

Highways England's analytical methods to inform proposals for the second Road Period (2020-2025)



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1. Purpose of this document

Background and context

This document sets out the thorough approach that we are adopting in Highways England for the appraisal, analysis and assurance that will inform our advice to DfT as they develop the RIS2 programme.

The analytical tools described here permit a step change in the strength of the evidence base available to underpin investment decisions. In particular, the suite of models that we have developed allows analysis to be carried out to assess how the balance of the different types of intervention (e.g. major enhancements and operational activities) generate value for the country. We will be able to better link the inputs to outputs and in turn to outcomes for the second Roads Period (RP2).

The remainder of the paper:

- Sets out the requirements of the analysis
- Explains the approach we have developed to meet these requirements – the analytical platform
- Introduces the framework we are applying to assure the analysis
- Identifies next steps for the further development of the analytical platform.

2. Objectives of the analysis

The purpose of the analysis is to provide comprehensive decision support for investment planning activities, with a view to:

- Improving the value-for-money (VfM) of our investment advice and demonstrating the VfM of the programme that is ultimately adopted;
- Informing the proposed balance of spend between options for operational, maintenance, enhancement and other expenditures;
- Adopting a more programmatic (rather than scheme-by-scheme) approach to road appraisal and capturing more of the associated benefits of our investments;
- Forming a better understanding of the potential impact of our proposals on the performance of the SRN in meeting our customer objectives, to inform the RIS2 performance specification; and
- Providing a foundation of robust assurance to give us more certainty on the benefits that the RP2 investment programme can deliver.

To achieve this, we set out to:

- Articulate the current performance of the SRN and project its future performance both with and without additional interventions;
- Inform the optimisation of the investment portfolio within and between areas of spend, to make sure the best solutions come together as a package;
- Link inputs such as our assets and people, to our outputs and in turn to outcomes that affect our customers, for distinct areas of investment;
- Assess the impacts of the whole RP2 portfolio investment, relative to the baseline, in terms of both strategic outcomes and value-for-money; and
- Develop, test and assure metrics for monitoring and reporting RP2 performance.

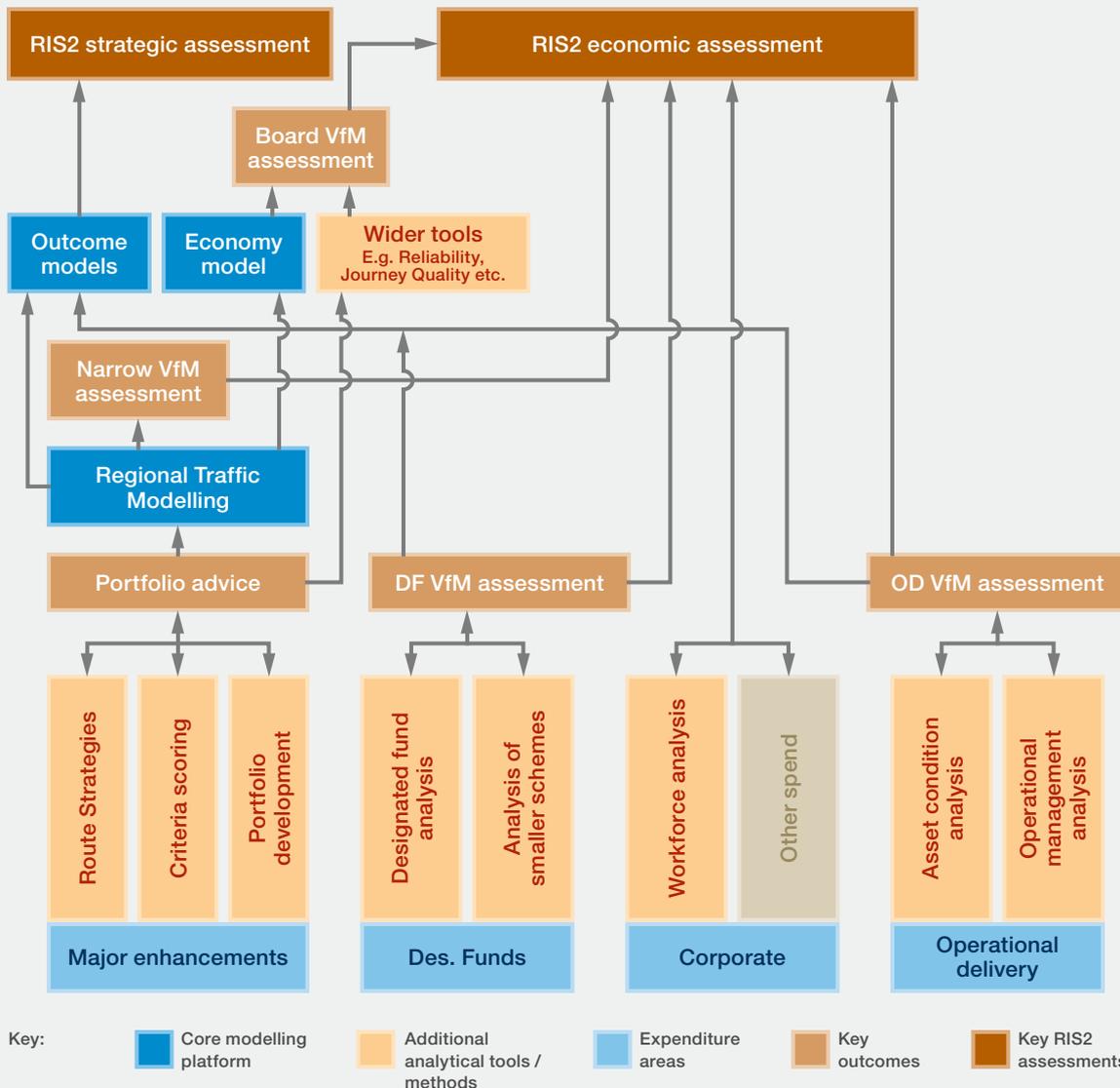
In the next section, we will explain the approach we have developed to fulfil these objectives – the “analytical platform”. In commissioning each of the tools within the analytical platform, we translated these objectives into individual “analytical requirements” that specified an expected level of functionality. These requirements have subsequently been drawn upon to quality assure the design of the tools and how these designs were implemented.

3. Our approach – the analytical platform

Highways England is responsible for modernising, maintaining and operating the strategic road network.. We have developed a suite of models and tools to analyse our spending across these core activities– which we refer to jointly as the “analytical platform”. We present the analytical platform in Figure 1 below and highlight:

- The analytical tools we have developed within each key area of expenditure;
- How the early-stage evidence we develop from these tools inform the strategic and economic assessment we will conduct as part of our advice to DfT;
- The key links between tools in different types of expenditure that we will manage to generate investment proposals that are internally consistent.

Figure 1: Map of the analytical platform



3.1 Core modelling suite

The core modelling suite has been developed to create a consistent and structured approach to appraising all major enhancement investments under consideration. The core modelling suite has three components which are coordinated and managed centrally:

- **Regional Traffic Models (RTMs)** – Five regional models covering the full SRN used to forecast how traffic flows and speeds change following major road enhancements
- **Outcome models** – A suite of national-level models that forecast the performance impacts of packages of investment in the areas of safety, the environment and customer satisfaction
- **Economy model** – A national-level macroeconomic model forecasting the impact of major road enhancements on economic activity such as GDP and employment.

These models are integrated through “soft linking”, meaning the outputs of one are used as inputs to another (rather than being fully automated) and we explain each of the models’ functionality below.

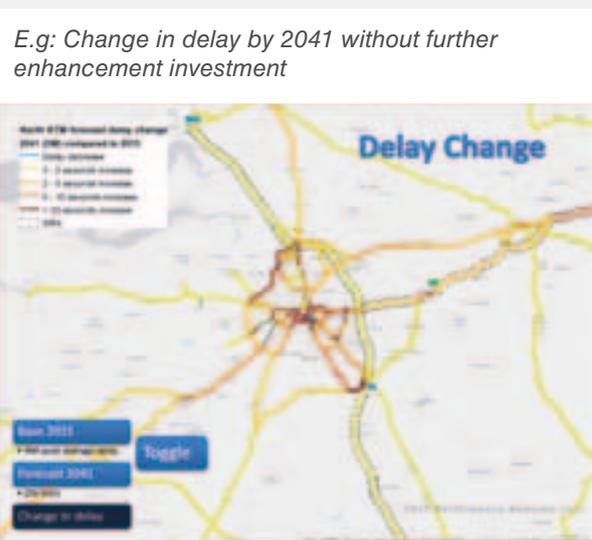
Regional Traffic Models (RTMs)

Traffic models are used to forecast how traffic flows and vehicle speeds change over time following infrastructure investment. We have built five regional traffic models together covering all of the SRN in England, along with other A roads and B roads (please see Figure 2, below). The data underpinning traffic models has traditionally been sourced solely from roadside surveys – for our new generation of RTMs we have instead drawn upon a wide data set including mobile phone and GPS data, allowing us to more accurately than ever capture user demands on the SRN. Our models also incorporate a simple rail model, allowing us to incorporate the impact of rail within our assessments.

Figure 2: Visualising the RTMs



Model coverage



We are already deploying these models to support appraisal within the six Strategic Study locations, and to help inform the appraisal of our existing investment programme within RP1. In addition, we are using the RTMs in the preparation of RP2 to provide an early relative indication of the potential opportunity from tackling current and future congestion challenges in over 100 different locations on the SRN. We will be using the RTMs to assess packages of illustrative major enhancement scheme proposals that are considered as part of the investment planning process for RP2 (described in more detail in Section 3.3). The RTMs allow us to analyse the interactions between different individual road schemes, informing our advice on how packages of schemes interact with each other.

The RTMs calculate the change in user benefits (e.g. journey time savings, vehicle costs and fuel costs) that we expect to be realised by road enhancements. In many instances, these time savings generate a large proportion of the total benefits we expect to be generated by the scheme. It is clear, however, that this reflects just one of many potential impacts that might result from a road enhancement. For example, a scheme might open up land for commercial development or encourage domestic productivity, or expose more individuals to noise. The remaining elements of the analytical platform allow us to formulate a broader view of value-for-money that effectively captures a wider range of impact categories and allows us to develop a more holistic assessment.

Outcome models

In addition to assessing the impact on traffic conditions from our major enhancement programme, we are using a range of models that allow us to assess the impact on our strategic objectives. These “Outcome Models” will cover three strategic outcomes:

- Safety
- Customer satisfaction
- The environment – including, carbon, air quality, noise and natural environment impacts

We have developed these models based on observed relationships between these outcomes and a number of internal and external factors. Changes in traffic conditions are a key factor driving our future performance in these outcome areas, however we also factor in where appropriate; the influence of other investment areas, our wider activities (e.g. operational service levels and maintenance programme) and external forces (e.g. technological or demographic trends).

We are using a number of the outcome models to assess how far potential new investments undertaken in Roads Period 2 might, both individually and in combination, be expected to contribute to delivering our strategic objectives. We will also be deploying the outcome models to inform appropriate target setting for the KPIs (Key Performance Indicators) contained within our performance specification for RP2.

We explain the models we have developed in more detail below.

Safety outcome model

We have developed a national safety model which forecasts the change in accidents and numbers of deaths and serious injuries per year (KSIs) on the SRN based on historic trends, external factors (e.g. expected traffic growth and expected improvements in car safety), and safety enhancements and improvements delivered by Highways England. The model has been independently peer reviewed. A regional version of the model is currently under development and further work is underway to incorporate traffic growth forecasts from the RTMs.

Customer satisfaction outcome model

We have built a customer satisfaction model based on a meta-analysis of wide range of internal and external research. We have identified six core factors that influence our customers' satisfaction from using the SRN:

- Journey time
- Signage/information
- The way we maintain the roads
- Incident management
- Road works
- Other drivers' behaviour

Our model is based on mapping the logical relationships that exist between each of these customer areas and key Highways England activities. This allows us to understand the "direction of travel" in customer satisfaction in each area that could stem from our investment proposals and other planned interventions on the network. These allow us to produce an overall forecast for the potential change in customer satisfaction from the proposals. Understanding both the likely overall direction of customer satisfaction and the potential implications for each component of customer service will help us better plan our proposals and better target interventions to mitigate any potential negative impacts.

Environmental outcome models

We have developed a series of analytical methods to assess the impact on the environment of our investment proposals in seven environmental areas:

- Greenhouse gases
- Air quality
- Noise
- Natural environment:
 - Landscape
 - Townscape
 - Biodiversity
 - Heritage
 - Water quality

At an early stage of assessment, we use a risk-based qualitative tool to identify the likely risk of a major enhancement affecting a designated or environmentally-sensitive area. For air quality, noise and natural environment, we have applied spatial buffers to identify environmental sensitivities within specific distances of an investment. We have developed a "Traffic Light" rating in each of these environmental categories which correspond to the potential significance of the implications of the environmental sensitivity on cost, design (both constraints and opportunities) and delivery of the scheme, and opportunities for investments to deliver better environmental outcomes (see example outputs in Figure 3, below left). For greenhouse gases, the RTMs allow us to assess the likely directionality of the impact, and we have applied a consistent "Traffic Light" approach to reporting the results of this early assessment.

We have developed more advanced environmental models in the areas of air quality, greenhouse gases and noise and we aim to apply the models to assess packages of enhancements that emerge from the investment planning process for RP2. We are working to link each of these models, where appropriate, to the changes in traffic speed and flows that are estimated through the RTMs.

Figure 3: Illustrative outputs of environmental risk model

Site/LED	Summary per theme							
	Overall Sensitivity	Air	Noise	Landscape	Townscape	Heritage	Biodiversity	Water
Site 1	Green	Green	Green	Green	Green	Green	Green	Green
Site 2	Green	Green	Green	Green	Green	Green	Green	Green
Site 3	Red	Green	Green	Red	Green	Green	Green	Green
Site 4	Red	Green	Green	Green	Green	Green	Red	Green
Site 5	Green	Green	Green	Green	Green	Green	Green	Green
Site 6	Green	Green	Green	Green	Green	Green	Green	Green
Site 7	Green	Green	Green	Red	Green	Green	Green	Green
Site 8	Green	Green	Green	Green	Green	Green	Green	Green
Site 9	Red	Green	Green	Red	Green	Green	Red	Green
Site 10	Red	Green	Green	Green	Green	Red	Red	Green

Metric forecast models

Alongside the suite of 'strategic' outcome models that predict performance impacts of different investment options, we are developing a series of "metric forecast" models as a contribution to the evidence base that will inform target setting within the final performance specification. We set out to develop metric forecast models across a range of RP2 KPIs, including in the areas of delay, availability, incident clearance, asset condition and delivery.

Metric forecast models will also help us explore the trade-offs involved in driving these different areas of performance and to better plan our operational interventions. For example, understanding the impact of pursuing a greater number of enhancement projects on delays on surrounding roads during construction can help us to better plan roadworks in the local area.

Economy model

We are developing a national-level macroeconomic model to forecast the impact of proposed major road enhancements on economic activity such as GDP and employment. It will be capable of informing both the strategic and economic cases for investment by producing estimates for changes in both economic activity and social welfare. The model will capture some of the key mechanisms by which road improvements impact the economy, as set out in the Road to Growth, including raising productivity (known as "agglomeration benefits"), enabling new developments and boosting employment.

This model builds on previous Land Use Transport Interaction models (LUTI) developed for the Transpennine Tunnel Study, High Speed 2 and Crossrail 2. First, prices are allowed to adjust such that markets clear. Second, firms are assumed to decide how much to produce and where in order to maximise their profits. Third, the model predicts how employment will change in response to changes in wages.

The economy model will be used alongside conventional methods to appraise wider economic impacts set out in WebTAG.

Wider tools

In addition to the core modelling suite, there are a number of other models we have used to inform an assessment that captures a broader range of impact categories, including:

- Reliability
- Distributional impacts
- Journey quality

Reliability

We will look at how far certain types of major enhancement schemes (e.g. smart motorway and other technology-enabled schemes) enable customers to arrive when expected, and avoid experiencing wide variations in journey times. Monetised reliability benefits will be estimated using Highways England's MyRIAD model. We will capture both incident delay and travel time variability impacts and factor in how these are likely to vary depending on different characteristics of the scheme in question – for example, the volume of traffic and scheme length. At later stages of the scheme development process, we will look to build new methodologies to capture the reliability impacts of a broader range of schemes (e.g. schemes involving single carriageways and junction improvements).

Distributional impacts

We set out to undertake a 'Distributional Impact Analysis' of user benefits and affordability impacts using outputs from the Regional Traffic Models, following WebTAG guidance. Simplified, we will show how benefits and dis-benefits are distributed between different income groups of the population. We will also examine how benefits are distributed between different geographical areas, adjusting for differences in the population of those areas. For areas of the country where noise, air quality, accidents and severance impacts could potentially be significant, we will also examine the socio-demographic make-up of the population in these areas. We aim to undertake this in relation to the specific social groups which are identified in WebTAG as more likely to be adversely affected by these impacts.

Journey quality

Transport Focus research¹ indicates that the number one priority for our customers is the quality of the road surface on their journeys. We have commissioned a literature review² to identify the key attributes of journey quality, with a view to understanding how Highways England can capture these views in RP2.

The results of the review demonstrated that there are limited evidence and valuation methods that can be directly applied.

Therefore, in our initial assessment, we will conduct a qualitative assessment of how far key aspects of Highways England's proposals will impact on our customers' journey quality in RP2, including in the areas of major enhancement and maintenance. As the RIS is developed, we are exploring the potential to conduct a valuation study which would attempt to link the level of journey quality to user's willingness-to-pay, to enable potential monetisation in future welfare-based appraisals.

¹ <https://www.transportfocus.org.uk/research-publications/publications/road-users-priorities-for-improvement-car-and-van-drivers-and-motorcyclists/>

² "Literature Review: Considering the Key Attributes of Roads on Journey Quality", Peak Economics, August 2017

3.2 Appraising operational and other expenditure

We are developing a wider set of analytical tools to be able to inform the strategic and economic assessment of wider Highways England activities in RP2, beyond our capital enhancement programme.

Operational delivery

We have undertaken analysis to identify key investment areas that jointly come together to deliver a consistent level of operational performance to users, which includes:

- Renewal of assets such as structures, the carriageway surface and drainage
- Operational maintenance of the network
- Operational management such as through traffic officer and information services

We have modelled asset condition to compare historic trends to current condition and to better understand the impact on the asset without further investment (example of carriageway surface below, modelled using the Pavement Investment Tool). Where detailed asset data, trends or history does not exist we will use existing risk based models and draw up plans for correcting any data gap. We have then drawn on technical and commercial expertise to define a “minimum” level of asset condition for RP2. This “minimum” level will be calibrated to take account of the major enhancement portfolio that we will pursue. Additional analysis will then be used to appraise further “improvement” options beyond this minimum, for example upgrading construction materials or pursuing the minimisation of whole life costs. This analysis will look to identify both cost savings that could be achieved and potential benefits – for example, applying the Highways Maintenance Appraisal Tool (HMAT), to assess potential user benefits.

Designated Funds and smaller schemes

We are undertaking analysis to estimate the typical value-for-money of interventions funded through the current Designated Funds, analysing existing appraisal evidence. In addition, we are developing a tool to estimate the potential safety and congestion relief impacts from different levels of spending on small schemes to address local pinch-point and safety issues. This analysis, together with wider strategic and other considerations, could help inform our proposals around the scope, shape and size of these funding programmes in RP2.

Workforce expenditure

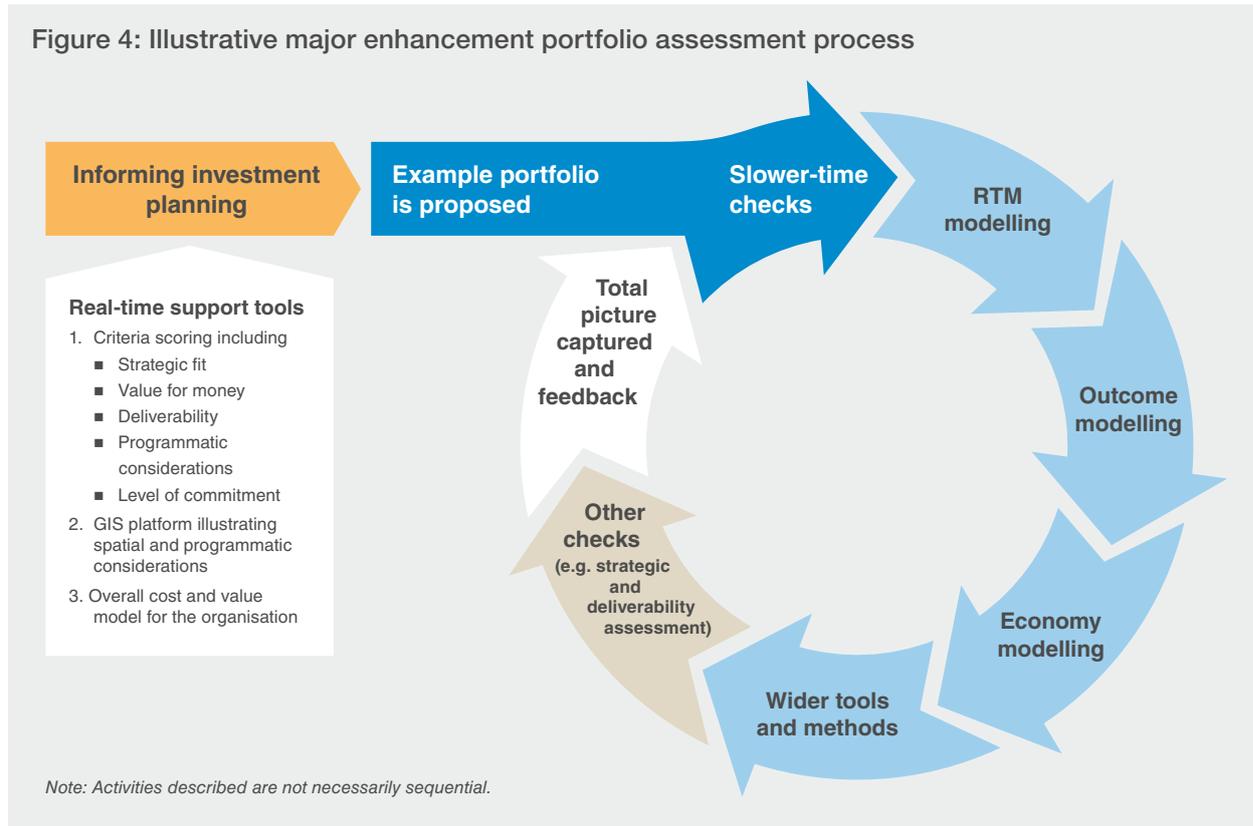
For RP2 we will aim to better understand the implications of our capital expenditure proposals and our corporate plan on our workforce expenditure. We are developing a workforce planning model that forecasts full time employees (FTEs) and the associated pay costs for RP2, building on our existing medium-term forecast model. The expenditure drivers we will assess include the size of the RIS programme, our organisational design, technologies, estates strategies and pay policy.

For all other areas of expenditure, we will include qualitative appraisal information within a ‘cost and value’ model that is comprehensive of all Highways England expenditure proposed to be delivered within RP2.

3.3 Role of analytical platform in forming our investment recommendations

We are using the tools we have developed to support decision making in RP2, including on the shape and size of the major enhancement portfolio and the appropriate balance between different types of activity.

For the area of major enhancements, this involves both real-time support to decision makers and then more detailed analysis through the full application of the analytical platform (see Figure 4, below). This allows for iteration of the analysis as the evidence base develops and new considerations emerge.



To form our advice around the locations for improvement in RP2, we have developed tools that allow summary information on potential schemes to be viewed in real-time in a spatial (GIS) format. Schemes can be added or removed from the overall portfolio and the impact on overarching outcomes can be viewed with each change. The information we draw upon includes:

- Strategic fit
- Value-for-money
- Deliverability
- Programmatic linkages
- Extent of any existing commitment

We can further test these proposals in more depth through our analytical platform and conduct other checks to optimise and update the advice as the RIS develops.

3.4 Informing an overall assessment

We will use analysis to make an overall assessment of the impact of the investment programme for RP2 and demonstrate how these proposals could have a positive impact for the country. We will use analysis to appraise both their value-for-money (e.g. the economic assessment) and to project the potential impact on a range of performance outcomes (e.g. the strategic assessment).

Our economic assessment

We will develop WebTAG-consistent assessment of value-for-money to provide an early and indicative view on where the greatest degree of public value might be achieved within three key activities:

1. Major enhancement portfolio proposals
2. Operational delivery proposals
3. Designated Funds and Local Capital

We will also form an overall judgement on value-for-money, which incorporates (1), (2) and (3) alongside other corporate services.

For the enhancement proposals, the Regional Traffic Models allow us to provide a monetised estimate for the change in user benefits. However, user benefits such as journey time savings reflect only a portion of the potential total benefits that might result from a scheme – for example, a scheme might open up land for commercial development, encourage domestic productivity or enable greater international connectivity. A scheme may also realise significant dis-benefits, such as spurring greater carbon emissions or exposing more individuals to noise pollution.

Therefore, we have complemented this important but “narrow” view of value-for-money with a “broader” view that incorporates an early assessment of some of these broader impacts. Our approach will be proportional to the stage of the process that the appraisal will inform. As the process advances, we will mature this economic appraisal, to ensure we fully capture each impact, and we capture the full range of impacts. For example, we aim to conduct more programmatic appraisal as our proposals for RP2 develop, to enable us to understand the contribution to each scheme within a programme of investment.

Our strategic assessment

The analysis will also enable us to capture a snapshot of the performance of the network against each of our key strategic outcomes:

- The current performance of the network,
- The future performance of the network with no additional investment, including the most material challenges to address
- The future performance of the network under one or more investment options
- Projected KPIs under one or more investment options.

These findings will enable us to better understand the impacts of our proposals, in order to better calibrate and optimise them, and help inform target setting that is appropriate and suitable.

3.5 Ensuring consistency in the overall assessment

Consistency in our assessment is not yet fully automated through automatically linked models – but in the longer-term, this is our ambition. We are still able to take a thorough approach to ensuring consistency in our proposals through a number of mechanisms:

- Soft-linking models where feasible and appropriate
- Ensuring all expenditure is traceable through to an underlying 'cost and value' model for the organisation
- To develop a core view of the world (our core external demand scenario) and a defined set of scenarios around that. Applying these scenarios consistently across the analytical platform to test how our proposals perform under different circumstances
- Mapping the relationships between inputs, outputs and outcomes so each element of the analytical platform can be traced back to a consistent set of value drivers

- Deploying a consistent approach to strategic-level cost estimation
- Tracking cross-cutting analytical assumptions and coordinating these centrally
- Appraisals articulated in the same way and impacts calculated consistently – consistent with WebTAG, but building on this through adopting our own Appraisal Manual
- Applying the Analytical Assurance Framework in a consistent way (see Section 4)

Whilst appreciating the evidence available to conduct our appraisal is at an early-stage, our assessment will set out to consistently capture the key interactions within the cost base (e.g. capturing the operational implications of enhancement spending) and across impact areas (e.g. how enhancement and operational interventions might impact on overall safety performance).

4. Analytical assurance

Highways England is required by its licence terms to “ensure that it has in place robust internal arrangements to achieve, and to demonstrate how it has achieved, value-for-money”. This obligation requires us to make informed decisions based on robust and clearly communicated expectations of benefits, costs and risks. Analytical failure can have consequences for effective operations and use of taxpayers’ funds.

Highways England has developed an “Analytical Assurance Framework” to provide a robust internal arrangement to assure the specification, production and use of analysis throughout the Company and its activities. The framework builds on existing good practice and resources and builds a structure of mutual responsibility between those delivering, reviewing and using analysis to ensure analysis and its outputs meet the Company’s evidential and quality requirements. It identifies required analytical processes, risks and materials, providing a common foundation for project leaders, analysts and assurers.

This framework is being applied across all areas of analysis in Highways England, including for RP2 preparation. Our application of this framework to RP2 includes:

- Defining the analytical requirements for each area of analysis
- Preparing and assuring analytical plans for each area of analysis
- Applying a “four lines of defence” approach to assuring analysis (see Figure 9, below) based on the likelihood and materiality of analytical failure
- Assuring the key analytical products (see Figure 5, below)

Figure 5: Example excerpts from Analytical Assurance Framework (AAF)

What are the Four Lines of Defence?

The Lines of Defence are not mutually exclusive; i.e. a scheme requiring the third line of defence also requires lines one and two.

The Lines are:

1. **Operational Management** – peer and management review within the project and programme;
2. **Executive Overview** – management review from the responsible officers for the task, project and/or programme;
3. **Internal Assurance** – independent technical specialists from within Highways England; and
4. **External Assurance** – independent technical specialists or quality assurance functions (such as the National Audit Office or Office of Road & Rail) from outside Highways England.



Analytical Assurance Statement: 3rd Line of Defence

Appropriateness	Compliance	Uncertainty	Fit for purpose
Amber	Green	Red	Amber

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This model, whilst not intended for this purpose, is reasonably appropriate to underpin this decision, although a customised model would avoid the weakness of using a national set of growth forecasts for this local region. Overall the analysis suggests that a road scheme is likely to provide a better alternative than a rail intervention.

5. Next steps

The analytical methods we have set out in this paper will be applied to inform the further development of the RIS and the Strategic Business Plan.

We are aiming to further streamline and automate our analysis over time, to reduce the time required to develop and assess schemes, and allow us to rapidly assess implications of changes to the programme as a whole and enable us to make “whole investment portfolio” value-for-money assessments. There will also be the need for further research to define new tools in a number of areas – journey quality, metric development and deliverability are three key priorities.

We will continue to aim to improve the capability of the platform over time, and have commissioned a number of peer reviews and will ensure lessons learned are incorporated.

We also invite you to respond to the Public Consultation to feedback your views on the high-level approach to the analysis we have set out in this paper.

Annex: Technical appendix

In this section, we provide a summary of the structure of a number of the core tools we discuss in this paper, with further technical specifications to follow at future milestones in the RIS process.

Model	Model scope	Overview	Inputs
RTMs	Traffic speeds, flows and delays	Large-scale regional based network traffic models, using SATURN and DIADEM software	<p>Road Network derived from 2015 Integrated Transport Network.</p> <p>National travel demands derived from mobile phone data combined with National Travel Survey, and Trafficmaster GPS</p> <p>Traffic count data from Highways England & Local Authorities</p> <p>Airport and Port demands (base and future)</p> <p>Forecast demand growth derived from DfT Tempo data.</p>
Safety Outcome Model	Predicted number of SRN casualties including the numbers of deaths and serious injuries per year (KSIs)	Excel-based software that predicts future SRN KSIs without interventions and casualty savings arising from the specific intervention. Includes 'background' casualty reductions from other factors such as vehicle technologies, education and enforcement.	<p>Accident savings from HE POPE projects</p> <p>Causality rates from DfT's COBALT model</p> <p>National traffic growth from DfT's Road Traffic Forecasts (work underway to link to RTMs)</p>
Customer Satisfaction Outcome Model	Overall direction in customer satisfaction using a Five-Point scale	Qualitative model that uses logic maps of inputs, outputs and outcomes to forecast aggregate customer satisfaction and individual components that contribute to it.	<p>Meta-analysis of existing research (e.g. Transport Focus, NRUSS and a number of academic papers)</p> <p>Multiple sources of HE internal data</p>
Environmental risk assessment	Traffic-light scoring of sensitivities to Greenhouse gases, Air Quality, Noise and Natural Environment	N/a (sensitivity model to existing constraints rather than a forecast model)	<p>GIS data for Air Quality, Quality, Noise and Natural Environment constraints</p> <p>Regional Traffic Model outputs for Greenhouse gases</p>
Myriad	Reliability, including incident delays and travel time variability. Current capabilities limited to smart motorway, technology schemes and dual carriageway widening schemes.	Excel-based software that assesses the reliability impacts and benefits of individual schemes over the scheme life.	<p>Scheme length, typical trip length and distribution for road type</p> <p>Observed traffic count data from HATRIS</p> <p>Traffic growth factors from Regional Traffic Models.</p>

Annex: Glossary of terms

Analytical platform – a group of tools and processes that come together to test and assess different options

Appraisal – an exercise undertaken as part of writing a business case to identify the 'right' option to pursue. This involves generating the available options and checking which options deliver the best outcomes and the offer the highest value-for-money.

Analytical assurance – the process of checking the robustness and accuracy of the analysis and that it's fit for purpose.

Capital enhancement programme – major road building projects that expand and enhance the SRN.

Designated funds – pots of money allocated to specific expenditure, such as "growth and housing", "environment", "innovation" and "cycling, safety and integration".

Local capital fund – a pot of money allocated to small congestion-relief schemes for tackling local pinch points.

Key Performance Indicators (KPIs) is a specific target that is a priority for Highways England – e.g. a target to aim for zero injuries on our network, or x% of customer satisfaction.

Performance specification – is the set of targets or aims that we are committed to delivering and held to by the government. The performance specification includes metrics such as KPIs.

Optimisation – the process of allocating resources to the best options available.

Meta-analysis – the process of forming a conclusion from reviewing a range of existing studies

Metrics – the individual measurements that will be monitored and tracked as part of the performance specification.

Model – a simplified representation of the world using numbers, images or diagrams, which can be adjusted to predict what may happen in certain scenarios.

Outcomes – the impacts that Highways England's "outputs" have on our customers, such as better reliability or improved safety.

Outputs – tangible activities and assets that Highways England delivers, such as numbers of schemes or the level of traffic officer coverage.

Pavement – refers to the carriageway surface, rather than the area for pedestrian use.

Programmatic appraisal – the process of looking at the full programme of potential schemes, then removing each individual scheme one at a time and assessing its contribution to the full programme.

WebTAG – DfT's guidance for conducting transport appraisals:
<https://www.gov.uk/guidance/transport-analysis-guidance-webtag>

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