

Cost and efficiency review

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Introduction

Background

National Highways, formerly known as Highways England¹, was set up by the UK Government in 2015. Its responsibilities include delivery of a major investment programme, as defined in the Department for Transport's (DfT) Road Investment Strategy (RIS).

In March 2020, the DfT published its second RIS (RIS2) covering Road Period 2 (RP2) which runs from April 2020 to March 2025. This allocated £27.4bn of funding to National Highways, of which £14.2bn was for a defined list of enhancement projects to the Strategic Road Network (SRN). RIS2 also defined efficiency savings of £2.23bn that National Highways is expected to deliver in RP2, with no defined target for enhancement projects to afford National Highways flexibility in how to deliver this saving across all areas of its business.

In August 2020, National Highways published its Delivery Plan² for RIS2, detailing the activities and projects it will deliver for the allocated funding, its approach to efficiency and risk, together with its performance framework, which brings together all of its proposed outputs for RP2.

The Office of Rail and Road's (ORR) role as independent Highways Monitor is responsible for monitoring and enforcing the performance and efficiency of National Highways (England only). The ORR also provides advice to the Secretary of State for Transport on the development of plans for future Road Periods.

The RIS3 for Road Period 3 (RP3) is from April 2025 to March 2030. National Highways is currently undertaking early strategic planning work in readiness for RIS3, with its draft plans expected to be developed in readiness for scrutiny by the DfT and ORR in early 2023.

ORR has commissioned Nichols to undertake this review to inform how it should approach its duties engagement in the RIS3 development process.

¹ Highways England was rebranded as National Highways in August 2021.

² An amended Delivery Plan was agreed with the DfT and published by National Highways in 2021.



Our remit

Nichols remit covers two key aspects of National Highways preparation for development of the portfolio of RIS3 enhancement schemes, structured as follows:

- Task 1 assesses National Highways approach to cost estimation and efficiency
- Task 2 assesses National Highways approach to forecasting project timescales and schedule risks

This is the Draft Report for Task 1, with a separate report that covers Task 2.

The scope of Task 1 is expressed in the remit as the following three questions:

1. How evidence from past project delivery is reflected in unit rates and other assumptions used in National Highways' cost models, the independent assurance regime applied to this data, and its use of comparator evidence to inform its models and challenge cost estimates.
2. How unit rates are updated over time and the extent to which efficiency gains achieved during RP1 and RP2 will be built in to cost estimates for projects delivered in future Road Periods (notably RP3), in order to provide assurance that increasing efficiency is reflected in these estimates and therefore in the funding provided.
3. How unit rates and assumptions compare with appropriate external benchmarks, with a focus on a limited selection of 'key' rates and assumptions, to provide confidence that these are in line with what might be expected elsewhere for unit rates for works costs and indirect costs uplifts. This review to consider benchmarking work undertaken to date, and the scope to depend on the assessment of the quality and coverage of this.

Review methodology

The review, undertaken in October and November 2021, comprised a desktop assessment of a range of National Highways documentation on its cost estimating models and unit rate data, supported by a number of workshops with cost planning and estimating leads within its Commercial Services Division.

We would like to thank the National Highway team for its cooperation and support during this review, providing all documents and responding to a series of clarifications requests for detailed evidence to support the review.



Structure of this report

Our findings are set out in Chapter 2. In Chapter 3 we set out our conclusions, and in Chapter 4 recommendations we are making to ORR to inform their preparations for their engagement in the development of the RIS3 portfolio. We also indicate the type of information and evidence that may be required from National Highways to support ORR's involvement and the areas we recommend it should examine in more detail.



Findings

Question 1: How evidence from past project delivery is reflected in unit rates and other assumptions used in National Highways' cost models, the independent assurance regime applied to this data, and its use of comparator evidence to inform its models and challenge cost estimates.

Finding 1: There is good evidence that National Highways operates and maintains a comprehensive framework for project cost estimating, and the management control and governance of estimates.

The framework comprises a documented methodology supported by a range of estimating models, tools and processes which have been developed by and are managed by the Commercial Services Division. The framework is underpinned by a comprehensive 'cost library'; a database comprising many thousands of unit rates for the following:

Pre-construction costs – Incurred during options and development stages, including design development activity, survey and investigation works, statutory planning process costs and National Highways client/Employer's Agent and assurance activity.

Direct costs – All construction costs that are related directly to the delivery of the new or upgraded highway assets; including all materials, labour and plant costs, and which are structured into a number of item 'series' aligned to standard methods of measurement for highway costs.

Indirect costs – Additional construction preliminaries costs and overheads that are essential to deliver the direct works; including site clearance, offices, vehicles, power, security, temporary works, traffic management, contract and construction management preliminaries, and contractor overheads; all of which are also aligned to standard method of measurement series costs.

Other costs – Costs incurred that fall outside of delivery contracts and that vary per scheme; notably for statutory undertakers and other asset owner/authority costs, bulk purchase items, technology commissioning, local authorities, planning inspectorate and non-recoverable VAT (NRVAT).



To complete all elements of a formal cost estimate for any project at any stage of development, National Highways adds three further cost components to the above:

Lands – Estimate costs for land and property acquisition, compensation for loss of value, blight and other claims, and all associated fees; and incorporating independent District Valuer Services input and cost norms.

Risk – Quantified provisions for project risk/uncertainty, unscheduled items and portfolio level risks, where the proportions of these provisions gradually reduce with greater certainty as the project develops through each PCF stage.

Inflation – Up until the point that project delivery costs are contracted with its supply chain, National Highways applies inflation in line with an agreed forecast inflation profile for each year of RP2³.

To finalise the estimate, National Highways then ensures that it is adjusted to align with the forecast delivery schedule for the project, which influences some elements of direct costs as well as the inflation allowance.

National Highways develops and delivers its enhancement projects within its Project Controls Framework (PCF) lifecycle model. The cost library is used to establish a formal project cost estimate for every project at every PCF stage, as illustrated in Figure 1 overleaf, with several estimating models used depending on the type of project and PCF stage.

As a key principle, National Highways assumes that a range of cost models are required, depending on scheme type, scope and the level of design detail and cost certainty at any given development stage. We saw examples of the range of cost models National Highways uses to prepare estimates. For example, it uses its Strategic Estimating Model (SEM) to derive an order of magnitude ‘top-down estimate’ for very early-stage schemes (at PCF stage 0) that have not been formally committed into its plans when there is no scheme option or design detail. Thereafter, including within the options phase (PCF stages 1 and 2), National Highways uses a suite of other models, including a ‘parametric’ estimating model⁴ for each scheme type, to establish a detailed ‘estimate. As a scheme matures, the focus of its estimating approach transitions from parametric estimating to full ‘bottom up’ estimate using quantified scheme designs that have been developed with designers and contractors, and market-tendered cost rates for construction.

³ Efficiency and Inflation Monitoring Manual (EIMM), July 2020.

⁴ Parametric models correlate key scope ‘parameters’ with those of previously delivered projects, in order to derive an cost estimate.



All cost estimating models are based on the rate library data, to ensure consistency and a ‘one version of the truth’ in all estimating data and assumptions. To reinforce this, all of the unit costs within the library are set at a consistent price base with consistent agreed inflation assumptions applied. They are also configurable by scheme ‘type’ (for example, junction improvement, and online widening/bypass) and by National Highways ‘Region’ so that they can be applied in the most appropriate way.

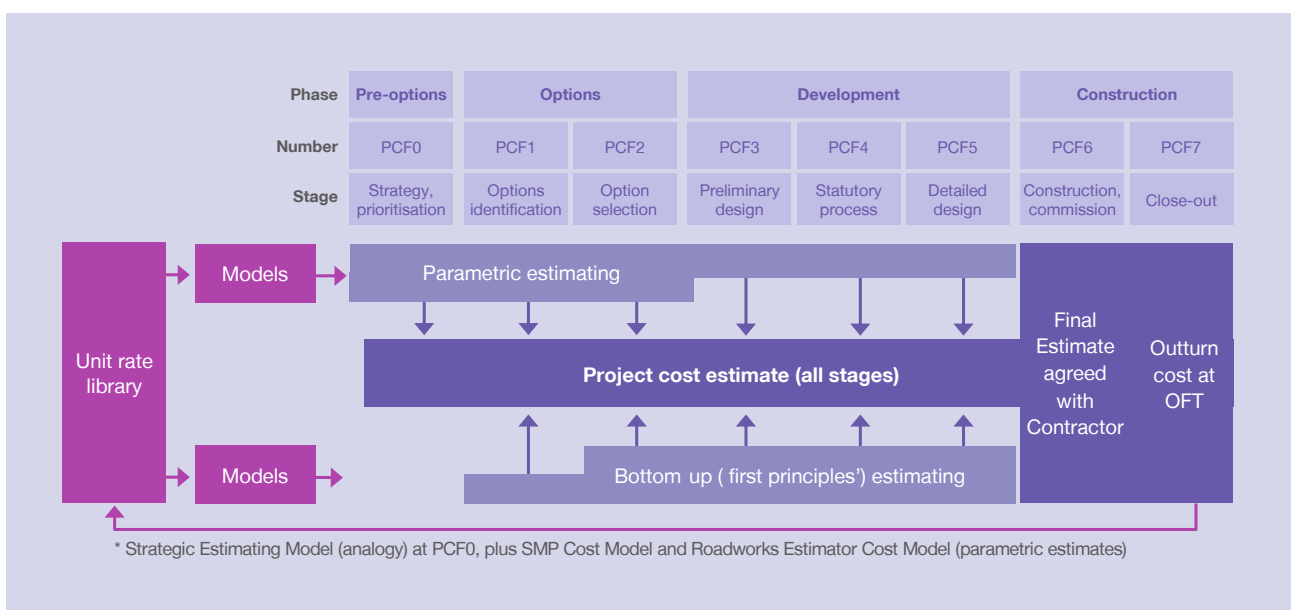


Figure 1: Summary of estimating process applied over project lifecycle

Finding 2: We saw examples of how evidence from past project delivery is used by National Highways in its cost models and in the specification of unit rates within the cost library.

The cost library is based on outturn unit cost rates based on evidence from past project delivery from completed or ‘Open for Traffic’ (OFT) schemes delivered by National Highways over the past 10 years. It covers all pre-construction, direct, indirect and other costs. It is structured via a defined cost Work Breakdown Structure (WBS) which is aligned to the standard Method of Measurement for Highway Works (MMHW) item coverage.

The unit cost rates are maintained in the cost library as ranges with minimum, most likely and maximum values, i.e., there is no single value for a unit rate. The ranges reflect the variability seen in outturn cost rates for completed projects. We saw evidence of these ranges during our review.



National Highways cost estimation process assumes that additional assured rate information can also be used when developing a project cost estimate. For example, it can draw on a range of key unit cost rates for items that make up the majority of scheme estimates that were tendered by the supply chain within its Regional Delivery Partnership (RDP) framework, which is used to deliver Regional Investment Programme (RIP) projects. This data provides both enhanced rate data for the cost library and is also the basis for contracting with the supply chain for scheme delivery.

Finding 3: There is recent evidence of external assurance undertaken on National Highways cost data.

National Highways commissioned Turner & Townsend (T&T) to undertake an audit of National Highways' cost database undertaken in 2020. This included assurance on the end-to-end process for its use, assurance on rate calculations and the process to update these via sampling of major cost items, and due diligence checks on calculations/statistics. The audit's primary finding was that the process followed, and data contained within the estimating software database was robust.

National Highways also commissioned Gardiner & Theobald (G&T) to undertake an independent review in 2020 of how cost data is used internally within National Highways, and to provide recommendations on continuous improvement towards further enhanced maturity of cost management process within the organisation. However, this review did not focus on the cost rates in the database.

Finding 4: We found little evidence of external benchmarking of costs.

While not the main purpose of T&T's independent audit report referred to above, it did include some benchmarking checks on a basket of detailed (i.e. MMHW 'Level 4') unit rates that make up a high proportion of project delivery expenditure including within drainage, earthworks, piling and retaining wall, structural concrete and steelwork cost series. These were compared with cost intelligence from T&T's own database of blended average cost rates from rail and the utilities sectors.

This analysis found that National Highways rates were similar or lower than comparators, however this finding was caveated in the audit report as there were obvious issues with the comparability of data across sectors, given intrinsic differences in project scope, delivery methods and in establishing 'like for like' data.

We explore potential options for external benchmarking in our response to Question 3.



Question 2: How unit rates are updated over time and the extent to which efficiency gains achieved during RP1-2 will be built in to cost estimates for projects delivered in future Road Periods (notably RP3) in order to provide assurance that increasing efficiency is reflected in these estimates.

Finding 5: We saw evidence of National Highways process for monitoring, reviewing, and updating unit rates over time.

We reviewed evidence and examples of the process that National Highways follows to maintain, update, and control its rate library. This process includes checks on new rate data to cleanse it for duplication, atypical abnormal items and to remove superseded data for projects that are over 10 years old where long-run inflation effects skew rates.

Updates are made to library rates nominally on an annual basis to include recently completed projects, plus also on a more ad-hoc basis when it is appropriate to incorporate a representative batch of completed schemes, for example unit rate checks and updates were made in 2021 for a batch of projects that were completed in 2020.

National Highways also re-sets the price base for all cost rates contained within the library, an exercise nominally undertaken every three years, in order to bring these to an up-to-date baseline date, and hence reduce the timescale term of indexation assumptions that need to be applied to new project estimates. The most recent update of rates was from a 2016 to 2019 price base, and this was audited by T&T in its review in 2019 referred to above.

Finding 6: Unit rates used in project cost estimates are not adjusted for efficiency gains. It is also not possible to explicitly identify how efficiency gains achieved during a Road Period are built into cost estimates used for enhancement projects in future Road Periods.

The following paragraphs provide more background to this finding.

Firstly, the unit rates contained in National Highways' cost library that are used to prepare future project cost estimates are based on actual outturn costs for a range of completed projects, normalised to ensure a consistent price base. The final capex cost of a scheme is broken down and used in the cost library, so this rate data does incorporate efficiencies. However, project outturn costs also include the effect of cost variances, for example due to risk and change, so rates do not represent a pure post-efficient position, and cannot be used to define an assumed 'efficient unit rate' for future projects.



Secondly, we reviewed National Highways reported evidence of efficiency gains for RP2 and RP1 and it is our view that while there are some transferable efficiencies, the majority of efficiency gains would not be expected to directly affect unit rates, notably for projects at early stages of scheme development when the majority of total efficiencies are realised. Examples of efficiencies that would not typically affect unit rates include: making changes to scheme options to reduce costs while delivering the same outputs; changes to design to avoid and reduce scope/quantities; to reduce the impact of or obviate the need for statutory processes; to address opportunities that result from departures from standard, Whole Life Cost (WLC) benefits and; route/programme optimisation initiatives. So, an efficiency achieved on one project may not translate into costs or rates that can be assumed to be achieved for other projects in future, although National Highways can capture design changes that are transferrable, to ensure future estimates are not based on inefficient design. Although, in practice it will be challenging to do so, it will be an important principle of the efficiency framework for RP3 that all transferrable efficiencies are incorporated into future pre-efficient cost estimates, in order to ensure that they are not put forward as new efficiencies in future Road Periods.

We note that National Highways promotes learning and good practice on efficiencies via project-specific efficiency registers and by production of thematic efficiency case studies that apply to a number of projects, that it shares across its project teams.

Finally, as unit cost rates do not comprise a singular value they could not be used to define a baseline on which to apply future efficiency targets; each rate comprises a range of values that reflect the inherent variability of observed delivery costs across a large portfolio of projects. Rates vary due to, for example, scope features, location, topography, site logistics, ground conditions, construction methodology, the individual contractor and framework involved and issues in past project delivery performance.

Finding 7: To set agreed efficiency targets for a Road Period relies on being able to define wholly transparent pre-efficient cost baselines for every project within the enhancements' portfolio; so that ORR and National Highways have a common view on "efficient compared to what?"

All cost estimates that National Highways produce initially are 'pre-efficient'. These estimates are based on historic cost benchmarks, and are set 'top-down' using parametric models, and 'bottom-up' by establishing a detailed cost estimate based on available scope and design information. The RIS for enhancement schemes is based on these pre-efficient estimates. When setting these pre-efficient costs, National Highways should provide evidence that previously modelled transferrable efficiencies have been factored in.

A post-efficient cost estimate that includes efficiencies is then defined and used to set an efficient cost baseline for each project. As well as project-specific efficiency initiatives, efficiency targets may also be defined with reference to programme commercial arrangements, for example the smart motorway alliance contract to deliver schemes more efficiently as a coordinated programme across the SRN.



The process to set the RIS every five years, takes place during a rolling programme of development of a large portfolio of projects. This inevitably means that some pre-efficient costs and efficiency targets are set for projects that are at an early stage of development. This may be before scope is mature and detailed designs exist, so cost uncertainties mean that, for these projects, baseline pre-efficient cost and efficiency targets contain more uncertainty. To illustrate this, we saw evidence from efficiency documentation of schemes with previously agreed efficiency targets which subsequently resulted in or are forecasting high-cost variances.

Finding 8: The underlying basis for efficiencies forecasts for RIS2 is a multi-faceted framework.

National Highways’ efficiency framework as applied to its enhancement projects comprises the following three elements:

RP1 carryover efficiency – Calculated for a portfolio of smart motorway and RIP projects where efficiencies were previously identified in RP1, but where part of this value is schedule to be realised in RP2.

RP2 generated efficiency – Calculated for schemes which are at an early stage of development, where scope and outputs cannot be defined with confidence, and where efficiency benefits may create increased funding headroom or reduce cost risks within RP2, or to deliver efficiencies in RP3.

RP2 embedded efficiency – Calculated for each project within the portfolio of smart motorway and RIP schemes that that were sufficiently developed by late-stages of RP1 to enable credible post-efficient targets to be set.

National Highways plans to monitor and report efficiencies throughout RP2 via a number of methods notably: performance in delivery of committed projects and baselines against post-efficient cost targets; a high-level ‘activity metric’ for total enhancement project costs per unit capacity delivered compared to baseline funding and; detailed efficiency registers and project-specific and thematic/programme level efficiency case studies.

Finding 9: A RIS3 pre-efficient cost baseline set in 2023 is unlikely to reflect efficiency gains on RP2 projects as there is a time-lag before any gains are processed through the cost models and resultant project cost estimates.



National Highways reflects efficiencies in its cost models after schemes have been completed (at OFT stage). As a result of the time-lag that results, at the time of this review (November 2021, at 1.5 years into RP2), it has delivered and reported only a small proportion of its total efficiency target for enhancement projects for RIS2⁵. The majority reported so far relates to schemes that were in construction in RP1 that include a carryover efficiency sum delivered when they were completed in early RP2. The RIS3 baseline planning process is expected to commence in 2023, two years before the end of RP2 and before efficiencies gained on RP2 projects would have been reflected back into the cost models used to forecast RP3 cost estimates. This is a consequence of the time lag between project efficiencies being achieved and being reflected in the cost models.

Finding 10: National Highways is making positive steps to further improve its cost management capability.

We have previously seen that its cost management and estimating capability already compares favourably with its peers involved in the UK Transport Infrastructure Efficiency Strategy (TIES)⁶. National Highways is now also deploying a new enterprise-level cost estimating software system that will integrate its suite of cost models and cost library and link this through into enhanced management reporting. This system is expected to be deployed in time to support RIS3 planning, and to support its goal to achieve greater Portfolio, Programme and Project Management Maturity Model (P3M3) maturity.

This system was procured in 2021 and work is now underway to plan for its deployment, which is scheduled for 2022/23. While this system will not change unit rates or the estimating computational process, it will provide additional benefits in support of its estimating process. For example, it will:

- Include a new Indirect Cost Model, to sit alongside its models for direct, pre-construction and other costs.
- Integrate all cost models across National Highways into one system, i.e., not just those related to its enhancement projects.
- Provide a 'single source of truth' on cost data, on one system rather than via multiple software formats, and driving all cost products from same baseline and assumptions.
- Enhance management information available on project estimates, including visibility to track changes over project life-cycle, and to strengthen quality control, monitoring and assurance arrangements.

⁵ £117m of efficiencies for enhancement projects has been delivered and reported in year 1 of RP2.

⁶ Nichols report to ORR: Assessment of Highways England's cost estimation approach for RIS2, 2018.



Question 3: How National Highways can use appropriate external benchmark evidence from elsewhere to inform models and/or challenge cost estimates.

The purpose of this element of Task 1 is to assess and recommend how ORR can further explore and ultimately improve its confidence that National Highways cost estimating assumptions are in line with what might be expected elsewhere. The assessment incorporated the following:

- To understand benchmarking work already undertaken by National Highways.
- Depending on the quality and coverage of the existing work, investigate the feasibility of and recommend additional benchmarking activity.

Finding 11: Except for the benchmark check undertaken by T&T as part of the inflationary up-lift audit (referred to in Finding 4 previously), we found no further documented evidence of external benchmarking activity.

We found references to external benchmarking with Transport Scotland and the Welsh Government in the National Highways Draft Strategic Business Plan (DSBP) for RIS2. National Highways advised that this referred to historic high-level exploratory discussions during RP1 for which there are no documented details or materials available to review.

Finding 12: In initial meetings with Transport Scotland and the Welsh Government, both organisations expressed a willingness to explore further the opportunities for benchmarking or comparisons, as a group with National Highways. However, they were both cognisant of the challenges of making valid comparisons between different projects.

ORR arranged meetings with Transport Scotland and the Welsh Government for Nichols to explore the opportunities for benchmarking or comparisons with National Highways. In the meetings, we identified significant differences in their cost estimating context to National Highways, including cost estimating data being held, and estimates produced by clients' agents and different commercial/contracting approaches to projects. Given the differences in cost estimating approaches it was decided that a pragmatic first step would be to undertake a pilot exercise to compare high-level cost estimates for a single scheme from both organisations with, in each case, a comparable National Highways project.

Finding 13: There are a number of factors that will need to be considered when making cost comparisons between National Highways projects and those of Transport Scotland and the Welsh Government, before any robust conclusions could be drawn.



Key factors and challenges identified in discussions with these organisations, and with National Highways, that arise in comparing actual costs and ‘should cost’⁷ estimates, even for outwardly similar schemes:

Various scope factors – for example, due to scheme type(s), location, topography, ground conditions; so even outwardly similar schemes can greatly differ in costs. National Highways provided examples of how these cost rates can vary significantly even within its own portfolio, by as much as an order of magnitude from lowest to highest rates.

Scale – for example, cost rates vary significantly depending on the size of scheme, and hence a wide-range of item cost rates can apply, again even within a portfolio of projects within one organisation.

Indirect cost regimes – for example, affecting construction methodology, temporary works, site setup and logistics, traffic management, environmental protection, etc; all of which can cause these costs to vary in proportion to direct works.

Commercial and procurement models – for example, different cost/risk transfer pricing arrangements with the supply chain, for example National Highways has a number of frameworks and partnerships for its sizeable portfolio, and Transport Scotland use Design Build Finance Operate (DBFO) model.

Supply chain factors – for example, competition and pricing vary cyclically, locally and across organisations, and that can be exacerbated across clients in charge of different geographic networks.

Other abnormal items – for example, land acquisition, stats, bulk purchase items, atypical scope items and NRVAT that can vary from negligible to as much as 25% of scheme costs.

Risk and inflation – for example, allowances vary significantly per project and over time; and can distort comparisons made between projects which are at different points in project lifecycles. If comparing actual outturn cost, then this becomes less of an issue, as these will have been incorporated into the cost of delivery.

Lifecycle stage – for example, affecting level of maturity of scope and costs, and hence cost certainty, assumptions, and that cause a compounding effect on risk and inflation differences.

Estimating methodology – for example, different clienting models and varying structures and levels of detailed breakdown of cost data available for benchmarking.

Estimate comparisons – for example, lack of equivalence in the maturity of estimates and their stability through delivery and into actual outturn cost, resulting in difficulty verifying if differences are due to unrealistic estimates, risks in supply chain tenders, scope/cost creep and change/compensation events.

⁷ Using historic cost rates for scope items as benchmarks to estimate what a scheme ‘should cost’ based on these, in lieu of or alongside detailed estimates.



Finding 14: A proportionate first step or ‘pilot’ external benchmarking activity would be to check a comparable sample of projects from the three highways infrastructure delivery clients, in order to identify and share the relevant learning that results.

In the light of the challenges listed above, we believe that this can be undertaken as follows:

- Compare suitable ‘pairs’ of similar scheme types and, as much as possible, similar primary scope elements, in order to reduce the number of factors that may undermine costs comparisons.
- Consider recent schemes that reached a defined point in their lifecycle at similar points in time, ideally those that are either well-established in construction with agreed delivery prices, or those that have recently been completed, to avoid distortion caused by estimating uncertainty, delivery risk and inflation, and market related factors.
- Compare schemes using the same cost estimating model, feeding schemes from the different organisations into this model in order to derive a benchmark ‘should cost’ value for each; in effect as if all of the comparator schemes were delivered by the same organisation, helping to immunise results from the above challenges as much as possible, and avoiding differences that may result from multiple models. The differences that result between the ‘should cost’ value and actual outturn cost that then be assessed.
- Consider a reasonable and pragmatic assessment of high-value direct and indirect cost items, i.e., not a forensic line-by-line assessment at unit rate level that will generate significant effort and (likely) spurious accuracy. Additionally doing so can process out abnormal items that cannot be compared directly.

In support of this aim, National Highways has identified that its Cost Analysis Simulation Tool (CAST) can be used to input key scope and cost data and scheme characteristics for suitable Transport Scotland and Welsh Government projects into this model. This will derive a theoretical ‘should cost’ value for each based on National Highways cost rates. This value can be compared directly with the actual estimated costs for the same scope elements within the sample projects from both organisations. An assessment of any similarities and differences can then be undertaken at a key component level, to understand these and if there are any issues associated with the comparison.

This process is illustrated in Figure 2 below.

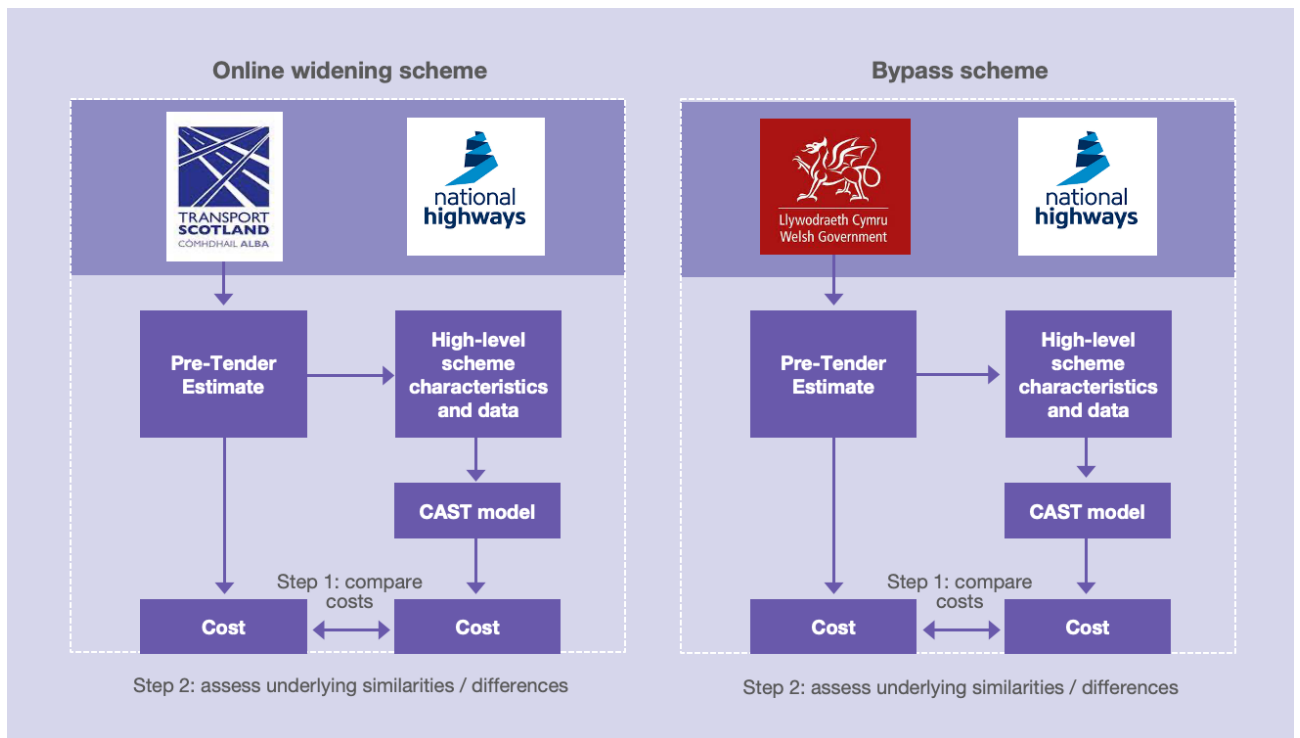


Figure 2: Summary of benchmarking analytical process



Conclusions

Question 1: How evidence from past project delivery is reflected in unit rates and other assumptions used in National Highways' cost models, the independent assurance regime applied to this data, and its use of comparator evidence to inform its models and challenge cost estimates.

Our conclusions:

National Highways operates and maintains comprehensive cost estimating tools, models, and processes. Evidence from past project delivery is reflected in unit rates and other assumptions used in these cost models. There is evidence of independent assurance being applied to the process of cost estimating using the models and when a planned price basis change takes place. Comparator evidence from other organisations is not used to inform its models or to challenge cost estimates. However, there are internal comparators that can be used to challenge cost estimates; for example, comparison with National Highways' competitively tendered framework rates.

Supporting notes:

- National Highways has developed a significant library of cost rates based on over 10 years of outturn data from its past project delivery, that covers all direct, indirect, pre-construction and other costs, with a library section for each of these four elements that make up the entirety of project estimates onto which risk and inflation sums are added in line with PCF stage norms.
- Making 'like-for-like' comparison of projects and data with other infrastructure sectors for the purpose of external benchmarking has been considered by National Highways and it has concluded that comparisons would not be meaningful due to the context in which projects take place. T&T, in its audit of National Highways' cost library in 2020, cited the challenge of drawing meaningful conclusions from its high-level comparison of sample National Highways direct works costs with rail and utility sectors which indicated comparable or lower National highways cost rates.



Question 2: How unit rates are updated over time and the extent to which efficiency gains achieved during RP1-2 will be built in to cost estimates for projects delivered in future Road Periods (notably RP3) in order to provide assurance that increasing efficiency is reflected in these estimates.

Our conclusion:

National Highways' updates its cost library of unit rates over time with outturn costs of completed projects, which would reflect achieved efficiencies or variances. Efficiency gains for RP2 projects would only be reflected in some aspects of the cost library and in other evidence after those projects have been completed, meaning that there is a 'time lag' before these are reflected in the cost library. There is no evidence of a direct link between efficiency gains reported in a Road Period and the updating of unit rates in the cost library. Furthermore, a substantial proportion of total efficiencies reported by National Highways do not yield a reduction in direct or indirect unit cost rates; for example, efficiencies deriving better value for money scheme options or optimised designs in development, which reduces the scope/volume of work required but not the unit rates.

During 2023 it is expected that cost estimates for RP2 carryover projects and new RIS3 projects will be consolidated into a RIS3 pre-efficient cost baseline against which RIS3 efficiencies will be forecast and agreed between the DfT, National Highways and ORR. As this RIS3 baseline will be set before outturn costs for RP2 completed are reflected in the cost model (due to the 'time lag'), the RIS3 pre-efficient baseline cost estimates would not include RP2 efficiency gains. As a consequence, ORR will not get the assurance it is seeking by looking for evidence of reductions in unit rates.

For ORR to gain assurance that the RIS3 pre-efficient cost baseline and post-efficient target is sufficiently challenging and takes account of relevant efficiencies, it will need to fully understand the process/framework used by National Highways to build these; what is assumed, what internal benchmarks have been used to challenge estimates and the approach to early-stage schemes the scope and costs for which will not be known with accuracy.



Supporting notes:

- The National Highways cost library comprises ‘as built’ cost data that does not represent either a pre- or post-efficient position. Efficiencies that are detailed in available project-specific efficiencies registers and efficiency case studies are incorporated into formal cost estimates by National Highways as a separate line item, not via alteration to the elemental cost built up or unit rates. The rates cannot, therefore, be used to establish a ‘line of sight’ between cost rates and efficiency targets for RP2, or to evidence how efficiency gains will be built in to estimates for projects in future Road Periods.
- It is challenging, and potentially impracticable, to set and to monitor efficiencies at a detailed unit rate level. Rates are impacted by a range of variable factors that are bespoke to each enhancement project, and are therefore expressed as a range from low, to most likely, to high values in the cost library, not as a single sum. These values are refined and updated within cost estimates at each stage of project development until the Final Target Cost (FTC) value is contracted with the supply chain ahead of construction, based on a detailed scope/design and agreed cost for delivery.
- A significant proportion of project efficiencies reported do not translate into unit rate changes. This is most obvious at early stages of project development, which is when the majority of efficiencies are realised by National Highways; notably initiatives that reduce costs via changes to scheme options, refinement to scheme design that reduce scope or that avoid construction works or statutory processes. These efficiencies reduce quantities and hence costs, and do so on a scheme-specific basis, so cannot be used as a premise to reduce unit rates or to securing efficiency in future projects. This reinforces the conclusion that it may be impracticable to monitor efficiency at rate level without significant complexity and caveats on results. A notable exception to this relates to National Highways suite of RDP framework rates for key direct works cost rates. It has flagged that it can monitor these during RP2 as projects are completed, to assess how these tender prices compare with outturn costs.
- Because of the ‘time lag’ before RP2 efficiencies are reflected in actual costs at project completion, there are elements of the RIS2 efficiency framework that may be achieved in the period during which the proposed RIS3 pre-efficient baseline and efficiency framework is being developed and discussed between National Highways and ORR. Also, there may also be elements that have not yet been achieved when the baseline has been agreed. ORR will therefore require details on the achievement of RP2 efficiencies on an ongoing basis for each element of the efficiencies framework for RIS2 (i.e. RP1 carryover, RP2 generated and RP2 embedded efficiency) to be able to check consistency of the underlying data and assumptions with the proposed framework and efficiency targets for RIS3 as these are developed in 2023.



- The capacity/cost ‘activity metric’ proposed by National Highways to monitor efficiency in RP2 is helpful, though may need further consideration. This is a high-level measure that can be used track efficient performance but may not reveal a clear trajectory of efficiency gains unless measured over several years and potentially multiple Road Periods. The headline value may also mask more granular variations in values; for example key differences between project types, if the few very large ‘Tier 1’⁸ or Complex Infrastructure Programme (CIP) scheme skew the overall metric and; whether such differences influence consideration on future RIS plans and future efficiency strategy. We also note that National Highways efficiency metrics do not capture all components of efficiency; for example in relation to maximising outcomes or benefits (i.e. ‘effectiveness’), reducing disruption to users, creating environmental benefits and optimising WLC. It is, however, possible for National Highways to claim these elements of efficiency in separate case studies.
- A key challenge will be to set and validate robust pre-efficient costs as part of the process to set the RIS3 baseline. National Highways efficiency targets rely on a range of high-level and more detailed models, data and assumptions in order to determine pre-efficient costs and set efficiency targets. This is particularly important for early-stage schemes with less developed solutions and significant gaps in information. It will also be important to learn from projects with efficiency targets that have subsequently experienced significant cost variances when planning for RIS3. We recognise that such variances do not mean that efficiencies were not delivered as planned, but they do raise questions on pre-efficient baselines and the need to understand interaction between efficiency, risk and change in order to establish a holistic picture on outturn efficiency needed for RIS3 planning.
- The RIS3 efficiency baseline may be struck before RIS2 efficiencies have matured sufficiently, with the potential for an incomplete picture at that time. This is due to the time-lag before efficiencies are realised. It is unclear what level of efficiency will have been realised, assured and reported in time for RP3 planning. This will also apply to the RDP framework of rates which will not derive robust data on efficient costs for completed projects for several years. We make this conclusion because the potential re-application of the RIS2 planning timescales for RIS3 would result in a draft RIS3 baseline being struck in 2023, before most RP2 schemes will have been delivered. As a result, there is likely to be a moving picture and complicated ‘line-of-sight’ to RIS2 efficiencies while concurrently setting the RIS3 baseline. This will require comprehensive reporting given the interaction of efficiency with risk, inflation, change control, portfolio/programme level optimisation and other internal cost challenge activities.

⁸ Schemes that are subject to close work with Government during development and delivery, including enhanced staged approvals by the DfT.



Question 3: How National Highways can use appropriate external benchmark evidence from elsewhere to inform models and/or challenge cost estimates.

Our conclusion:

External benchmarking of costs is good practice for major infrastructure clients. As a first step to achieving this, there is value in undertaking a proportionate check of cost estimates for comparable sample National Highways, Transport Scotland and the Welsh Government projects, in order to share the relevant learning that results.

We support the use of National Highways' CAST model to pilot this process as it is available and is a deliverable means to derive useful outputs that can be compared and, in respect of this review remit, to provide assurance on cost estimating in support of development work on the RIS3 enhancement programme.

Supporting notes:

- There may be notable cost differences, potentially significant ones, when comparing different highways schemes, even in the same highways sector and/or outwardly similar scheme types. These differences may make meaningful comparisons challenging or even impossible.
- However, such challenges are not, on their own, a reason not to undertake benchmarking checks, and as identifying and understanding these differences will be important as evidence, and may still reveal important learning. Findings will also help to manage funders' expectations on the value and use of external benchmarking in future.

Recommendations

We have made recommendations to ORR in respect of Task 1 on cost estimation and efficiency. These are intended to support ORR as it prepares its approach to its engagement in the RIS3 baseline development process, and to identify activity or evidence that would be required from National Highways.

| No. | Recommendation to ORR |
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| 1. | <p>To work with National Highways (as soon as practicable) to understand how the pre-efficient RIS3 DSBP baseline will be constructed, and to clarify the associated RIS3 efficiencies framework; this would include the process and timetable for constructing it and; the range of evidence required to support its development, review and approval.</p> <p>This will give ORR a focus for its engagement with National Highways on RIS3 preparation in 2022, and to clarify the RP3 information/evidence needed to:</p> <ul style="list-style-type: none"> • Set robust RIS3 efficiency targets against the pre-efficient baseline. • Establish a line of sight from RIS2 to RIS3 efficiencies; to take account of the time lag on realising RIS2 efficiencies, and how this will change during the period of constructing the RIS3 baseline is struck. • Verify the alignment of efficiencies with project costs, risks, schedules, inflation and change control. • Consider if and how the framework can include additional emphasis on effectiveness/outcome benefits and on WLC benefits, to address the fact that metrics otherwise focus largely on up-front capital delivery cost and targets within a Road Period. • Work with National Highways and the DfT during the RIS3 development process, to agree how early-stage projects should be reflected in the RIS3 baseline, recognising the challenge of not having a mature scope and pre-efficient estimate. • Consider how efficiencies will be monitored during RP3; to clarify this early enough and to seed it into the planning process. |

| No. | Recommendation to ORR |
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| 2. | <p>To place its scrutiny on how pre-efficient costs are determined for each element of the RIS3 efficiency framework (i.e. RP2 carryover, RP3 generated and RP3 embedded efficiency) at individual project level.</p> <p>The pre-efficient costs are expected to provide a baseline against which to agree efficiencies targets for RP3. ORR’s scrutiny could include a review of the top-down approach and process for the definition of pre- and post-efficient costs, together with a review of cost build-ups and assumptions for a representative sample of National Highways projects of each type.</p> <p>There is a significant time-lag before some RP2 efficiencies will be reflected in actual costs for completed projects, and these being used to update unit rates and hence flowing through into project cost build-ups. To address this, ORR should expect that National Highways applies lessons learnt from RP2 by making adjustments during the cost build-up process for projects in the RIS3 pre-efficient cost baseline. This could be by adjusting specific rates or quantities downwards if National Highways has found a more efficient way of delivering activity in RP2, by reducing design and delivery costs because of its emerging experience from its RDP contract model as applied to RP2 schemes and selected RP3 schemes⁹, and the via benefits of applying its new Indirect Cost Model to future cost estimates.</p> <p>This will enable ORR to:</p> <ul style="list-style-type: none"> • Gain assurance that National Highways have already overlaid lessons learnt from RP2 into their pre-efficient cost build-ups and assumptions, including the factors influencing the achievement of and also risks to efficiencies, where this learning can be proactively applied to RP3 efficiency planning and scrutiny. • Verify the robustness of the methodology used and resultant cost and efficiency data, again recognising the challenge posed given the time-lag on realising RIS2 data. • Demonstrate that targets strike the right balance between being stretching and deliverable, cognisant of available evidence from RIS2 efficiencies and cost variances. • Ensure that the level of focus on early-stage schemes is commensurate with the quantum of these proposed in RIS3, although also given the lower cost certainty and greater risks to defining efficient targets for these and the longer period of time that it will take before they realise efficiencies. |

⁹ The RDP is in place for RP2. National Highways contractual models for RP3 are not yet defined, and may affect if/how efficiencies achieved via RDP and other frameworks can be applied in RP3.



| No. | Recommendation to ORR |
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| 3. | <p>To work with National Highways during 2022/23 to conduct an assessment of the proposed high-level efficiency activity metric for its potential use in the RIS3 efficiency framework for enhancement projects.</p> <p>ORR is already planning to review the current position on the efficiency activity metric in the first quarter of 2022. This assessment would follow-on from that review, and will help to identify and address:</p> <ul style="list-style-type: none"> • Likely timescales for this metric to derive a meaningful results trend in reporting, and hence whether or not this will inform RIS3 efficiency planning. • The level of contribution to this metric from sample projects and each project type, in order to surface any implications that result from this for RIS3 planning and efficiency monitoring. • Whether there is merit and also robust data to retrospectively determine values for this activity metric for RP1/RP2 as a starting point for RP3 data. |
| 4. | <p>To request additional granularity in the reporting of efficiencies data from National Highways for RP3.</p> <p>Themes to include are:</p> <ul style="list-style-type: none"> • A form of quantified ‘efficiency breakdown’ detailing forecast/actual values aligned to a broad framework of efficiency headings, and clarity on which initiatives do/do not show up in unit rates; which may be achieved via augmented cost data fields in efficiency case studies. • Coverage of efficiency updates within National Highways quarterly status reports, and hence clarity (at portfolio level) on the alignment with the comprehensive data these contain on costs, risks and change control. • Whether and how National Highways’ new Enterprise Portfolio Management (EPM) system, when deployed, provides an opportunity to enhance reporting/products for monitoring and reporting of efficiencies for RIS3, linked to reporting of costs/trends over time at project and portfolio level. |



| No. | Recommendation to ORR |
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| 5. | <p>Arrange a regular forum where National Highways collaborates with Transport Scotland and Welsh Government to undertake pilot targeted cost benchmarking comparisons on appropriate example projects.</p> <p>Aspects to consider in implementing this recommendation are:</p> <ul style="list-style-type: none"> • Undertaken as per the methodology summarised in Finding 14. • A working group comprising cost leads from the parties to lead this work, review progress and outputs, and advise on cost comparisons/differences. • Create good, formal case studies as an output for this work that can be used to support development work on the RIS3 enhancement programme. • Ensure that commercial confidentiality is maintained at all times when sharing cost data. |
| 6. | <p>Work with National Highways with a view to it undertaking further regular cost benchmarking checks in future, as good practice for major infrastructure enhancement programmes.</p> <p>Aspects to consider in implementing this recommendation are:</p> <ul style="list-style-type: none"> • Such further work to be based on the results and learning from the initial pilot. • If the opportunity arises, to consider an additional shared goal to collaborate with Transport Scotland and/or the Welsh Government on a notable future project – for example, major new scheme proposed where value in examining all of key aspects of it. • Consider how the forum for this work could be adapted to include further projects, in the event that there is a limited pool within Transport Scotland and/or the Welsh Government. |

Table 1: summary of review recommendations

Abbreviations

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| CAST | Cost Analysis Simulation Tool |
| CIP | Complex Infrastructure Programme |
| DBFO | Design Build Finance Operate |
| DCO | Development Consent Order |
| DfT | Department for Transport |
| DSBP | Draft Strategic Business Plan |
| EIMM | Efficiency and Inflation Monitoring Manual |
| EPM | Enterprise Portfolio Management (system) |
| FTC | Final Target Cost |
| G&T | Gardiner & Theobald |
| MMHW | Method of Measurement for Highway Works |
| NRVAT | Non-Recoverable VAT |
| OFT | Open For Traffic |
| ORR | Office of Rail and Road |
| P3M3 | Portfolio, Programme and Project Management Maturity Model |
| PCF | Project Controls Framework |
| RDP | Regional Delivery Partnership |
| RIP | Regional Investment Programme |



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|------|----------------------------------------------|
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| RIS2 | Road Investment Strategy 2 (for RP2) |
| RIS3 | Road Investment Strategy 3 (for RP3) |
| RP1 | Road Period 1 (2015/16 to 2019/20) |
| RP2 | Road Period 2 (2020/21 to 2024/25) |
| RP3 | Road Period 3 (2024/25 to 2029/30) |
| SEM | Strategic Estimating Model |
| SOW | Start Of Works |
| SRN | Strategic Road Network |
| T&T | Turner & Townsend |
| TIES | Transport Infrastructure Efficiency Strategy |
| TS | Transport Scotland |
| WBS | Work Breakdown Structure |
| WLC | Whole Life Cost |