, one as neutral and eight as beneficial.

3.12.6 Finally, out of 12 non-monetised environmental and social impacts, six are shown to be positive, one was scoped out and five are negative due to the impact of the scheme on the environment and the increased vehicle operating costs impacting on affordability.

3.12.7 Table 3-23 presents a summary of key monetised costs and benefits as set out in this economic dimension. Based on the monetised, indicative monetised and non-monetised impacts that the scheme is expected to deliver the scheme's final VfM category is considered to be Medium. The economic appraisal shows that the medium categorisation for the scheme is robust to a range of sensitivity tests as to be assessed as a 'Low' VfM scheme the benefits would need to decrease by £105 million.

Table 3-23 Summary of scheme economic appraisal (£000s)

Item	Impacts
Costs	
Core cost estimate	212,862
Journey times	272,338
Vehicle operating costs	-57,680
Accident benefits	75,725
Construction impacts	-17,843
Increase in pollution from higher speeds and flow	-66,421
Noise benefits	481
Wider public finances	37,054
Benefits included in initial BCR	243,653
Initial BCR	1.14
Reliability benefits	61,579
Wider economic benefits	118,350
Benefits included in adjusted BCR	423,582
Level 3 indicative monetised impacts (landscape monetisation assessment and natural capital assessment (carbon sequestration))	-47,637
Natural capital assessment	15 ecosystems assessed. Six are assessed as an adverse impact, one was assessed as neutral and

Item	Impacts
	eight are assessed as beneficial, see Table 3-17 for more details
Non monetised impacts	6 out of 12 are positive, one was scoped out and five are adverse see Table 3-14 for non-monetised environmental and Table 3-18 for non-monetised social impacts
Final VfM judgement	Medium

Notes: All monetary values are expressed in 2010 prices, discounted to 2010

4 Commercial dimension

4.1 Introduction

4.1.1 The commercial dimension outlines the viability of the scheme, and the procurement strategy used to engage the market. It provides the approach to risk allocation and transfer, contract and implementation timescales, as well as how the capability and technical expertise of the team delivering the project is secured.

4.2 Output specification

4.2.1 The scheme must be designed and constructed to current standards and must be compliant with the requirements of the Road Investment Strategy (RIS).

4.2.2 The procurement exercise undertaken ensures that the expertise required is obtained so that the scheme:

- is delivered within the budgets that are made available for RIS2
- achieves the objectives, as set out in the strategic dimension (Table 2-4)
- delivers best value
- delivers appropriate quality
- offers an affordable whole life cost solution with full consideration of future maintenance
- reduces risks to a level that is 'as low as reasonably practicable' (ALARP)

4.2.3 The successful delivery of the project objectives, at an outturn cost within the allocated budget of £250-500 million, will be determined by a number of factors that go beyond the chosen approach to the procurement strategy for the delivery of the project. For example, the form of contract on its own will not determine whether the project is successful.

4.2.4 Factors which will contribute to a successful outcome of delivery within budget, and which have been considered within both procurement and across the project as a whole, include the following:

- Clarity of objectives and common understanding by all parties
- Robustness of cost estimate, and achieving confidence that the scheme can be delivered within the funding package
- Adequacy of the risk allowance including allowance for inflation
- Effectiveness of project control processes including gateways
- Quality of the design, specification and contract documents
- Engagement with the supply chain and timing of the procurement process
- Compliance with procurement regulations and avoidance of challenges
- Appropriateness of the selection process and selection criteria
- Robustness of the tender assessment process
- Adequacy of the tender sum to deliver requirements
- Clear understanding and allocation of contractual risks allied to a fair and transparent risk management process
- Effectiveness of partnership and team working during construction
- Quality of the project and contract management
- Alignment of contractual performance incentives

- Early contractor involvement in the project development, planning and design stages to encourage innovation and input into the assessment of buildability and delivery risks
- Effectiveness of dispute avoidance and resolution procedures
- Health and safety considerations during construction
- Availability of the necessary resources.

4.3 Procurement strategy

PCF stage 0 to 2

4.3.1 Mott MacDonald Sweco Joint Venture was appointed as consultant to support PCF stages 0 and 1, and subsequently PCF stage 2, through Lot 1 (professional design and engineering services) of the Collaborative Delivery Framework (CDF).

PCF stage 3 to 5

4.3.2 Arup were appointed for PCF stages 3-4 using National Highways Lot 1 (professional design and engineering services) of the CDF. Arup were subsequently instructed for PCF stage 5 under the same framework.

4.3.3 National Highways managed the procurement process and selected the most suitable consultant on the basis of factors such as experience and availability of key staff, proposed methodology, and capacity and ability to deliver to the required timescale.

4.3.4 Taylor Woodrow provided contractor support at PCF stages 3 and 4. The contractor's scope at PCF stage 3 (preliminary design) was to progress the scheme design and assist in preparing the DCO application. During PCF stage 4 (statutory procedures and powers) the scope involved providing support to the project team and its legal advisors during the DCO application submission.

4.3.5 Subsequent to the project presenting an updated Commercial Case to DfTs Project Approval Board (PAB) on 1 October 2019, the project pursued an opportunity to appoint a Delivery Integration Partner (DIP) to undertake PCF stage 4 and beyond, via the Regional Delivery Partnerships (RDP) framework. This required the termination of the CDF contract with the previous supplier. The CDF contract allows termination by National Highways, but in this case, terms could not be agreed with Taylor Woodrow and National Highways continued with Arup in place for PCF stages 4 and 5 under the CDF contract.

PCF stage 5 to 7

4.3.6 A national procurement exercise was undertaken to identify a preferred contractor for the scheme. All tender submissions were sent to the National Highways commercial team for assessment and were assessed solely on quality, with the DIP having a pre agreed basket of goods rates. These rates differ based on overhead and profit and hence are not used as part of the award criteria. However, each must submit a budget, with a simple pass/fail check subsequently undertaken by National Highways to ensure these comply with the framework.

4.3.7 Following this process, Kier Highways Ltd (Kier) was appointed as DIP contractor for PCF stages 5 to 7 under National Highways' RDP framework in December 2021. The majority of the scope for detailed design at PCF stage 5 was transferred from Arup to Kier. This includes (but is not limited to) the Geotechnical

Investigation Report, Scheme Wide Geotechnical Design Report, S200 Site Clearance: Detailed Design for DF5 and IFC, S300 Fencing: Detailed Design for DF5 and the Big Cut and Crickley Hill catchment assessments.

4.3.8 The DIP subsequently formed an Integrated Project Team (IPT) consisting of Kier Design Services (KDS), RPS Group, Tony Gee and Partners and Arup. The key project workstreams along with workstream owner are listed in Table 4-1. The project organogram included at Figure 6-3 also provides further detail regarding roles and responsibilities.

Table 4-1 DIP workstream breakdown

Owner	Workstream
Kier Design Services (KDS)	Principal designer, highways de-trunking, pavements, lighting, electrical, Traffic Management design
Tony Gee and Partners	Structures, geotech, junctions and Local Authority highways
RPS Group	Mainline highways, geotech, drainage
Arup	Landscaping, archaeology, environmental survey management and mitigation, technical assurance support, statutory licenses and DCO integration

4.3.9 The key contract milestones are shown in Table 4-2. This shows that the contract length is currently estimated to be 75 months from contractor appointment in December 2021 to the completion of construction currently estimated for February 2028. It should be noted that under RDP there is no contract negotiation period.

Table 4-2 Key contract timescales

Activity	Date
Tendering process	September 2021
Tender evaluation	November 2021
Contractor appointed	December 2021
Completion of construction	RIS3

4.3.10 The contract form is under the New Engineering Contract (NEC4) – ECC Main Option C Target Contract with Activity Schedule.

4.3.11 Some of the additional conditions of contract (Z clauses) to the standard contract terms are noted in Annex two of the contract.

What is Routes to Market?

4.3.12 The Routes to Market programme was established in March 2016 to develop the most appropriate procurement routes for National Highways' major programmes of work arising from the RIS1 (2015-2020) and RIS2 (2020-2025) periods. Routes to Market was designed to provide a strong foundation for more collaboration, supported by appropriate contractual mechanisms to deliver programmes and programme level incentives. The programme has developed new procurement routes that are, since Spring 2018, replacing existing National Highways contracts.

4.3.13 The RDP is the main new procurement route that has been developed by the Routes to Market programme, covering the development, design and construction

of capital road projects. Contemporary market rates for a basket of good items and fixed price percentages formed part of the tender and are fixed for the duration of the Regional Delivery Partnership and are adjusted for inflation.

4.3.14 In accordance with His Majesty's Treasury (HMT) guidance, the commercial dimension describes the procurement route and delivery framework and procurement strategy ensuring the A417 scheme can:

- Drive progress towards National Highways being an intelligent capable owner that's easy to do business with.
- Develop relationships that allow businesses and people to thrive.
- Set industry standards to exceed investor expectations.
- Deliver RIS2 efficiency for the A417.
- Deliver viable and robust procurement that offers value for money.
- Deliver a solution that removes the inherent productivity shortfalls and optimises the capacity and utilisation of scale across a region.
- Optimise risk allocation between the public and private sector which will deliver the scheme's Client Scheme Requirements (CSRs).
- Meet the criteria for affordability and value for money.
- Aligns with National Highways' CSRs and objectives.

4.3.15 This commercial dimension has been developed in accordance with prevailing governmental guidance and with reference to learning outcomes from other large-scale infrastructure projects carried out in the UK, including RIP and wider project portfolio.

4.3.16 The commercial dimension considers the viable procurement options for the scheme – using the recently procured RDP framework in November 2018.

Procurement Options Considered

4.3.17 National Highways operates in accordance with the Public Contract Regulations 2015 and the procurement options considered were:

- Use the RDP framework solution which is a delivery framework designed and implemented by National Highways in 2017 and 2018 and has completed its procurement phase. It provides for a contractor – the Delivery Integration Partner (DIP) – to take a lead role in the early contractor involvement (ECI) design development and delivery of the specified works (including this scheme).
- Initiate a new standalone procurement where the commercial strategy is developed and moved through the full procurement cycle commencing with issue of a new Contract Notice in the Official Journal of the European Union (OJEU).
- Utilise another suitable framework available to National Highways.

4.3.18 The RDP approach provides distinct advantages for the scheme compared to a single OJEU approach, with the key areas described as follows:

- **Well-defined predictable solution**. By locking down costs as part of the competitive process and ensuring the incentive mechanism focuses on the overall scheme budget, the RDP provides a higher level of certainty for the scheme. The DIP is incentivised to deliver to this scheme budget and is rewarded by being given the opportunity for more potential follow-on work in

the National Highways portfolio without having to go through a procurement process again.

- **Direct link to improving BCR**. With RDP, the DIP is encouraged and awarded to improve the BCR, which includes wider economic benefits outside the scheme boundaries and benefits to the region as a whole.
- **Continuous improvement and innovation**. The performance management regime is designed to enable innovation and continuous improvement across the region with DIPs naturally incentivised to look for innovation in terms of how the work is delivered.
- **Productivity**. The opportunity to improve productivity as the RDP is embedded with better long-term planning and use of the same resource, increasing plant utilisation.
- **Design responsibility**. The DIP delivers the scheme under a wider fit-for-purpose obligation for the 'as built' scheme they deliver to perform and achieve the design life as intended. This was included as a core requirement of the RDP procurement, compared to a narrower good industry practice and reasonable skill and care obligation generally obtained under a standalone tender.
- **Best practice**. National Highways and the DIP have a unique opportunity to transfer good practice to the scheme by using proven approaches and methodologies from other regions.

4.3.19 The RDP framework provides 'contract ready' arrangements for the scheme with incentives, reporting, collaboration, and other provisions already agreed. These were designed for the RDP programme rather than this scheme in isolation, but National Highways considers these features to be applicable to the scheme.

4.3.20 The RDP has advantages over a standalone tender resulting from the incentives for the DIP to perform on this scheme supplemented by the programme nature of the framework that uses performance management and incentives to allocate future work under the framework. It also provides a strong incentive to deliver to schedule as the DIP has contracted to put their fee at risk. Conversely, a standalone tender could include bespoke incentives, reporting, collaboration, and other provisions that are tailored for this scheme, but would not have these programme advantages.

4.3.21 Procurement through the RDP framework also offers a number of scheme and programme level advantages, and hence has been used in this instance to contract a supplier to take the scheme design from the end of the Development Consent Order process, through design, construction, commissioning, and handover to National Highways for ongoing maintenance.

Procurement strategy conclusions

4.3.22 The proposed contracting approach and procurement solutions have been considered using National Highways' considerable experience and intelligence around delivery of highways works and commercial arrangements in place and available; in particular. the recently awarded RDP framework.

4.3.23 The RDP framework offers a ready to use basis for finalising the DIP contract award with a high level of certainty and is consistent with and aligned to National Highways' approach. It has the commercial terms, obligations, and incentives necessary for this scheme, and offers significant cost, schedule, risk, and

incentivisation advantages over the next best alternative of retendering as a standalone project.

4.3.24 The RDP structure allows the investment governance requirements of National Highways and the DfT, including development of this FBC based on RDP tendered rates, to be fully met. This includes the use of the notice to proceed break point mechanism included in the RDP framework contract.

4.3.25 The benefits and opportunities which exist within RDP arrangements offer significantly greater value than the alternative solutions.

4.3.26 Having completed the assessment to support this case, National Highways concluded RDP to be the right solution for the scheme and hence this was taken forward as the preferred approach with one of the RDPs for the South-West to commence construction preparation and complete the construction phases (PCF stages 5 to 7), noting the robust commercial protection measures in place to protect National Highways.

4.4 Social value

4.4.1 In delivering on apprenticeship targets, National Highways is committed to increasing the diversity of the sector's workforce and contribute to achieving the Transport Infrastructure Skills Strategy ambition for:

- 20% of apprentices recruited to be female by 2020, achieving parity with the working population by 2030.
- Meeting the Government's target for the number of Black, Asian and Minority Ethnic candidates undertaking apprenticeships.
- Identification and quantification of any additional outputs and how these will be delivered.

EDI Plan to be provided by DIP to PM

4.4.2 The contractor will assist National Highways in the achievement of its Equality, Diversity and Inclusion (EDI) objectives. The objective of National Highways is to embed the principles of equality, diversity and inclusion into all areas of its business, driving real change in how it works with its customers and communities, its supply chain and its employees. This will be done through working collaboratively with all project partners to ensure inclusivity and that the strategic road network is accessible and integrated for both its users and nearby communities.

4.4.3 To ensure that these principles are followed, within three months of the start date, the Contractor will confirm to the PM the plan to demonstrate how it will develop an iterative approach to supporting its EDI objectives through the life of the contract.

Social Value and Sustainability Lead

4.4.4 The A417 Social Value & Sustainability Lead will identify opportunities with other functions to support apprenticeships and as part of the social value plan, will maximise the use of local resources and suppliers, including opportunities for apprentices and graduate engineers with 20%, 100% and 40% resource allocation these groups between PCF stages 5-7 respectively.

4.4.5 As set out in further detail in Section 4.5, the project's Supply Chain Manager will work to develop a plan seeking to meet a target of 43% SMEs by 2024.

Community engagement plan

4.4.6 Community engagement will also be undertaken throughout future scheme stages, and a Community Benefits Plan (CBP) developed based on early and regular engagement with communities. This will help:

- build relationships and integrate with local community
- establish a programme of community engagement sessions
- elevate the scheme's community offer to leave a greater legacy

4.4.7 Further detail regarding future consultation and engagement is set out within Section 6.4.

4.5 Sourcing options

4.5.1 National Highways have and will continue to work with the supply chain community to understand the demands on them from across the industry, to understand potential resource requirements and to capture the appropriate risks on both a strategic and project basis.

4.5.2 During scheme delivery, the contractor will maximise the value of its in-house delivered services through engaging with partners as a single integrated delivery team.

4.5.3 Strategic subcontractors with local resources and knowledge will be utilised, including category management suppliers where appropriate, aligned with the specific needs of the A417 project. They have been chosen through use of their supply chain selection processes to ensure they bring significant value through provision of key specialist skills and experience, aligned collaborative behaviours and innovative solutions. The approach includes some of the subcontractors already engaged as part of the A417 programme.

4.5.4 To address resource demand risks from other major concurrent projects and other RDP projects, commitment will be gained through placing orders early and providing long term programme visibility.

4.5.5 The majority of the supply chain have local facilities and local Small and Medium Enterprises (SMEs) have been identified who can complement the strategic sub-contractors. During PCF stage 5, the DIP Supply Chain Manager will work to develop an SME plan to meet a target of 43% SMEs by 2024.

4.5.6 With the challenges of plant and material availability and inflation, the project supply chain strategy is based on early engagement. The DIP Supply Chain Manager and Commercial Manager have identified and secured strategic procurement options for required plant, materials and offsite fabrication facilities, ensuring resilience in each case by having at least two 'approved' suppliers.

4.5.7 For the duration of the project, challenges will be made to readiness by continually reviewing supply chain risks with suppliers to ensure visibility of pricing, supply or performance issues. All suppliers and the RDP will work together to identify bulk buying and early procurement options for key materials. For example, purchasing all barriers for several RDP projects to help assure supply and cost benefits.

4.5.8 Going forward, National Highways and its suppliers will undertake periodic reviews of both the marketplace and its risk registers to ensure the most recent positions are represented.

4.6 Pricing framework and charging mechanisms

Payment

4.6.1 Payment is made based on the price of work done to date, which varies for the development phase and the construction phase. During the development phase, payment is cost reimbursable based on the total of the amounts stated in the cash flow forecast, due on or before the assessment date. During the construction phase, payment is made on the total defined cost which the PM forecasts will have been paid by the Supplier before the next assessment date.

4.6.2 The contract also includes the flexibility on payment for landscaping aftercare.

4.6.3 If the final project cost is less than the budget, the Supplier receives a cost saving as stated in Table 4-3.

Table 4-3 Final project cost supplier share percentage

Budget share range	Supplier's budget share percentage
Less than 70%	0%
From 70% to 100%	20%

4.6.4 If the price for work done to date is greater or less than the target cost, the Supplier receives a saving or is liable for additional costs as stated in Table 4-4. In this instance both share percentages are 0%, which results in the Contractor being paid defined cost, plus fee (operating as a cost reimbursable contract).

Table 4-4 Work done to date supplier share percentage

Share range	Supplier's share percentage
Less than 100%	0%
Greater than 100%	0%

Delay damages and change events

4.6.5 There are no delay damages included within the contract for completion of the whole of the works.

4.6.6 If any variations or additional scope is added to the works information as a compensation event, then the agreed fee will be adjusted, and the contractor will be entitled to payment for any agreed additional works. Any change in scope and resultant compensation event would be reviewed by National Highways' independent technical advisors (Atkins) and independent cost consultants (Mace) and would need to be agreed between the PM and contractor.

Key performance indicators (KPIs)

4.6.7 The contract also contains the ability to reward the contractor for achieving targets set by National Highways through incentivisation on Key Performance Indicators (KPIs) as an additional payment through the contract.

4.6.8 The incentive schedule for KPIs is set out in Table 4-5.

Table 4-5 Incentive schedule for KPIs

KPI Target	Amount paid if target achieved
Additional Opportunity 1 (Interim Payment): Achieving SoW by the start of works date	5% of forecast Budget Saving[1]
Additional Opportunity 1: Achieving SoW by the start of works date	10% of Budget Saving or, if there is a Budget Overspend, one sixth of the Budget Overspend or of the Band 1 Limit (whichever is lower)
Additional Opportunity 2: Achieving Journey Time Reliability (JTR) during PCF Stage Two of the contract equal to or better than the JTR target	10% of Budget Saving or, if there is a Budget Overspend, one sixth of the Budget Overspend or of the Band 1 Limit (whichever is lower)
Additional Opportunity 3: Achieving Open for Traffic by the open for traffic date	10% of Budget Saving or, if there is a Budget Overspend, one sixth of the Budget Overspend or of the Band 1 Limit (whichever is lower)

1. Budget Saving is the amount (if any) by which the final Project Cost is less than the final Budget

4.6.9 A report of performance against each KPI will be provided monthly. If there is gain, they share the saving for incentives 1-3 (as per Table 4-5) based on a pass or fail assessment. If there is gain and all the metrics are met, the contractor could achieve 100% of the saving against the budget.

4.6.10 The PM will make a preliminary assessment of the budget share at the completion of PCF stage 5 using the current budget and the forecast final project cost.

4.6.11 A further preliminary assessment will be made following completion works (other than the section comprising landscaping aftercare). This share is included in the amount due following completion of the whole of the works.

4.6.12 A final assessment of the budget will then be made using the final budget and final project cost, with the share included in the final amount due.

4.7 Risk allocation and transfer

4.7.1 A key aim of the procurement process has been to allocate risk to the party who is best able to manage the risk. The appropriate allocation of risk was considered as part of the procurement strategy.

4.7.2 A detailed risk register has been produced as part of the wider project (the top ten ranked risks are included in the Management dimension in Table 6-6) in order to identify and assess the risks to the project's success. The project team have assessed the probability and impact of each risk and agreed risk mitigation strategies. A number of risks were identified on the project as being suitable for transfer to the contractor and risk allocation and ownership has also been identified within the register.

4.7.3 Some of the key commercial risks associated with the scheme are listed in Table 4-6, along with the contractual risk allocation.

Table 4-6 Commercial project risks

Risk title	Contractual allocation
Exceptional weather	Supplier

Market conditions affect labour land and materials cost	Employer
Unknown archaeology	Employer
Contaminated ground material	Supplier
Direct protestor action frustrating activities on site	Supplier
Utilities - additional diversionary works required	Employer
Detailed design increases construction costs	Employer
Risk of judicial review	Employer
Unforeseen invasive plant species	Employer

4.7.4 A single integrated team for PCF stages 5-7 will build on the collaborative working foundation already established in PCF stages 3 and 4 between National Highways and its suppliers and bring lessons learned from other projects.

4.7.5 The risk manager, appointed in September 2022, will work with the IPT to implement effective risk management through the project. Using a robust risk management framework, aligned to ISO31000, the risk manager will work with the project management team and continue to develop the Risk Management Plan (RMP).

4.7.6 The RMP lists all the design activities, identifies risks (through risk workshops) and considers possible 'worst case' scenarios, likelihood, severity and consequences; and identifies treatment and control measures.

4.7.7 The RMP will be continually reviewed throughout PCF stage 5, with risk reduction meetings held with the risk manager, integrated design manager, and risk owners to reduce the likelihood of occurrence by developing and implementing contingency plans, design reviews, and escalation.

4.8 Human resource issues

RDP Partnership Director Role

4.8.1 It is not anticipated that there will be any resourcing issues associated with this procurement/project.

4.8.2 Technical resources required to deliver the project, contract management and delivery of the complementary measures will be the responsibility of the contractor. The RDP Partnership Director will be accountable for resourcing across the RDP to ensure the optimum balance across all projects and will bring his experience of adopting this role on the A417 to develop and link project, RDP and regional resource plans to include all relevant project resources as well as National Highways and supply chain resources.

4.8.3 The contractor team has very good experience levels of similar schemes and their tender submission included a number of senior named staff, as well as the vast staffing pool available between contractor and key partners.

Resource and Resilience Plan

4.8.4 The contractor will produce a Resource and Resilience Plan to provide programme certainty and continuity, especially during PCF stage 5. This will include:

- Resource mapping and analysis including all parties to show availability and continuity throughout the programme.
- Using all suppliers' knowledge and resources to assure the critical path is on track, particularly during early mobilisation and transition stages.
- Engaging construction teams early to provide input into the developing design.
- Leveraging pre-existing relationships with key stakeholders.

4.8.5 This will be reviewed quarterly to ensure all emerging risks are identified and to assure continuity of appropriately skilled resources through all phases of the project.

4.9 Service support

4.9.1 At this stage, it is not expected that there will be a need for additional resource to support operations, nor in terms of monitoring and evaluation during roll-out or project closure. The appointed contractor tender submission includes clear roles and responsibilities set out between all those involved on PCF stage 5 of the A417 RDP Framework. Adequate resource is available to provide resilience and access to the resources required to deliver a project of this nature.

4.9.2 As outlined previously, the RDP partnership director will be accountable for resourcing across the RDP to ensure balance and resilience and will be supported by the planning manager. This means that resourcing gaps can be identified as soon as possible, and support drawn in should it be required.

4.10 Contract management approach

4.10.1 Effective contract management guidance is set out within The Sourcing Playbook - GOV.UK (www.gov.uk)[36] and its principles have been embedded within the contracting approach for the A417. Further guidance on the assessment, procurement and delivery of schemes is also set out within The Construction Playbook - GOV.UK (www.gov.uk)[37].

4.10.2 Contract management will be taken forward by National Highways (i.e. the project director) through use of CEMAR, a market-leading contract management solution. Specific working areas will be set up between the relevant parties, including Kier and National Highways, which will be used to raise early warnings and compensation/change events. The software ensures simplification of the management of contracts and ensures that commercial risk is minimised through improved contract compliance.

4.10.3 As set out in Section 4.6.6, a technical and commercial challenge process will be in place to deal with any change in scope and resultant compensation events. National Highways' independent technical advisors (Atkins) and cost consultants (Mace) will review and validate each compensation event and would then need to be agreed between the PM and the contractor.

4.10.4 As set out previously, the incumbent designer will be integrated into the established RDP Professional Services Alliance (PSA) for the duration of the A417 project to ensure efficiency and to maximise the value of all the work done to date.

[36]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/987353/The_Sourcing_Playbook.pdf
[37]https://www.gov.uk/government/publications/the-construction-playbook

4.10.5 The PSA comprises three major design houses in Kier Design Services (KDS), RPS Group and Tony Gee and Partners (TGP), providing exceptional capability, capacity and resilience across all disciplines relevant.

4.10.6 As part of the strategy to work across the RDP portfolio and encourage enterprise working, a partnership has been formed between Kier and RDP Band A contractor Volker Fitzpatrick (VF). VF have been a key contributor to the A417 Early Contract Involvement (ECI) process to date during PCF stage 5, working closely and collaboratively with Arup on project buildability, developing the design, detailed programmes, and validation of the Taking Over Certificate (TOC).

4.11 Best value

4.11.1 Up to PCF stage 5, an efficiency register has been utilised throughout the scheme design phase, with each efficiency having an owner responsible for realisation and progress reporting. Further detail regarding efficiencies (including monetary values) are set out in Section 5.4. Moving forward into PCF stages 5-7, the efficiency register will remain a live document and will be updated, with efficiencies mapped as part of the Building Information Modelling (BIM) 'digital twin' model to analyse them in context and highlight where efficiencies can be grouped together to add further value. A Building Information Modelling Execution Plan (BEP) has been produced, setting out how the DIP will collaboratively produce, share, and manage information to enable delivery of a complete, validated, and secure Project Information Model and Asset Information Model for the scheme.

4.11.2 To ensure that best value on scheme delivery is maximised, early engagement between all parties will ascertain the most efficient and expedient way to deliver the design. Maximising the value of in-house delivered services will be done through engaging the entire single integrated delivery team, who will meet on a bi-weekly basis to ensure any risks are identified and mitigated as soon as possible.

4.11.3 A Critical Challenge Team (CCT) will form an independent team to provide quarterly challenge throughout the project, with initial focus on challenging the design to ensure all High-Level Requirements (HLRs) and project objectives are achievable, maximising the value offered and driving best practice in key areas such as health, safety and environment, customer/communities and delivery. The team will include industry experts from within our organisations, key RDP leads and external experts across sectors to provide independent challenge focused on National Highways imperatives, RDP, HLRs and scheme objectives. The CCT will also continually challenge solutions prior to decision points to ensure stage gates are navigated successfully and will help identify innovations which can reduce cost and also further improve the benefits of the scheme.

4.12 Commercial dimension conclusions

4.12.1 Kier Highways Ltd (Kier) was appointed as DIP contractor for PCF stages 5 to 7 under National Highways' RDP framework in December 2021. The DIP subsequently formed an Integrated Project Team (IPT) consisting of Kier Design Services (KDS), RPS Group, Tony Gee and Partners and Arup.

4.12.2 The contract form is under the New Engineering Contract (NEC4) – ECC Main Option C Target Contract with Activity Schedule and is currently estimated to be for a duration of 75 months from contractor appointment in December 2021 to the completion of construction estimated for February 2028.

4.12.3 The scheme will deliver against National Highways' EDI objectives in terms of equality, diversity and inclusion. To maximise Social Value, an Employment and Skills Plan and a Community Engagement Plan will be produced and overseen by a dedicated Social Value and Sustainability Lead for the project.

4.12.4 The contractor will maximise the value of in-house services as far as possible, with local resources and knowledge also utilised. To address resource demand risks from other major projects, commitment will be gained through placing orders early and providing long term programme visibility. To provide further resilience, the DIP Supply Chain Manager and Commercial Manager have identified and secured strategic procurement options for required plant and materials by securing at least two 'approved' suppliers.

4.12.5 There are no delay damages included within the contract for the completion of the whole of the works. However, it does contain the ability to reward the contractor for achieving targets set by National Highways through incentivisation on KPIs as an additional payment.

4.12.6 A number of commercial risks have been identified for the project and recorded on the Risk Register. These have been identified early and a Risk Management Plan (RMP) has been produced to mitigate any potential impacts on the scheme.

4.12.7 No additional resource to support operations is likely to be required. Clear roles and responsibilities have been set out between all those involved on PCF stage 5 of the A417 RDP Framework with adequate resource available to provide project resilience.

4.12.8 CEMAR will be used by National Highways (i.e. the project director) to ensure appropriate contract management. A technical and commercial challenge process will be in place to deal with any change in scope and resultant compensation events, and National Highways' independent technical advisors and cost consultants will validate and assure these as they arise.

4.12.9 The scheme aims to deliver Best Value through use of a Digital Efficiency Register. Formation of a CCT will also provide challenge in terms of scheme design throughout the project lifetime, helping to maximise innovation and benefits, whilst also looking to introduce cost efficiencies where appropriate.

5 Financial dimension

5.1 Introduction

5.1.1 The financial dimension presents evidence of the scheme's affordability for the development and delivery stages. It includes information on the estimated scheme outturn cost and also identifies the budgetary arrangements and funding sources for the scheme.

5.2 Cost estimates

5.2.1 Cost estimates for the scheme have been prepared using Delivery Integration Partnership (DIP) cost forecasts. These have subsequently been assured by National Highways' Commercial team.

5.2.2 Key cost assumptions are as follows:

- All prices have been indexed to 2021/2022 prices as the starting point. Inflation predictions have been applied to the forward cost profile
- Reported costs are inclusive of inflation, derived through use of Estimated Final Cost (EFC) inflation indices
- Lands cost estimates have been identified and are included in the total scheme cost estimates
- The amount of land take required, and balance of work required inside and outside the existing highways boundary, will impact upon the VAT recoverability rate for the scheme
- Costs presented are inclusive of VAT (calculated at 83%) based on the construction value carried out inside and outside of the highway boundary. It has been assumed that VAT for all new bridges is non recoverable.

5.2.3 A breakdown of the cost estimates are provided in Table 5-1.

Table 5-1 Capital cost estimate (£ million)

Phase	Total including approval (£m)
Options	6.5
Development	[redacted]
Construction	[redacted]
Lands	[redacted]
Sub-Total	**463.5**
Portfolio Risk	[redacted]
Total	[redacted]

Source: National Highways

5.2.4 P-values for the scheme have been provided and a summary of the capital costs (including and excluding portfolio risk) are provided in Table 3-8, Section 3.6. The P-values are based on the pre-efficient Official Journal of the European Union cost estimate.

Changes in cost between IPDC

5.2.5 Table 5-2 shows the current cost estimate, against previous baselines agreed with IPDC's held between January 2020 and the next IPDC which is scheduled in December 2022.

Table 5-2 Summary of IPDC cost estimates

IPDC	Paper	Start of Works	OJEU (FaTS) Comparison Estimate	Latest Cost Estimate (ex. PR)	Latest Cost Estimate (incl. PR)
IPDC Jan 2020	OBC	Mar 2022	[redacted]	[redacted]	[redacted]
IPDC Feb 2021	OBC Update	Feb 2023	[redacted]	[redacted]	[redacted]
IPDC Dec 2021	Funding / Procurement	Mar 2023	[redacted]	[redacted]	[redacted]
IPDC Jun 2022	Contract Award Update	Mar 2023	[redacted]	[redacted]	[redacted]
IPDC Dec 2022	FBC	Mar 2023	[redacted]	[redacted]	[redacted]

Source: National Highways

Impact of rising inflation

5.2.6 Table 5-3 shows how EFC inflationary impacts will be managed and which risk pots will be drawn down from. It confirms that a total of £[redacted] has been allocated within the contract award value for managing inflation risk; £[redacted] (DIP inflation pot) and £[redacted] (client risk pot draw down).

5.2.7 Table 5-3 also includes additional inflation scenarios as sensitivity tests, to assess the impact of further rising inflation. Five scenarios are provided, between 1-5% above the EFC inflation index used. This shows that inflation would have to increase by an additional 5% (up to a value of £[redacted]) before it would be required to return to DfT/HMT to request additional funding.

Table 5-3 Inflation impacts

Inflation scenario	Inflation total (£m)	DIP inflation pot (£m)	Client risk pot draw down (£m)	NH CRR drawn down (£m)	Additional funding from DfT/HMT (£m)	Impact on contract award value (£m)	Contract award increase
Funding available	-	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
EFC (26 May 22)	24.3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
EFC +1%	31.0	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
EFC +2%	37.9	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
EFC +3%	45.0	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
EFC +4%	52.2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
EFC +5%	59.5	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Source: National Highways

5.2.8 EFC inflation indices for the EFC +5% scenario (i.e. at the rate where it would be required to return to DfT/HMT for additional funding) is shown below in Table 5-4.

Table 5-4 Inflation index (EFC +5% inflation index)

Inflation Profile	FY23/24 (£m)	FY24/25 (£m)	FY25/26 (£m)	FY26/27 (£m)	FY27/28 (£m)	FY28/29 (£m)	FY29/30 (£m)	FY30/31 (£m)	Total (£m)
EFC +5%	9.25%	8.53%	8.19%	8.32%	8.43%	8.53%	8.61%	8.68%	-

Source: National Highways

5.2.9 In summary, it is considered that appropriate measures have been put in place with additional funding allocated within the contract award value to mitigate against the impacts of further rising inflation.

5.3 Budget arrangements

5.3.1 Road Investment Strategy 2 (RIS2) was published on 11 March 2020 and sets a long-term strategic vision for the network. With that vision in mind, it then: specifies the performance standards National Highways must meet; lists planned enhancement schemes expected to be built; and states the funding that will be made available during the second Road Period (RP2), covering the financial years 2020/21 to 2024/25.

5.3.2 In total, RIS2 commits the Government to spend £27.4 billion during RP2. Some of this will be used to build new road capacity, but much more will be used to improve the quality and reduce the negative impacts of the existing SRN, so that every part of the country will benefit.

5.3.3 The scheme is identified in RIS2 in Part 3: Investment Plan, under the South and West section. It is referred to on pages 103 and 104 as a scheme committed in the RP2 funding period, citing the importance of the route to the local economy. RP2 provides funding for road schemes to start on site by 1 April 2025.

5.3.4 The budget set aside for the scheme is between £250-£500 million.

5.4 Funding arrangements

5.4.1 The funding arrangements for the scheme is summarised in Table 5-5.

Table 5-5 Summary of funding arrangements

Phase	Previously approved (£m)	Funding request (£m)	Total incl. approval (£m)
Options	6.5	-	6.5
Development	[redacted]	[redacted]	[redacted]
Construction	[redacted]	[redacted]	[redacted]
Lands	[redacted]	[redacted]	[redacted]
Sub-Total	**137.0**	**326.5**	**463.5**
Portfolio Risk	[redacted]	[redacted]	[redacted]
Total	[redacted]	[redacted]	[redacted]

Source: National Highways

5.4.2 Current and future stages of the project are to be funded by National Highways with approvals given by the DfTs IPDC, HM Treasury and the Cabinet Office. This follows a decision to classify the scheme as a Tier 1 scheme, due to its size and complexity with it being situated within an Area of Outstanding Natural Beauty (AONB).

5.4.3 Based on current estimates, the most likely outturn cost of the scheme is £[redacted] including portfolio risk. A proportion of these costs have been incurred during the RIS1 (2015-2020) period while the scheme has been developed. The remaining development and the majority of the construction costs are incurred during the RIS2 (2020-2025) period.

5.5 Budget, affordability and funding requirements

5.5.1 In creating National Highways and providing it with a licence to manage, maintain and improve the trunk road network on behalf of the Secretary of State for Transport for the period 1 April 2015 to 31 March 2020 (Road Investment Period 1), the Government provided a Statement of Funds Available for this investment period. For categorisation purposes, the scheme was placed within the RIS1 cost range of £250 - £500 million, with the PCF stage 3 design used to provide cost estimates for this FBC. Schemes identified in the RIS are assumed to be publicly funded.

5.5.2 The project is programmed for delivery during RIS2 and National Highways is reviewing its forward programme of work to manage its budget across portfolios. The project will forecast expenditure on a stage-by-stage, month-by-month basis, and report on actual expenditure against that operational plan forecast. Variances will be explained, with change managed appropriately, via National Highways governance processes.

5.5.3 The latest cost estimates suggest that the scheme outturn cost will be £[redacted], which includes portfolio risk. This places the scheme within the outlined budget of £250 - £500 million from RIS1.

5.5.4 As set out in Section 5.2, cost estimates also account for inflation forecasts and £[redacted] has been included for inflation risk within the Client Risk pot. A total of £[redacted] has therefore been set aside within the contract award value for managing inflation risk and providing additional resilience.

5.6 Efficiencies

5.6.1 An Efficiency Register is being used to capture efficiencies, with associated reporting information, value, evidence and approval information also included. Each efficiency is supported by justification as to why the entry is considered to be an efficiency. The National Highways efficiency reporting process has been reset for Roads Period (RP) 2. From RP 2 onwards, scheme efficiencies are divided into those previously identified within RP 1 (referred to as “RP1 carry over”) and those subsequently generated within Roads Period 2 (referred to as “RP2 generated”).

5.6.2 At time of writing, RP1 carry over efficiencies to the value of £4.8 million have been Level 2 (L2) assured for the project, i.e. have been assured by the Commercial Services team. The scheme target for RP2 generated efficiencies is £37 million. At the time of writing, £41.8 million of efficiencies have been L2 assured and are recorded on the Digital Efficiency Register (DER).

Table 5-6 Efficiencies summary

Efficiency	Value
Roads Period 1 (RP1)	£4.8m
Roads Period 2 (RP2)	£37m
Total	**£41.8m**

Source: National Highways

5.6.3 Moving forward into PCF stages 5-7, the A417 DER will capture, assess, and categorise any additional efficiencies. Each efficiency will have an owner responsible for realisation and reporting. Efficiencies will be mapped as part of the BIM 'digital twin' model to analyse them in context and highlight where efficiencies can be grouped together to add further value.

5.6.4 Monthly workshops will be held with efficiency owners to track progress and gather evidence. Targets and KPIs will be set for each efficiency to determine whether it is delivering value, if action is required to improve value, and whether the efficiency should be shared beyond the scheme. Outputs from these workshops will be reported as part of monthly efficiency register submission to National Highways.

6 Management dimension

6.1 Introduction and objectives

6.1.1 The purpose of the management dimension is to outline project management processes, governance arrangements for developing and delivering the scheme including organisational structure, demonstrate that timescales are realistic, highlight the key risks and risk management procedures, and demonstrate that a robust communications and stakeholder engagement strategy exists.

6.1.2 Separate documents, which are referenced throughout this section, have been prepared to ensure that the scheme is managed effectively – some of which are live documents which will be reviewed and updated continually throughout the remaining stages of the project. These are set out in Table 6-1.

Table 6-1 Scheme supporting documents

Document	Purpose
Project Plan/Programme	The project plan provides a detailed overview of the programme for the scheme, including scope of works and highlights the key project milestones.
Communications and Stakeholder Engagement Plan (CSEP)	The CSEP will be a live document, containing each communication and stakeholder activity (with identified owners). It will include a programme of communication events/activities designed to connect with key stakeholder groups, to inform and enhance trust and relationships.
Risk Management Plan (RMP)	The RMP identifies how risks and opportunities will be managed, monitored and reported. The Risk Register will act as a live document, with risks identified and updated (with clear owners) to ensure risks and managed and addressed.
Risk Register	
Digital Efficiency Register (DER)	Captures any potential project efficiencies that could be implemented to reduce the funding gap between the total outturn and the operational plan baseline cost.
BIM Execution Plan (BEP)	Outlines how the DIP will collaboratively produce, share and manage information. The BEP also provides a set of controlled processes with the assignment of functions and responsibilities for information creation and data integration at project initiation to deliver on project requirements.
Carbon Management Plan (CMP)	Sets out the current projected carbon emissions, proposed targets for carbon reduction, current and planned actions to achieve those targets, and the approach to implementation and communication.
Benefits Realisation Plan (BREP)	The BREP outlines the activities required to maximise the impact of benefits identified for the scheme to enable them to be planned, managed, and realised.

6.2 Project governance, organisation structure and roles

6.2.1 The scheme is being progressed by National Highways' South-West Major Projects team, in accordance with the National Highways Project Control Framework (PCF).

6.2.2 Due to its size and complexity, being situated within an Area of Outstanding Natural Beauty (AONB), the scheme moved into Tier 1 governance and assurance structure in April 2018. As a Tier 1 project, the ultimate authority to invest is granted by the DfT's Secretary of State (SoS) and the Chief Secretary to

HM Treasury. Prior to the Ministerial submission, approvals must be given at all levels of defence - the approval sequence is set out in Figure 6-1.

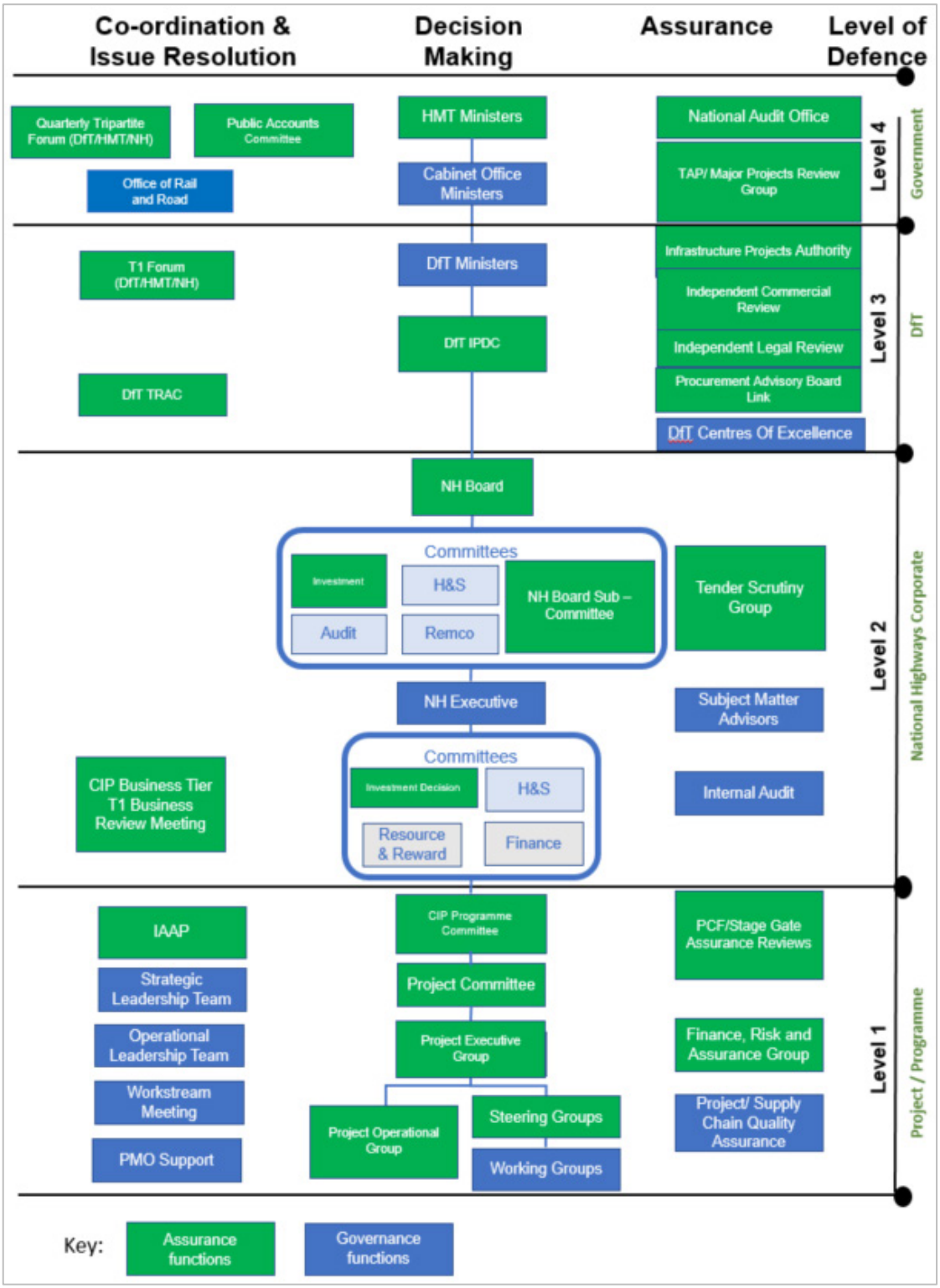


Figure 6-1 Project governance and assurance – Tier 1 model and document templates

6.2.3 A Stage Gate Assessment Review (SGAR) is held at the end of each PCF stage, with Independent Assurance Reviews (IARs) at set milestones (Figure 6-2).

6.2.4 The scheme has brought in additional resource to manage the requirements of the project. These services were procured by the project using the RIP Project

Controls Framework (PCF), via the southwest supplier Corderoy for the duration of PCF stages 3 and 4. Mace have replaced Corderoy as National Highways' independent cost consultants going forward for PCF stages 5-7.

6.2.5 In addition, in Q2 2020/2021 the A417 scheme entered the Government Major Projects Portfolio (GMPP).

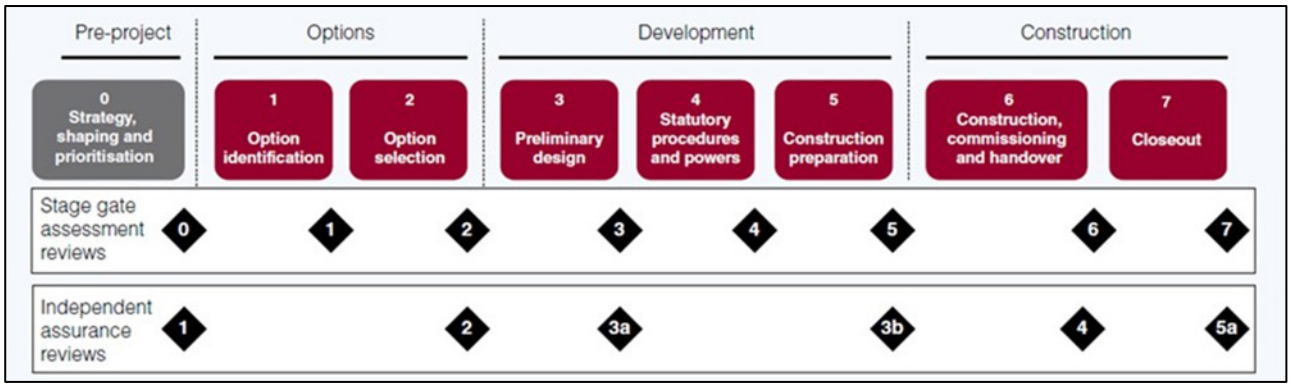


Figure 6-2 PCF stages

Reviews completed

6.2.6 PCF Stage Gate Assessment Review (SGAR) 0 was completed successfully in June 2016, followed by SGAR 1 in January 2018. An IAR was undertaken in June 2018 with an amber/red outcome and an action plan in progress to close these out.

6.2.7 SGAR 2 took place in December 2018 with an amber outcome.

6.2.8 An IAR 3a was held in October 2019 and gave an Amber rating. All the recommendations were subsequently completed to the satisfaction of the Senior Responsible Owner (SRO). A further IAR 3a was undertaken in December 2020 with Green/Amber rated outcomes and have since been completed to the satisfaction of the SRO.

6.2.9 SGAR 3 took place in May 2021 with a green outcome and an updated IAR (3b) is due to be completed in October 2022.

6.2.10 In addition to these reviews, the scheme design has been reviewed three times by the Design Panel Review (DPR). The first DPR was in April 2019, the second in November and the third in February 2021.

Reviews relating to this business case stage

6.2.11 SGAR 4 is scheduled for December 2022 and SGAR 5 (interim) is due to take place in December 2022.

6.2.12 IAR 3b was held in October 2022 and received a green rating for delivery confidence.

DfT's Investment Portfolio and Delivery Committee (IPDC)

6.2.13 In April 2018 the DfT's IPDC formally agreed that improvements to the Existing A417 should be classified as a Tier 1 scheme. This new classification will require key decisions and governance points to be reviewed by IPDC before approval is sought from DfT Ministers, Cabinet Office and HM Treasury.

6.2.14 Following the IPDC in early 2020, the OBC was approved, but on the condition that it is revised to reflect a de-risked schedule, as proposed by National Highways. This de-risking of the schedule was the change in the design of the scheme, in particular the removal of the Green Bridge onto National Trust land, the change in gradient from 7% to 8% thereby reducing the amount of excess material and the delay in the DCO submission to allow more time for completion of surveys.

6.2.15 It was also requested that the scheme returns to the DfT and HM Treasury for approval, should the BCR fall to 1.5, or costs rise by 10% before the next formal decision.

6.2.16 In November 2020 the scheme went to IPDC for the design changes to approve the revised programme including the revised Start of Works (SoW) in Q4 2022-2023 and Open for Traffic (OfT) in RIS3. These changes to the programme were approved.

6.2.17 In July 2022 National Highways went to IPDC for continued funding for the scheme. The outcome of this was approval of the re-baselined cost estimates and Tier 1 Trigger points. It should be noted that National Highways are returning through Tier 1 governance as instructed by IPDC and HMT, to provide an update on the contract award costs profile and schedule.

Government Major Projects Portfolio (GMPP)

6.2.18 In Quarter 2 2020/2021 the project entered the GMPP. The Independent Project Authority (IPA) advised they wish to carry out an Assurance Review in late December/early January to support the DfT/HMT approvals in February/March 2021.

6.2.19 The project team have attended site visits with the National Trust to both the A303 Stonehenge Project and to the A354 Weymouth Relief Road to discuss stakeholder views on environmental and landscape good practice and capture lessons learnt. Following the success of these visits a series of individual site visits to the A417/A419 route at Air Balloon roundabout have taken place with the various environmental stakeholders to discuss what they value in the landscape.

Design panel reviews

6.2.20 Three DPRs were undertaken during PCF stages 2 and 3. The first was undertaken in April 2018 prior to the Preferred Route Announcement (PRA), the second was in November 2019 on the 7% gradient scheme and the final review was February 2021 on the 8% scheme that was submitted for DCO in May 2021.

<u>April 2018 design panel review</u>

6.2.21 The first DPR was undertaken prior to the preferred route announcement and compared the two main options. The outcome of this DPR was that the panel advised that landscape considerations should drive the design of whichever option was selected. The scheme also needed a design narrative and visualisations of key structures and intersections.

<u>November 2019 design review panel</u>

6.2.22 At this point of the DPR the scheme had moved into PCF stage 3. The DPR noted that the design team had changed and that the new team had challenged the brief

to provide more emphasis to all users and that new emphasis was applied to landscape and biodiversity.

February 2021 design review panel

6.2.23 At the third DRP it was agreed that the scheme was a genuinely landscape-led scheme that could become an exemplar design. The change in the road gradient from 7% to 8% was seen as better for the visual landscape and driver experience. The continued refinement of structures was also seen as a positive.

6.2.24 The DPR did advise on certain aspects to be considered for the next stage, these being:

- a narrative to explain the design
- more work needed to green the Cotswold Way crossing
- walkers, cyclists and horse riders should be considered separately at the next stage as their needs are very different
- actively assess sections of the road that would no longer be part of the network as these still need to work positively for those who continue to use them as local routes

DCO Submission

6.2.25 As set out in more detail in Section 2.2, PCF stage 3 (preliminary design) completed in May 2021 with the submission of the Development Consent Order (DCO) application.

6.2.26 On 16 August 2022, the Examining Authority issued their Recommendation Report to the Secretary of State which recommended that the DCO should be granted[38]. On 16 November 2022 the Secretary of State granted development consent for the scheme as set out in the Secretary of State's Decision Letter[39].

PCF stage 5 review and evaluation

6.2.27 At the start of PCF stage 5, an Innovation 'Challenge' was launched to further review the scheme design. The purpose of these is to provide a fresh pair of eyes and ensure that innovation opportunities are maximised within the design, provide programme and costs savings/certainty and drive environmental enhancements. Continuous reviews will also be undertaken throughout the life of the project at appropriate stages.

6.2.28 During PCF stage 5 of the project, design assumptions and proposed solutions will be continually challenged throughout the remainder of the project and as it develops with a focus on construction phasing and methodology reviews to ensure predicted timescales are reasonable and that resources are available. This will be undertaken by a Critical Challenge Team (CCT) to provide independent quarterly challenge and ensure benefits are maximised.

6.2.29 Budgetary requirements will be assessed through quarterly defined cost audits.

[38] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010056/TR010056-001892-20221116_TR010056_A417_Missing_Link_Recommendation_Report.pdf, accessed 21 November 2022
[39] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010056/TR010056-001898-20221116_TR010056_A417_Missing_Link_SoS_Decision_Letter.pdf, accessed 21 November 2022

6.2.30 Weekly buildability reviews will also be undertaken along with commercial, design and operational teams to provide early indications of issues and agree recovery plans.

Organisational structure and roles

6.2.31 National Highways has nominated Dean Sporn as the scheme's Senior Responsible Owner (SRO). The SRO is accountable to National Highways' Committee and will ensure successful project delivery. The SRO will ensure that the scheme maintains its business focus and has clear authority. The SRO is able to make key decisions and provide leadership and direction.

6.2.32 The project committee supports the SRO. Chaired by the SRO, the project committee takes a forward-looking perspective on the project and advises the SRO on the overall strategic direction, notably in the development of stakeholder support and the case for the scheme.

6.2.33 The SRO will also be supported by the Regional Delivery Director (RPD) and Project Director (PD), who will take overall responsibility for the successful delivery of the scheme.

6.2.34 National Highways have also nominated a PM who runs the project on a day-to-day basis within the constraints laid down by the project committee and the SRO. The PM ensures that the project produces the required products within the specified tolerances of time, cost, quality, scope, risk and benefits and ensures that a result is produced which can achieve the benefits defined in the business case.

6.2.35 The PM will report to the PD and will be supported by internal business support and assurance through Safety, Engineering and Standards including:

- Safer Roads Group
- Environment Group
- Strategy and Planning -Transport Planning Group
- Commercial Services and the Operations Directorate

6.2.36 In addition to the PM and SRO, is the project sponsor. Key responsibilities of the project sponsor are to oversee business case development, secure funding for the project and undertake post-completion benefit reviews. Once the FBC has been completed, the project sponsor will continue to remain involved and will support the risk and baseline change management process through liaison with the entire Integrated Project Team (IPT).

PCF stage 5 Organisational Structure

6.2.37 Workstream roles and responsibilities have been previously set out in the Commercial dimension at Table 4-1. The scheme organogram for PCF stage 5 is shown in Figure 6-3.

6.2.38 National Highways reviews project governance structures periodically and makes changes as required.

6.2.39 For PCF stages 5-7 of the project, the main appointed contractor (Kier) will integrate the incumbent designer, Arup, into the established RDP Professional Services Alliance (PSA).

6.2.40 The PSA comprises three major design houses in Kier Design Services (KDS), RPS and Tony Gee and Partners (TGP), providing significant capability, capacity, and resilience across all relevant disciplines. Kier have also formed a partnership with RDP Band A contractor Volker Fitzpatrick (VF). VF have been a key contributor to the A417 ECI process to date during PCF stage 5, working closely and collaboratively with Arup on project buildability, developing the design, detailed programmes, and validation of the Taking over Certificate (TOC).

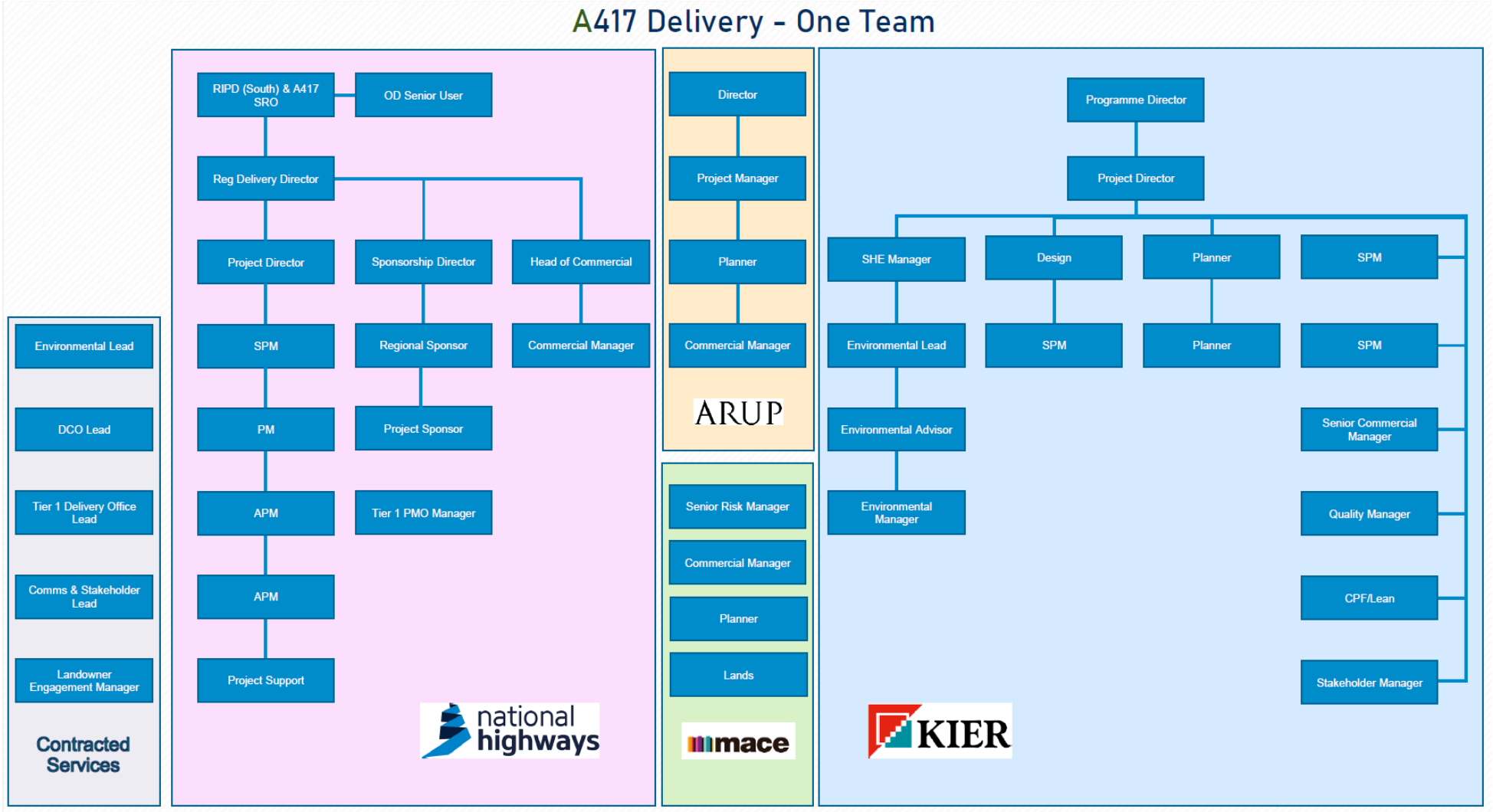


Figure 6-3 A417 organogram

6.3 Project plan

6.3.1 A detailed project schedule has been produced, which sets out the key project tasks, their duration as well as key project milestones. The schedule is considered to be a live document with progress on planned task completion being monitored against actual progress by the PM. The PM will also report progress against the plan to the wider project team. Progress against these programmes is being reviewed monthly along with regular reviews which help to manage overall risk to the scheme.

6.3.2 A series of project milestones have been agreed between National Highways and DfT. These include:

- Preferred route announcement: March 2019
- Start of Works (SoW): March 2023
- Open for Traffic (OfT): RIS3

6.3.3 Planned start and end dates for each of the PCF stages are shown in Table 6-2 and milestone dates from the strategic programme are shown in Table 6-3. PCF stage 5 (construction preparation) commenced in December 2021 and is due to be completed by September 2024. PCF stage 6 (construction phase) is due to start in March 2023, with completion currently expected in RIS3. It should be noted that the overlap between PCF stages 5 and 6 is due to early construction works that can be undertaken on site e.g. site clearance which can start whilst construction preparation continues.

6.3.4 PCF stage 7 (Close-out) is due to take place In RIS 3.

Table 6-2 PCF stage dates

PCF stage	Start	End
PCF stage 1 (option identification)	Sep-16	Jan-18
PCF stage 2 (option selection)	Mar-18	Dec-18
PCF stage 3 (preliminary design)	April-19	May-21
PCF stage 4 (statutory procedures)	May-21	Dec-22
PCF stage 5 (construction preparation)	Nov-21	Sept-24
PCF stage 6 (construction phase)	Feb-23	RIS3
PCF stage 7 (close-out)	RIS3	RIS3

Table 6-3 Milestone dates

Milestone	Date
SGAR 1	Jan-18
SGAR 2	Dec-18
Preferred Route Announcement	Mar-19
Pre-application consultation	Sept/Oct-19 and Oct/Nov-20
SGAR 3	May-21
DCO application	May-21
Secretary of State decision	Nov-22
SGAR 4	Dec-22

Milestone	Date
SGAR 5 (interim)	Dec-22
SGAR 5	Sep-24
Construction start	Mar-23
SGAR 6	RIS3
SGAR 7	RIS3

6.4 Communications and stakeholder management

PCF stage 1 to 4 public consultation strategy

6.4.1 A public consultation strategy was developed at PCF stage 1 with two key components. The first involved pre-consultation engagement with local political and community leaders (July 2017 to November 2017). The second component involved a six-week public consultation period (February 2018 to March 2018). Individuals and organisations were able to respond and provide feedback through a variety of communication channels, including stakeholder meetings, staffed public exhibitions, events for affected landowners, scheme newsletters and brochures, social media, and press releases.

6.4.2 For PCF stage 3, a Statutory Consultation Strategy was developed to set out how National Highways will fulfil its statutory duties under the Planning Act 2008 to conduct pre-application consultation. A Statement of Community Consultation, a statutory requirement of the Planning Act 2008, set out the specific activities to be undertaken as part of the statutory consultation, and this was developed through engagement with Gloucestershire County Council, Tewkesbury Borough Council and Cotswold District Council.

6.4.3 The 2019 statutory consultation ran between 27 September and 8 November 2019 and sought feedback on the scheme design that had been developed following the 2018 non-statutory consultation and subsequent Preferred Route Announcement. In total, there were seven public information events held during the consultation and there were 1,520 attendees to these events in total. National Highways received a total of 903 responses to the consultation – via the online and freepost feedback form, email and letter.

6.4.4 In 2020, a supplementary public consultation was undertaken between 13 October and 12 November 2020, seeking feedback on the design changes to the scheme made since the 2019 statutory consultation. Due to the Covid-19 pandemic, National Highways took a ‘digital first’ approach to the consultation. As face-to-face public events in the locality of the scheme were not possible, National Highways created a virtual exhibition room which was open 24/7 during the consultation period and provided all of the consultation material in an interactive manner, including a fly-through visualisation of the scheme and an interactive viewpoints map. The Preliminary Environmental Information (PEI) report was also presented digitally, with the information presented in a more interactive and accessible format, with the option to download individual sections or the full report. A feedback form was available to fill out online as a survey throughout the consultation period.

6.4.5 To provide access to further information, and a chance to speak directly with the project team, National Highways ran five live online events between 19 and 23 October 2020, focused on particular themes. These included the opportunity for

live Q&A with the team. In addition, 17 scheduled online webchats throughout the consultation period enabled members of the public to have a live conversation with members of the team, as well as an option to submit queries at any time outside of the scheduled live sessions. A project email address was provided to contact the team with queries or submit feedback.

6.4.6 National Highways has also recognised the need for more traditional methods of communication, so throughout the consultation period there was always an option available to request hard copies of the consultation brochure, feedback form and materials from the PEI report. Feedback was also able to be submitted by post. Finally, members of the public could request a phone call (including a video call if preferred) with members of the team via the National Highways phone line, email address or webchat. National Highways received a total of 433 responses to the supplementary consultation.

DCO application

6.4.7 A Consultation Report[40] was prepared by National Highways to accompany the application for the DCO for the scheme. This sets out a detailed account of all pre-application consultation activities carried out by National Highways prior to the submission of the DCO Application.

6.4.8 On 16 November 2022 the Secretary of State granted development consent for the scheme as set out in the Secretary of State's Decision Letter[41].

Environmental Impact Assessment (EIA)

6.4.9 Consultation and engagement activities were also undertaken with regard to the EIA process.

6.4.10 The scheme currently under consideration would be classed as a Nationally Significant Infrastructure Project (NSIP) under the Planning Act 2008 Section 2 as amended by The Highway and Railway (Nationally Significant Infrastructure Project) Order 2013. As a result, a DCO application to the Planning Inspectorate was submitted for the scheme in May 2021.

6.4.11 An EIA and Environmental Statement (ES) was prepared to support the DCO application. This was carried out in accordance with the requirements of the Infrastructure Planning (EIA) Regulations 2017.

6.4.12 At PCF stages 1 and 2, an Environmental Scoping Report and Environmental Assessment Report were prepared. When combined, the main purpose of these reports is:

- To identify and report the baseline condition of the existing environmental asset.
- To determine which (if any) environmental topics will require further examination in the course of the Environmental Impact Assessment.
- To inform project and design managers of all relevant environmental constraints present, ensuring adverse effects can be reduced, and that the environmental assessment process is iterative.

[40] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010056/TR010056-000184-5.1%20Consultation%20Report.pdf
[41] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010056/TR010056-001898-20221116_TR010056_A417_Missing_Link_SoS_Decision_Letter.pdf, accessed 21 November 2022

- To identify if there are any opportunities for environmental enhancement associated with the site of proposed works that could simply be incorporated into the proposed design.

6.4.13 At PCF stage 3, a Preliminary Environmental Information (PEI) Report was produced prior to Statutory Consultation with an updated PEI report prepared for the supplementary consultation in October/November 2020. The PEI Reports enables the local community and any other interested persons and stakeholders to understand the environmental effects of the scheme and enable an informed response to consultation. The PEI Report sets out how each environmental topic is assessed, potential environmental impacts and the measures proposed to avoid or reduce these impacts.

6.4.14 Following submission of the PEI Report, an Environmental Statement (ES) was submitted as part of the DCO submission. This set out the baseline (updated from that reported in PCF stage 2 with new survey data) impact the scheme would have on the environment and mitigation proposed to reduce the impact of the scheme on the surrounding area.

6.4.15 Following the end of PCF stage 4, an Evaluation of Change Register was developed to review and assess any design changes coming out of the DCO examination and continued consultation with stakeholders. Further information regarding EIA consultation is included within the Consultation Report.

6.4.16 For PCF stage 5, there is no requirement for an ES, but during this stage the Environmental Management Plan and the Project Design Report are produced and the Evaluation of Change Register is refined to account for changes during detailed design.

Equality Impact Assessment

6.4.17 An Equality Impact Assessment (EqIA) has been undertaken for the scheme and was submitted with the DCO Application (Document reference 7.8). An EqIA is a systematic assessment of the likely or actual effects of policies or proposals on social groups with characteristics protected under the Equality Act 2010. These groups are:

- age
- disability
- gender reassignment
- marriage and civil partnership
- pregnancy and maternity
- race and ethnicity
- religion and belief
- sex, and sexual orientation

6.4.18 The project must demonstrate that equality, diversity and inclusion issues have been taken into consideration during the development and delivery of the project.

6.4.19 Aspects of the EqIA are being completed during each stage of the scheme. At PCF stage 1, EqIA screening was undertaken following option selection. The PCF stage 1 Equality Impact Screening report concluded that the scheme has the potential to impact on groups with protected characteristics, and that equality diversity, and inclusion issues are likely to be a factor in effective scheme delivery.

6.4.20 At PCF stage 2, a full EqIA was undertaken for the options to assess the impact of these options on those social groups with protected characteristics. The PCF stage 2 identified a potential for temporary negative impacts during the construction period, relating to an increase in both noise and air pollution, disruption to access of community facilities used by protected characteristic groups and a change in road layout affecting driver confidence. However, the potential for permanent negative impacts is less significant, relating primarily to impacts on driver confidence for older age groups and air quality at a regional level. The EqIA identifies various activities, with recommended completion dates, to be undertaken by the project team to address potential negative impacts and deliver positive outcomes

6.4.21 At PCF stage 3, a full EqIA was undertaken for the scheme and was included in the DCO submission. The PCF stage 3 EqIA took the PCF stage 2 EqIA and updated the assessment based on the current scheme design. The PCF stage 3 EqIA identified risks during construction and operation with these risks being in line with those identified at PCF stage 2. Recommendations for activities, during construction and operation, to address any potential negative impacts or risks were outlined in the EqIA.

6.4.22 In summary, the embedded mitigation measures detailed in the Environmental Statement (DCO Application Document Reference 6.2) and accompanying documents, together with recommendations outlined in the PCF stage 3 EqIA, will provide benefits to, and help minimise any adverse impacts upon groups with protected characteristics. Full customer and stakeholder engagement can be evidenced in the EqIA with those likely to be affected by the scheme.

6.4.23 The EqIA will continue to be reviewed, updated, and approved during the lifecycle of the scheme.

PCF stage 5 consultation and construction strategy

6.4.24 A Communications and Stakeholder Engagement Plan (CSEP) for PCF stage 5 has been produced.

6.4.25 The contractor will take forward responsibility for all consultation activities.

6.4.26 A summary of the roles and high-level responsibilities of those involved in stakeholder engagement is set out in Table 6-4.

Table 6-4 Stakeholder/engagement roles and responsibilities

Owner	High level responsibility
Communications and Stakeholder Manager (C&SM)	The C&SM will work with various disciplines to update and implement a CSEP. They will ensure alignment with NH stakeholder processes and communication teams and ensure integration and coordination with design and construction programme, through involvement in design team meetings.
Communications and Project Liaison Officer	Main responsibilities will be to provide support the C&SM to ensure the day-to-day stakeholder operations are delivered operationally. They will also be responsible for being the first point of contact for all general public and stakeholder queries.
Community Benefits Lead (CBL)	The CBL will lead on the development of a Community Benefits Plan (CBP) based on early and regular engagement with communities. The key aims for the CBL will be to build relationships

Owner	High level responsibility
	with local communities and groups, establish engagement sessions and elevate the community offer to leave a legacy.

6.4.27 Leading the communications and customer team, the DIP Communications and Stakeholder Manager (C&SM) will develop and deliver a Contract Communications Strategy and plans based on active and visible communication and engagement.

6.4.28 The C&SM will work with the National Highways Communications Team and key disciplines on consultation and engagement. A CSEP has been produced, setting out recommendations for stakeholder engagement and communications for the scheme during PCF stage 5 and outlines the key stakeholder groups (internal and external). It is the intention that this remains a live document and is updated at major milestones to adapt and react to challenges presented.

6.4.29 Going forward, the C&SM will manage a team that includes a Communications and Project Liaison Officer (PLO) lead and a sub-team of stakeholder interface leads, including land, environment, local authorities and a Design, Build, Finance and Operations (DBFO) team who will manage key interfaces and relationships.

6.4.30 Early engagement with other teams, such as Communication and Stakeholder Management and Early Works and Construction teams will also be undertaken to ensure the design fully considers stakeholder feedback from the DCO, stakeholder requirements and design to budget.

6.4.31 In addition to the above, the CBL will develop and own a CBP based on early and regular engagement with communities. They will work with the Communications and PLO Lead to enhance communication activities.

6.4.32 To ensure effective engagement, the project team will develop and implement a number of products including:

- An online ‘Now and Next’ section of the project webpage with monthly reviews and amendments. A customer interactive web page will also be used to inform of project updates and give customers the opportunity to comment and ask questions.
- Regular, pre-prepared web / feature copy and information for partners to cascade that provides updates on the project progress
- An enhanced project newsletter that effectively showcases the project
- Regular local radio slots
- Regular project information provided to parish councils including newsletters

6.5 Programme/project reporting

6.5.1 A range of project reports will be produced during PCF stage 5 on a regular basis to record progress against schedule and cost forecasts. Regular reports are summarised in Table 6-5.

Table 6-5 Regular reports

Report	Description	Occurrence	Owner
Monthly Project Programme	Monthly project progress/programme to be submitted via CEMAR	Monthly	Project manager
CPF	Quarterly submission of commercial performance against targets	Quarterly	Project manager
Quality Reporting	Monthly submission of scheme Quality Points register	Monthly	Quality manager
Issues Log	Issues log to be sent to the National Highways team on a weekly basis	Weekly	Project manager
Apprentice Performance Monitoring	Monitoring report detailing annual performance against the annual proposal in respect of each apprentice appointed	Quarterly	Social value & sustainability lead

6.6 Risk management strategy

Risk management

6.6.1 The risk management process aims to identify and manage all foreseeable risks and opportunities in a manner which is proactive, effective and appropriate, in order to maximise the likelihood of the project achieving its objectives, while maintaining risk exposure at an acceptable level. The risk management process aims to engage all project participants appropriately, creating ownership and buy-in to the project and to risk management actions.

6.6.2 The risk management process enables project participants to focus attention on those areas of the project most at risk, by identifying the major risks and opportunities and strategies for managing them. The process covers all activities undertaken by the project team during the lifetime of the project. Risk-based information is communicated to project stakeholders in a timely manner at an appropriate level of detail, to enable the project strategy to be modified in the light of current risk exposure.

PCF stage 4 risk management

6.6.3 The project RMP was updated at PCF stage 4 to provide an overview of how risks are being managed, monitored and reported on the project. The plan sits alongside a Risk Register which was managed through Xactium and reviewed/updated monthly.

6.6.4 The ‘top risks’ reported to the DfT at PCF stage 4 are as follows:

- failure to deliver A417 scheme Open for Traffic (OfT) within RIS2
- surveys, such as GI and ecology surveys could be delayed and key milestones (such as DCO and SoS decision) may be missed
- cost risk, particularly relating to construction price inflation
- programme delay resulting in failure to achieve delivery

PCF stage 5-7 risk management

6.6.5 The scheme will be implemented in accordance with the Construction (Design Management) Regulations 2015 and all relevant Health and Safety legislation. It is essential that risks are mitigated to levels that are 'as low as reasonably practicable' from the concept and design phases to opening and maintenance. A proactive approach is being taken through the design process to identify, mitigate and/or eliminate all risks associated with the design.

6.6.6 The Risk Register has now been transferred to the contractor and will be continually updated throughout the remaining stages of the project, using Xactium. The top 5 risks in terms of expected monetary value (EMV) have been extracted and are listed in Table 6-6.

Table 6-6 Top 5 risks

Risk	Cost EMV (Current)
Detailed Design increases construction costs	[redacted]
Market conditions affect labour, land and materials costs	[redacted]
Rising energy costs impact building material production	[redacted]
DCO successful legal challenge	[redacted]
Delay to DCO decision overlaps updates to the National Policy Statement for National Networks (NPSNN)	[redacted]

6.6.7 To mitigate the above risks between PCF stages 5-7, risk workshops and dedicated risk review meetings with the project risk manager (PRM), project management team and design and construction teams will take place bi-weekly and repeated through the project life cycle at regular intervals. The collaborative session will review progress on risks and produce forward plans including design and construction teams.

6.6.8 The PRM will implement effective risk management through the project. Using a robust risk management framework aligned to ISO31000, they will work with the project management team to continually update the Risk Management Plan (RMP).

6.6.9 The RMP will be frequently reviewed, with risk reduction meetings held with the PRM, Integrated Design Manager, and risk owners to reduce the likelihood of occurrence by developing and implementing contingency plans, design reviews, and escalation.

Opportunities and efficiencies management

6.6.10 As part of the risk management process, National Highways identifies opportunities and efficiencies. The minimum efficiency contribution required for the scheme in RIS1 was £1.15 million. There is also an initiative and challenge to find 25% time and costs saving for options and development work across all schemes. In RIS1, the scheme supported National Highways' efficiencies target by identifying £1.15 million of efficiencies. For RIS2 National Highways have identified efficiencies in the region of £42 million.

6.7 Contingency Plan

6.7.1 If the scheme is not delivered, the current level of service provided by the existing highway infrastructure would continue to act as a barrier to the sustainable development of the area, restricting economic growth. If for any unforeseen reason the scheme is put on hold, it will have been developed to a suitable stage to place on hold until such time that it can be taken forward for completion.

6.7.2 However, a number of contingencies will be implemented during PCF stage 5 of the works to ensure that any potential issues are responded to effectively for the remaining programme.

6.7.3 As outlined in Section 5.5.1, a total of £[redacted] has been allocated within the contract award value to cover potential increases in inflation during the remaining programme.

6.7.4 Given that the tender process has already been completed, this reduces some elements of risk, including risks associated with the supply chain, resourcing and tender price.

6.7.5 The project risk manager (as set out within Section 6.6) will work to implement effective risk management through the project alongside all relevant project partners.

6.8 Change management

6.8.1 Change management including contractual change will be undertaken using CEMAR, a market-leading contract management solution. Specific working areas will be set up between the relevant parties and will be used by National Highways and the IPT to raise early warnings and change/compensation events. The software ensures simplification of the management of contracts and ensures that commercial risk is minimised through improved contract compliance.

6.8.2 A technical and commercial challenge process will be in place to deal with any change in scope and resultant change/compensation events. Each change event proposed will be reviewed and assured by National Highways' independent cost consultants, Mace and technical advisors, Atkins and would then need to agreed between the PM and contractor.

6.9 Benefits realisation management

6.9.1 The vision is for a landscape-led highways improvement scheme that will deliver a safe and resilient free-flowing road whilst conserving and enhancing the special character of the Cotswolds AONB; reconnecting landscape and ecology; bringing about landscape, wildlife and heritage benefits, including enhanced visitors' enjoyment of the area; improving local communities' quality of life; and contributing to the health of the economy and local businesses.

6.9.2 A number of economic, environmental, and social impacts have been identified and quantified for the scheme, set out in more detailed within the economic dimension (Section 3).

Roles and responsibilities

6.9.3 Benefits management for the project is being undertaken in line with the 'National Highways Benefits Management Manual' October 2018. This approach has been

used successfully on RDP North projects and more widely on major programmes such as Smart Motorways to maximise performance and benefits delivered.

6.9.4 A project benefits dashboard has been prepared and a benefits map produced following a number of benefits workshops, both of which support project objectives.

6.9.5 A collaborative RDP Benefits Realisation and Evaluation Plan (BREP) is being used to define the RDP framework and scheme level functions, roles, accountabilities and responsibilities for benefits planning and realisation. For the scheme, this will be aligned with the project's High-Level Requirements (HLRs) and project objectives to produce an A417 BREP.

6.9.6 The project sponsor will be accountable for benefits management and will own the Benefits Management process to ensure the benefits included in the FBC are delivered and not degraded by risk. The project sponsor will be supported by a Benefits Realisation Manager (BRM). To ensure project benefits are fully understood by everyone in the IPT, including the supply chain, they will be presented to teams including during project inductions, ensuring they continue to be visible throughout the project lifecycle.

Independent challenge

6.9.7 Each agreed benefit will be assigned to the most appropriate member of the management team. Owners will be tasked with ensuring the benefit is considered as the design develops and construction processes formulated. Maximising benefits realisation will also be a key part of the role of the Critical Challenge Team, providing independent quarterly challenge to the BRM and IPT to ensure benefits are maximised.

6.9.8 Building on the identification and quantification of benefits obtained from PCF stage 3, the IPT will review key stakeholders, and continue to identify benefits that align to project objectives. Resources will be allocated to the initiatives that are measurable and represent the best value for money to ensure benefits are realised. All teams and supply chain will also contribute to benefits identification through workshops where emergent benefits and disbenefits will be reviewed and assessed. The team will also review other potential benefits from sources including the RDP digital efficiency register, innovations programme, supply chain and parent organisations.

Benefits mapping and dependencies

6.9.9 Through liaison with the National Highways benefits manager, the BRM will organise a benefits mapping workshop and produce the benefits map. Guidance provided in the National Highways Benefits Management Manual will be used, and each of the seven prioritising factors will be scored within a spreadsheet to produce a weighting and ranking for each benefit. This will then allow the top 20 to be taken into PCF stage 5 and provide the input to the above approach and production of action plans. Target benefits will be recorded on the Benefits Register, using sub-categories A-D from National Highways Benefits Management Manual.

Benefits prioritisation

6.9.10 A benefits prioritisation workshop with National Highways will be held in early 2023 to understand benefits evaluation criteria including dependency and relative

importance of key factors e.g. cost, programme, customers and HLRs, so benefits are prioritised and protected effectively. This will be recorded on the Benefits Register, identifying owners and risks associated with delivering benefits, ensuring accountability and clarity on timing, metrics and outcomes. The BRM will keep the benefits map and Benefits Register up to date to support iterative business case development and refinement. In the event of change, these will be documented in the Evaluation of Change Register for National Highways' acceptance.

Benefits targets

6.9.11 Progress of benefits realisation will be measured against the actions, timescales and outcomes identified in the Benefits Register, and will capture evidence of realisation. Metrics built into this register will enable associated activities, such as value management and innovation implementation, to be monitored to ensure alignment with benefit actions. The BCR will be updated in parallel to reflect additions and improvements to support economic approvals and demonstrate overall value for money.

6.9.12 A BREP sets out how wider benefits defined in the Benefits Register are evaluated after completion and monitored to assess performance against scheme KPIs, including the four Client Scheme Requirements (CSRs) and six scheme objectives, previously set out in .

Benefits measurement

6.9.13 The BREP sets out the agreed approach to benefits monitoring and evaluation, including during and post-construction.

6.9.14 The BREP will be reviewed and updated every three months and assessed by the contractor and National Highways to track progress and agree improvement actions as required. This will help the IPT demonstrate the project's contribution to the scheme objectives as well as the Government's Road Investment Strategy, and National Highways' KPIs.

6.10 Carbon management

6.10.1 The scheme has considered the management and opportunities to reduce carbon throughout its design and development.

6.10.2 Key changes include the decision to amend the gradient of the scheme from 7% to 8%, thereby reducing the amount of excess material requiring excavation.

6.10.3 In addition to the above, optioneering work has been undertaken in previous stages looking at excess material within landscaped bunds and the transportation of materials to and from site (seeking to avoid lorry movements), and the potential use of materials excavated on nearby construction sites. The contractor is currently looking at the excess material to see whether any could be accommodated behind curb lines/bridge abutments to reduce the amount of concrete required and the amount of material requiring to be hauled off site.

Carbon Management Plan (CMP)

6.10.4 In addition to the above, Kier has produced a Carbon Management Plan (CMP) setting out the approach going forward on the scheme in terms of carbon management. The CMP is a 'live' document that will require regular updates as

data becomes available and specific actions/targets are identified as activities get underway.

6.10.5 The implementation of the CMP will be overseen by the Environment Manager and the PM and will be reviewed at least annually with periodic reviews of progress against targets in between.

6.10.6 As set out within the CMP, a Low Carbon Working Group has been set up to help drive the initiative, comprising key project members, including Kier Highways Head of Sustainability and the Head of Innovations.

6.10.7 A tracker has been developed to record all known available low carbon materials, innovation ideas and other low carbon solutions which will be saved on the project shared space so all individuals working on the project can access the resource.

6.10.8 A series of interactive workshops are being held with the design teams to explore options to design out carbon during PCF stage 5 and 6. These options are outlined as follows.

PCF stage 5 design options

6.10.9 Design options currently being considered at PCF stage 5 include the following:

- Reducing concrete thickness of structure abutments
- Incorporating renewable energy generation into the design
- Specifying super-low carbon materials
- Utilising either site won or offsite waste materials such as biochar or concrete fines
- Trialling and analysis of new / innovative products and processes, that involves the use of:
  - Materials with high recycled content
  - Materials with longer lifecycle expectancy
  - Materials with alternative primary raw ingredients, with lower embodied carbon

PCF stage 6 design options

6.10.10 Further opportunities are being considered to reduce carbon during the construction phase at PCF stage 6. These include the following:

- All vehicles to be powered by alternative fuel such as Hydrotreated Vegetable Oil
- Onsite renewable energy production
- Hydrogen fuel cells
- New to market electric/hybrid fleet and plant
- Innovative traffic management solutions
- Sustainable compound set up such as eco cabins, rainwater harvesting, welfare facilities suitable to encourage active travel (lockers and showers) and green features to promote biodiversity (wildflower verges, nesting boxes etc.)
- Incentives to car share for commuting and business travel (car travel only where necessary) Processes that eliminate / reduce the need for logistics/travel (e.g. inspections) that create unnecessary mileage and use labour resource, that could be better invested elsewhere.

6.11 Lessons learned and post-implementation review

6.11.1 ‘Lessons learned’ is a constant process of information sharing and knowledge gathering. Pertinent information is shared between National Highways and its suppliers as and when available regarding both lessons learned from other projects, and on the scheme itself.

6.11.2 The DIP Collaborative Performance Framework Manager will own the lessons learned process, capturing data and providing regular reports through to the Project Management Team and National Highways. The contractor has reviewed RDP project reference points for the A585 Windy Harbour as well as a broader range of relevant projects including (but not limited to) Mersey Gateway Bridge (MGB), Smart Motorways Programme (SMP – M23/M20/M6), HS2, A13 Thurrock and A30 Cornwall.

6.11.3 A lesson learned log has been used on the scheme to record relevant lessons from earlier stages of scheme development and from other schemes. The lessons learned log contains items covering aspects such as project planning, PCF product reviews, evidence sources, risk recording, risk workshop preparation, expert involvement, and land access enquiries. This will ensure that key risks are mitigated and will provide greater programme and cost certainty.

6.11.4 Table 6-7 outlines some of the key lessons learned during PCF stage 4 and 5, along with the main impacts on the project.

Table 6-7 Lessons learned

Lesson category	Description	Impact
PCF stage 4		
Customer and stakeholder liaison	Statements of Common Grounds (SoCGs) were started at a very early stage in the pre-examination process. This provided a good platform for their development and by the time of submission to PINS were at a very advanced stage, with consensus being reached in the most part and very few matters unresolved. Collaborative planning sessions were also critical to successful engagement with stakeholders. Sessions between the project team and various stakeholders where there was more than one voice present in the room led to informed decision making (on issues such as design) and the resolution of blockers with many of our stakeholders. Furthermore, development of the stakeholder role has been beneficial, having a designated member of the team to oversee stakeholders has critical to the success of the DCO team.	De-risking of DCO examination.
Health and safety - hazard logs and hazard elimination	Management and communicating site hazards supporting information (e.g. data/site reports referenced in the PCI or in SafetiBase). Identified the need to improve background site data storage, and hence should consider a unified data environment for the purposes of storing communications.	Slower delivery and dissemination of background safety data to other parties.
Consents orders and planning	Earlier use of powers required to gain access to lands for relevant surveys to be undertaken. Need to identify and execute earlier use of powers to mitigate.	More effective use of powers led to land access licenses being signed leading to reduction of delay in the programme and cost savings.
PCF stage 5		
Design - Innovation and improvement	The iTwin software has been used and implement on the scheme for design reviews. This allows communication, review and audit trail of actions in a virtual environment with the design models. Should be incorporated into everyday activities.	Improved design quality and highlighting issues earlier. Coordinating designs better and fixing issues earlier. This is not software dependent – web based so easy to access for non-design team members.
Design - BIM	Transforming CAD models from a national grid to a local grid system, leading to changes to/rebuilding of models.	Impact on programme due to additional work

6.11.5 Following delivery of the scheme, a separate lessons learned log will be produced to capture and identify both positive and negative lessons from the project in order to apply to comparable projects in future. The key lessons will be communicated across the wider project team and captured in a lessons report to take to IPDC.

6.12 Management dimension conclusions

6.12.1 The scheme is being progressed by National Highways South-West Major Projects team, in accordance with the National Highways PCF. The scheme can be undertaken as a stand-alone project, without direct dependency on any other project.

6.12.2 The organisational structure and key processes have been designed and established to ensure that key milestones and value for money of the scheme are achieved on time and in full. The integrated nature of the organisational structure also means that appropriate processes are in place for independently checking on progress and reporting both internally and externally.

6.12.3 Top risks have been identified (using Xactium) and are being managed with robust mitigation plans, and an agreed quantified risk contingency pot. The risk management process adopted for the scheme also aims to identify and manage all foreseeable risks and opportunities in a manner which is proactive, effective and appropriate. Risk workshops will be undertaken bi-weekly and the project risk manager will implement effective risk management through the production of a RMP.

6.12.4 Change management including contractual change will be undertaken using CEMAR. A technical and commercial challenge process will be in place to deal with any change in scope and resultant change/compensation events.

6.12.5 A detailed programme has been developed with key activities and milestones up to project completion and progress will be monitored on a monthly basis.

6.12.6 PCF stage 4 stakeholder engagement documents have been produced and published, and the contractor will take forward responsibility of future stakeholder and communication strategies. Moving forward to PCF stage 5, a CSEP has been developed and outlines a number of proposed engagement and consultation methods.

6.12.7 Efficiencies have been identified and have been L2 assured for the project. The A417 Efficiency Register will capture, assess and categorise any additional efficiencies going forward to ensure the value for money of the scheme remains robust.

6.12.8 A CMP has been produced, setting out the approach to management and opportunities to reduce carbon throughout the scheme's design and development with a number of design options identified to be explored during PCF stage 5 and 6.

6.12.9 A number of lessons learned have been identified throughout the scheme's development. The contractor and other RDP members will come together as one IPT to capture lessons learned from other major projects and programmes to ensure best practice. A series of workshops will be held across all disciplines to align expectations and understanding and to inform the detailed design programme.

Abbreviations List

In Full	Abbreviation
Air Quality Management Area	AQMA
Analysis of Monetised Costs and Benefits	AMCB
Ancient Woodland Inventory	AWI
Annual Average Daily Traffic	AADT
Appraisal Summary Table	AST
Area of Outstanding Natural Beauty	AONB
As Low As Reasonably Practicable	ALARP
Benefit Cost Ratio	BCR
Business, Energy and Industrial Strategy	BEIS
Benefits and Realisation Evaluation Plan	BREP
Benefits Realisation Manager	BRM
Board Investment and Commercial Committee	BICC
Building Information Modelling	BIM
Building Information Modelling Execution Plan	BEP
Business, Energy and Industrial Strategy	BEIS
Carbon Budget	CB
Carbon Management Plan	CMP
Client Scheme Requirements	CSRs
COst and Benefit to Accidents – Light Touch	COBALT
Collaborative Delivery Framework	CDF
Combined Modelling and Appraisal	ComMA
Communications and Stakeholder Manager	C&SM
Communications and Stakeholder Engagement Plan	CSEP
Community Benefits Plan	CBP
Community Benefits Lead	CBL
Construction (Design Management)	CDM
Critical Challenge Team	CCT
Cyclists, Walkers and Horse Riders	WCH
Delivery Integration Partner	DIP
Department for Transport	DfT
Design Fix 2b	DF2b
Design, Build, Finance and Operations	DBFO
Design Manual for Roads and Bridges	DMRB
Design Panel Review	DPR
Development Consent Order	DCO
Digital Efficiency Register	DER
Distributional Impacts	DI
Do-Minimum	DM
Do-Something	DS
Dual Carriageway All-Purpose road	D2AP
Early Assessment and Sifting Tool	EAST Plus

Early Contractor Involvement	ECI
Economy Assessment Tool	EAT
Economic Opportunity Areas	EOAs
Emissions Factor Toolkit	EFT
Environmental Impact Assessment	EIA
Environmental Statement	ES
Equality, Diversity and Inclusion	EDI
Equality Impact Assessment	EqIA
Estimated Final Cost	EFC
Expected Monetary Value	EMV
Frequently Asked Questions	FAQs
Full Business Case	FBC
Government Communications Headquarters	GCHQ
Gloucestershire County Council	GCC
Government Major Projects Portfolio	GMPP
Gross Domestic Product	GDP
Gross Value Added	GVA
Heavy Goods Vehicles	HGVs
High Level Requirements	HLRs
His Majesty	HM
His Majesty's Revenue and Customs	HMRC
His Majesty Treasury	HMT
Independent Assurance Review	IAR
Investment Decision Committee	IDC
Independent Project Authority	IPA
Integrated Project Team	IPT
Investment Portfolio and Delivery Committee	IPDC
Index of Multiple Deprivation	IMD
Joint Core Strategy	JCS
Journey Time Reliability	JTR
Key Performance Indicators	KPIs
Kier Design Services	KDS
Killed or Seriously Injured	KSI
Local Enterprise Partnership	LEP
Local Wildlife Site	LWS
Lower Super Output Areas	LSOA
Major Road Network	MRN
Members of Parliament	MP
Monetisation of Landscape	MoL
National Policy Statement for National Networks	NPSNN
National Trip End Model	NTEM
Nationally Significant Infrastructure Project	NSIP
Net Present Value	NPV

New Engineering Contract	NEC
Nitrogen Dioxide	NO_2
Noise Important Area	NIA
Office of Road and Rail	ORR
Official Journal of the European Union	OJEU
Open for Traffic	OfT
Outline Business Case	OBC
Particulate Matter 2.5	$PM_{2.5}$
Personal Injury Accident	PIA
Preferred Route Announcement	PRA
Preliminary Environmental Information Report	PEI Report
Present Value of Benefits	PVB
Present Value of Costs	PVC
Private Finance Initiative	PFI
Professional Services Alliance	PSA
Project Approval Board	PAB
Project Control Framework	PCF
Project Director	PD
Project Liaison Officer	PLO
Project Manager	PM
Project Risk Manager	PRM
Public Rights of Way	PRoW
QUeues And Delays at ROadworks	QUADRO
Regional Delivery Director	RDP
Regional Delivery Partnership	RDP
Regionally Important Geological Sites	RIGS
Risk Management Plan	RMP
Road Investment Programme	RIP
Road Investment Strategy 2	RIS2
Road Period 2	RP2
Road Traffic Forecasts produced in 2018	RTF18
Secretary of State	SoS
Senior Responsible Owner	SRO
Sites of Special Scientific Interest	SSSI
Small and Medium Enterprises	SME
South-West Regional Traffic Model	SWRTM
Special Area of Conservation	SAC
Special Parliamentary Procedure	SPP
Stage Gate Assessment Review	SGAR
Statements of Common Ground	SoCG
Start of Works	SoW
Statutory Environmental Bodies	SEBs
Strategic Road Network	SRN

Strategic Stakeholder Panel	SSP
Taking Over Certificate	TOC
Technical Working Group	TWG
Tonnes of Carbon Dioxide Equivalent	tCO_2e
Tony Gee and Partners	TGP
Transport Analysis Guidance	TAG
Treasury Approval Point	TAP
Transport Decarbonisation Plan	TDP
Transport Economic Efficiency	TEE
Transport User Benefits Appraisal	TUBA
Value for Money	VfM
Volker Fitzpatrick	VF
Walking, Cycling and Horse Riding	WCH
Wider Economic Impact	WEI
Wider Impacts in Transport Appraisal	WITA