Appendix E – Appraisal Specification Report (ASR)

Hereford Eastern River Crossing (ERiC) (SOC)

Herefordshire Council

April 2023

Delivering a better world

Quality information

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1. Introduction

Overview

1.1 Herefordshire Council has recently undertaken a review of the Hereford Transport Strategy (2020), with a preferred strategy comprising of four packages of measures for the future Hereford transport system being identified:

- Walking and cycling measures;
- Improving public transport;
- Managing traffic demand; and
- Providing a new river crossing.

1.2 River Wye passes through Hereford, dividing the city in two. There is a lack of resilience as a result of the single river crossing. Problems are compounded by regular congestion and a network that is close to capacity during peak periods and increasingly more frequently, throughout the day as well.

1.3 An additional river crossing is deemed as essential in providing an alternative route for addressing the resiliency issues in the city centre and facilitating the future growth of the city.

1.4 AECOM have been appointed to take the scheme through the business case process.

Purpose of ASR

1.5 This Appraisal Specification Report (ASR) sets out the proposed methodology and scope of transport modelling and appraisal work planned for the Hereford Eastern River Crossing (ERC). Initially the modelling and economic appraisal will use the existing Hereford Transport Model as an evidence base, which has a base year of 2016. Sensitivity tests will be used to deal with uncertainty in forecasting, including the effects of COVID on travel behaviour.

1.6 A new Hereford Transport Model is being developed by AECOM, which is expected to be operational for at least the Full Business Case stage of development. If the model is available for the OBC, we will aim to use it for the transport modelling and economic appraisal.

Report structure

1.7 The remainder of this report is structured as follows:

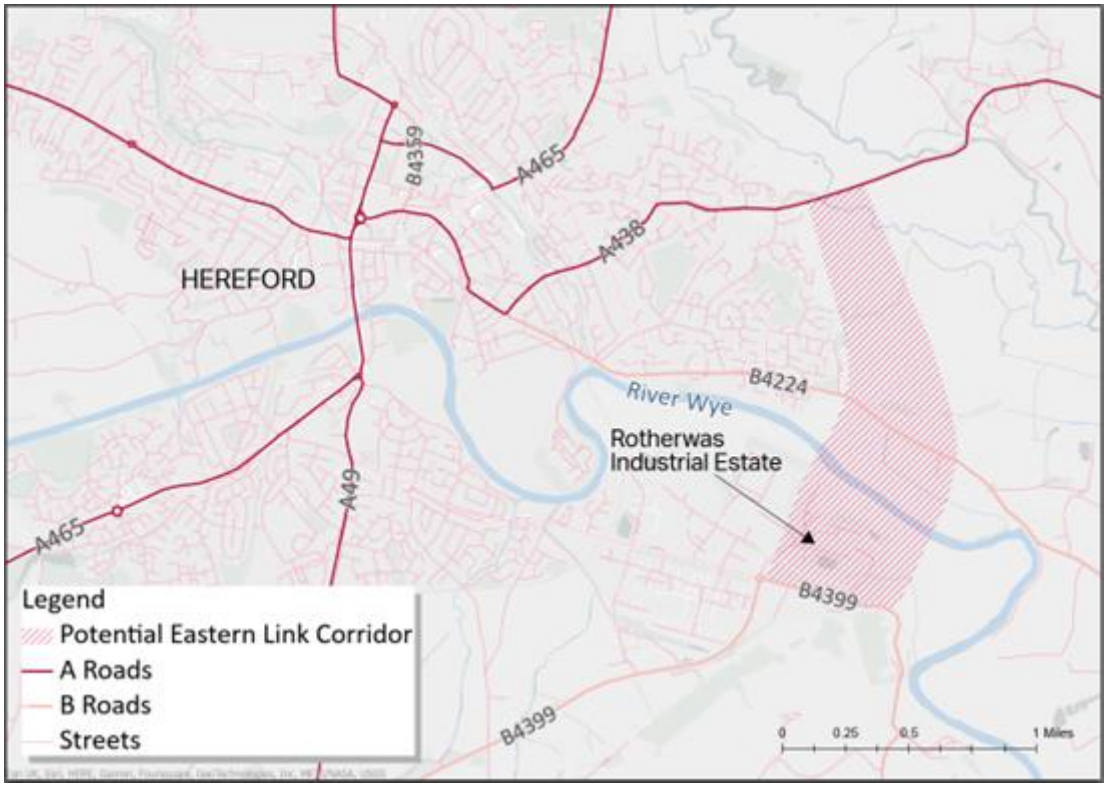
- Section 2: Scheme Background
- Section 3: Guidance Documents
- Section 4: Transport Modelling
- Section 5: Economic Assessment
- Section 6: Public Accounts
- Section 7: Environmental Assessment
- Section 8: Social Impact Appraisal
- Section 9: Sensitivity Testing
- Section 10: Summary
- Appendix A: Appraisal Specification Summary Table (ASST)

2. Scheme Background

The Study Area

2.1 The broad study area and potential location for the eastern river crossing is set out in Figure 2-1. The potential Eastern Link Corridor comprises of the B4224, B4399 and the A438. It is expected that the crossing will connect the B4399 to the A438 with a midway access to the B4224 and that the new infrastructure will be a multi-modal corridor which will provide infrastructure for active modes.

Figure 2-1: Site location.



Scheme Objectives

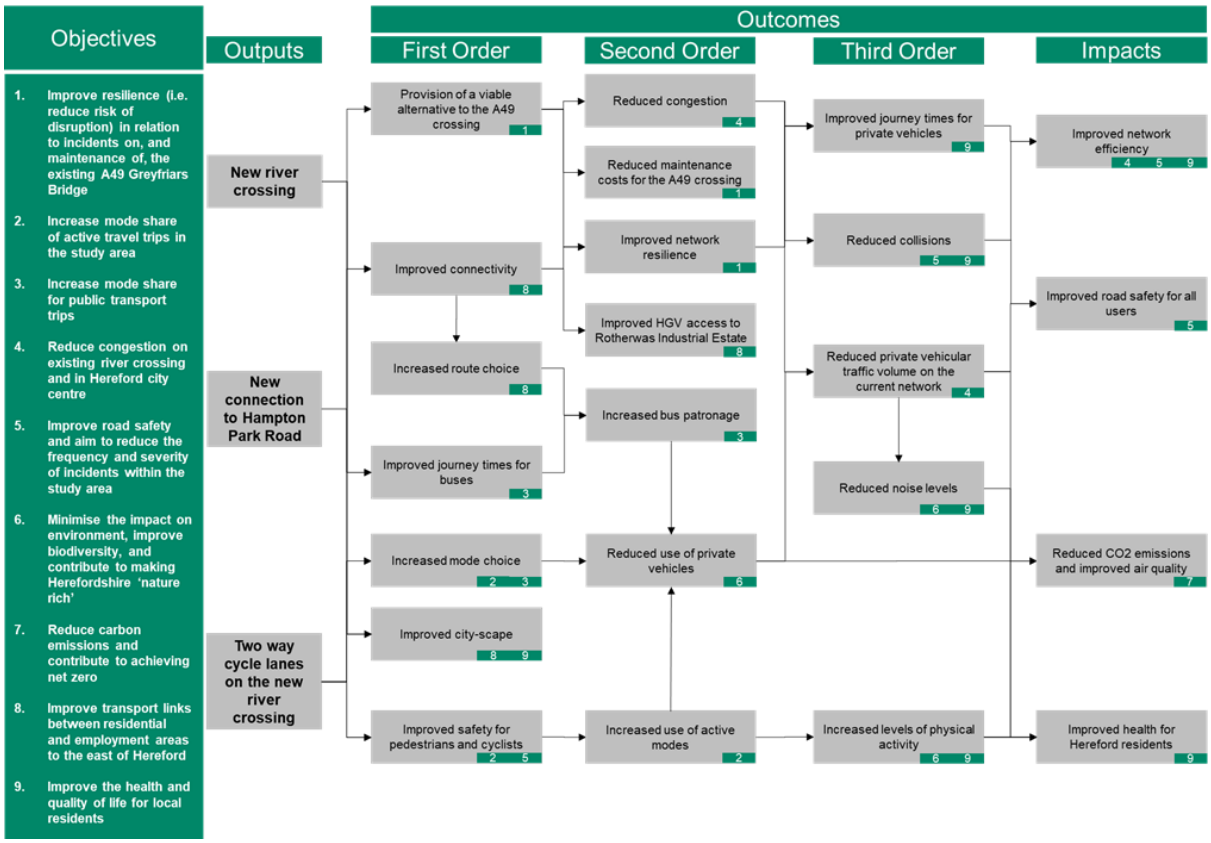
2.2 The objectives shown below have been established following a review of the problems and need for intervention described above and through liaison with Herefordshire Council. As the project develops consideration will be given to setting SMART (Specific, Measurable, Achievable, Realistic and Timebound) targets to sit under these objectives.

- **Resilience**: Improve resilience (i.e. reduce risk of disruption) in relation to incidents on, and maintenance of, the existing A49 Greyfriars Bridge.
- **Active travel**: Increase mode share of active travel trips in the study area.
- **Public transport**: Increase mode share of public transport trips.
- **Congestion**: Reduce congestion on existing river crossing and in Hereford city centre.
- **Safety**: Improve road safety and aim to reduce the frequency and severity of incidents within the city.

- **Environment**: Minimise the impact on the environment, improve biodiversity, and contribute to making Herefordshire 'nature rich'.
- **Carbon**: Reduce carbon emissions and contribute to achieving net zero.
- **Growth**: Improve transport links between residential and employment areas to the east of Hereford.
- **Health & Well-being**: Improve the health and quality of life for local residents.

2.3 The implementation of the scheme is likely to have the impacts shown in Figure 2-2.

Figure 2-2: Logic Map.



Note: The numbers shown below the outcomes relate to the objectives that they address.

Option Development

2.4 The Options Assessment Report which has been produced as part of the Strategic Outline Case (SOC) outlines a long-list and short-list of potential options. Following a four-stage process, the long-list of 18 options has been refined to four options which form the short-list. These short-listed options are to be assessed using the business case process.

2.5 The recommended short-list of options, which are shown in Figure 2-3, are:

Options 1a/1b

2.6 Options 1a/1b connect to the B4399 at the Chapel Road roundabout around the west of Rotherwas Chapel to an at-grade crossing at Hampton Park Road. It then skirts closely to residential receptors and connects to the A438 to the west of the access road to the A&D plant. This requires a structure to be built over the River Wye as well as two public footpaths. Dedicated provision for active travel facilities is also included as part of Options 1a/1b.

2.7 These options are considered with two different speed limits:

- Option 1a – Eastern River Crossing and Link Road Alignment 1 (30mph)
- Option 1b – Eastern River Crossing and Link Road Alignment 1 (40mph)

  The alignment for Option 1b would be wider to accommodate the faster speeds.

Options 3a/3b

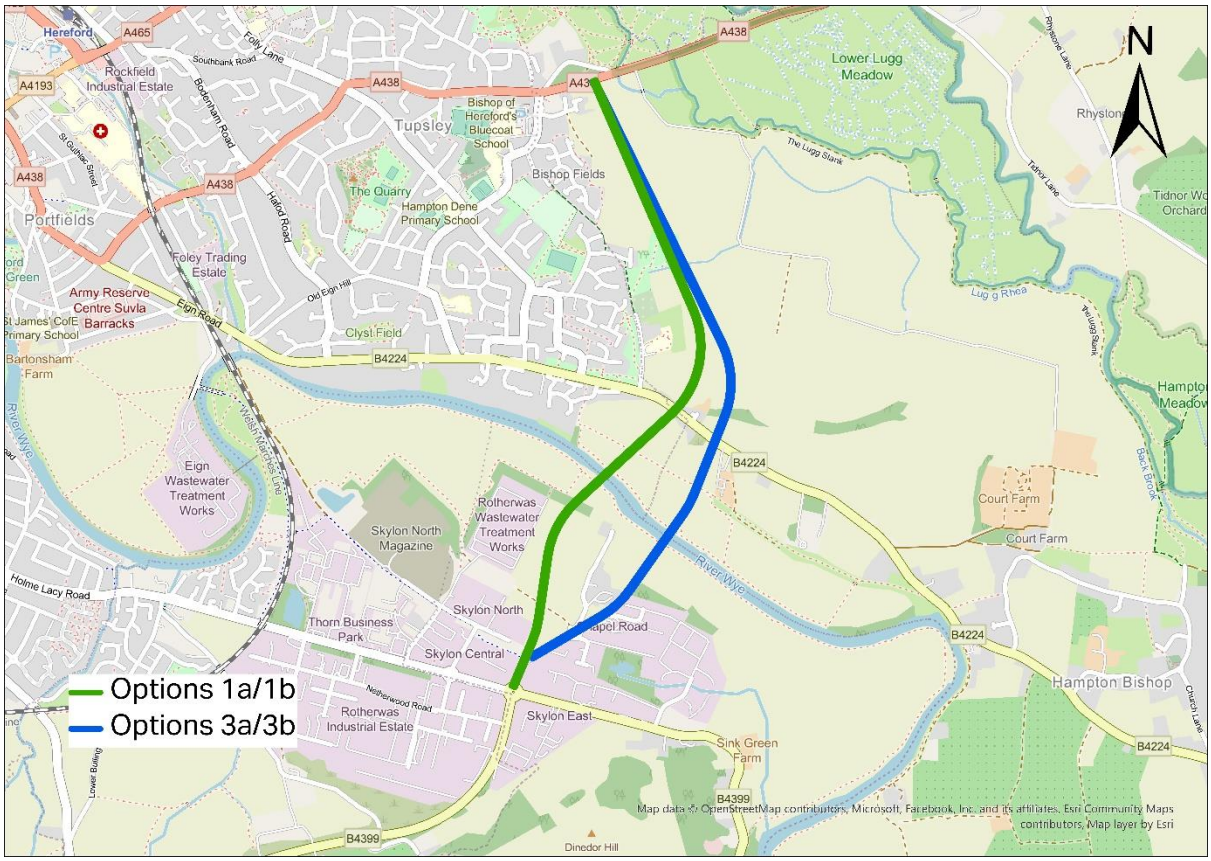
2.8 Options 3a/3b connect to the B4399 at the Chapel Road roundabout around the east of Rotherwas Chapel to an at-grade crossing at Hampton Park Road. This partly utilises Chapel Road existing carriageway and alignment however an additional junction would be required where the ERiC alignment deviates from the Chapel Road alignment. The route then connects to the A438 at the same point as Options 1a/1b. Options 3a/3b is similar to Options 1a/1b except the crossing at Hampton Park Road is more to the east and Options 3a/3b are further away from residential receptors. This requires a structure to be built over the River Wye as well as two public footpaths. Dedicated provision for active travel facilities is also included as part of Options 3a/3b.

2.9 These options are considered with two different speed limits:

- Option 3a - Eastern River Crossing and Link Road Alignment 3 (30mph)
- Option 3b – Eastern River Crossing and Link Road Alignment 3 (40mph)

  The alignment for Option 3b would be wider to accommodate the faster speeds.

Figure 2-3 Shortlisted Options



Stakeholder Engagement Strategy

2.10 A stakeholder engagement strategy has been developed as part of the SOC and is included as part of Appendix L of that document. The document will be updated as the project develops.

2.11 The engagement strategy sets out how Herefordshire Council will work collaboratively to engage with stakeholders on the projects and sets objectives for communication and engagement.

2.12 At SOC, there has been limited stakeholder engagement. At future stages of the business case development, more detailed engagement will be required with a wide range of stakeholders. The key stakeholders and their relevance to the project are set out as part of the Strategy.

3. Guidance Documents

3.1 The following guidance documents have been reviewed in determining an appropriate methodology for this project:

TAG Transport Appraisal Process

3.2 This ASR has been developed in line with information outlined in:

- Transport Analysis Guidance (TAG) 'Guidance for the Technical Project Manager' – May 2018
- Transport Analysis Guidance (TAG) 'The Transport Appraisal Process' – May 2018

3.3 Reference to other units of TAG are made throughout this document where relevant.

Updates to TAG

3.4 The Department for Transport (DfT) have issued updated Transport Analysis Guidance (TAG) in November 2022. These changes reflect the DfT Route Map (July 2020) and subsequent reviews and releases of policy documents. The latest version of the TAG Databook, May 2023 v1.20.2 is being used to develop the updated Hereford Strategic Transport Model base year and forecast year models. It is not considered proportionate to update the forecasts used for the appraisal every time that TAG is updated. However, the economic appraisal will use the latest version of TAG.

3.5 Table 1 in the 'Appraisal and Modelling Strategy – TAG Update Report – May 2021' summarises the development activities completed as part of the TAG route map programme which have been incorporated into the most recent TAG releases in November 2021.

Table 3-1: Changes to the appraisal framework resulting from the route map programme

Issue	Impacts on	Actions
Long-term growth forecasts	Appraisal and modelling	TAG data book updated to March 2021 OBR long-term growth for use in appraisal and annual values for use in modelling
Green Book Review	Appraisal, potentially modelling	Updates to Transport Business Case guidance to be published subsequent to this update; further review of TAG units planned.
Impacts on appraisal accounting	Appraisal	TAG Unit A1.1 to be updated alongside new OBR forecasts that fixes the growth rate used to uprate appraisal values linked to GDP to the OBR long-term rate.
Appraisal period	Appraisal	TAG Unit A1.1 updated to provide guidance on how analysts may look beyond 60 years to provide indicative analysis of potential impacts, for inclusion in business cases and value for money statements as sensitivity tests. Guidance is expanded to describe what uncertainties need to be taken into account.
Optimism bias (OB)	Appraisal	Updated TAG data book with new OB values for use in appraisal at different stages in scheme development. The data set is also expanded in terms of dimensions to allow a more thorough analysis of costs.
Agglomeration elasticities	Appraisal, potentially modelling	Further research is mapped out on agglomeration, to be undertaken in 2021, leading to potential guidance changes thereafter.
Uncertainty Toolkit	Appraisal and modelling	Uncertainty toolkit published, allowing a more structured and thorough understanding of uncertainty presented in

Issue	Impacts on	Actions
		appraisal. This will continue to be developed through collaboration with stakeholders and TAG users.
Scenarios guidance	Modelling that informs appraisal	Common analytical scenarios as part of a major update to the National Trip End Model (NTEM) data set, and its presentation in TEMPRO, is programmed for -Autumn 2021. This will come with updated guidance in TAG Unit M4 on how scenario analysis, particularly using the common analytical scenarios, should be used to support appraisal.
COVID-19 impacts	Modelling that informs appraisal	Common analytical scenarios account for uncertainties brought about by COVID-19. Ahead of publication, sensitivity testing and explicit consideration of the impact of COVID-19 should continue to be reflected in appraisal.
Carbon values	Appraisal	Carbon values will be published in the TAG data book as a forthcoming change notification soon after these values are officially published.
Fleet mix assumptions	Appraisal and modelling	Different fleet mix assumptions will be developed as part of the ongoing enhancements to environmental (carbon) appraisal in support of the Transport Decarbonisation Plan to be published soon after this route map documentation. They will be included in guidance through the common analytical scenarios.

3.6 The TAG Uncertainty Toolkit was released in May 2021 with the aim to provide practitioners with practical advice on the analysis and presentation of uncertainty, and continues to be updated in line with other TAG updates. The Toolkit sets out techniques for exploring uncertainty as part of transport modelling and appraisal, with a focus on the use of scenarios for assessing uncertainty around future travel demand.

3.7 The Uncertainty Toolkit introduces the Common Analytical Scenarios. They are a set of consistent, off-the-shelf, cross-modal scenarios exploring national level uncertainties which have been developed by DfT for use in forecasting and appraisal. This is discussed further in Section 9 of this report.

4. Transport Modelling

Overview

4.1 This section provides a description of the transport modelling methodology that will be undertaken as part of the OBC, including a review of existing transport models, proposed transport modelling and data collection. The Options Assessment Report (OAR) contains the assessment of potential options and identification of a shortlist of options for further appraisal at the OBC stage.

Existing Models

Hereford Transport Model (Existing)

4.2 The Hereford Transport Model is a strategic multi-modal transport model comprising of a full transport demand model, in DIADEM, with separate highway assignment model, in SATURN, and public transport assignment model, in VISUM. The two assignment models interact under the demand model, which is a conventional incremental model with nested hierarchy, consistent with the TAG Unit M2 guidance.

4.3 The highway assignment model represents a weekday morning peak hour (08:00-09:00), and average inter-peak hour (10:00-15:00), and an evening peak hour (17:00-18:00).

4.4 The public transport assignment model represents the same morning and evening peak hours as the highway assignment model, and an average inter-peak hour (10:00-12:00).

4.5 The demand model operated at a 24-hour level, with morning (07:00-10:00), inter-peak (10:00-16:00), evening (16:00-19:00) and off-peak periods (19:00-07:00).

4.6 The model is a strategic transport model of Hereford with sufficient detail to capture trips travelling to/from Hereford and within Herefordshire and is separated into simulation and buffer areas.

4.7 The model was originally developed with a base year of 2012 but has since been updated to a base year of 2016 using observed data from that year. The Hereford Transport Model has the following forecast years, which have been developed in accordance with TAG:

- 2020
- 2032
- 2041
- 2051

4.8 The demand model represents car, public transport (with sub-modes of bus and rail), active modes (with sub-modes of walk and cycle). The model does not consider the demand response of Light Goods Vehicles (LGV) and Heavy Goods Vehicles (HGV), but they are included in the highway assignment model

Hereford Transport Model (In Development)

4.9 In 2022, Herefordshire commissioned AECOM to develop a new Hereford Transport Model, with a base year of 2023. Hereford Transport Model is currently in development. The model covers the Herefordshire region in detail and will consist of:

- A highway assignment model (HAM) in SATURN software;
- A public transport assignment model (PTAM) in Visum software; and
- A variable demand model (VDM) in Visum software.

Proposed approach

OBC Modelling

4.10 Given the proposed timescales of the OBC and the availability of suitable modelling suites to inform strategic and economic case narrative, it is proposed that the existing Hereford Transport Model (HTM) is used. However, the transport model that is currently being developed could be used at the end of the OBC stage to provide increased confidence in the appraisal results.

4.11 HTM is the preferred model for this study due to a number of reasons, including:

- Suitable geographic area of coverage in relation to the study area;
- It contains the most up to date data in terms of demand in the region;
- It is able to forecast changes in mode share and therefore will be able to estimate mode shift with the implementation of various schemes; and
- It has been built to be used for economic and environmental appraisal.

4.12 A local LinSig model will also have a role in helping to refine and optimise the OBC designs including operational assessment, but will not be used in economic appraisal of the scheme.

4.13 The Hereford Transport Model will represent the region at a strategic level. A review of the base year network and detail of the zone system in the proposed scheme study area has been undertaken to ensure that the level of detail in the model in the vicinity of the scheme is appropriate. This review has been undertaken on both the highway and PT networks and zone systems to ensure consistency and compatibility between the highway, PT and VDM elements of the HTM.

FBC Modelling

4.14 Given the proposed timescales of the FBC it is proposed to use the Hereford Transport Model that is currently in development.

4.15 The new Hereford Transport Model is the preferred model for this study due to a number of reasons, including:

- Suitable geographic area of coverage in relation to the study area;
- It will contain the most up to date data in terms of demand in the region;
- It is able to forecast changes in mode share and therefore will be able to estimate mode shift with the implementation of various schemes; and
- It has been built to be used for economic and environmental appraisal.

4.16 The new Hereford Transport Model will represent the region at a strategic level. A review of the base year network and detail of the zone system in the proposed scheme study area has been undertaken to ensure that the level of detail in the model in the vicinity of the scheme is appropriate. This review has been undertaken on both the highway and PT networks and zone systems to ensure consistency and compatibility between the highway, PT and VDM elements of the Hereford Transport Model.

Forecasting Approach

4.17 We will use the HTM forecast year transport models which have been developed and are currently being tested. The forecast year models have been developed following guidance in TAG Unit M4 – Forecasting and Uncertainty, as described below.

4.18 A core scenario will be defined reflecting expected network changes in model year and in line with TAG guidance, it will be:

- Based on published plans (not including speculative proposals);
- Unbiased (un-likely to over or under achieve, given existing plans and evidence);

- Coherent and self-consistent (if X is unlikely to go ahead unless Y also goes ahead, then X should only be included if Y is also included); and
- Realistic and plausible.

4.19 It is proposed that two forecast years will be assessed, it is likely we will use the Hereford Transport Model forecast year Foundation-Case transport models. The years will be discussed and agreed with Herefordshire Council in advance of any forecast year transport modelling being undertaken. Our current assumption is that we model the opening year and 15 years after scheme opening.

Highway Model

4.20 Highway trip growth between base year and future year has been based upon the forecast growth contained in the National Trip End Model (NTEM) v8.0, at a spatial area consistent with the defined zone system. Freight traffic growth will be based on DfT national model forecasts (RTF18, scenario 1).

4.21 As part of the HTM development, an uncertainty log has been developed in discussion with other relevant stakeholders (e.g. National Highways) to ensure the local planning data is included within the core scenario. This will assume that any developments and schemes that are 'more than likely' or 'near certain' will be included within the core scenarios. This data has been used to define the spatial distribution of future growth, whilst retaining the total growth levels forecast within the National Trip End Model (NTEM). This uncertainty log has been reviewed as part of this project to ensure that relevant developments and infrastructure schemes have been included in the Foundation Case.

4.22 For the future year, any committed highway infrastructure / schemes, which will be open by the future model year, will be added to the respective future year networks. In any forecast scenarios, traffic signal times will be reviewed and adjusted to remove any excessive or unrealistic delays. These will be undertaken to ensure they are consistent across all forecast scenarios.

Public Transport Model

4.23 It will be assumed that in the reference case public transport service levels will be maintained at base year levels, unless otherwise specified in the Uncertainty Log. The Log will be reviewed to ensure that schemes are included.

4.24 Public transport growth will be considered at a strategic level, with growth factors applied at a Local Authority level. The proposed approach to sensitivity testing is provided in section 9 (Sensitivity Testing).

Option Testing

4.25 This preferred option will then be taken forward and assessed using the Hereford Transport Model. The scheme will be represented in a consistent manor in both the highway and PT models.

4.26 In the FBC stage the preferred option will be assessed using the new Hereford Transport Model. The scheme will be represented in a consistent manner in both the highway and PT models.

Data Collection

4.27 Given that the COVID-19 pandemic has dramatically changed travel patterns for the short-term and could also be a driver for long-term change due to the impacts of social distancing, it is important to try and understand how transport modelling will adapt. There are several uncertainties around the extent to which previous trends and relationships will continue and how the number and types of trips made will differ in a post COVID world. Modelling different scenarios to account for these changes and assessing a range of forecasts to establish the resilience of schemes to travel demand variation will be critical.

4.28 A wide range of surveys and transport related data is available through Herefordshire Council. Furthermore, extensive data collection is underway for the design of the new Hereford Transport Model.

5. Economic Assessment

Active Modes Benefits Appraisal

5.1 Benefits associated with the provision of dedicated cycling routes and facilities as part of the scheme will be considered, alongside the Social Impact Assessment set out in Section 8.

5.2 The approach will be to calculate the benefits using the version 2.08 of November 2022 of the DfT's Active Mode Appraisal Toolkit (AMAT). This ensures that the calculation of benefits is in accordance with DfT guidance, as set out in Transport Analysis Guidance Unit A5.1. The value for money provided by the schemes can thus be consistently compared against other proposals.

5.3 By using the AMAT, the following benefits will be quantified for the walking and cycling elements of the scheme:

- User Benefits - estimated journey time savings and journey ambience uplift;
- Business Benefits - reduction in absenteeism;
- Health Benefits - economic benefits of preventing early mortality through cycle exercise; and
- Marginal External Cost Savings – reduction in the number of car trips of 5km due to mode switch to cycling.

5.4 Care will be taken to avoid double-counting of benefits between MECs and benefits appraised through TUBA. The DfT guidance on using the AMAT provides a full explanation of these benefits, and the external sources from which they are derived.

5.5 To maintain consistency with the highway and public transport economic appraisal, the cycling benefits will be considered over a 60-year appraisal period. This is because of the proposed step change in cycling facilities such as segregated cycle lanes, which will be enduring over the 60 year appraisal period. Alongside the 60-year appraisal, the appraisal will be re-run using a 20-year appraisal period as outlined in TAG.

5.6 To calculate the scheme impacts, the AMAT requires the user to input several scheme-specific variables, including:

- Scheme opening year;
- Last year of funding;
- Type of area scheme is located (e.g. Hereford, Urban);
- Number of walking and cycle journeys per day without the proposed scheme;
- Number of walking and cycle journeys per day with the proposed scheme;
- The average proportion of a trip which uses the scheme infrastructure;
- Current walking and cycling infrastructure for the route;
- Proposed new walking and cycling infrastructure;
- Appraisal period; and
- Annualisation factor that converts daily trips into annual trips.

Cycling Trips

5.7 To calculate the baseline number of cycling trips that may use the proposed facilities, the following data sources will be used in the appraisal, in order of preference depending on the quality of the data:

- Hereford count data (including data from existing surveys).
- Strava Metro data (assuming sufficient coverage of routes).

- Propensity to Cycle tool (PCT) origin-destination flows. The PCT is based on 2011 census journey to work data. For on-road sections the relevant road link will be used to determine the potential demand. In some cases (i.e. where there are any off-road sections), the road link which runs adjacent to the scheme will be used to understand the potential demand. As the PCT only accounts for commuting trips which according the National Travel Survey (NTS) (2017) account for 34.3%, the PCT value will be converted into all trips by multiplying by a factor of 2.92 to account for trips other than commuting.
- DfT Annual Average Daily Flow (AADF) counts.

5.8 Given the uncertainty of what the demand for the scheme will be in the scheme opening year compared to the PCT's 2011 database, TEMPro will also be used to forecast the demand for the opening year.

5.9 The appraisal will also consider the May 2022 AMAT guidance regarding:

- Adjusting the health-based calculations based on average trip length;
- Utilising the new Area Lookup function to support MEC based calculations;
- Updated absenteeism formula;
- Number of user's formula changed to reflect return journey percentage as a percentage of journeys that have both an out and back leg (appear twice in daily counts); and
- Updated GDP per capita and GDP deflator forecasts.

5.10 The economic benefits of the walking and cycling improvements will be appraised over a 60-year period in the core scenario, as the proposals are considered to have a comparable design life to major road and rail capacity improvements. Maintenance costs for the community connections (i.e. local community links) are included in general highways maintenance costs for the local authority. Maintenance costs for the strategic cycling corridor will also be included.

5.11 In accordance with the latest TAG guidance, the 10% annual decay factor for walking/cycling appraisal will be removed meaning the uptake due to the scheme remains constant for the appraisal period.

5.12 For the sections that propose new cycle infrastructure, benefits will be captured to account for the attraction of new cyclists shifted from other modes. The uplift is proposed to be based on the following:

Strategic cycling corridor

5.13 Cycling demand uplift will be calculated using the HTM informed by the changes to cycling generalised costs. Uplift will be adjusted to consider abstraction of trips from current routes if data allows.

Community connections

5.14 Approach 1 - Comparative Study: This requires researching other schemes that have been implemented elsewhere to see what level of impact they have had in terms of uplifts in walking and cycling trip numbers. This will involve analysis of the similarities and differences between the comparators and the schemes. Justification will be provided to highlight how the comparative studies are applicable.

OR

5.15 Approach 2 – Sketch Plan Method: This technique employs the approximate elasticity estimate for the change in demand for cycling in a district, based on a change in the proportion of available routes that have facilities for cycle traffic. This method would be used for a network of routes across the area.

5.16 For sections that do not propose any dedicated cycling infrastructure, no demand uplift will be assumed.

5.17 PT demand uplift will be captured through the inclusion of improved passenger accessibility to the bus service through the improved community connections (walking and cycling). However, journey quality benefits will be captured for existing cycle users on all sections of the network where there are improvements.

5.18 When calculating how much of an average cycling trip will use the intervention, the scheme length will be divided by the average cycle trip length (derived from NTS). As suggested by the Emergency Active Travel Fund (EATF) guidance, a cap of 50% should be used if using MCCs or DfT AADF counts for baseline trips (PCT approach already factors down users based on how much of the scheme they would use).

5.19 As the AMAT does not account for reductions in cycling accidents because of segregated infrastructure, an assumption of a reduction in accidents will be gained utilising current cycling casualty statistics for the last five years and TAG Databook accident prevention values for cyclists.

5.20 An additional qualitative assessment will be undertaken using journey quality worksheets to support the AMATs.

Walking Trips

5.21 Benefits for pedestrians as a result of the scheme will also be assessed in the AMAT. To establish the without scheme demand, the following data sources will be used in the appraisal, in order of preference depending on the quality of the data:

- Hereford count data (including data from existing surveys).
- Strava Metro data (if available and sufficient coverage of routes).
- Propensity to Cycle tool (PCT) origin-destination flows. Where there is a lack of count data, an assumption on the number of pedestrians will be made based on the 2011 census walking and cycling mode shares for Hereford. This will be calculated using the Propensity to Cycle Tool demands for cycling along links where pedestrian infrastructure improvements are to be implemented. This value will be adjusted to estimate the number of pedestrians using the entire scheme length and proportion of non-commuting pedestrians from NTS (in line with EATF guidance).

5.22 Given the uncertainty of what the demand for the scheme will be in the scheme opening year compared to the PCT's 2011 database, TEMPro will also be used to forecast the demand in the opening year. This is felt to be a conservative approach.

5.23 There is limited guidance within TAG for estimating walk uplifts. The comparative study approach is recommended including justification of how the proposed schemes accord with a comparative study. Given the multi-faceted nature of the scheme proposals, it is considered that the comparative study approach where comparison with similar schemes implemented elsewhere would provide the most realistic level of change estimates for walking.

5.24 The DfT Uplift Tool, as provided as part of the Tranche 2 of the Emergency Active Travel Fund (EATF), will be used as a sensitivity test for uplift. There will also be a zero and high uplift sensitivity test.

5.25 As with the cycling appraisal, when calculating how much of an average walking trip will use the intervention, the scheme length will be divided by the average walk trip length (derived from NTS). As suggested by the EATF guidance, a cap of 50% should be used if using MCCs for baseline trips (PCT approach already factors down users based on how much of the scheme they would use).

5.26 An additional qualitative assessment will be undertaken using journey quality worksheets to support the AMATs.

Assumptions within AMAT

5.27 Several other parameters are also included within the AMAT (e.g. the assumed average speed for walking and cycling). For these, the DfT has provided default values based on various DfT-defined sources and research; these default values were retained in this model unless specified elsewhere as part of the appraisal. The exception being annualisation factors.

5.28 The benefits, particularly for non-commuting trips, are under-represented in appraisal of active mode schemes, due to the application of an annualisation factor. Within the AMAT there is a default assumption of 253 days set for the "Number of days for which intervention data is applicable per year". This is based on 365 days per year minus weekends and bank holidays. As such this assumes the scheme is applicable only on "workdays", however most schemes will be available for use every day and for all types of trip e.g. leisure, commuting, education etc.

5.29 A suggested approach to account for this is as follows:

- If there is sufficient Hereford count data and Strava Metro data for the scheme being assessed, it is possible to calculate an average daily flow of active modes. Therefore, the default of 253 can be amended to 365 to take account of the average flow per day across the year. It should be noted that several independent academic studies have analysed the relationship between Metro data and data recorded by MCCs and found robust correlations between the two and therefore that Strava users' travel patterns are representative of the overall population. These studies will be explored further to inform generation of an adjustment factor to capture cyclists that don't use Strava.
- If there is no, or insufficient Hereford count or Strava Metro data available for a scheme component, the method to ascertain demand is to use the PCT (as set out above). This will provide the number of commuting and non-commuting trips. This breakdown of trip types can then be used in separate AMATs for each trip type:
  - Commuting flows – for this AMAT, the flow input is commuter flows only, and the default value for proportion of people employed is changed to 100%. The 253 days is retained as the annualisation factor.
  - Non-commuting flows – for this AMAT the flow input is the non-commuting flows only. The default proportion of people that work is unchanged; as some of these trips will be made by people in employment and absenteeism benefits still apply. However, the annualisation factor is amended to 365, to account for the non-commuting trips which effectively can occur on any day.

5.30 To maintain consistency with the highway and public transport economic appraisal, the walking benefits will be considered over a 60-year appraisal period, factoring in the costs of maintenance and renewal of the infrastructure over that period. In addition, a sensitivity test will be undertaken using a 20-year appraisal period.

Highway User Impacts

5.31 The interventions as part of the package will impact on general traffic through rerouting as a result of the new road systems, road closures, junction reconfigurations, banned traffic movements and road space reallocation. The impact on the highway users will be assessed using the Hereford Transport model. The outputs from 'with scheme' and 'without scheme' forecast year scenarios will inform the economic appraisal.

5.32 The appraisal will make use of the latest version of TUBA to quantify the economic impacts of the schemes for highway users.

5.33 The economic appraisal of highway user impacts will be undertaken over a 60 year appraisal period, which is in-line with TAG Unit A1.1. Annualisation factors will be calculated using observed traffic count data from across the study area.

Accidents

5.34 A proportionate quantitative assessment will be undertaken to monetise the accident impact of the proposed scheme. To capture the direct impact of the scheme on general traffic user accidents, a localised COBA-LT assessment will be undertaken. In addition, the impact on accidents will also be calculated as part of AMAT appraisals and will be detailed in the Transport Case. To ensure there is no double counting, the AMAT impacts associated with mode shift (congestion, infrastructure maintenance, accident, local air quality, noise, greenhouse gases and indirect taxation) will not be included within the Transport Economic Efficiency Tables within the Economic case.

5.35 The proposed approach to accident appraisal is described in more detail in Section 8 (Social Impact Appraisal).

Construction and Maintenance Impacts

5.36 As the scheme progresses we will work with Herefordshire County Council to define a suitable methodology based on availability of relevant information associated with construction phases and maintenance schedules.

5.37 A construction sequence plan will be defined based on the information presented in the deliverability plan. We will undertake a qualitative assessment unless the emerging construction sequencing plan indicates that there will be significant detrimental impacts.

Wider Impacts

5.38 Any transport intervention that improves transport opportunities and brings businesses and employees closer together has the potential to generate wider economic impacts. Such impacts are additional to the standard user benefits calculated in a Stage 1 cost benefit appraisal. Three critical forms of economic impact outlined within TAG unit A2.1 include:

- **Productivity Impacts**: benefits can be generated by bringing businesses closer together with suppliers, collaborators, and specialist staff; which increases business productivity.
- **Labour Supply Impacts:** benefits can arise if areas of under-employment are brought closer to areas with job vacancies. Reduced commute times can widen pools of jobs for people looking for work and for employees to fill business vacancies. Together this has the potential to increase levels of employment with associated benefits.
- **Dependent Development Impacts:** if a scheme provides transport capacity and accessibility that makes new development viable that would otherwise not be there, there is potential to capture the increase in land values as a scheme benefit.

5.39 The initial stage in determining the potential for a transport scheme to generate wider economic impacts is the development of an Economic Narrative. This represents a study of the local and regional economy relevant to the study area, in order to identify any market failures, for instance caused by poor access to services, staff or materials for local businesses.

Reporting (TEE, AMCB etc.)

5.40 A Transport Economic Efficiency (TEE) table, an Analysis of Monetised Costs and Benefits (AMCB) table and Public Accounts Table (PAT) will be produced to compare each shortlisted option against each other. A Value for Money category will be given based on the information on these tables and other factors addressed in the appraisal. A rationale for the assigned Value for Money category will be provided.

5.41 Justification of the preferred scheme option will be made on both value for money and scheme objective and strategic case grounds. Recent changes in guidance have placed a reduced

emphasis on the BCR and corresponding increased emphasis on the Strategic Case in business cases.

5.42 To support the scheme appraisal, we will produce a summary which demonstrates how the preferred option aligns with the scheme objectives, strategic case grounds and current government policy (e.g. Carbon Net Zero and Levelling Up).

6. Public Accounts

6.1 The public accounts element of the OBC and FBC will follow the guidance contained within TAG Unit A1.2 (May 2022).

Scheme Costs Estimation

6.2 Scheme costs will be estimated by quantity surveyors working closely with Herefordshire Council and other technical specialists inputting to scheme design and development e.g. structural engineers. They will include:

- Investment costs, including:
  - construction costs including enabling works
  - land and property costs
  - preparation and administration e.g. design, engagement, project management, planning approvals.
- Operating, maintenance and renewal costs, to estimate the whole life costs for the scheme

6.3 These costs will provide the base cost estimate. A real cost adjustment will be applied to the base costs to account for general inflation and construction inflation.

6.4 For the OBC stage the design of options will be at a Preliminary level, with cost estimation informed by a quantification of linear measures and proposed cross-sections. High level estimates of cut/fill and structural costs based on similar schemes and linear estimates will be used to inform the costs.

6.5 Cost estimates for scheme development and further design, assurance and implementation stages will be calculated for the options assessed at the OBC stage.

6.6 At FBC stage the preferred option and final agreed project price are to be presented.

Treatment of Risk

6.7 A programme risk register is being prepared and risks will be quantified for the OBC and FBC. A full Quantified Risk Assessment (QRA) will be used in the risk-adjustment process at OBC and FBC stage. To account for the level of uncertainty surrounding scheme costs at the OBC and FBC stage, a suitable optimism bias will be applied based on the detail of the cost estimates, a quantified risk assessment and following the guidance in TAG Unit A1.2 (May 2022).

Indirect Tax Revenues

6.8 Indirect tax revenues will be calculated using outputs from the highway assignment model and TUBA software (60-year appraisal and construction period).

7. Environmental Assessment

Introduction

7.1 A wide range of environmental constraints are present in the vicinity of the study area, including a Special Area of Conservation (SAC), Sites of Special Scientific Interest (SSSIs), Scheduled Monuments, and listed buildings. For the purposes of this report, the study area is illustrated on **Error! Reference source not found.** and **Error! Reference source not found.**, below, which comprises a 2 km radius around the indicative site boundary.

7.2 Environmental constraints have been identified with regard to the environmental disciplines included within Transport Analysis Guidance (TAG) Unit A3: Environmental Impact Appraisal[1], these include:

- air quality;
- cultural heritage;
- landscape (including townscape) and visual impacts;
- biodiversity;
- noise and vibration;
- road drainage and the water environment; and
- climate (greenhouse gases).

7.3 The following sections summarise the constraints identified in relation to the environmental disciplines listed above, with reference to the constraints plan shown in Figure 7-1 and Figure 7-2, below.

7.4 Reporting at OBC will include input into high level Appraisal Summary Tables (ASTs) and the relevant TAG worksheet for the proposed Scheme.

[1] Department for Transport (2022). *TAG Unit A3 Environmental Impact Assessment*. Available at: Tag Unit A3 [Accessed 12/05/2023]

Figure 7-1: Environmental Constraints Page 1 of 2

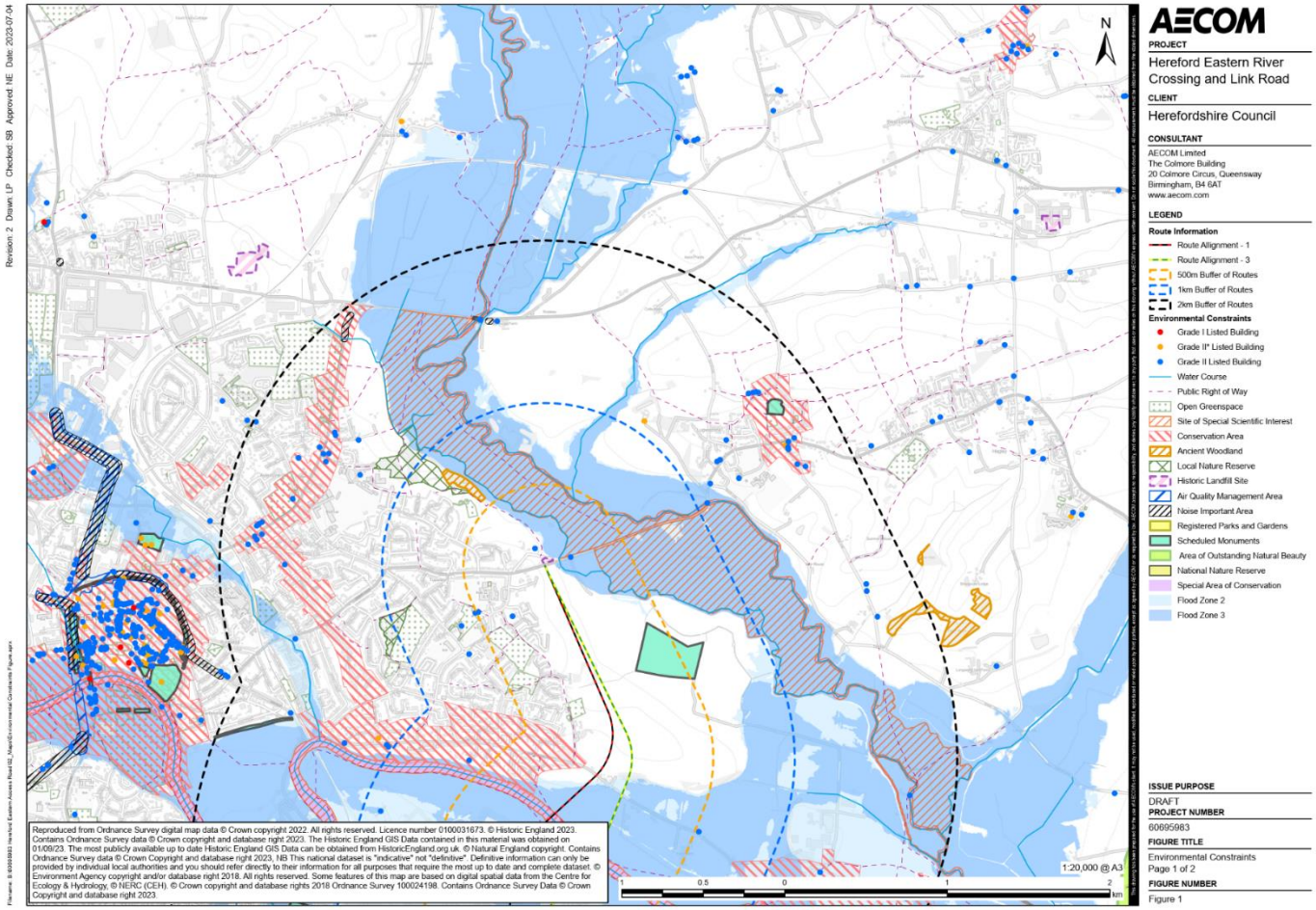
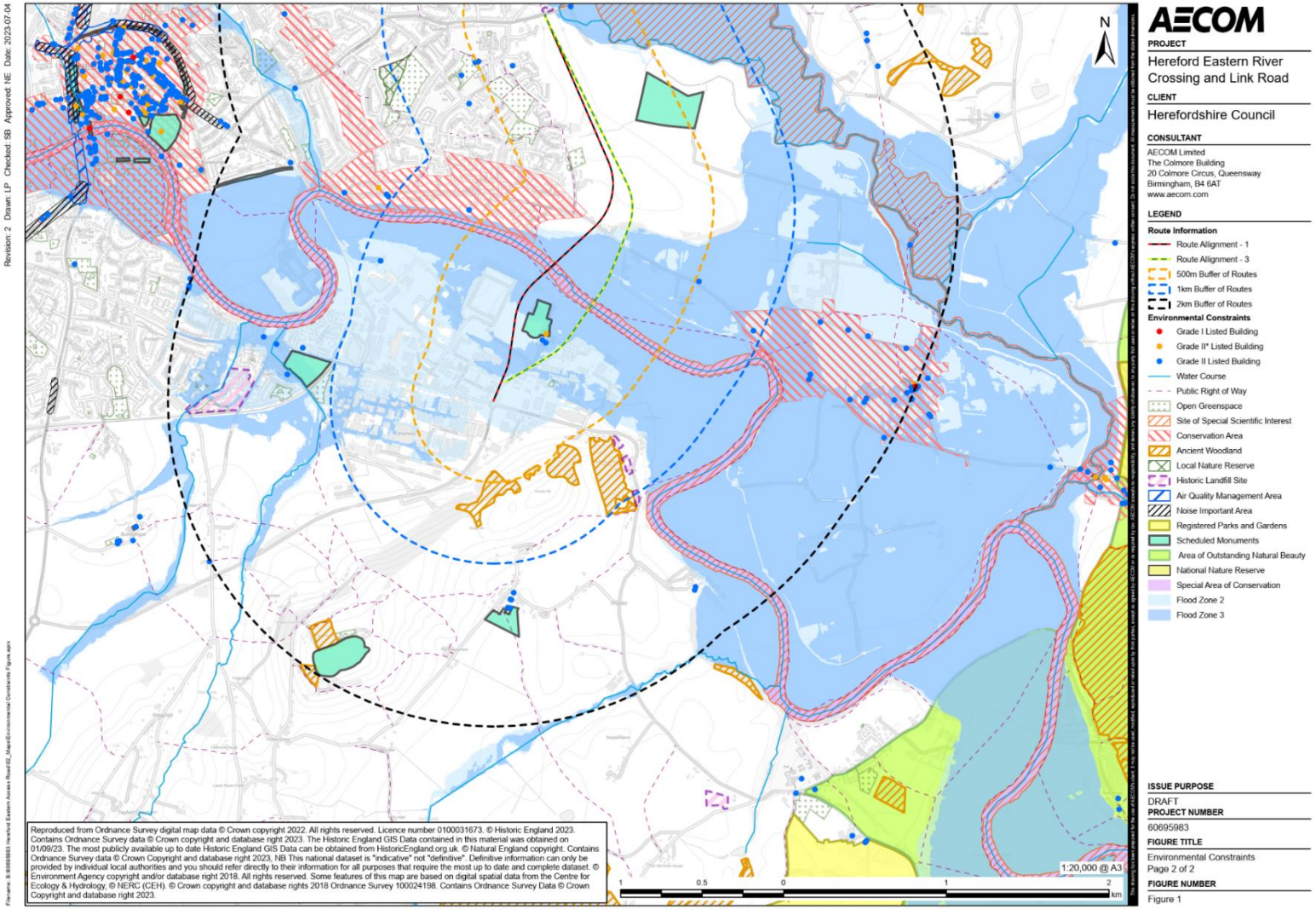


Figure 7-2: Environmental Constraints Page 2 of 2



Air Quality

Constraints

7.5 Herefordshire Council has two Air Quality Management Areas (AQMAs), the nearest is Hereford AQMA, which includes parts of the A49 and A438 in Hereford city centre, approximately 2.3 km west of Options 1a/1b and 3a/3b. This AQMA was declared in 2001 for exceedances of the annual mean NO_2 objective value. There is no current or proposed Clean Air Zone in Hereford.

7.6 Air quality sensitive receptors include residential receptors, schools, and hospitals. Designated ecological receptors may also be sensitive to changes in air quality.

7.7 According to Herefordshire Council's 2020 Air Quality Annual Status Report (ASR)[2], Herefordshire Council had one continuous monitoring station (CMS), on the A49 in Hereford city centre, which measured nitrogen dioxide (NO_2) and particulate matter (PM_{10}) in 2019. There were 46 NO_2 diffusion tube monitoring sites across the local authority area. Relevant monitoring is described below:

- the CMS monitored concentration of NO_2 was 38 µg/m^3 which is below the annual mean objective of 40 µg/m^3 in 2019;
- all but one of the NO_2 diffusion tube monitoring results were below the annual mean objective of 40 µg/m^3 in 2019. The monitored exceedance of 46.0 µg/m^3 was at site 61b, in Leominster, more than 19 km away from the proposed Scheme;
- within 2 km of the Scheme there are three NO_2 diffusion tubes: Site 92 on Netherwood Road on the Rotherwas Industrial Estate measured 13.5 µg/m^3; site 93 on the B4399 measured 10.5 µg/m^3 and site 105 on the A465 near Hereford station measured 28.0 µg/m^3;
- the CMS monitored concentration of PM_{10} was 21 µg/m^3 which is below the annual average objective of 40 µg/m^3 in 2019; and
- $PM_{2.5}$ was not monitored by the Council in 2019.

7.8 Defra projects background pollutant concentrations across the UK on a 1 km by 1 km grid basis. The mapped background annual mean concentrations within the study area for 2019 were 5.5 µg/m^3 for NO_2, 12.8 µg/m^3 for PM_{10}, and 7.8 µg/m^3 for $PM_{2.5}$. These are well below the respective annual mean objectives. Background concentrations are projected to fall in the future due to improving emissions standards.

7.9 Defra also provides output from the Pollution Climate Mapping (PCM) model. The PCM model is a collection of models designed to fulfil part of the UK's EU Directive (2008/50/EC) requirements, providing roadside NO_2 concentrations for a number of roads considered to be at risk of failing to comply with the Air Quality Directive. There are three PCM links within 2 km of the proposed Scheme; the A438, the A4103, and the A465. None of these links are projected to experience annual mean NO_2 concentrations above the EU Limit Value (40 µg/m^3) in 2019, with the highest projected concentration being 19.3 µg/m^3. Roadside concentrations are projected to fall in the future due to improving emissions standards.

7.10 During construction, changes to air quality, including deterioration in relation to large particulate matter (dust), fine particulate matter (PM_{10} and $PM_{2.5}$) and exhaust emissions from construction vehicles may adversely impact amenity, human health, and ecological sites within 200 m of construction activity.

7.11 During operation there may be a deterioration in local air quality as a result of the introduction of new road links close to air quality sensitive receptors. In the wider area the proposed Scheme may result in changes in concentration of the pollutants associated with vehicle emissions due to changes in the flow, composition and speed of traffic on the surrounding roads affected by the proposed Scheme. These changes may be beneficial or adverse. Within the Hereford AQMA

[2] Herefordshire Council (2021). *2020 Air Quality Annual Status Report (ASR)*. Available at: ASR 2020 [Accessed 12/05/2023]

beneficial impacts are expected due to the proposed Scheme providing an alternative route to the A49.

Proposed Method of Assessment

7.12 Assessment of air quality impacts will be undertaken in accordance with TAG Unit A3, Section 3. A quantitative air quality assessment will be undertaken as part of the appraisal process.

7.13 On the basis of likely effects on the nearby AQMA, a detailed level of assessment will be required. This will comprise detailed dispersion modelling (ADMS-Roads) and an assessment in accordance with the relevant TAG sub-objectives, suitable for inclusion in the OBC submission.

7.14 The detailed air quality assessment will be based on National Highways DMRB LA 105. Relevant National Highways and Defra air quality tools and guidance will also be utilised as required. The changes in NO_x and $PM_{2.5}$ emissions and exposure will be monetised in line with TAG guidance.

7.15 In line with DMRB LA 105, the air quality study area will be determined by analysis of the proposed Scheme traffic data and will include air quality sensitive locations within 200 m of an affected road link (collectively known as the affected road network (ARN)). An affected road link is defined as a road that experiences one or more of the following changes with the proposed Scheme options in operation:

- Annual average daily traffic (AADT) ≥1,000; or
- Heavy duty vehicle (HDV) AADT ≥200; or
- A change in speed band; or
- A change in carriageway alignment by ≥5 m.

7.16 The Local Air Quality TAG workbook and Air Quality Valuation workbook will be completed in accordance with TAG Unit A3 (section 3), and the conclusion incorporated into the AST.

Survey/Data Requirements

7.17 The air quality assessment will be informed by traffic data provided by the proposed Scheme traffic and transport consultant from the HTM modelling, air quality monitoring data sourced from publicly available information from the Local Authorities, background pollutant concentration data made available by Defra and hourly sequential meteorological data from a representative site sourced from a private supplier.

7.18 Traffic data is required to cover the following:

- 24-hour Annual Average Daily Traffic (AADT) flow, %HDV, average speed (km/hr) and speed band category for all links within the traffic model.
- An existing baseline scenario (e.g. 2022), a Do-Minimum scenario (year of opening and design year) and Do-Something scenarios for each proposed Scheme option (year of opening and design year).

7.19 Traffic data should be provided for all key traffic links, to include all links within 500 m of the proposed Scheme options and all roads potentially affected by the proposed Scheme options, including in areas where an AQMA has been declared.

7.20 It is not recommended that any additional air quality monitoring data is required to supplement the data available from HC for the OBC.

Cultural Heritage

Constraints

7.21 There are no World Heritage Sites (WHS), registered battlefields or registered parks and gardens within the study area.

7.22 There are nine Scheduled Monuments within the study area, the closest being ‘ ‘Site of Rotherwas House, earthwork remains of formal gardens, and Rotherwas Chapel’, 50 m east of Options 1a/1b and 100 m west of Options 3a/3b.

7.23 There are 94 Listed Buildings within the 2 km study area, one of which is Grade I, 88 are Grade II and five are Grade II*. The closest of these are: ‘Lower House Farmhouse’ Grade II Listed Building, 120 m north of Options 1a/1b and 3a/3b; ‘Barn About 60 Yards South of Rotherwas Chapel’ Grade II Listed Building, 70 m west of Options 3a/3b; ‘Former Stable Block About 40 Yard South of Rotherwas Chapel’ Grade II Listed Building, 100 m west of Options 3a/3b; and ‘Rotherwas Chapel’ Grade II* Listed Building, 110 m west of Options 3a/3b.

7.24 According to the Herefordshire Council Conservation Area Map[3], there are six conservation areas within the study area.

7.25 The potential impacts include direct physical impacts on buried assets of archaeological interest and changes to the setting of heritage assets, arising from temporary construction effects such as the use of construction plant, the location of construction compounds, soil storage areas and associated noise and lighting; and permanent effects resulting from the earthworks and structures of the completed scheme, associated noise, increased lighting and volumes of traffic.

7.26 All options have the potential for adverse impacts on the designated assets relating to Rotherwas Chapel and ‘Lower House Farmhouse’ Grade II Listed Building. All options may have impacts on ‘Ring ditches and rectilinear enclosures east of Tupsley’ Scheduled Monument and the Grade II Listed ‘Milepost at SO538403’ . Review of aerial imagery indicates that the milepost has already been removed.

Proposed Method of Assessment

7.27 Assessment of impacts on the historic environment will be undertaken in accordance with TAG Unit A3, Sections 8. Direct and indirect impacts will be assessed.

7.28 Baseline information will be established using publicly available information on the historic environment, for example, Historic Environment Records, Historic England list of heritage assets, Defra’s Magic Maps, Street View and aerial mapping.

7.29 The Historic Environment TAG worksheet will be completed in accordance with TAG Unit A3 (sections 8), and the conclusion set out in the qualitative comments section incorporated into the AST.

7.30 Further assessment in the form of a Cultural Heritage Assessment following DMRB LA 106 is likely to be required in order for planning permission to be granted, which is not scoped here.

Survey/Data Requirements

7.31 Historic Environment Record datasets are required from the Herefordshire Historic Environment Record.

7.32 Site surveys are not considered to be required at OBC but would be required to support a Cultural Heritage Assessment as part of any planning application for the proposed Scheme.

[3] Herefordshire Council (2023). *Conservation Area Maps*. Available at: Conservation areas [Accessed 12/05/2023]

Landscape (including townscape) and Visual Impact

Constraints

7.33 The study area is located within National Character Area (NCA) 100 Herefordshire Lowlands, characterised by a gently undulating landscape with steep-sided cornstone hills dominated by ancient woodlands and small dispersed settlements.

7.34 According to the Herefordshire Council Landscape Character Assessment (2004, updated 2009)[4], at the local level, the study area falls within the Landscape Character Area (LCA) Central Herefordshire.

7.35 The study area is not located within a National Park or Area of Outstanding Natural Beauty (AONB), the nearest being the Wye Valley AONB, approximately 3 km southeast of the nearest option. The study area is not located within the Green Belt.

7.36 The proposed options are located close to a number of sensitive receptors, including Public Rights of Way (PRoW) and residential receptors.

7.37 According to the Herefordshire Council administrative map[5], there are approximately 59 Tree Preservation Orders (TPOs) within 500 m of the options.

7.38 Each of the options would have an adverse impact on residential receptors on the eastern boundary of Hereford and the suburb of Tupsley. Options would have a visual impact on the 'Ring Ditches and rectilinear enclosures east of Tupsley' Scheduled Monument.

7.39 Due to the open agricultural landscape and flat topography on the wide flood plan, visual implications will be felt within a wide area. The Scheme is located within an expanse of agricultural land within a wide flood plain. This allows far reaching views across the open flat valley. Options 1a/1b especially run close to the urban fringe and will bring an added visual intrusion to the residential areas on the outskirts of Hereford. Many of the properties have direct views across this open flood plain and the physical and visual intrusion of this Scheme would result in adverse impacts.

7.40 All options will result in visual intrusions on the recreational users of the River Wye corridor; there are PRoW running along both sides of the Wye and their severance as well as that of the ecology designations of the River Wye SAC/SSSI will result in adverse impacts to this valuable recreational and ecologically sensitive landscape.

Proposed Method of Assessment

7.41 Assessment of impacts on both landscape and townscape will be undertaken in accordance with TAG Unit A3, Sections 6 and 7.

7.42 Baseline information will be established using publicly available information on the landscape and townscape, for example, Landscape Character Assessment, National Landscape Character Assessment, OS maps, Street View and aerial mapping.

7.43 A Landscape worksheet, Townscape worksheet, and Landscape Monetisation TAG workbook will be completed in accordance with TAG Unit A3 (sections 6 and 7), and the conclusions set out in the qualitative comments section incorporated into the AST.

7.44 Further assessment in the form of a Landscape and Visual Impact Assessment following DMRB LA 107 is likely to be required in order for planning permission to be granted, which is not scoped here.

[4] Herefordshire Council (2009). *Landscape Character Assessment 2004 (Updated 2009)*. Available at LCA [Accessed 15/05/2023]
[5] Herefordshire Council (2023). *Administrative Map.* Available at: Administrative map – Herefordshire Council [Accessed 15/05/2023]

Survey/Data Requirements

7.45 A site visit will be required in order to supplement the desk-based baseline study. The site visit would establish local landscape and townscape character of the study area and identify the extent of the area that would potentially experience adverse impacts. Land access permissions and contacts as necessary to carry out this survey will be required.

Biodiversity

Constraints

7.46 There are no Special Protection Areas (SPAs), National Nature Reserves (NNRs) or Ramsar Sites within the study area.

7.47 There is one Special Areas of Conservation (SACs) within the study area, River Wye SAC, which covers both the River Wye and River Lugg. The River Wye is designated for the Annex aquatic and wetland habitats present and the range of Annex II populations, including fish, white-clawed crayfish and otter. All options intersect the SAC at the River Wye, near the Rotherwas Industrial Estate.

7.48 Two SACs have been identified within a 30 km study area for bats, both approximately 21 km southeast of Options 1a/1b and 3a/3b:

- Wye Valley & Forest of Dean Bat Sites, designated for lesser horseshoe bat (Rhinolophus hipposideros) and greater horseshoe bat (Rhinolophus ferrumequinum); and
- Wye Valley Woodlands, designated for lesser horseshoe bat.

7.49 There are three Sites of Special Scientific Interest (SSSI) within the study area, the closest being River Wye SSSI, which all the options cross, and Lugg Hampton Meadows, 90 m northeast of Options 1a/1b and 3a/3b.

7.50 There are two Local Nature Reserves (LNRs) within the study area, the closest being Broadlands LNR, 650 m northwest of Options 1a/1b and 3a/3b.

7.51 According to the Herefordshire Local Wildlife Trust[6], there are seven LWS located within 1 km of the options. There are five ancient woodlands within 1 km of the options, the nearest being approximately 410 m southeast of Options 1a/1b and 3a/3b.

7.52 All proposed options cross the River Wye SAC and are in proximity to SACs designated for their bat populations. Due to this, a Habitats Regulation Assessment (HRA) would need to be conducted. All options would result in permanent changes to the topography of the River Wye SAC which may sever or alter the pathways used by species for movement, increasing the risk of collision and the decline of some species. The light and shade caused by a bridge over the SSSI would also have an effect on aquatic species. The options may also sever the commuting routes used by bats that are qualifying features of the nearby SACs, increasing the risk of collision or limiting access to regularly used foraging areas.

7.53 Options would cause indirect impacts on the nearest of the ancient woodlands. These indirect impacts include increases to the amount of dust, light, water, air and soil pollution. There would also be disturbance of wildlife due to noise, light and vibration. The increase in nitrogen deposition also needs to be considered in relation to the ancient woodlands due to the increase of traffic during the operational phase.

7.54 All options have the potential to directly or indirectly impact other notable habitats that are present, including lowland deciduous woodland and woodland pasture and parkland habitats of principal importance. The impacts include direct loss and include increased dust, light, water, air and soil pollution, there will also be an increase in nitrogen disposition. There may also be impacts

[6] Herefordshire Wildlife Trust (2023). *Herefordshire's Local Wildlife Sites*. Available at: LWS [Accessed 12/05/2023]

to protected and notable species present in the study area, with potential impacts including the loss, fragmentation and deterioration of habitats.

Proposed Method of Assessment

7.55 Assessment of impacts on biodiversity will be undertaken in accordance with TAG Unit A3, Section 9.

7.56 Baseline information will be established using publicly available information, for example, Defra's Magic Maps, Street View and aerial mapping, biodiversity policy documents published by local authorities. Site surveys are not considered to be required at the next stage but would be required to support an assessment of impacts as part any planning application for the interventions.

7.57 A Preliminary Ecological Appraisal (PEA) will be carried out in accordance with current guidance (Chartered Institute of Ecology and Environmental Management (CIEEM), 2013). This will comprise an initial desk study, Phase 1 habitat survey, and constraints and opportunities mapping, and will confirm which further species or habitat surveys are required. A desk study will be completed to identify existing areas of importance for nature conservation, protected species and habitats in proximity to the site, and a site visit will also be undertaken to identify and map existing ecological features. The main habitats present will be recorded using standard Phase 1 Habitat Survey methodology[7].

7.58 Although not required at OBC, the Environment Act 2021 was recently brought into UK law and requires that developers undertake a Biodiversity Net Gain assessment. As such, the project is expected to be required to deliver a Biodiversity Net Gain of 10%. In accordance with best practice it will be necessary for the Biodiversity Net Gain calculation to be made after the application of the mitigation hierarchy and separately from any measures that are necessary to address impacts upon statutory designated sites or irreplaceable habitats. A Biodiversity Net Gain Assessment will be carried out using the most current Biodiversity Metric[8], in accordance with the accompanying guidance[9] and best practice principles[10]. To facilitate this, the calculation requires baseline habitat distinctiveness and condition scores determined by a Phase 1 habitat survey data, that would be converted into UK Habitat Classification habitat types, and habitat areas measured through GIS. Habitat condition would be assigned based on the condition assessment criteria outlined in the Biodiversity Metric and recommendations to achieve the required 10% net gain with be included in the PEA.

7.59 The Biodiversity TAG worksheet will be completed in accordance with TAG Unit A3 (section 9), and the conclusion set out in the qualitative comments section incorporated into the AST.

7.60 Further assessment in the form of an Ecological Impact Assessment following DMRB LA 108 and/or Habitats Regulations Assessment following DMRB LA 115 is likely to be required in order for planning permission to be granted, which is not scoped here.

Survey/Data Requirements

7.61 Baseline ecological data are required from the local Biological Records Centre (Herefordshire Biological Records Centre) and other relevant data providers.

7.62 Any relevant habitat mapping or studies commissioned by, or otherwise held by, HC should be provided.

7.63 A Phase 1 habitat survey will be required in order to supplement the desk-based baseline study. Land access permissions and contacts as necessary to carry out this survey will be required.

[7] JNCC, (2010), Handbook for Phase 1 habitat survey – a technique for environmental audit, JNCC, Peterborough, ISBN 0 86139 636 7
[8] Natural England's Biodiversity Metric 3.1 http://publications.naturalengland.org.uk/publication/6049804846366720
[9] Natural England (2022). Biodiversity metric 3.1: Auditing and accounting for biodiversity – User Guide. Natural England.
[10] Biodiversity Net Gain: Good Practice Principles for Development, A Practical Guide (2019)

7.64 Further specialist habitat and protected and notable species surveys may be required to support a full Ecological Impact Assessment and/or Habitats Regulations Assessment as part of any planning application for the proposed Scheme.

Noise and Vibration

Constraints

7.65 The existing noise sources in the vicinity of the proposed options are predominantly from traffic on the A438 at the northern tie-in, B4224 just north of the River Wye and surrounding local roads to the west. Other sources of noise in the surrounding areas include industrial noise from the Rotherwas Industrial Estate and agricultural noise from surrounding farms. A number of residential noise sensitive receptors have been identified in the vicinity of all options. Non-residential noise sensitive receptors close to all options include Bishop of Hereford's Bluecoat School, St Paul's Church of England Primary School and St Paul's Church in the Tupsley suburb of Hereford, two Scheduled Monuments and a number of Public Rights of Way (PRoWs).

7.65 There are two Noise Important Areas (NIAs) located in the study area:

- NIA 11812, approximately 1.5 km north of all options; and
- NIA 14589, approximately 1.8 km northwest of all options.

7.66 All of the proposed options have the potential to result in adverse noise and vibration impacts at nearby sensitive receptors during the construction phase. Earthworks and road construction operations between the A438 and B4224 are likely to result in adverse construction noise and vibration impacts at properties in the east of the Tupsley suburb, with Options 1a/1b likely to result in the greatest adverse impact of all the options, due to this route being located closest to these properties. The construction of the bridge over the River Wye in Options 1a/1b is likely to result in adverse construction noise impacts at properties to the south of Tupsley.

7.67 The proposed bridge crossing associated with Options 3a/3b being located further east and, as a result, is likely to result in adverse construction noise impacts at isolated residential receptors alongside the B4224, including properties at Camperdown Lane and Field Farm House Residential Home. Options 1a/1b and 3a/3b also have the potential to result in adverse construction noise and vibration impacts due to earthworks and road construction activities in the vicinity of Rotherwas Chapel and residential receptors to the south of the River Wye.

7.68 There is the potential for tie-in works to existing roads associated with all options to result in short-term construction noise and vibration impacts at residential properties located in the immediate vicinity of these tie-in locations.

7.69 During the operational stage there is the potential for Options 1a/1b and 3a/3b to result in road traffic noise increases at residential properties, nursing homes, schools and places of worship in the suburb of Tupsley, as a result of these options introducing a new traffic noise source directly to the east of the suburb.

7.70 As a result of Options 3a/3b being further to the east of Hereford, these options have the potential to result in increased traffic noise levels at isolated properties along B4224, including properties at Camperdown Lane and Field Farm House Residential Home to the south of the River Wye, Options 1a/1b and 3a/3b have the potential to result in increased traffic noise levels at Rotherwas Chapel and nearby residential properties.

Proposed Method of Assessment

7.71 Assessment of noise and vibration impacts will be undertaken in accordance with TAG Unit A3, Section 2.

7.72 A quantitative operational traffic noise assessment will be undertaken to inform the appraisal findings.

7.73 As required by TAG, daytime ($L_{A10,18h}$ facade) traffic noise levels at residential and non-residential noise sensitive receptors will be predicted using the methodology set out in the Calculation of Road Traffic Noise (CRTN).

7.74 TAG also requires an assessment of night-time (i.e. between 23:00 and 07:00) traffic noise levels ($L_{Aeq,8h}$ free-field). However, this parameter is not calculated by the standard CRTN methodology. DMRB LA 111 Rev 2 refers to three methods for calculating night-time traffic noise levels developed by the Transport Research Laboratory (TRL). As noted in DMRB, 'Method 3' provides reliable results for most UK roads and therefore will be used in the TAG appraisal of operational road traffic noise.

7.75 The study area for the TAG appraisal will be determined following the guidance set out within DMRB LA 111 Rev 2 and will consist of an area within 600 m of each proposed option and the sections of existing routes bypassed by the proposed Scheme.

7.76 Commercial noise modelling software which implements the CRTN methodology will be used to predict daytime and night-time traffic noise levels at receptors. The model will be based on traffic data provided in the traffic model forecasts and will also include the ground topography, ground type and buildings to form a 3D representative of the study area.

7.77 The Noise TAG worksheet will be completed in accordance with TAG Unit A3 (section 2), and the conclusion incorporated into the AST.

Survey/Data Requirements

7.78 The operational traffic noise assessment will require the following

- 18-hour Annual Average Weekday Traffic (AAWT) flow, %HDV and average speed (km/hr) for all links within the traffic model, to be obtained from HTM, for:
  - Baseline Year;
  - Opening Year: Do Nothing;
  - Opening Year: Do Something (with Scheme);
  - Future Year/Design Year: Do Nothing; and
  - Future Year/Design Year: Do Something.
- OS Mastermap (including building heights) and OS AddressBase Plus data within 1.5km of each option and the roads bypassed by the proposed scheme will be required to identify location, type and height of buildings and
- Drawing file of each option including 3D information if available .

7.79 Baseline sound surveys are not required at OBC.

Road Drainage and the Water Environment

Constraints

7.80 According to the Environment Agency's (EA) Flood Map for Planning[11], large areas of all the options fall within Flood Zone 3 (1% annual exceedance probability (AEP) of fluvial flooding, or 0.5% or greater AEP of tidal flooding) where they cross the River Wye, and both Flood Zones 2 (1%-0.1% AEP of fluvial flooding, or 0.5%-0.1%% AEP of tidal flooding) and 3 where they connect to the B4399 in the Rotherwas Industrial Estate. Much of the wider study area falls within Flood Zone 3, along the routes of the River Wye and River Lugg which are Environment Agency Main Rivers.

[11] Environment Agency (2021). *Flood Map for Planning*. Available at: Flood Map [Accessed 15/05/2023]

7.81 The EA's Flood Map for Surface Water[12] shows the majority of the study area falls within an area of 'Very Low Risk' (less than 0.1% AEP) of surface water flooding, however there are areas of 'Low' (0.1%-1% AEP), 'Medium' (1%-3.3% AEP) and 'High' (>3.3% AEP) surface water flood risk mainly associated with watercourses in the study area, along with other small, isolated areas where water is shown to accumulate.

7.82 All options cross an agricultural drainage ditch east of Copsewood Drive.

7.83 The Environment Agency's Flood Risk from Reservoirs[12] map shows that the study area is not located within the inundation extent of any major reservoir.

7.84 Herefordshire's Preliminary Flood Risk Assessment (PFRA)[13] published in 2011 has been reviewed which states that there are very few instances of groundwater flooding in Herefordshire. A historic flood event which groundwater contributed to occurred in January 1999 in the area of Hoarwithy Road, which is located at the south-western edge of the study area and caused flooding to one residential property and the road itself; no other historic groundwater flood events in the study area have been identified in the PFRA.

7.85 According to the EA Catchment Data Explorer, the study area falls within the Wye and the Arrow Lugg and Frome Water Framework Directive (WFD) surface water Operational Catchments[14]. There are two WFD watercourses within the study area:

- Lugg – confluence River Arrow to confluence River Wye (WFD ID: GB109055036790; overall classification for Cycle 3 2019: moderate); and
- Wye – Bredwardine Bridge to Hampton Bishop (WFD ID: GB109055037113, overall classification for Cycle 3 2019: moderate).

7.86 There is one groundwater body beneath the Site. This is the Wye Secondary Devonian ORS Water Body (WFD ID: GB40902G205200) and which for Cycle 3 (2019) has an overall status of poor (for quantitative status; chemical status is good).

7.87 According to the British Geological Survey (BGS) Aquifer Designation Map[15], the bedrock beneath the study area is identified as Secondary A aquifer. The superficial drift underlying the majority of the study area is identified as Secondary A aquifer and there is a small area of Secondary B aquifer.

7.88 The study area falls entirely within the Hereford Nitrate Vulnerable Zone (NVZ)[15]. All four options fall partially within a Drinking Water Protected Area (Surface Water)[15], where they cross the River Wye (noting that the whole of England is classified as a groundwater Drinking Water Protected Area). The study area does not fall within a Source Protection Zone (SPZ) or Drinking Water Safeguard Zone for either surface water or groundwater[15].

7.66 Construction and operation of the proposed Scheme could potentially result in adverse impacts upon the water environment, including construction and future highway runoff, physical impacts to watercourses (including shading of riparian vegetation), flood risk impacts, and impacts on groundwater quality, levels and flows depending on any below ground works that may be required. All of the options include the crossing of an Ordinary Watercourses and the River Wye which could result in adverse impacts upon these watercourses and increase flood risk. Therefore, a number of assessments will ultimately be required to support the Scheme.

7.67 Irrespective of which option is taken forward, the construction and operation of the preferred route would lead to an increase in impermeable area and subsequently increase surface runoff and flood risk. Therefore, a drainage strategy will need to be provided as part of a Flood Risk Assessment (FRA) to accompany the relevant planning or consenting application(s). This strategy will need to ensure that flood risk from surface water is not increased to both the

[12] Environment Agency (2019). *Learn more about flood risk*. Available at: Flood Risk [Accessed 15/05/2023]
[13] Herefordshire Council (2011). *Herefordshire Preliminary Flood Risk Assessment*. Available at: PFRA [Accessed 15/05/2023]
[14] Environment Agency (2021). *Catchment Data Explorer*: Catchments [Accessed 15/05/2023]
[15] Defra (2023). *Magic Maps*. Available at: Magic [Accessed 15/05/2023]

development and third-party land as a result of the Scheme. It will also need to demonstrate the water quality risks from routine runoff and spillages are adequately managed.

Proposed Method of Assessment

7.89 A qualitative impact appraisal of potential effects (adverse and beneficial) on the water environment will be undertaken in accordance with TAG Unit A3, Section 10. This will include impacts on surface and groundwater quality and resources, hydromorphology, flood risk and drainage.

7.90 A study area for the assessment of flood risk and potential impacts on water environment receptors will be defined by the extent to which flood risk, water quality, flows and levels may be influenced and the extent of the relevant flood zones, following TAG Unit A3, Section 10. Typically, water features and their attributes (including abstractions) that may be directly impacted are identified within a 1 km study area from the scheme. For groundwater or watercourses that may be impacted, and along which these impacts may propagate, a wider study area downstream of the point of impact will also be considered. This will be determined at a later stage but may be a few kilometres.

7.91 Baseline information will be compiled using publicly available data including:

- Ordnance Survey Mapping;
- Environment Agency's online indicative flood maps;
- Environment Agency's catchment data explorer;
- Environment Agency's water quality archive;
- Environment Agency's hydrology data viewer;
- National Rivers Flow Archive;
- The MAGIC geographical information portal;
- The Severn River Basin Management Plan (RBMP);
- Herefordshire's 2019 Level 1 Strategic Flood Risk Assessment (SFRA);
- Herefordshire's 2011 Preliminary Flood Risk Assessment (PFRA);
- British Geological Society's (BGS) Geological Viewer;
- BGS Borehole Records Viewer; and
- Welsh Water Sewer Plans (if available).

7.92 In addition to the above, it will also be necessary to obtain records of any licenced water abstractions from the Environment Agency, and any Private Water Supplies from the local Environmental Health Officer, both under Freedom of Information requests.

7.93 The citations and conservation objectives for the River Wye SSSI/SAC, the River Lugg SSSI, and the Lugg and Hampton Meadows SSSI will also be reviewed.

7.94 Water Environment TAG worksheets will be completed in accordance with TAG Unit A3 (section 10), and the conclusion set out in the qualitative comments section incorporated into the AST. These will focus on the components of the scheme that are permanent and any material differences between options. Although construction of a new bridge across the River Wye will be a significant undertaking and may itself have significant adverse impacts without appropriate mitigation measures, this activity is assumed to be consistent across all options.

Requirements for Planning Application

7.95 According to the National Planning Policy Framework (NPPF), a FRA should accompany the planning application for all proposals located within Flood Zones 2 and 3. When a site is located within Flood Zone 1, an FRA should be produced for: Sites of 1 hectare or more; land which has

been identified by the Environment Agency as having critical drainage problems; land identified in an SFRA as being at increased flood risk in the future; and/or land that could be subject to other sources of flooding, where its development would introduce a more vulnerable use.

7.96 A drainage strategy will be required for the scheme in order to demonstrate that surface water runoff can be managed sustainably, without exerting an impact upon third parties. This will be required alongside the FRA to support a planning application. The drainage strategy will also need to be informed by a water quality risk assessment to determine what level of treatment is required to protect receiving watercourses or groundwater from the impact of sediment and chemical pollutants found in routine highway runoff and any risk of chemical spillage following a road traffic accident. It is assumed that there will be adequate space within the site boundary for the inclusions of sustainable, vegetated drainage measures (e.g. swales, ponds etc.).

7.97 The NPPF and local planning policy requires future development in Hereford to take account of the River Basin Management Plans determined under the Water Framework Directive (WFD) as implemented in England by the Water Environment (WFD) (England and Wales) Regulations 2017. Therefore, any planning application will most likely need to be supported by a WFD assessment.

7.98 New developments must not cause deterioration or prevent the improvement of water bodies, taking into account the conservation objectives of relevant designated nature conservation sites. The WFD assessment will need to focus on new watercourses crossings such as the River Wye, but also smaller watercourses that need to be crossed by the scheme and any groundwater bodies beneath the Site. There should be a predisposition in favour of clear-span crossings with abutments set back from the top of the banks, batter or defence surrounding the watercourse. Where clear-span watercourse crossings are not possible, the alternative will need to robustly justified with mitigation to compensate for the impact (both embedded design measures and compensatory enhancements). The Environment Agency and Lead Local Flood Authority should be consulted on the design of all crossings from the outset.

7.99 Overall, further assessment in the form of an impact assessment in accordance with the methods set out in DMRB LA 113 including FRA, drainage strategy, water quality risk assessment (for surface and groundwater and covering both road runoff, spillage risk and the impact of new foundations/piling works and cuttings or embankments), and a WFD assessment is likely to be required in order for planning permission to be granted, which is not scoped here. The FRA is likely to require applicable flood risk modelling, and may indicate the need for flood storage compensation measures if the proposed Scheme results in the loss of floodplain.

7.100 Finally, the River Lugg catchment is an area where Natural England has determined that the designated conservation sites are impacted by excess nutrients (in this case phosphorus) and any future new development must be nutrient neutral. Such restrictions usually apply to development that involves an increase in population (defined by the proposed occupancy of the development) or result in other emissions of phosphorous. Although nutrient neutrality is unlikely to apply to this type of development, it is recommended that a screening level of assessment is undertaken followed by consultation with Natural England to confirm this.

Survey/Data Requirements

7.101 Site surveys are not considered to be required at OBC but would be required to support an impact assessment (including the possibility of water quality monitoring to provide data for a DMRB compliant water quality risk assessment, if there is insufficient baseline data), FRA and a future WFA assessment (which will also need to consider compliance with meeting the conservation objectives of the River Wye SSSI/SAC, the River Lugg SSSI, and the Lugg and Hampton Meadows SSSI) as part of any planning application for the proposed Scheme.

Climate (Greenhouse Gases)

Constraints

7.102 Greenhouse Gas (GHG) emissions will be produced during construction due to the embodied carbon within construction materials, and construction work activities.

7.103 There will also be associated operational emissions in the form of road-user emissions. There is the potential for long-term impacts on GHG emission during the operational phase through induced demand, however this may be mitigated or reversed due to alleviation of congestion in Hereford, through encouraging the use of active travel methods and public transport over private cars, or by otherwise reducing vehicle-kilometres in the study area.

7.104 The UK has legally binding GHG reduction targets and Hereford also has local policies concerning carbon reduction and Net Zero targets.

7.105 Future climate projections published by the UK Met Office (UKCP18)[16] predict that as a result of climate change the UK will generally experience wetter winters and warmer summers resulting in an increased incidence of storm events, high winds and heavy precipitation potentially leading to disruption of infrastructure networks and their surrounding environment.

Proposed Method of Assessment

7.106 Assessment of carbon impacts will be undertaken in accordance with TAG Unit A3, Section 4.

7.107 The assessment of road user greenhouse gas emissions will be monetised using the net present value of carbon dioxide equivalent emissions from the transport model, using the Greenhouse Gases TAG Workbook.

7.108 An assessment of road user carbon emissions will be undertaken using the National Highways Emissions Tool (which incorporates data from Defra's Emissions Factors Toolkit (EFT)). Calculations will be undertaken for the opening year with and without the proposed Scheme options and for a future year with and without the proposed Scheme options and the 60-year impact of the proposed Scheme on carbon dioxide equivalent (CO_2e) emissions will be extrapolated. CO_2e emissions for the non-traded sector (exhaust emissions) and traded sector (indirect emissions associated with electric vehicles) will be calculated and monetised separately.

7.109 The study area for the road user emission calculations will be agreed with the traffic modelling team.

7.110 A Greenhouse Gases TAG workbook will be completed in accordance with TAG Unit A3 (section 4), and the conclusions incorporated into the AST.

7.111 Further assessment in the form of a Climate Assessment following DMRB LA 114 is likely to be required in order for planning permission to be granted, which is not scoped here.

[16] ukcp18_headline_findings_v4_aug22.pdf (metoffice.gov.uk) [Accessed 06/01/2023]

8. Social Impact Appraisal

Overview

8.1 This section outlines the approach to scoping whether the Social Distributional Impact assessments are required and summarises the analysis which will be undertaken. Initial scoping work of each impact will be undertaken to determine the requirements for the appraisal. An Equality Impact Assessment (EqIA) will be undertaken using the relevant guidance. This will be completed during the OBC stage and updated as the progress progresses.

8.2 The approach set out below follows the guidance set out by DfT in TAG Unit A4.1 Social Impact Appraisal (November 2022)[17] and Unit A4.2 Distributional Impact Assessment (May 2023).

Social Impacts

8.3 All social benefits associated with the scheme will be qualitatively assessed using the guidance in TAG Unit 4.1 for completion of qualitative social aspects. Table 8-1 outlines which social impact criteria will be scoped in for appraisal at OBC and FBC stage.

Table 8-1. Social impact scoping

Social Impacts	Appraised?
Accidents	Yes
Physical Activity	Yes
Security	Yes
Severance	Yes
Journey Quality	Yes
Option Values and non-use values	Yes
Accessibility	Yes
Personal affordability	Yes

8.4 A detailed social impact assessment will be undertaken to assess how the scheme impacts on the following sub-topics.

Accidents

8.5 To capture the direct impact of the scheme on general traffic user accidents, a localised COBA-LT assessment will be undertaken. Outputs from Hereford Transport Model will be used to inform the accident appraisal. The COBA-LT network will represent each of the highway links within the study area. This will assess a small number of key routes which are undergoing changes as a result of the scheme, based upon the changes in speeds, number of lanes and traffic flows. The assessment will be supported by qualitative narrative for locations where the impacts are not significant enough to show up using the COBA-LT method.

8.6 The suggested approach involves monetising the accidents involving cyclists and pedestrians that may have been prevented if the improved walking and cycling infrastructure was already in place. To undertake the analysis, detailed accident data (STATS19 or CrashMap) will be used for the last full five years to understand the accidents along the scheme extent that involved pedestrians and cyclists. TAG Databook monetary values for the prevention of causalities will

[17] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1007447/tag-unit-a-4-1.pdf

then be used to calculate the overall accident prevention benefit for pedestrians and cyclists (2010 prices and values).

8.7 Reduction in cycle accidents by implementation of segregated cycle lanes will be based on empirical evidence.

Physical Activity

8.8 There is longstanding recognition of the interrelation between transport, the environment and health; transport can affect and impact levels of physical activity. Physical inactivity is a primary contributor to a broad range of chronic diseases such as coronary heart disease, stroke, diabetes and some cancers[18]. Active travel schemes or developments, alongside changes to bus stop locations etc., can all impact on future levels of physical activity.

8.9 TAG Unit A4.1, Section 3 recommends appraising health impacts of active travel, based on estimating the change in premature death (mortality) resulting from a change in walkers and cyclists, i.e. health benefits from gaining more life years. This will be calculated by the change in number of walkers and cyclists, estimated using the AMAT forecasting tool, described in Section 5. The AMAT toolkit adopts a simple, proportionate approach of estimating health benefits based on the number of additional users and standard NTS active travel profiles.

Security

8.10 Transport interventions may affect the level of security for transport users, perceived or otherwise. The assessment of the impacts to security will reflect the changes in security and the likely number of users affected. This includes public transport passengers and road users.

8.11 The Security Impacts Worksheet, set out in TAG Unit A4.1, Section 4, will appraise the impact of different options on security. It will be completed for different mode users to highlight any changes in security. The following security indicators will be assessed at a poor, moderate and high level for road and public transport users:

- Public Transport Users and Road Users
  - Visibility of site perimeters, entrances and exits
  - Formal Surveillance
  - Informal Surveillance
  - Landscaping on its impact on visibility and level of deterrence to intruders
  - Lighting and Visibility of the area
- Road users
  - Vulnerability to Crime in circumstances where they are required to stop their vehicles or travel at slow speeds, such as at the approaches to signals or in congested conditions, or at locations where they are required to leave their vehicles, such as at service stations, car parks and so on.

Severance

8.12 Community severance is defined as the separation of residents from facilities and services they use within their community, created by substantial changes in transport infrastructure or by changes in traffic flows.

8.13 The severance assessment primarily relates to non-motorised users, in particular pedestrians. It only represents an issue where either vehicle flows are significant enough to impede pedestrian movement or where infrastructure presents a physical barrier to movement. The impact of

[18] Department of Health (2004): At Least Five a Week. A report from the Chief Medical Officer.

severance on cyclists will differ for two reasons: they travel more quickly; and crossing facilities may not be available to them, nor are they as necessary.

8.14 To assess the impact of projects on severance, the difference in the level of severance for the without-scheme and with-scheme cases will be examined, aligning with TAG Unit A4.1, Section 5. Several locations will be assessed, evaluating the numbers of people that will be affected by the scheme(s), and an overall assessment will be determined based on the following guidelines:

- The overall assessment is likely to be Neutral if increases in severance are broadly balanced by relief of severance;
- The overall assessment is likely to be Slight where change in severance is slight or the total numbers of people affected across all levels of severance is low (less than 200 per day, say);
- The overall assessment is likely to be Large where change in severance is large, and affects a moderate or high number of people or the total numbers of people affected across all levels of severance is high (greater than 1,000, say); and
- The overall assessment is likely to be Moderate in all other cases.

Journey Quality

8.15 Journey Quality represents a measure of the real and perceived physical and social environment experienced while travelling. It includes factors such as public information provision, perceptions of safety, accessibility provision, physical crowding on public transport etc, and can be affected by both travellers and by network providers and operators.

8.16 A new transport scheme has the ability to change travel conditions and hence journey quality, beneficially or adversely. This change must be assessed by comparing the without-scheme and with-scheme scenarios. The impact on journey quality will be qualitatively assessed in three groups, following TAG Unit A4.1, Section 6:

- Traveller care: aspects such as cleanliness, level of facilities, information, and the general transport environment;
- Travellers' views: the view and pleasantness of the external surroundings in the duration of the journeys; and
- Traveller stress: frustration, fear of accidents and route uncertainty.

8.17 The analysis will assess whether the difference between the without-scheme and with-scheme cases will be better, worse or neutral, and arrive at an overall impact using the following guidelines:

- The assessment is likely to be neutral, if the assessment is neutral for all or most of the sub-factors, or improvements on some sub-factors are generally balanced by deterioration on others;
- If the change in impact across the sub-factors is, on balance, for the better, the assessment is likely to be beneficial, and, conversely, it is likely to be adverse if there is an overall change for the worse;
- The assessment is likely to be slight (beneficial or adverse) where the numbers of travellers affected is low (less than 500 a day, say);
- The assessment is likely to be large (beneficial or adverse) where the numbers of travellers affected is high (more than 10,000, say);
- The assessment is likely to be moderate (beneficial or adverse) in all other cases.

Option Values and Non-Use Values

8.18 Option and non-use values should be assessed if 'the scheme includes measures that will substantially change the availability of transport services within the study area (e.g. the opening or closure of a rail service, or the introduction or withdrawal of bus services in a particular area)'.

8.19 The current scope of the project is likely to include the provision of a new Park and Ride bus service and therefore assessment of this area is therefore assumed to be within scope. This would be assessed via a qualitative statement only.

Accessibility

8.20 Increasing car use has provided greater opportunity for people to travel and access the services they require, however for those without access to a car accessibility levels rely on the provision of public transport services and active travel networks to key destinations and services.

8.21 The reliance on these active and public networks, which are often limited, can lead to social exclusion as a result of the following barriers:

- The availability and physical accessibility of transport;
- Cost of transport;
- Services and activities located in inaccessible places;
- Safety and security; and
- Travel horizons (people are sometimes unwilling to travel long journey times or distances)

8.22 A full screening of accessibility impacts will be undertaken, supported by a Distributional Impact Analysis (see following section on Distributional Impacts) where there are impacts identified that may affect different groups of people either positively or adversely.

Personal Affordability

8.23 Personal affordability relates to the monetary cost of travel, which can be a barrier to mobility for certain groups of people. The provision of a P&R site is likely to involve some form of charges; for parking, bus services or active travel hire facilities. A personal affordability assessment will be completed via completion of a Personal Affordability Worksheet to understand these impacts.

Distributional Impacts

8.24 The assessment of Distributional Impacts (DIs) is designed to help understand the impacts of transport interventions on different groups of people, including those people that are potentially more vulnerable to the potential negative effects of transport schemes. The analysis of DIs is mandatory in the appraisal process and is a constituent of the Appraisal Summary Table (AST).

8.25 The DI analysis will be undertaken in line with TAG Unit A4.2, the appraisal of DIs is split into three steps.

- Step 1 - Screening Process: Identification of likely impacts for each indicator
- Step 2 - Assessment: Confirmation of the area impacted by the transport intervention (impact area); Identification of social groups in the impact area; and Identification of amenities in the impact area.
- Step 3 - Appraisal of Impacts: Core analysis of the impacts; Full appraisal of DIs and input into AST

8.26 A detailed distributional impact assessment will be undertaken to assess how the scheme impacts on the following sub-topics:

- User Benefits
- Noise
- Air Quality
- Accidents
- Severance
- Security
- Accessibility
- Personal Affordability.

8.27 Table 8-2 provides a summary of the distributional impact appraisal proforma assessment for the scheme. This outlines the TAG Unit A4.2 recommended appraisal outputs for each indicator, as well as an initial assessment of whether there will be an impact (positive or negative) or not. This will inform which indicators are scoped into full assessment, and which will not be expected to be assessed in detail.

8.28 Of those with expected impacts, it is not clear at this stage what the scale of impact will be, and who might be affected. At this stage of project development, there is some uncertainty around which scheme options and options packages will be selected to be taken forward for OBC assessment.

8.29 As such, this ASR will remain a live document, and will be reviewed and updated once the scheme for appraisal has been confirmed. Once the impacts have been established the distributional analyses required according to the appropriate guidance in TAG Unit A4.2 will be undertaken. A full review will follow in turn, to ensure assumptions made are still valid and proportionate.

Place Based Impacts

8.30 TAG Unit A4.3 outlines the new requirement for consideration of Place-Based Analysis introduced in November 2022. Place-based analysis is similar to Distributional Impacts Analysis but focuses on the spatial distribution of impacts, rather than the dispersion across population groups.

8.31 The guidance identifies two criteria in determining whether Place-Based Analysis is recommended:

- Criteria 1: For proposals with geographically focused local or regional development objectives referenced in the strategic dimension of the scheme and/or in local or regional growth strategies and plans.
- Criteria 2: Where proportionate, for proposals with substantial potential impacts either positive or negative on ‘geographical areas in scope’. Scheme promotors should consider proportionality when balancing the cost and feasibility of analysis with its potential impact.

8.32 Consideration has been given to the application of these two criteria to the proposed Hereford Eastern River Crossing:

- In relation to Criteria 1 the proposals do not include objectives in relation to local or regional development in relation to the scheme and the schemes are not references in local or regional growth strategies and plans.
- In relation to Criteria 2 the catchment area for users of the River Crossing is anticipated to be large, with users coming to the site for a wide range of areas. Because of this the impacts on specific geographic areas are not expected to be significant. It is therefore not considered proportionate to undertake a Place Based Impacts Assessment. Further analysis will be undertaken once modelling has been completed to confirm the catchment area of the site and determine if any localities are substantially impacted. Should this

identify any substantial impacts then the decision not to undertake Place Based Impacts Assessment will be revisited.

Table 8-2. Distributional Impact Appraisal Screening Proforma

Indicator	(a) Appraisal output criteria	(b) Potential impact (yes / no, positive/negative if known)	(c) Qualitative Comments	(d) Proceed to Step 2 (scoped into full appraisal?)
User benefits	The TUBA user benefit analysis software or an equivalent process has been used in the appraisal; and/or the value of user benefits Transport Economic Efficiency (TEE) table is non-zero.	Yes, positive	TUBA modelling results would be used to inform user benefit impacts, and the scale of impact expected for different groups.	Yes
Noise	Any change in alignment of transport corridor or any links with significant changes (>25% or <-20%) in vehicle flow, speed or %HDV content. Also note comment in TAG Unit A3.	Yes, negative	Noise impacts are likely to occur where an intervention results in changes to traffic flows or speeds, or where the physical gap between people and traffic is altered.	Yes
Air quality	Any change in alignment of transport corridor or any links with significant changes in vehicle flow, speed or %HDV content: • Change in 24 hour AADT of 1000 vehicles or more • Change in 24 hour AADT of HDV of 200 HDV vehicles or more • Change in daily average speed of 10kph or more • Change in peak hour speed of 20kph or more • Change in road alignment of 5m or more	Yes, impact unknown	Air quality impacts are likely to occur where an intervention results in changes to traffic flows or speeds, or where the physical gap between people and traffic is altered. The scheme is expected to increase traffic and active travel levels in the new link road and thus a change to air quality is expected.	Yes

Indicator	(a) Appraisal output criteria	(b) Potential impact (yes / no, positive/negative if known)	(c) Qualitative Comments	(d) Proceed to Step 2 (scoped into full appraisal?)
Accidents	Any change in alignment of transport corridor (or road layout) that may have positive or negative safety impacts, or any links with significant changes in vehicle flow, speed, %HGV content or any significant change (>10%) in the number of pedestrians, cyclists or motorcyclists using road network.	Yes, positive	Impact on accidents largely stems from any change in alignment of a transport corridor that may have safety impacts. Vulnerable groups (e.g. children, older people, young males, and motorcyclists) are likely to receive some positive benefit from the introduction of segregated cycle infrastructure along the new link road.	Yes
Security	Any change in public transport waiting/interchange facilities including pedestrian access expected to affect user perceptions of personal security.	Yes, impact unknown	No major changes to public transport waiting/interchange facilities, pedestrian access, lighting, and surveillance are part of the scheme.	Yes
Severance	Introduction or removal of barriers to pedestrian movement, either through changes to road crossing provision, or through introduction of new public transport or road corridors. Any areas with significant changes (>10%) in vehicle flow, speed, %HGV content.	Yes, positive	Altered severance can impact upon vulnerable groups (e.g. the elderly, those with disabilities, or without access to a car), occurring as a result of the introduction or removal of barriers to pedestrian movement. The proposal will create a link in the east of the city, connecting two communities that currently have high levels of severance due to the River Wye and the inexistence of transport infrastructure connecting the communities.	Yes

Indicator	(a) Appraisal output criteria	(b) Potential impact (yes / no, positive/negative if known)	(c) Qualitative Comments	(d) Proceed to Step 2 (scoped into full appraisal?)
Accessibility	Changes in routings or timings of current public transport services, any changes to public transport provision, including routing, frequencies, waiting facilities (bus stops / rail stations) and rolling stock, or any indirect impacts on accessibility to services (e.g. demolition & re-location of a school).	Yes, impact unknown	The project will involve new (or altered) public transport routing and frequencies.	Yes
Personal Affordability	In cases where the following charges would occur; Parking charges (including where changes in the allocation of free or reduced fee spaces may occur); Car fuel and non-fuel operating costs (where, for example, rerouting or changes in journey speeds and congestion occur resulting in changes in costs); Road user charges (including discounts and exemptions for different groups of travellers); Public transport fare changes (where, for example premium fares are set on new or existing modes or where multi-modal discounted travel tickets become available due to new ticketing technologies); or Public transport concession availability (where, for example concession arrangements vary as a result of a move in service provision from bus to light rail or heavy rail, where such concession entitlement is not maintained by the local authority[1]).	Yes, positive	Congestion will be reduced and a new route will lead to reduced car fuel and non-fuel operating costs. TUBA modelling results could be used to assess which areas are receiving the best impacts in personal affordability.	Yes

Source: TAG Distributional impact appraisal proforma,

9. Sensitivity Testing

9.1 A number of sensitivity tests will be explored in the OBC appraisal which will provide a contribution to the value for money assessment, these will be agreed with the client and are likely to focus on key areas of national and local uncertainty. In addition, in line with TAG Unit M4, High and Low Growth scenarios will be developed alongside the Core Growth scenario.

9.2 The DfT first published its Uncertainty Toolkit in May 2021. The Toolkit continues to be updated, with the latest release being May 2023. Four key principles are defined in this toolkit for the treatment of uncertainty in transport appraisal and modelling:

- The treatment of uncertainty is a core part of any transport analysis and is needed to inform robust decision making. It should be considered early in the development of a scheme.
- Analysis should not focus exclusively on a core scenario. Uncertainty analysis and the consideration of wider 'what if' scenarios should be undertaken as standard. To help navigate uncertainty in transport analysis, decision makers need to be provided with analysis showing how different futures may affect the outcomes of the decisions they are taking today.
- Proportionate appraisal techniques for defining, measuring and reducing uncertainty should be used.
- Uncertainty should be considered holistically across the strategic and economic cases and throughout the planning process. There are several stages of transport scheme development at which considering uncertainty in the future may be required. Consideration of uncertainty should be built in throughout the planning process and the 5-stage business case model.

9.3 The Uncertainty Toolkit introduces Common Analytical Scenarios. They are a set of seven consistent, off-the-shelf, cross-modal scenarios exploring national level uncertainties which have been developed by DfT for use in forecasting and appraisal, which include:

- Growth in the population and the economy;
- Distribution of economic activity across the regions;
- Technological advances and uptake;
- Social and behavioural change;
- Level of decarbonisation and fleet mix ambition.

9.4 The application of the scenarios will be supported by the publication of TEMPro datasets alongside more detailed guidance on their use.

9.5 Crucially, the Uncertainty Toolkit emphasises the need for a proportionate approach to uncertainty and sensitivity testing, as defined in its Proportionality Framework (Section 3.5 of the Uncertainty Toolkit). Subject to the release of further guidance and datasets in Autumn 2021, the Proportionality Framework will be reviewed to determine whether further sensitivity test scenarios should be developed to support the scheme appraisal.

9.6 It is proposed that High and Low Growth scenarios will be assessed and the need for further sensitivity test scenarios will be evaluated using guidance defined in the DfT Uncertainty Toolkit, and subject to the release of the required datasets in line with the proposed project programme.

10. Summary

10.1 This Appraisal Specification Report (ASR) sets out the proposed methodology and scope for undertaking the transport modelling and appraisal for the Hereford Eastern River Crossing scheme to inform the Outline Business Case (OBC) and the Full Business Case (FBC).

10.2 The key sections which have been included within this ASR are:

- Section 2: Scheme Background: an overview of the study area, scheme objectives, options, and engagement strategy;
- Section 3: Guidance Documents: key documents which have been reviewed to determine the methodology, these include DfT Transport Appraisal Guidance and any updates to TAG;
- Section 4: Transport Modelling: approach to transport modelling including existing and future models; forecasting approach using Hereford Transport Model and data collection;
- Section 5: Economic Assessment: assessment will include highway user impacts, bus user journey time benefits; active modes benefit appraisal and wider economic impacts;
- Section 6: Public Accounts: an overview of scheme costs estimation, treatment of risk and indirect tax revenues;
- Section 7: Environmental Assessment: description of proposed methodology for appraisal including noise, air quality, greenhouse gases, landscape, townscape, historic environment, biodiversity and water environment;
- Section 8: Social Impact Appraisal: outlines the approach to scoping whether the Social Distributional Impact assessments are required and summarises the analysis which will be undertaken; and
- Section 9: Sensitivity Testing: an overview of the treatment of uncertainty and proposed sensitivity tests.
- An Appraisal Specification Summary Table is provided in Appendix A.

Appraisal Outputs

10.3 A Transport Economic Efficiency (TEE) table, an Analysis of Monetised Costs and Benefits (AMCB) table and Public Accounts Table (PAT) will be produced for each shortlisted option. A Value for Money category will be given based on the information on these tables and other factors addressed in the appraisal. A rationale for the assigned Value for Money category will be provided.

10.4 Justification of the preferred scheme option/s will be made on both value for money and scheme objective and strategic case grounds.

10.5 Following the most recent TAG update, there is a reduced emphasis on the BCR and corresponding increased emphasis on the Strategic Case in business cases. Projects will first need to demonstrate national policy alignment in the earliest part of the optioneering stage and show a contribution to these policies in the Strategic Case, specifically alignment to current government policy such as Carbon Net Zero and Levelling Up.

Reporting

10.6 The value for money analysis will be supported by the following:

- Appraisal Summary Table (AST); and
- Outline Business Case (OBC) following DfT Transport Business Case guidance.
- Full Business Case (FBC) following DfT Transport Business Case guidance.

10.7 The Appraisal Specification Summary Table (ASST) is provided in Appendix A and summarises the appraisal approach.

Appendix A – Appraisal Specification Summary Table

Each TAG impact criteria has been assessed quantitatively, with estimated impact given a score from -3 to +3, as shown below:

- Significant Beneficial (3)
- Moderate Beneficial (2)
- Slight Beneficial (1)
- Neutral (0)
- Slight Adverse (-1)
- Moderate Adverse (-2)
- Significant Adverse (-3)

Impacts	Sub-impacts	Current Estimated Impact	Level of uncertainty	Proposed proportionate appraisal methodology	Reference to evidence and rationale in support of proposed methodology	Type of Assessment Output (Quantitative/ Qualitative/ Monetary/ Distributional)
Economy	Business users & transport providers	Beneficial for transport providers, positive for business users	Not estimated	Highway modelling and PT modelling to use Hereford Transport Model and appraised using TUBA	To be assessed in line with TAG Unit M1-M4	Quantitative
	Reliability impact on Business users	Beneficial due to congestion relief and improved resilience issues around the A49 Bridge.	Not estimated	To be assessed in line with TAG Unit A1.3.	Assessment to be based on TAG.	Quantitative
	Regeneration	Regeneration will be covered in the appraisal in the following ways: • Committed development for the corridor will include some regeneration proposals • Wider Economic Impacts will assess the dependent development impacts (qualitative)				
	Wider Impacts	Beneficial due to improved access to business (industrial estate) and jobs in Hereford.	Not estimated	To be assessed in line with A2-1.	Assessment to be based on TAG.	Quantitative
Environmental	Noise	Potential adverse noise and vibration impacts during construction. Potential for beneficial and adverse impacts during operation.	Not estimated	To be assessed in line with TAG Unit A3 Section 2, and DMRB LA 111.	Assessment to be based on TAG.	Quantitative

Impacts	Sub-impacts	Current Estimated Impact	Level of uncertainty	Proposed proportionate appraisal methodology	Reference to evidence and rationale in support of proposed methodology	Type of Assessment Output (Quantitative/ Qualitative/ Monetary/ Distributional)
	Air Quality	Potential for beneficial impacts within Hereford AQMA and adverse impacts close to the proposed Scheme options during operation.	Not estimated	To be assessed in line with TAG Unit A3 Section 3, and DMRB LA 105.	Assessment to be based on TAG.	Quantitative
	Greenhouse Gases	Potential for beneficial or adverse impacts due to reducing or increasing vehicle kilometres during operation of the proposed Scheme.	Not estimated	The appraisal will be carried out in accordance with TAG Unit A3 Section 4.	Assessment to be based on TAG.	Quantitative
	Landscape	Potential for adverse impacts on local landscape character and pattern as a result of change in land use, loss of vegetation and the introduction of large structures.	Not estimated	The appraisal will be carried out in accordance with TAG Unit A3 Section 6.	Assessment to be based on TAG.	Qualitative

Impacts	Sub-impacts	Current Estimated Impact	Level of uncertainty	Proposed proportionate appraisal methodology	Reference to evidence and rationale in support of proposed methodology	Type of Assessment Output (Quantitative/ Qualitative/ Monetary/ Distributional)
	Townscape	Potential for beneficial impacts on local townscape character as a result of decreased traffic in Hereford town centre.	Not estimated	The appraisal will be carried out in accordance with TAG Unit A3 Section 7.	Assessment to be based on TAG.	Qualitative
	Historic Environment	Potential for adverse impacts as a result of changes to the setting of designated heritage assets. Potential for adverse impacts on buried archaeological remains.	Not estimated	The appraisal will be carried out in accordance with TAG Unit A3 Section 8.	Assessment to be based on TAG.	Qualitative

Impacts	Sub-impacts	Current Estimated Impact	Level of uncertainty	Proposed proportionate appraisal methodology	Reference to evidence and rationale in support of proposed methodology	Type of Assessment Output (Quantitative/ Qualitative/ Monetary/ Distributional)
	Biodiversity	Potential for adverse impacts to the River Wye, as a result of the bridge construction and to the Wye Valley & Forest of Dean SAC and Wye Valley Woodlands SAC as a result of bridge or road construction. Potential for adverse indirect impacts on other habitats including ancient woodland, Lugg Meadow SSSI, potential impacts to protected species as a result of the bridge or road construction.	Not estimated	The appraisal will be carried out in accordance with TAG Unit A3 Section 9.	Assessment to be based on TAG.	Qualitative

Impacts	Sub-impacts	Current Estimated Impact	Level of uncertainty	Proposed proportionate appraisal methodology	Reference to evidence and rationale in support of proposed methodology	Type of Assessment Output (Quantitative/ Qualitative/ Monetary/ Distributional)
	Water Environment	Potential for adverse impacts on watercourses. Potential for adverse impacts on flood risk as a result of an increase in impermeable area in Flood Zone 3.	Not estimated	The appraisal will be carried out in accordance with TAG Unit A3 Section 10.	Assessment to be based on TAG.	Qualitative
Social	Commuting and Other users	Beneficial due to a reduction in traffic congestion in Hereford	Not estimated	Highway modelling to use SATURN with PT spreadsheet model and appraised using TUBA	To be assessed in line with TAG Unit M1-M4	Quantitative
	Reliability impact on Other users (Non-business users)	Beneficial due to improving resilience around the A49 bridge in the city centre and of the transport network in Hereford.	Not estimated	To be assessed in line with TAG Unit A1.3	Assessment to be based on TAG.	Quantitative
	Physical activity	Beneficial: Additional walking and cycling routes and public transport use will increase physical activity	Not estimated	To be assessed in line with TAG Unit A4.1 Section 3	Assessment to be based on TAG.	Quantitative

Impacts	Sub-impacts	Current Estimated Impact	Level of uncertainty	Proposed proportionate appraisal methodology	Reference to evidence and rationale in support of proposed methodology	Type of Assessment Output (Quantitative/ Qualitative/ Monetary/ Distributional)
	Journey quality	Beneficial: Improved facilities for travelling by public transport and active trave;	Not estimated	To be assessed in line with TAG Unit A4.1 Section 6	Assessment to be based on TAG.	Quantitative
	Accidents	Slight beneficial. The scheme will lead to higher speeds for motorised vehicles, due to a relief in congestion, which will have a adverse impact on accidents. However, a beneficial impact is expected due to the segregated cycle infrastructure proposed in the new link road and bridge, and that some LGVs and HGVs will have an alternative route other than through the centre of Hereford.	Not estimated	To be assessed using COBALT in line with TAG Unit A4.1	Assessment to be based on TAG.	Quantitative
	Security	Neutral: No major impacts anticipated.	Not estimated	To be assessed in line with TAG Unit A4.1 Section 4	Assessment to be based on TAG.	Qualitative

Impacts	Sub-impacts	Current Estimated Impact	Level of uncertainty	Proposed proportionate appraisal methodology	Reference to evidence and rationale in support of proposed methodology	Type of Assessment Output (Quantitative/ Qualitative/ Monetary/ Distributional)
	Access to services	Beneficial; scheme will offer additional routes and improve the reliability and journey times of bus services.	Not estimated	To be assessed in line with TAG Unit A4.1 Section 8	Assessment to be based on TAG.	Qualitative
	Affordability	Beneficial; Infrastructure that allows for safe travel by active means will be provided. Active means of transport is the most affordable.	Not estimated	Output from TUBA Appraisal to inform a personal affordability review	To be assessed using in line with WebTAG Unit A4.1 Section 9	Quantitative
	Severance	Beneficial; The infrastructure will provide an extra crossing of the river and connect communities.	Not estimated			Qualitative
	Option values	Neutral; No major impacts are anticipated.	Not estimated			
Public Accounts	Cost to Broad Transport Budget	N/A	Not estimated	Cost estimates including optimism bias to be produced in line with TAG	Assessment to be based on TAG.	Quantitative

Impacts	Sub-impacts	Current Estimated Impact	Level of uncertainty	Proposed proportionate appraisal methodology	Reference to evidence and rationale in support of proposed methodology	Type of Assessment Output (Quantitative/ Qualitative/ Monetary/ Distributional)
	Indirect Tax Revenues	Beneficial: Increased capacity of the network will lead to higher numbers of vehicles on the road.	Not estimated	To be assessed using outputs from the TUBA models	Assessment to be based on TAG.	Quantitative