Hereford Eastern Links Study

Route Assessment Report

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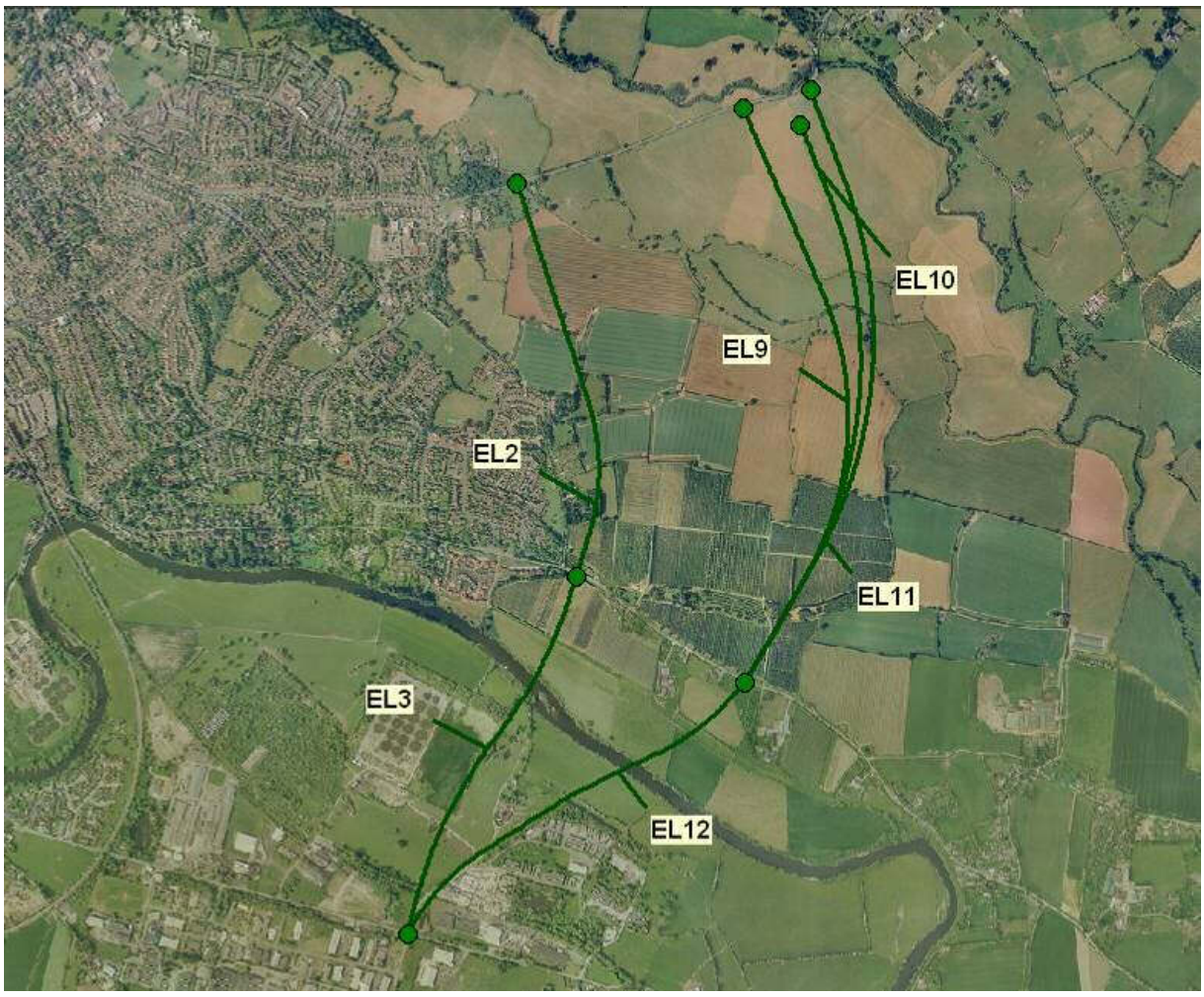

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Executive Summary

In 2012 Herefordshire Council commissioned an assessment of a link between the B4399 at Rotherwas and the A438 Ledbury Road in the context of the recent Enterprise Zone status at Rotherwas. The route provides a second river crossing but avoids the more environmentally sensitive links that were identified in the Hereford Relief Road Study of Options Report (Amey, 2010).

Background

The Hereford Relief Road Study of Options Report (Amey, 2010) identified the engineering and environmental advantages and disadvantages associated with the introduction of a relief road to either the west or the east of the city. It considered the traffic impact of the Relief Road and packages of sustainable transport options against four Growth Point housing options. The report identified a Relief Road as an effective measure for accommodating future growth.

Of the Relief Road options the eastern routes performed only marginally better in terms of reducing overall traffic delay within the City. As the difference was marginal it was recommended that this should not influence the overall route choice above environmental and engineering considerations.

The Study of Options Report (Amey 2010) concluded that the Eastern corridors present a high risk in terms of delivery of a scheme due to the environmental constraints identified in the report. The Eastern corridors run through and adjacent to the River Lugg SAC (a component of the River Wye SAC), SSSIs, Special Wildlife Sites (SWS) and Local Nature Reserves (LNR). A major area of concern was the impact upon the local hydrology both in terms of surface water and ground water environments. From the survey works undertaken it was considered that the risk of successful challenge of an Eastern corridor through the Conservation Regulations (2010) would be significantly high; the risk of challenge through the Countryside and Rights of Way Act (2000), and by statutory and non-statutory bodies would also be high.

Further work carried out in The Study of Options Environmental Addendum Report (Amey, 2011) identified the impact on cultural heritage associated with the introduction of a relief road to either the west or the east of the City, and concluded with recommending a Western Relief Road.

The Study of Options Traffic Forecasting Addendum: Reduced Housing and Employment Report (Amey, 2012) identified the impact of a reduced housing and employment scenario. The report concluded that despite the reduction in the number of dwellings and employment sites in Housing Option 5, combined with sustainable transport measures, there remains a need to provide congestion relief in the form of a Relief Road.

Eastern Links Study

This study considers the impact of introducing a link between the B4399 at Rotherwas and the A438 Ledbury Road only, without a new link to the A4103 Worcester Road. Eastern Links EL2 and EL3 form an ‘inner’ route, passing to the west of Rotherwas Chapel and joining the B4224 at the Junction with Holywell Gutter Lane and the A438 250m east of the junction with Hampton Dene Road. Eastern Links EL9, EL10, EL11 and EL12 form options for the ‘outer’ routes; passing east of Rotherwas Chapel and joining the B4224 700m southeast of the junction with Holywell Gutter Lane and the A438 in the vicinity of the Lugwardine Bridge, see Figure ES1.

The study considered the following aspects:

- Network Assessment
- Route Engineering Assessment
- Link Cost Assessment
- Route Environmental Assessment

In the network assessment the impact of introducing a link between the B4399 at Rotherwas and the A438 only, without a new link to the A4103, has a number of significant impacts upon the re-routing of traffic through the City and the local environment.

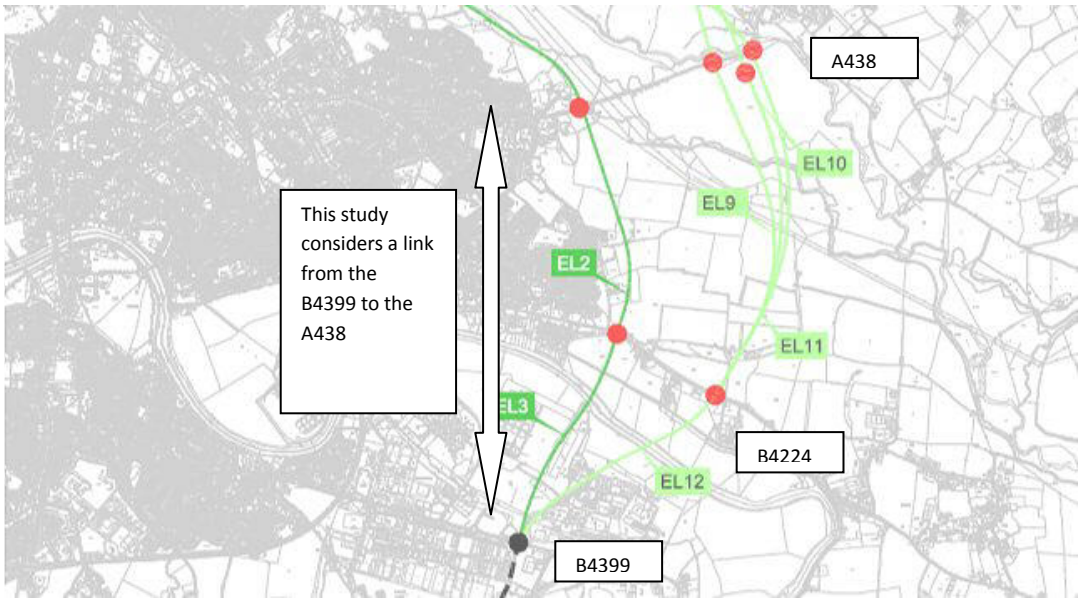

Figure ES1 Eastern Links

The effect of the reassignment of traffic, which has destinations within the City or to the north, is to transfer a significant number of trips onto lower classification roads, and into mainly residential areas to the East of the City. There is the creation of a significant additional traffic flow along Hampton Park Road, Hafod Road and Bodenham Road which then connects with the A465 Aylestone Hill to use the proposed new Link Road to get to the A49 south of the city.

The effect of traffic with destinations to the east, via Ledbury or Worcester, is to increase traffic flow on the A438 through the villages of Lugwardine and Bartestree. The Eastern Link also creates a demand between the A438 and the A4103, using lanes which are currently unsuitable for large volumes of traffic and heavy goods vehicles.

The Eastern Link delivers traffic relief benefit to the City Centre with a reduction in traffic flows on the A49 but with the result of transferring these trips to less suitable, residential and low standard routes as described above. The problems introduced by the Eastern Links are not then mitigated by the opening of a Western Relief Road, as much of the traffic would continue to favour the routes described.

An assessment of long distance journey times demonstrates that 10 minutes are saved for trips from the Rotherwas Industrial Estate to Junction 7 of the M5 (Worcester) as a result of

implementing the Eastern Link. However, the link standards, particularly gradients on the A4103 and the journey time reliability bypassing Worcester would reduce the attractiveness of this route, particularly for HGVs.

Economics

An assessment using the TUBA (Transport User Benefit Appraisal) software has been undertaken to assess the economic worth of the Eastern Link in isolation and then with the Western Relief Road in place. The assessment compares scheme delivery costs with benefits over a 60 year period to provide a Benefit/Cost Ratio (BCR). The benefits are calculated from journey time savings, giving users of the network a Value of Time (VOT) and reduced costs to users through reductions in Vehicle Operating Costs (VOC). This economic assessment does not take into account environmental dis-benefits associated with the scheme.

The assessment demonstrates that both scenarios provide healthy BCRs, exceeding 2 which the DfT would consider to be the threshold for demonstrating good value for money. The Eastern Link in isolation produces a BCR of 13 and assessed with the Western Relief Road a BCR of 4. This is not surprising given that the Eastern Link can be delivered for a lower cost than Full Western Relief Road but presents good journey time savings.

Care should be taken however with these BCR figures as it is considered that the traffic model will not be capturing all of the dis-benefits associated with congestion in the east of the City, Lugwardine and Bartestree. Therefore actual reduced journey time and reduced economic benefits are likely to reduce the BCR following more detailed modelling of this area of the City.

Engineering

Although both inner and outer Eastern Link routes require a net import of material for the construction of embankments, the 'inner' links provide the potential to increase cutting and have far less embankments. As such the inner links are more likely to provide a solution with an overall cut/fill balance.

This assessment concludes that the increased traffic through the villages of Lugwardine and Bartestree, and the links between the A438 and the A4103 will lead to an accelerated deterioration in highway condition and would have an adverse impact upon residents due to increases in noise and vibration. Risk of highway injury collisions through the villages, on the links between A438 and A4103 and at the junctions would be expected to increase as usage increases and modifications to the highways and junctions will become necessary.

The impact of increased traffic over the Lugwardine Bridge has been considered, whilst the original structure can take full highway loading, a later bridge widening extension may not. Also, the tight radii already contribute to some larger vehicles striking the parapets for which the risk would increase with the additional predicted traffic.

Provision at the structure for non-motorised users is already a concern and increased traffic flows will deter non-motorised users.

Figure ES2 A438 Lugwardine Bridge

Link Cost Assessment

The Inner Eastern Link has the lower delivery cost, primarily due to lower construction costs as the outer route requires more embankments and structures to cross the floodplain. These cost assessments provide very early stage estimates with significant contingency figures (optimism bias) to account for currently unknown costs.

Route Environmental Assessment

Since the Study of Options Report (Amey 2010) the Lugg and Hampton Meadows SSSI has been provisionally extended into the Lower Lugg area, over which the Outer Eastern Link corridor crosses.

In addition to potential impact on local habitats, all the Eastern Links have potential to adversely affect:

- the River Lugg SSSI,
- proposed Lugg and Hampton Meadows SSSI and
- River Wye SAC,

Impacts include loss of habitat, pollution of watercourses, changes to hydrological relationships between the designated sites and disturbance to protected species. The Outer Eastern Links would involve direct land take from the proposed Lugg and Hampton Meadows SSSI. Both the Inner and Outer Eastern Links would have significant adverse impacts on the designated features of the River Wye SAC, River Lugg SSSI and proposed Lugg and Hampton Meadows SSSI. The Inner Eastern Links would have less of an impact on the designated sites and are preferred over the Outer Eastern Links.

It is predicted that the Eastern Links will result in a significant change to the noise environment of receptors located along the following routes: Eastern Links, Hampton Park Road, Holme Lacy Road, Rotherwas Access Road, A49 Ross Road and A49 Victoria Street.

Both the Inner and Outer Eastern Links will require a bridge crossing over the River Wye, with the loss of floodplain around EL3. All the Outer Eastern Links cross floodplain and extensive excavations in ground with a high water table will be required, with potential for detrimental impacts to the groundwater regime. There are likely to be complex hydrological relationships between the River Wye SAC, River Lugg, Lugg Rhea and proposed Lugg and Hampton Meadows SSSI and the wider floodplain. Therefore any impacts on any one of these features is likely to have indirect/direct impacts on the rest.

Summer Briefings

A number of briefings were held with key stakeholders on 22nd June 2012 and 16th August 2012. These

Conclusions and Recommendations

The Eastern Link would have a major adverse traffic impact upon Lugwardine, Bartestree and low standard links between the Ledbury Road and the Worcester Road.

The Eastern Link is identified in the traffic modelling as an attractive alternative route to traffic using the A49 through Hereford but in its present proposed form, without the appropriate standard of connecting road infrastructure, it would cause considerable traffic related problems in the areas of east Hereford, Lugwardine and Bartestree.

The economic assessment demonstrates that the Eastern Link represents good value for money. However, the purely economic assessment is only a part of the overall appraisal process. Previous studies have concluded that there is a need to provide congestion relief for the city in the form of a Relief Road. The construction of an Eastern Link between B4399 Rotherwas Industrial Estate and A438 Ledbury Road would have a detrimental impact upon the business case for a Western Relief Road.

In addition to the prohibitive traffic impacts, there are environmental impacts upon local residents from increased noise and vibration and reduced air quality. All routes will have a major adverse impact upon the setting of the Scheduled Ancient Monument and associated buildings at the Rotherwas Chapel. These environmental impacts further reinforce the recommendation not to pursue these links.

Due to the extent of floodplain and associated impacts on the groundwater regime and ecologically designated sites, the Inner Eastern Link is the preferred option for any eastern link. However even EL3 crosses a large area of floodplain and flood risk assessments and compensation flood relief measures will be required.

Of the Eastern Links considered, the inner links closest to the City have the least impact upon the environment, primarily due to the increased distance from the Lugg Floodplain. This is further reinforced by the recent extension of the SSSI designation associated with the River Lugg, floodplains and meadows.

If the business case for a Western Relief Road is undermined with the Eastern Links being in place by 2019, and a continuation of the route across the sensitive Lugg Meadows is still undeliverable, then the A49 will remain Trunk Road and the sustainable package of measures assumed to be included in this study may become more difficult to achieve. In addition much of the strategic traffic

would be using non-strategic routes of a far lower standard than the trunk road. The highway maintenance burden for the strategic traffic would therefore remain the concern of the local highway authority.

Primarily due to the traffic impact upon the East of the City and the villages of Lugwardine and Bartestree, but also due to the environmental impacts, it is recommended that a link between the B4399 and the A438 only is not pursued.

Contents

Figures

Appendix A - Traffic Flow Difference Plots and Select Link Analysis Plots
Appendix B - Lugwardine Bridge Pedestrian Access Feasibility Study
Appendix C - Transport Economic Efficiency (TEE) Tables
Appendix D - Consultation Responses
Appendix E - Summer Briefings

List of Figures

List of Tables

1. Introduction

1.1. Background

1.1.1. Herefordshire covers a predominantly rural area of 842 square miles and Hereford is the main service centre and largest urban area, with a population of 54,850. The A49 strategic highway passes through the City from north to south and crosses the River Wye at Greyfriars Bridge close to the historic City Centre. The pattern of main roads in the County is focussed on Hereford itself and peak hour congestion is frequently experienced on the City's highway network and river crossing.

1.1.2. Herefordshire Council have considered a number of options to alleviate the impacts of the traffic passing through Hereford City whilst balancing the need for economic growth. Recent work undertaken has demonstrated the benefits of a relief road with the final recommendations to be included in the forthcoming Local Development Framework (LDF).

1.1.3. A Multi Modal Study was completed to assess the broadly defined transport and development strategies and supported the need for a Relief Road. This confirms the existing capacity problems associated with the local highway networks; predicting worsening congestion with the predicted growth scenarios.

1.1.4. In 2010 a corridor assessment was undertaken towards determining a preferred corridor for the Relief Road for the purposes of the Local Development Framework (LDF) Core Strategy. The Study of Options Report considered potential alignments for routes to the east and the west of the city.

1.1.5. The recommendation within the final report completed in September 2010 was for a Western Relief Road, primarily due to the impact of an eastern route upon the River Lugg and River Wye Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI). A Western Relief Road was considered to have a lesser impact upon these designated sites and remaining potential impacts would be more easily mitigated (figure 1).

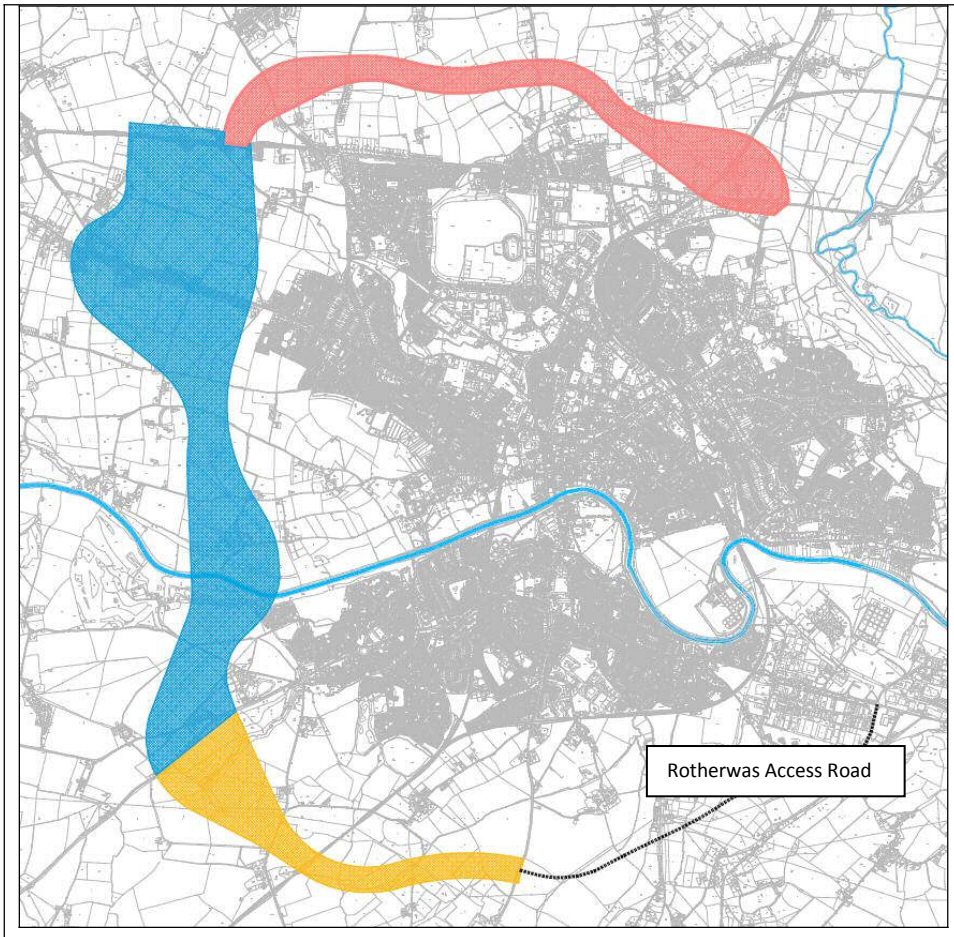

Figure 1: Preferred Western Relief Road of the 2010 Study of Options

1.1.6. Further work carried out in The Study of Options Environmental Addendum Report (Amey, 2011) identified the impact on cultural heritage associated with the introduction of a relief road to either the west or the east of the City. Given the number and range of known archaeological and architectural sites, it was again concluded that both of the Eastern corridor options would have a more adverse impact upon the cultural heritage of the area than the Western corridor options. It therefore recommended that, from the viewpoint of Cultural Heritage, a route should be chosen within the Western corridors.

1.1.7. The Study of Options Traffic Forecasting Addendum: Reduced Housing and Employment Report (Amey, 2012) identified the impact of a reduced housing and employment scenario on the previous recommendations for the introduction of a relief road to the west of the City. The report concluded that despite the reduction in the number of dwellings and employment sites in Housing Option 5, combined with sustainable transport measures, there remains a need to provide congestion relief in the form of a Relief Road.

1.2. Study Scope

1.2.1. Herefordshire Council commissioned a further assessment of options in respect of road infrastructure in the context of the recent Enterprise Zone status for Hereford. The study explores the implications of a new River Wye crossing and road links to the east of Hereford, both as a proposal in its own right and in conjunction with the preferred Western Relief Road corridor.

1.2.2. The study assesses the impacts of implementing an Eastern Link from the B4399 at the Rotherwas Industrial Estate to the A438 Ledbury Road. The route does not cross the sensitive Lugg Meadows and the study investigates whether it will provide traffic benefits to the City and access improvements to the Rotherwas Enterprise Zone.

1.2.3. The Study of Options report in 2010 considered a number of route options for a link between the B4399 and the A438. These routes differed to consider the impacts upon the Scheduled Ancient Monument at Rotherwas Chapel and to compliment the options for the continuation as a full eastern route around the City.

1.2.4. The relevant data from the 2010 Study of Options report has been extracted and new information added to produce an Engineering Assessment for the Eastern Links between the B4399 and the A438 only.

1.2.5. The scheme cost estimates for the original links have been presented in isolation and the basis for the costing is the same as the 2010 Study of Options to allow any comparative assessment with the 2010 report and western routes to be made.

1.2.6. The 2010 study of Options Report has been reviewed and the impacts of the relevant eastern link alignments have been reconsidered and summarised. In addition the traffic model outputs have been used to undertake Air Quality Screening Assessments for the modelled scenarios.

1.2.7. Figure 2 below shows the eastern links considered within the 2010 Study of Options. For clarity, this study considers links EL2, EL3, EL9, EL10, EL11 and EL12 only. This report refers to the links considered within this study as the 'Eastern Links'. Links to the North of the A438 have been disregarded.

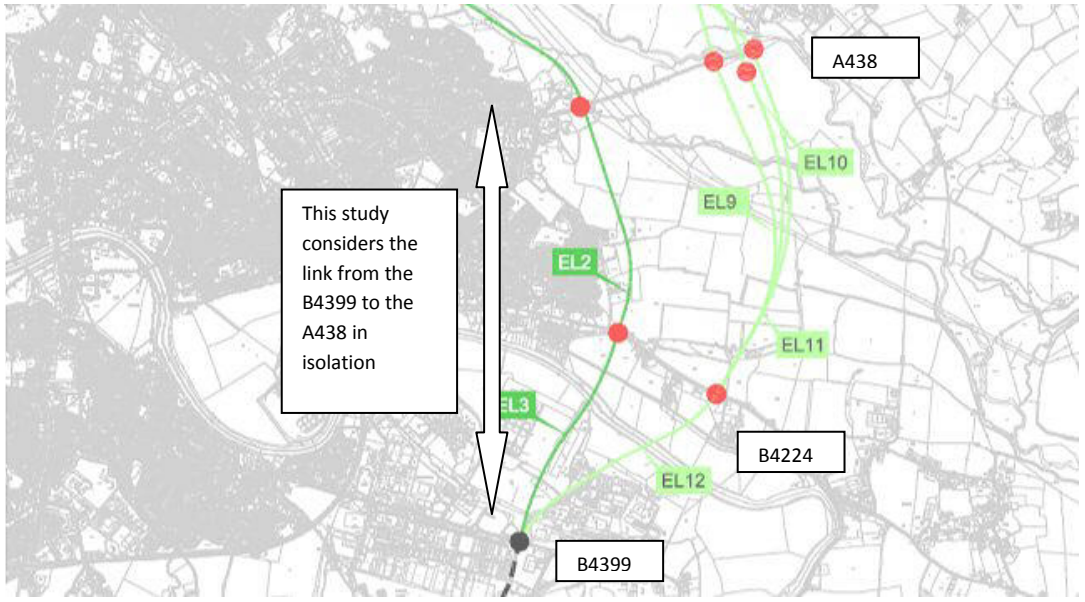

Figure 2: Eastern Links considered in the 2010 Study of Options

2. Network Assessment

2.1. Introduction

2.1.1. In order to inform of the impact of the Eastern Link from the B4399 to the Ledbury road, the Hereford SATURN model was used to model the Eastern Link and to assess its impact on congestion, traffic volumes and travel speeds. The model was used to assess the areas of the Eastern Links, Lugwardine and Bartestree, the east of the city and in Hereford city.

2.1.2. The model was used to observe what changes occurred in travel patterns in the city with the opening of the Eastern Link. It was also used to observe the distribution of traffic which used the Eastern Link and to assess the origins and destinations of traffic using the link in 2019.

2.1.3. In 2031, the potential opening year of the Western Relief Road has to be considered in the context of this study of the Eastern Links. Therefore, model scenarios were coded which included the Western Relief Road (WRR) and assessed the operation of both measuring how the Eastern Links and the WRR impacted on the performance of each other in terms of traffic volumes and distributions.

2.2. Modelling Methodology

2.2.1. The existing traffic model for the Study of Option and the Housing Option 5 assessment has also been used for this study.

2.2.2. The model is the Hereford SATURN - TRIPS multimodal model which was developed by JMP Consultants and has a calibrated base year of 2008.

2.2.3. For the forecast future year demand matrices, the matrices developed by Amey-TPi during the Housing Option 5 assessment were used (new housing growth scenario following removal of Growth Points status and the removal of the West Midlands Regional Spacial Strategy). The derivation of these matrices is detailed in the report "Hereford Relief Road- Study of Options Report, Addendum: Reduced Housing and Employment Option (Amey Herefordshire, January 2012)" which details the volumes and distributions of the forecast growth. The assumptions in this report regarding the creation of the matrices are summarised below:

- NTEM 6.2 was used for forecasting the future growth for the year 2031.
- Housing Option 5 is the assumed Growth Point scenario used for the Hereford area. The Hereford area growth associated with Growth Point Housing Option 5 is additional to the growth forecast in NTEM 6.2 and the distribution and quantity of growth associated with this is explained in detail in Study of Options Addendum, Amey 2012.

- Overall car trip demand was reduced by 20% under the assumptions in the Study of Options which represents reduced future car demand through introducing a package of sustainability measures including travel planning, improved public transport services and infrastructure, promotion of non-car modes including cycling and walking, parking restrictions and other measures (20% is accepted to exceed any best case for modal shift as a result of sustainable measures. This was used in the Study of Options to ensure that any case made for a new road was robust and could not be challenged. This figure has then continued to be used to ensure consistency with these earlier studies).

2.2.4. As this study is primarily concerned with the impacts of the Eastern Link on the conditions of the road network and road users, it was decided to only use the SATURN element of the Hereford model. The SATURN model is a highway model and is used to assess impacts of road network changes on the performance of the road network and the impacts on road users only and not the wider economic benefits.

2.2.5. The Hereford multi-modal model is currently under-going an update by Amey and should be completed by the end of 2012. At that stage, it might be desirable to assess the further multi-modal impacts of the Eastern Link on non-car users but for the present in this assessment only the highway impacts are being considered.

2.2.6. For the purposes of this study, an interim assessment year of 2019 was created to consider the changes over time of the opening of the Eastern Link road. This interim assessment year of 2019 was also a required input into the TUBA economic appraisal which was also carried out of the Eastern Link.

2.2.7. Following commonly used modelling methodology; it was assumed that growth between the base year of 2008 and the forecast year of 2031 was linear which would include NTEM and Growth Point growth. An interpolation for 2019 was then used to obtain the 2019 trip demand matrices. Using this methodology it is implicit that an element of the car trip reduction through implementation of Sustainability Option 3 is included in the 2019 demand matrices.

2.2.8. Two 1-hour peak time periods were modelled which were the AM peak period between 08:00 and 09:00 and the PM peak period between 17:00 and 18:00.

2.2.9. The trip totals for car trips, Light Goods Vehicles (LGVs) and Heavy Goods Vehicles (HGVs) for the base year (2008), interim year (2019) and forecast year (2031) are shown below in Table 1. The totals shown are vehicle totals which are assigned to the network and are shown for the two modelled time periods of AM and PM peaks.

2.2.10. The growth rates for LGV and HGV trips were taken from the National Transport Model (NTM) Rev 1.1 from May 2010.

Table 1: Trip Totals for base and future years					
Year	**Time Period**	**Car Trips**	**LGV Trips**	**HGV Trips**	**Total**
2008	AM Peak	13,739	1,034	495	15,268
2008	PM Peak	14,420	1,357	334	16,111
2019	AM Peak	14,224	1,367	521	16,112
2019	PM Peak	14,964	1,793	352	17,109
2031	AM Peak	14,751	1,726	549	17,026
2031	PM Peak	15,554	2,266	371	18,191

2.2.11. The model network as it is represented in SATURN is shown in Figure 3. The main radial routes into Hereford are represented with the focus of the model being Hereford City rather than the surrounding hinterland.

2.2.12. Figure 4 shows the centre of the model representing Hereford city centre with some of the major roads noted on the model screenshot to assist with orientation.

2.2.13. The original JMP calibrated model included the city road network but did not extend to include the three road links between the A438 and the A4103 at Lugwardine. In the context of this study these road links assume importance as traffic accessing the Eastern Link from the east, from the direction of Worcester and the M5, could potentially use these connecting roads to access the eastern link road.

2.2.14. The three road links between the A438 and the A4103 in this area of the model is in buffer network, which is model network where junctions are not modelled explicitly and speeds are calculated along links using speed-flow curves. Speed flow curves are curves which control the relationship between speed and flow and reduce the speed on links as the volume of traffic increases. The nature and shape of the curves are also determined by the characteristics of the road.

2.2.15. In this area of the buffer network a connecting road between the A438 and the A4103 at Bartestree exists. It was therefore decided that since the connections already exist at Bartestree in the model buffer network, traffic distributions in this area would be catered for with this link. The additional connecting roads at Lugwardine would not be coded and included in the model as this would introduce too great a change to the existing model to be confident in understanding the impact of addition of the Eastern Link road. It is accepted that introducing additional connecting roads in the new base model would create more variables, compromising the ability to draw robust conclusions from the study.

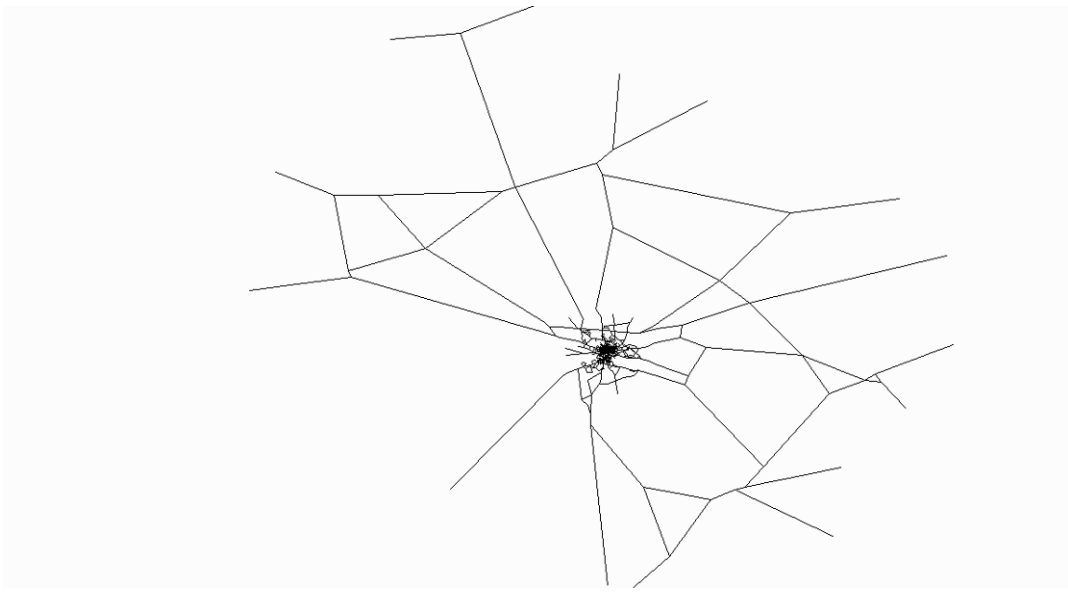

Figure 3: Full Hereford Model Network 2008

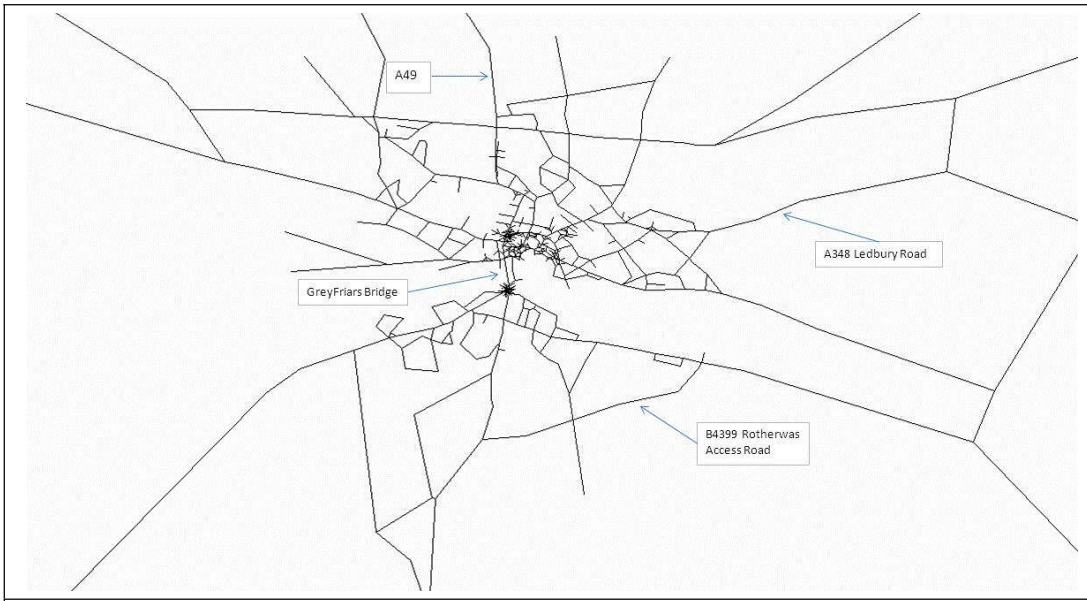

Figure 4: Hereford City Centre Model Network 2008

2.3. Modelled Scenarios

2.3.1. In total, seven model scenarios were considered for the interim and future years. In each of these scenarios, different assumptions were made regarding the highway network infrastructure provisions which included the Eastern Link. This list of scenarios together with their description is shown below in Table 2. The seventh scenario was added during the assessment and was introduced to measure the impact of the Eastern Link in 2031. It was requested by the Air Quality Assessment team and by the TUBA Economic Appraisal team. The trip demand to be included in each of these scenarios was shown previously in Table 1.

Table 2: List of Scenarios and highway infrastructure provisions in each

Scenario No.	Year	Infrastructure Description
Scenario 1	2019	As exists with Edgar Street link
Scenario 2	2019	As scenario 1 with Eastern Link
Scenario 3	2019	As scenario 1 with Eastern Link and Southern Corridor
Scenario 4	2031	As exists with Edgar Street link
Scenario 5	2031	As scenario 4 with Western Relief Road
Scenario 6	2031	As scenario 4 with Western Relief Road and Eastern Link
Scenario 7	2031	As scenario 4 with Eastern Link

2.3.2. These model scenarios will enable an assessment of the impact of the Eastern Link and Western Relief Road (WRR) infrastructure by comparing those scenarios which contain the Eastern Link and WRR with the do-nothing scenarios (scenarios 1 and 4).

2.3.3. Since the only changes in the model runs will be the provision of the Eastern Link and WRR infrastructure, any observed changes in traffic conditions or distributions can be directly attributable to the opening of these roads:

- In 2019 the Edgar Street Grid road between A465 Aylestone Hill and A49 Edgar Street is completed and open to traffic. The introduction of the eastern link between B4399 Rotherwas Access Road and the A438 Ledbury Road is tested, with a junction on B4224 Hampton Bishop Road;
- In 2031, the Western Relief Road is the full length of the relief road and includes the Southern Corridor. The Southern Corridor exists as an independent link only in 2019.

2.4. Ledbury Road, Lugwardine and Bartestree areas

2.4.1. Due to the location of the Eastern Link and the connection it enables between the A438 Ledbury Road and the B4399, the areas of Lugwardine and Bartestree could be subject to increased traffic volumes and congestion. Since these roads are non-strategic local roads, the potential traffic increases after the opening of the Eastern Link could be significant and as such warrant specific analysis.

2.4.2. This section of the report assesses the likely impact in the Lugwardine and Bartestree area and tries to identify the volume and distribution of potential additional traffic in the area as a result of the opening on the Eastern Link.

2.4.3. The model is considered accurate in predicting volume and distribution changes with the introduction of the Eastern Link infrastructure. Though it will not be able to predict levels of junction congestion and delay on local roads in the buffer network, the volume and distribution of the induced trips in the area due to the opening of the Eastern Link should be accurate.

2.4.4. The traffic flows volumes for a selected number of locations in the Lugwardine and Bartestree area are shown below in Tables 3 and 4. All flows are two-directional flows and are in total vehicles (vehs).

Table 3: Traffic flows for AM period for Lugwardine and Bartestree (vehs)

Location	2008 Base	2019 Scenario 1 Base	2019 Scenario 2 EL	2019 Scenario 3 EL + SC	2031 Scenario 4 Base	2031 Scenario 5 WRR	2031 Scenario 6 WRR + EL	2031 Scenario 7 EL
A438 West of Lugwardine	1,093	1,010	1,441	1,489	926	886	1,378	1,444
A438 at Bartestree	577	645	725	727	658	654	762	762
A4103 at Whitestone	650	813	924	942	809	839	928	934
Lane between Bartestree and Whitestone	756	1,001	1,238	1,276	979	997	1,252	1,294

Table 4: Traffic flows for PM period for Lugwardine and Bartestree (vehs)								
Location	**2008 Base**	**2019 Scenario 1 Base**	**2019 Scenario 2 EL**	**2019 Scenario 3 EL + SC**	**2031 Scenario 4 Base**	**2031 Scenario 5 WRR**	**2031 Scenario 6 WRR + EL**	**2031 Scenario 7 EL**
A438 West of Lugwardine	810	769	1,142	1,215	735	698	1,125	1,143
A438 at Bartestree	569	684	671	680	724	653	697	681
A4103 at Whitestone	280	421	631	628	420	364	569	666
Lane between Bartestree and Whitestone	457	815	1,047	989	872	785	1,019	1,140

2.4.5. In 2019 the biggest increase in traffic flow is on the A438 Ledbury Road West of Lugwardine, where there is an increase of 431 vehicles (43%) in the AM and 373 vehicles (49%) in the PM after the opening of the Eastern Link when compared against the scenario 1 base in 2019.

2.4.6. The other road to experience a significant increase is the A4103 at Whitestone in the evening PM peak. In this time period, the traffic volumes increase by 210 vehicles, equivalent to a 50% increase in flow. This traffic increase would have to use the existing connecting local road network.

2.4.7. The connecting lane between Bartestree and Whitestone experiences growth in 2019 with the opening of the Eastern Link. In the AM peak there is an increase of 236 vehicles (24%) while in the PM peak there is an increase of 232 vehicles (29%). This shows the significant level of traffic increases on the three local connecting roads: Cotts Lane, Lumber Lane and C1130 Whitestone and which in total is likely to be in the region of 230 – 240 vehicles.

2.4.8. While there is a further increase in overall traffic levels in the area with the opening of the Southern Core in isolation, it is a small increase in the region of 40 – 70 vehicles for each location and does not have the same significant traffic level increases which occur after the opening of the Eastern Link.

2.4.9. In 2031, there is very little growth in traffic levels in the area, when compared against the 2031 base scenario 4, with the opening of the WRR (scenario 5). There is actually a decrease in the region of 5% - 13% in traffic flows in the area in the PM peak with the opening of the WRR which is to be expected as the opening of the WRR provides general traffic relief to the city. The largest traffic volume increase is on the A4103 at Whitestone in the AM but it is a minor increase of 30 vehicles.

2.4.10. In 2031, with the opening of the Eastern Link, the same large traffic increases in the Lugwardine area are observed on the network as in the 2019 when compared against 2031 base scenario 4. The largest increase is again on the A438 Ledbury Road with an increase in the AM peak of 452 vehicles (49%) and an increase in the PM peak of 390 vehicles (53%). These increases in traffic flows are approximately the same as observed in 2019 with the opening of the Eastern Link and are not significantly different.

2.4.11. Overall traffic volume increases in 2031 with the Eastern Link approximately match those increases observed in 2019. The only significant differences are on the A4103 and the connecting lane between Whitestone and Bartestree in the PM peak in 2031 which are lower than those in 2019. It suggests that there is some traffic relief in the area due to the WRR which is approximately 60 – 90 vehicles in the PM peak for these two roads. These results reliably show that with the opening of the Eastern Link, there is significant growth in traffic levels in the Lugwardine area and along the A438 as traffic uses the A438 Ledbury Road to access the Eastern Link. This occurs in both future years (2019 and 2031) and in both time periods (AM and PM). It also occurs regardless of other infrastructure interventions i.e. the opening of the WRR.

2.4.12. To demonstrate graphically the change in flows in the Lugwardine and Bartestree areas with the introduction of the Eastern Link, a series of traffic flow difference plots have been produced. These plots are a screen shot produced from SATURN and show graphically the change in flows from the 2019 and 2031 base scenarios (scenarios 1 and 4) to the two scenarios with the Eastern Link and the WRR (scenarios 2 and 6). These are the two scenario comparisons which contain the greatest traffic volume difference (see figure 5 and 6).

2.4.13. In the screenshots, the change in flow has been plotted as a bandwidth with the green bandwidth representing an increase in flow and blue bandwidths representing traffic relief and a decrease. The thicker the bandwidth the greater the change in flow. Traffic flow volumes have not been annotated on the screenshots in order to prevent cluttering of the diagrams which reduces legibility. The tables provided above contain all traffic volume changes. The purpose of these figures is not to provide exact traffic volume changes but to provide a visual impression of the changes and the change in routing of traffic with the opening of the Eastern Link.

2.4.14. To save on space in this report, only difference plots for the AM are shown below but difference plots for all time periods are contained in Appendix A.

Figure 5: AM 2019 Traffic flow difference plot: Scenario 2 vs Scenario 1

Figure 6: AM 2031 Traffic flow difference plot: Scenario 6 vs Scenario 4

2.4.15. As can be seen in the plots, the increase in flow along the A438 can mostly be attributed to traffic which diverts from the B4224 and the B4399. A route which travels along the A438 and over Eastern Link to reach the south and south-western parts of the city has large time savings against a route which travels along the B4224 and particularly the B4399. The A438 and Eastern Link route represents an attractive route for traffic from the east areas of Herefordshire in the direction of Ledbury and Worcester.

Traffic Distributions

2.4.16. In order to assess the routing of traffic using the Eastern Link and how they travel through the Lugwardine – Bartestree area, a series of select link analysis was carried out on the Eastern Link.

2.4.17. A select link analysis is a function within SATURN software which allows an inspection of the spatial distribution of traffic using a certain link or stretch of road. It graphically displays the origins and destinations of traffic travelling through a stated stretch of road. It displays the routes which traffic used both to reach that road from their origin and the routes the traffic uses to reach its destinations after it has passed through the selected stretch of road; In this case an inspection of traffic passing through the Eastern Link on the proposed river crossing section will give an indication on how the introduction of the Eastern Link is likely to impact on the local road network.

2.4.18. The figures below show the select link analysis which was carried out for 2019 Scenario 2 and 2031 Scenario 6. In order to save space in the report, the select link analyses shown below are for the AM peak period only. Select link analysis for all time periods are contained in Appendix A.

2.4.19. A select link analysis is direction dependent and each figure is labelled with the direction of travel of the analysis in the northbound or southbound direction. The annotations on the select links are total Passenger Car Units (PCUs) and indicate the number of selected trips travelling along that link. As the select link analysis uses a given matrix from the original assignment, which in our case was a matrix of PCU trips, it was only possible to extract a select link analysis showing PCUs rather than vehicles, which have been reported on earlier in this section.

2.4.20. With relation to the volume of traffic shown in the select link analysis, the Passenger Car Unit is a standard traffic unit of measurement and other vehicles are assessed in terms of PCU. For example a car has a PCU value of 1, a motorcycle equates to ½ a PCU and a heavy goods vehicle in the Hereford model is 2.3 PCUs.

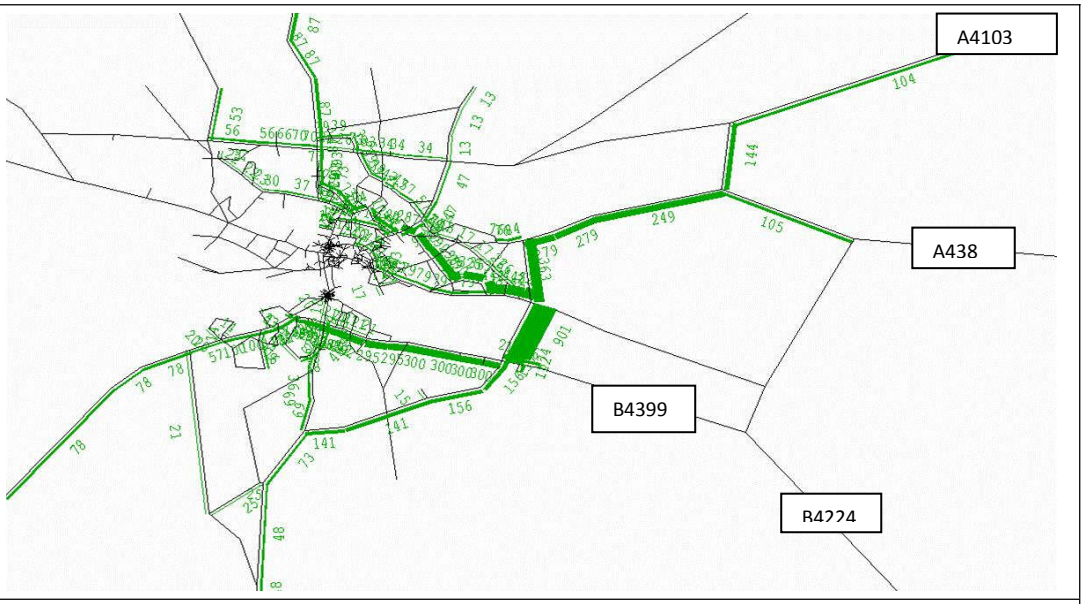

Figure 7: Select Link Analysis AM 2019 Scenario 2: Southbound

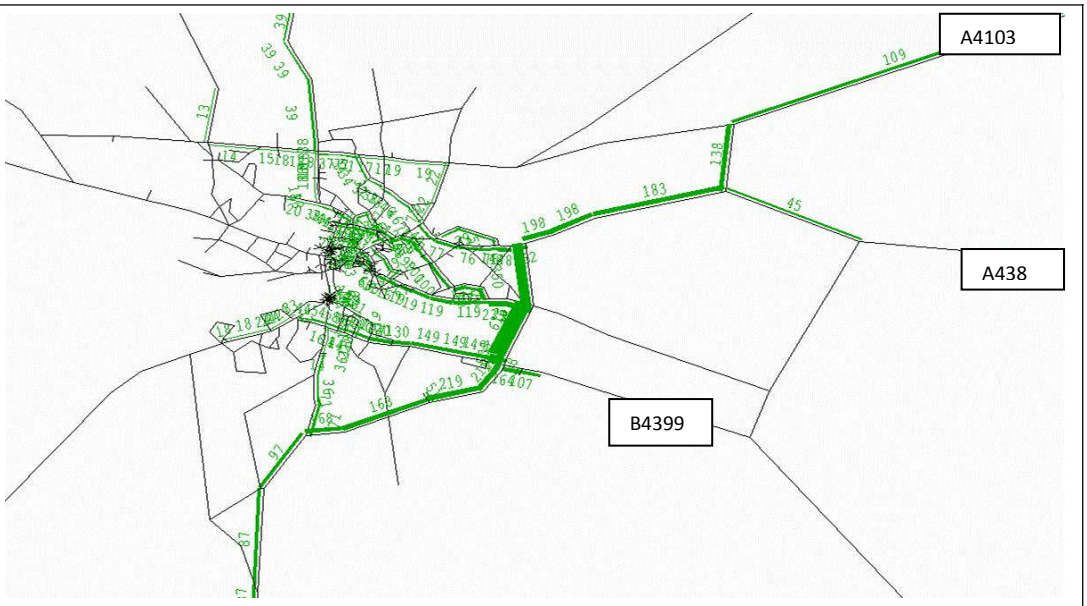

Figure 8: Select Link Analysis AM 2019 Scenario 2:Northbound

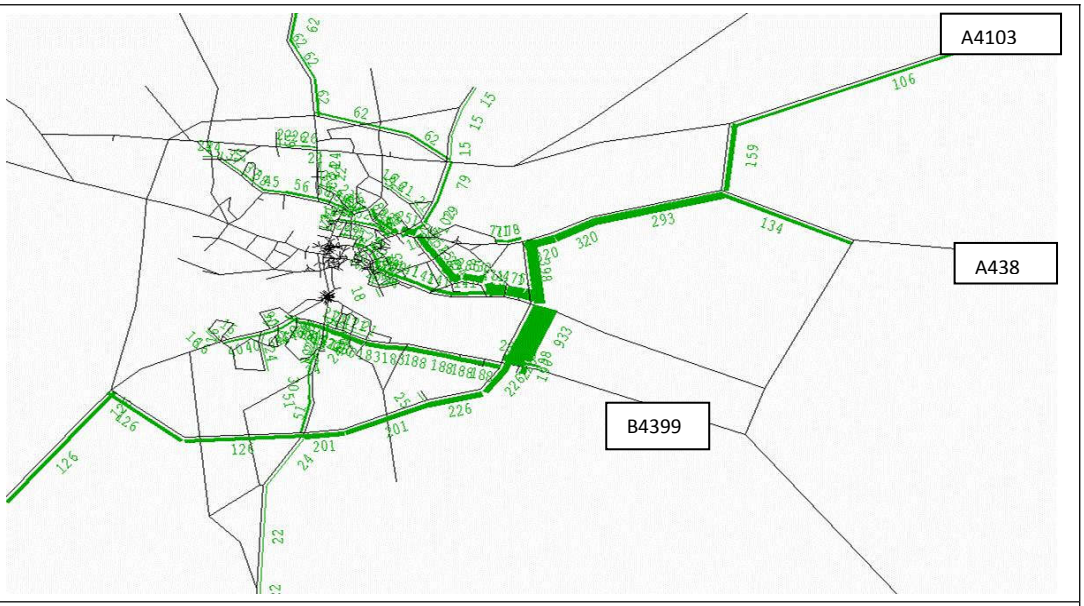

Figure 9: Select Link Analysis AM 2031 Scenario 6: Southbound

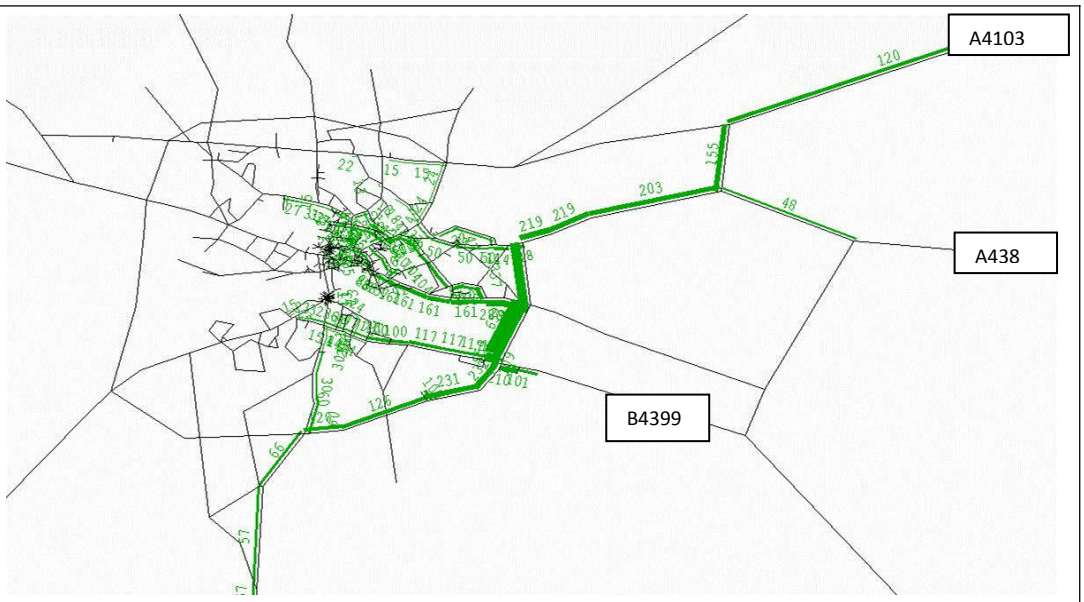

Figure 10: Select Link Analysis AM 2031 Scenario 6: Northbound

2.4.21. Focussing on traffic flow to the east of the city, the select link analysis indicates that approximately a quarter to a third of the southbound and northbound traffic crossing the Eastern Link has travelled along the A438 Ledbury Road. It also shows the proportions of traffic which travels along the A4103.

2.4.22. The select link analysis shows that potential exists for traffic using the Eastern Link Road to come from or be travelling to the A4103 and traveling along the A438 Ledbury road, accessing the Ledbury road from the connecting lanes between Bartestree and Whitestone. It indicates that in the morning AM peak, the two-directional traffic increase on these lanes could be in the region of 280 – 320 PCUs.

2.4.23. A further item to note from the select link analysis plots above is the strong increase in traffic in the east of the city along Hampton Park Road, Hafod Road and Bodenham Road. This increase is particularly noticeable when observing the traffic increases due to southbound traffic in Figures 7 and 9. This increase in traffic in the east of the city will be assessed in detail in the following section.

2.5. Hereford East City Area

2.5.1. With the opening of the Eastern Link, there is a large local increase in traffic levels in the east of the city which is attributable to traffic accessing and coming from the Eastern Link, particularly in the Hampton Park Road area. In order to properly assess this impact, this section of the report will examine this area specifically.

2.5.2. The model indicates that the main area of traffic increase is on the Hampton Park Road west of the Eastern Link with traffic feeding into this area from the north-west and the Hafod Road and Bodenham Road direction. The tables below indicate the traffic growth on these roads. All volumes shown are in total vehicles and are combined two-directional flows.

Table 5: Traffic flows for AM period for the east city areas (vehs)

Location	2008 Base	2019 Scenario 1 Base	2019 Scenario 2 EL	2019 Scenario 3 EL + SC	2031 Scenario 4 Base	2031 Scenario 5 WRR	2031 Scenario 6 WRR + EL	2031 Scenario 7 EL
B42224 Hampton Park Road west of Eastern Link	543	537	945	997	552	459	1,019	1,060
B42224 Hampton Park Road east of Eastern Link	623	609	407	403	645	545	366	390
Hafod Road	499	366	591	586	391	361	577	637
Bodenham Road	631	496	703	681	477	500	668	721

Table 6: Traffic flows for PM period for the east city areas (vehs)								
Location	2008 Base	2019 Scenario 1 Base	2019 Scenario 2 EL	2019 Scenario 3 EL + SC	2031 Scenario 4 Base	2031 Scenario 5 WRR	2031 Scenario 6 WRR + EL	2031 Scenario 7 EL
B42224 Hampton Park Road west of Eastern Link	441	452	851	892	462	397	904	945
B42224 Hampton Park Road east of Eastern Link	537	544	351	343	575	497	321	360
Hafod Road	319	341	510	504	356	340	509	564
Bodenham Road	565	491	618	643	505	555	661	642

2.5.3. As shown in tables 5 and 6, the largest increase in traffic volumes in absolute terms is along the B4224 Hampton Park Road immediately to the west of the Eastern Link in the AM peak period when comparing the scenarios where the Eastern Link is opened with the no improvement base scenario in each modelled year. In the 2019 opening year, along this stretch of road there is an increase of 408 vehicles with the opening of the Eastern Link (scenario 2) and an increase of 460 vehicles with the further opening of the Southern Core (scenario 3). This corresponds to an increase of 76% and 86% respectively.

2.5.4. In the 2019 PM peak with the same comparison, the absolute growth of the traffic volumes is less. However, in percentage terms, the increase is greater with an 88% increase in traffic along Hampton Park Road after the opening of the Eastern Link and a 97% increase with the opening of both the Eastern Link and the Southern Core.

2.5.5. In 2031, significant increases in traffic volumes are also observed with the opening of the Eastern Link. In the AM peak in 2031, when observing the traffic volume changes which occur after the opening of the Eastern Link, there is an increase of 467 vehicles (85%) on the Hampton Park Road when the Eastern Link is opened in conjunction with the WRR (scenario 6) and an increase of 508 vehicles when the Eastern Link is opened in isolation (scenario 7). Similar though slightly smaller increases are observed in the PM peak in 2031.

2.5.6. One of the main routes which traffic uses to access the Eastern Link in the east of the city is through an axis formed of Hafod Road and Bodenham Road. This traffic distribution was seen previously graphically in the select link analysis presented in Figures 7 to 10. The increase in traffic volumes can also be observed from the tables above.

2.5.7. The map below (Figure 11) shows in detail the network in the east of the city which experiences the largest traffic increases. The Hafod Road – Bodenham Road axis referred to above can be seen on the map and this route which experiences traffic volume increases skirts the 20 mph speed zone and the traffic calming measures on Folly Lane.

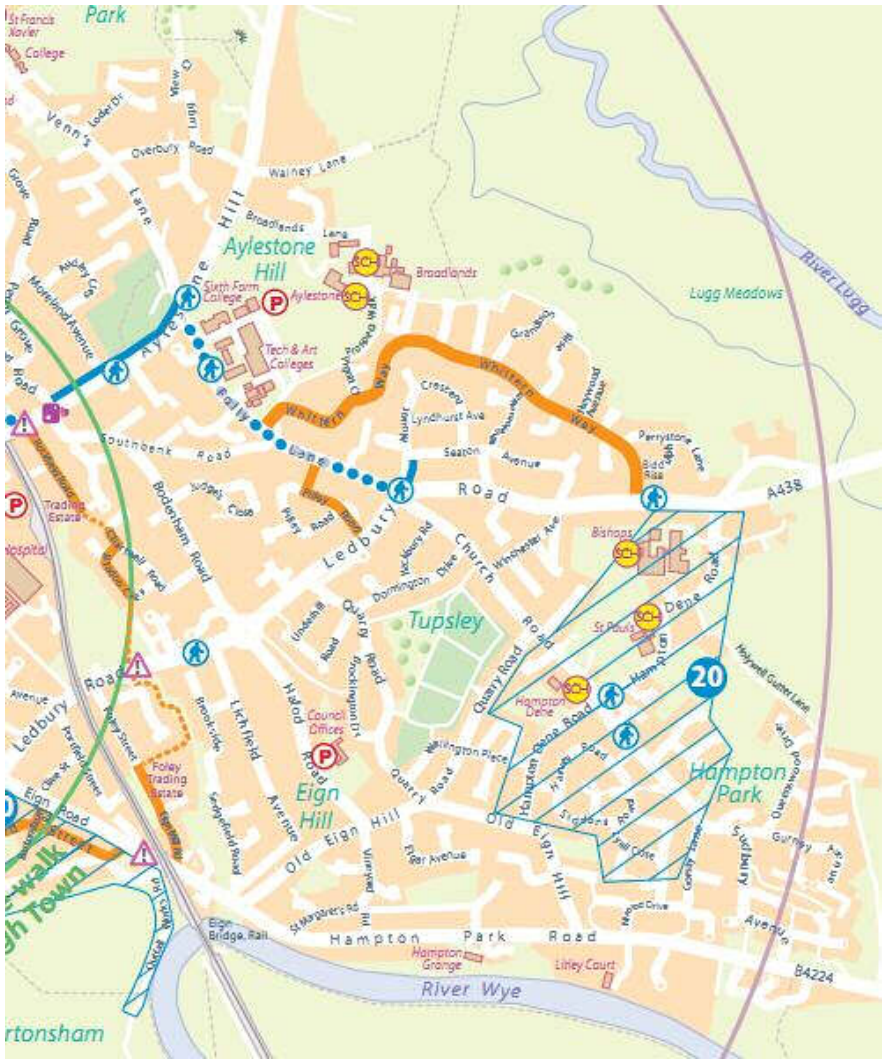

Figure 11: Extract of City Street Plan (Herefordshire Council)

2.5.8. The largest increases in traffic volumes are seen in the AM peak period and so the AM peak period is the key time period described here. In the 2019 AM peak on the Hafod Road with the opening of the Eastern Link there is an increase of 225 vehicles, equivalent to a 61% increase in traffic. On Bodenham Road in 2019 after the opening of the Eastern Link there is an increase of 206 vehicles, equivalent to a 42% increase.

2.5.9. In the 2031 AM peak, after the opening of the Eastern Link (scenario 7 compared against scenario 4) there is an increase of 246 vehicles, corresponding to 63%, on Hafod Road. This is slightly mitigated against with the opening of the WRR when the increase is 186 vehicles, equivalent to a 48% increase.

2.5.10. On Bodenham Road in 2031 in the AM peak, after the opening of the Eastern Link there is an increase of 244 vehicles, an increase of 51%. When the Eastern Link is opened in conjunction with the WRR, the traffic increase is 191 vehicles, 40%.

2.5.11. As can be seen from Tables 5 and 6 above, and from the most substantial increases which are described in the previous paragraphs, the opening of the Eastern Links causes a large inducement of traffic to the eastern areas of Hereford city and particularly to Hampton Park Road and Hafod / Bodenham Road. The typical increases in traffic on these roads range from 40% to 97% depending on the road and the time period. These all represent significant increases in traffic volumes on what are non-strategic and residential roads.

2.5.12. To demonstrate the areas of highest traffic impacts, traffic volumes difference plots are shown below for the AM peak for 2019 and 2031 for scenarios 2 and 6. These plots demonstrate graphically the areas of highest traffic flow increases with the thickest green bands representing the largest increase in traffic flows. Traffic volumes have again not been annotated on the graphs for reason of legibility, Tables 5 and 6 contain the traffic flow information for these plots.

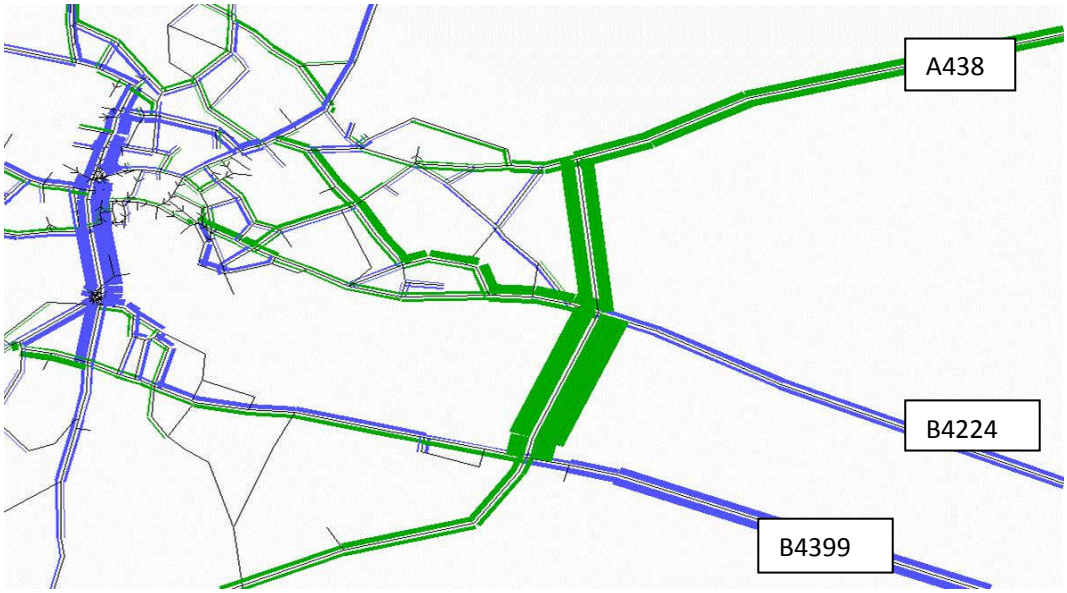

Figure 12: 2019 AM Traffic flow Difference Plot: Scenario 2 (EL)vs Scenario 1 (Base)

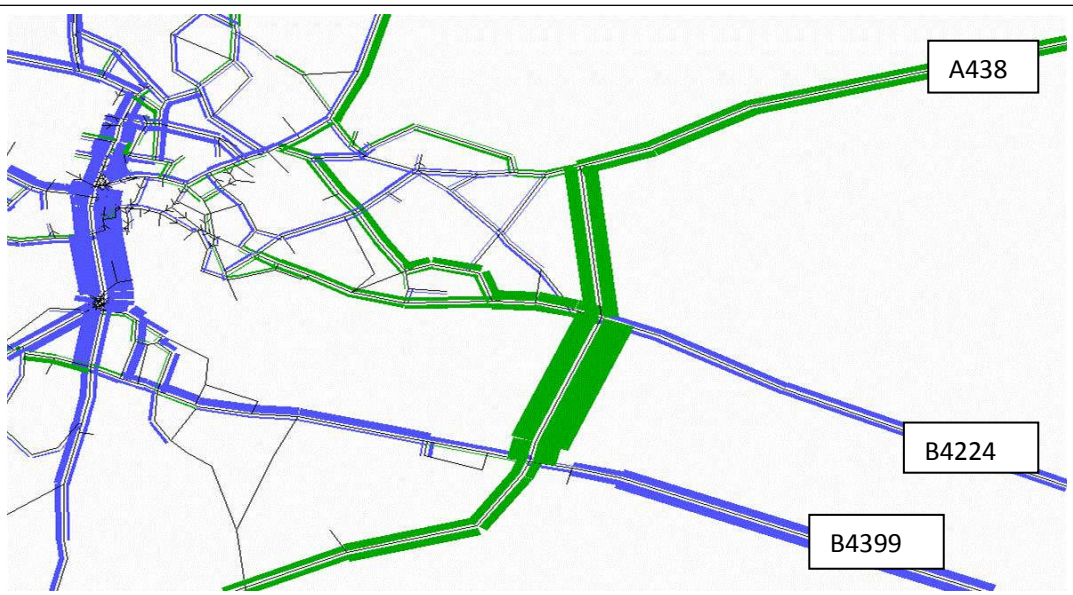

Figure 13: 2031 AM Traffic flow Difference Plot: Scenario 6 (WRR+EL)vs Scenario 4 (Base)

2.5.13. The plots above graphically demonstrate the increases on Hafod Road and Bodenham Road and how traffic volumes on these roads increase when the Eastern Link is opened. As traffic from the north of the city is attracted towards the Eastern Link river crossing rather than Greyfriars Bridge, residential roads such as Hafod Road, Bodenham Road, Eign Road and Hampton Park Road are the main routes used to access the new crossing in the east of the city.

2.6. City Centre Links

Traffic Flows for 2019

2.6.1. Shown below in Table 7 are AM peak traffic flows for a selected number of locations in Hereford City centre. Traffic flows have been extracted for the 2008 base year as well as all modelled scenarios for 2019. This demonstrates the change in flows in 2019 in the city centre with the opening of the Eastern Link and the Southern Corridor in 2019.

2.6.2. Table 8 shows flows for the same locations in Hereford City centre for the PM peak period.

Table 7: AM Peak Period City Centre Traffic Flows (vehs)

Location	2008 Base	2019 Scenario 1 Base	2019 Scenario 2 Eastern Link	2019 Scenario 3 EL + SC
A438 Eign Street	1,355	1,526	1,506	1,513
A49 Edgar Street	2,011	2,859	2,160	2,044
A465 Commercial Road	1,448	780	714	698
A438 New Market Street	2,273	995	959	953
Greyfriars Bridge	3,219	3,408	2,639	2,510
A465 Belmont Road	1,061	1,091	1,080	851
A49 Ross Road	1,120	1,156	1,045	1,038
Eastern Link between Rotherwas and B4224	-	-	1,384	1,554
Southern Corridor at Grafton	-	-	-	341

Table 8: PM Peak Period City Centre Traffic Flows (vehs)				
Location	**2008 Base**	**2019 Scenario 1 Base**	**2019 Scenario 2 Eastern Link**	**2019 Scenario 3 EL + SC**
A438 Eign Street	1,730	1,703	1,703	1,654
A49 Edgar Street	1,859	2,523	2,375	2,252
A465 Commercial Road	1,468	497	554	506
A438 New Market Street	2,213	1,021	966	922
Greyfriars Bridge	3,812	3,846	3,265	3,060
A465 Belmont Road	2,037	2,014	2,051	1,720
A49 Ross Road	1,043	1,189	953	980
Eastern Link between Rotherwas and B4224			1,366	1,677
Southern Corridor at Grafton				629

2.6.3. As can be seen from Tables 7 and 8 above, the city centre experiences the greatest traffic relief after the opening of the Eastern Link. On Greyfriars Bridge in the morning peak there is a traffic flow reduction of 770 vehicles in scenario 2 and 898 vehicles in scenario 3. This corresponds to a reduction in flow on the bridge of 23% with the opening of the Eastern Link and 26% with the further opening on the Southern Core in the AM peak.

2.6.4. Edgar Street also experiences significant congestion relief with a 699 vehicles (24%) reduction in scenario 2 and an 815 vehicles (29%) reduction in scenario 3. Another location to experience significant traffic relief (>15%) is the A465 Belmont Road. In scenario 3, with the opening of the Southern Corridor. In this scenario in the AM peak, the two-way flow reduces by 240 vehicles, equivalent to a 22% reduction in traffic flow.

2.6.5. It can also be seen that there is an increase in the volume of traffic crossing the river in scenarios 2 and 3 (Eastern Link and Greyfriars Bridge) in comparison to the 2008 base and scenario 1 (Greyfriars only). This is due to traffic which crosses the river on the B4224 at Mordiford now using the Eastern Link to cross the river when it opens. This demonstrates again the effect of the Eastern Link which is to induce traffic into the residential areas to the east of the city.

2.6.6. Traffic flow difference plots are shown below in a series of flow difference screenshots from SATURN which graphically displays the changes in traffic volumes which have been tabularised above.

2.6.7. To save on space in this report, only the results for the AM peak period have been shown as traffic flow difference plots. Traffic flow difference plots for all time periods are contained in Appendix A.

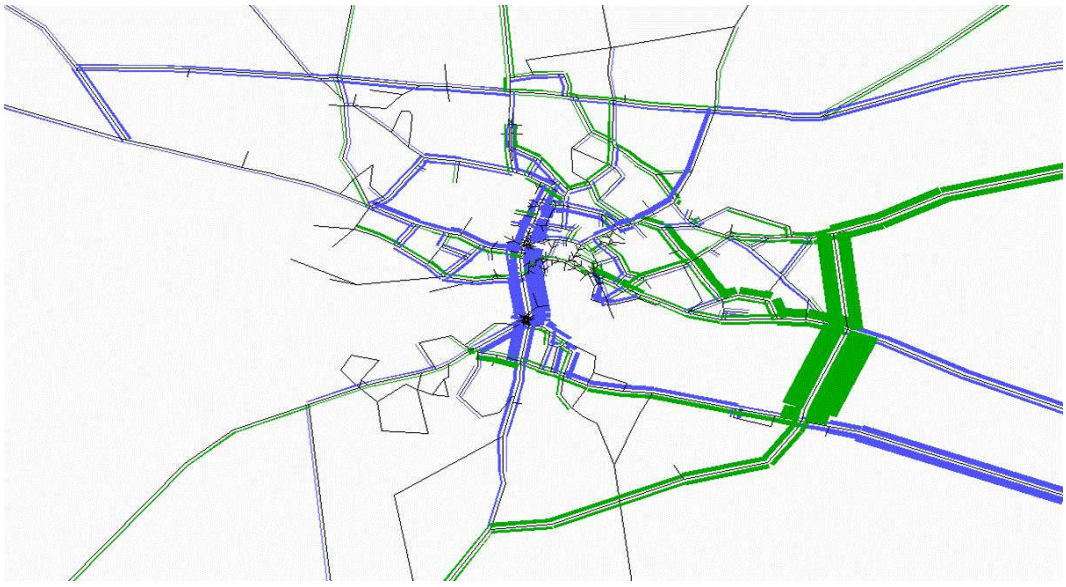

Figure 14: AM 2019 Traffic flow difference plot: Scenario 2 vs Scenario 1

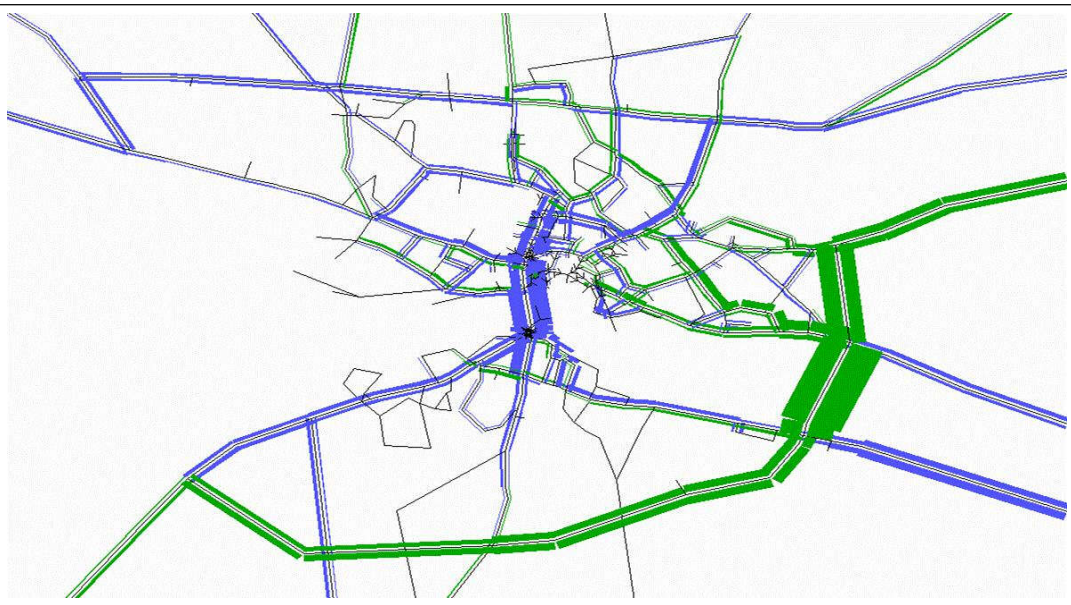

Figure 15: AM 2019 Traffic flow difference plot: Scenario 3 vs Scenario 1

2.6.8. Figures 14 and 15 graphically demonstrate the areas which experience traffic volume changes, both increases and decreases. The traffic relief in the city centre can be seen as traffic diverts to the Eastern Link. The primarily used routes to the Eastern Link can also be seen as green bands along roads headed towards the Eastern Link.

2.6.9. The reduction shown along the B4224 and the B4399 demonstrates the decrease in traffic crossing the river at Mordiford with the opening of the Eastern Link. A portion of the traffic which normally crossed at Mordiford would travel along these two routes. With the opening of the Eastern Link this traffic in now diverted to routes in the east of the city, such as the A438 and demonstrates again how the opening of the Eastern Link induces traffic into the east of the city.

Traffic Flows for 2031

2.6.10. Shown below in Tables 9 and 10 are the AM and PM peak flows for the 2031 scenarios. These flows have been exported from the model for the same city centre locations that were used in Tables 7 and 8 above. All flows shown are in vehicles and are two-way flows.

Table 9: AM Peak Period City Centre Flows, 2031 (vehs)

Location	2031 Scenario 4, no infrastructure	2031 Scenario 5, WRR	2031 Scenario 6, WRR With Eastern Link	2031 Scenario 7, Eastern Link Only
A438 Eign Street	1,619	1,377	1,376	1,539
A49 Edgar Street	2,997	2,616	2,057	2,276
A465 Commercial Road	758	669	687	713
A438 New Market Street	990	920	934	976
Greyfriars Bridge	3,578	2,965	2,248	2,731
A465 Belmont Road	1,150	884	843	1,124
A49 Ross Road	1,160	1,020	895	1,078
Eastern Link between Rotherwas and B4224	-	-	1,502	1,586
Southern Corridor at Grafton	-	582	567	-
WRR at Bridge Crossing		724	558	

Table 10: PM Peak Period City Centre Flows, 2031 (vehs)				
Location	**2031 Scenario 4, no infrastructure**	**2031 Scenario 5, WRR**	**2031 Scenario 6, WRR With Eastern Link**	**2031 Scenario 7, Eastern Link Only**
A438 Eign Street	1,766	1,320	1,359	1,698
A49 Edgar Street	2,588	2,600	2,204	2,393
A465 Commercial Road	451	508	504	544
A438 New Market Street	1,034	946	924	1,018
Greyfriars Bridge	3,921	3,455	2,801	3,324
A465 Belmont Road	1,983	1,764	1,778	2,041
A49 Ross Road	1,277	957	774	983
Eastern Link between Rotherwas and B4224	-	-	1,457	1,481
Southern Corridor at Grafton	-	821	748	-
WRR at Bridge Crossing		754	578	

2.6.11. As can be seen from the above tables, in the AM peak period the areas with the largest traffic flow reduction is Greyfriars Bridge and the A4103 to the north of the city. On the Greyfriars Bridge in 2031, with the opening of the WRR (scenario 5) compared against the base scenario 4, there is a traffic reduction of 613 vehicles, equivalent to 17%. With the subsequent opening of the Eastern Link (scenario 6), there is a reduction of 1,329 vehicles equivalent to 37%.

2.6.12. Edgar Street also experiences large traffic flow reductions in 2031 with the opening of the WRR and the Eastern Link. In scenario 5, the traffic flow on Edgar Street drops by 381 vehicles (13%) shown in fig. 15. In scenario 6 there is a larger fall in traffic flow with a reduction of 940 vehicles (31%) shown in fig. 16.

2.6.13. For the 2031 scenarios, a series of flow difference screenshots from SATURN have been produced to graphically display the changes in traffic volumes which have been tabularised above. These plots are the same in scope, area covered and bandwidth unit size as the plots produced for the 2019 scenarios.

2.6.14. In Figure 17, the traffic flow changes have not been compared against the do-nothing scenarios for 2031 which has been the method used up to now. Instead scenario 6 (Eastern Link and WRR) is compared against scenario 5 (WRR only) to assess what impact the opening of the Eastern Link has on the performance of the WRR when the two pieces of infrastructure are opened concurrently.

2.6.15. To save space in this report, only plots for the AM peak are shown below. A full set of traffic flow difference plots are contained in Appendix A.

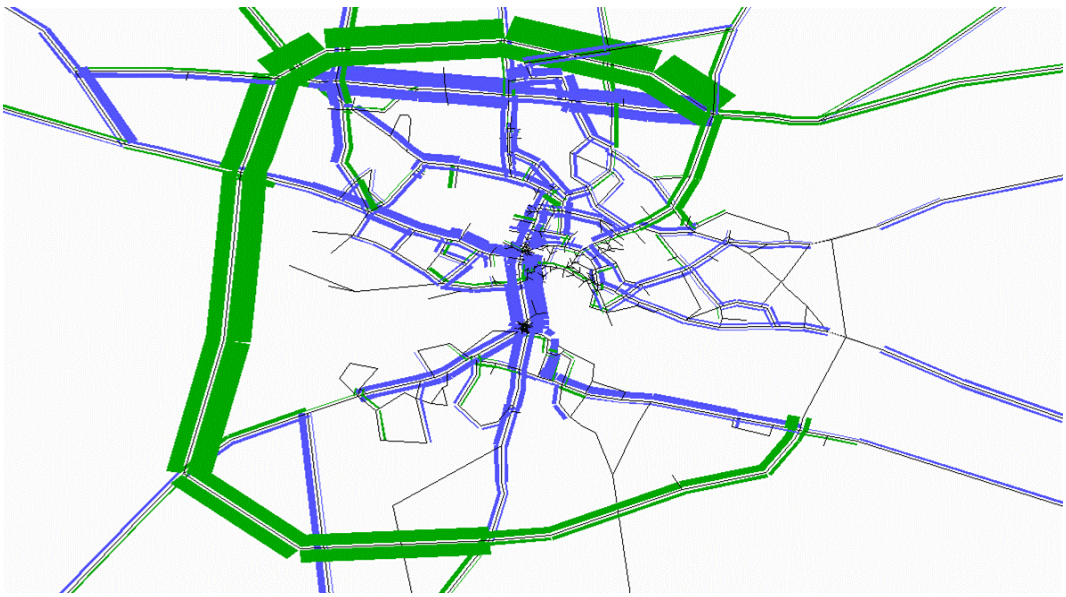

Figure 16: AM 2031 Traffic flow difference plot: Scenario 5 (WRR) vs Scenario 4 (Base)

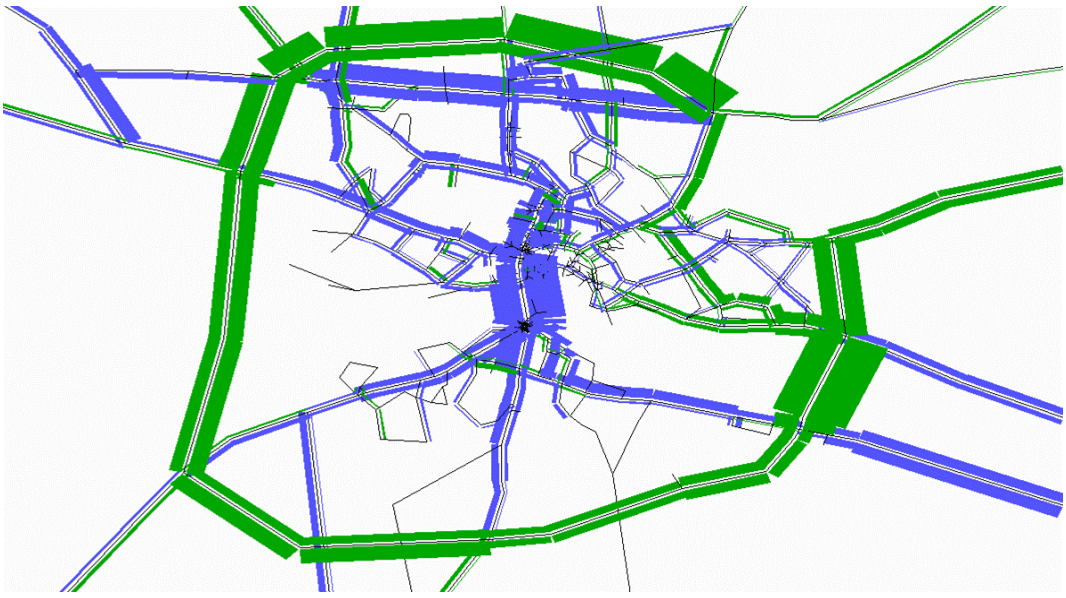

Figure 17: AM 2031 Traffic flow difference plot: Scenario 6 (WRR+EL) vs Scenario 4 (Base)

Figure 18: AM 2031 Traffic flow difference plot: Scenario 6 (WRR+EL) vs Scenario 5 (WRR)

2.6.16. The figures above show graphically the changes reported in tables 9 and 10. They particularly demonstrate the traffic relief experienced in the city centre with the opening of the WRR. They also demonstrate how the Eastern Link still attracts a significant volume of traffic even when the WRR is opened. Traffic volumes increase in the residential areas in the east of the city to access the Eastern Link when the Eastern Link is opened regardless of the availability of the WRR.

2.6.17. Of particular interest is the drop in traffic flow on the WRR with the opening of the Eastern Link. This is shown graphically above in Figure 18 which compares the scenarios where the WRR and the Eastern Link are open (scenario 6) against just the WRR open (scenario 5). When the Eastern Link is opened, the traffic flow on the WRR drops by 166 vehicles (23%) in the AM peak. Although it is not shown graphically, it can be seen in the tables that something similar happens in the PM peak, where the traffic flow on the WRR drops by 176 vehicles (also 23%) with the opening of the Eastern Link.

2.6.18. The greatest traffic relief in the city centre is experienced in scenario 6 where the WRR and the Eastern Link are opened concurrently. In this scenario, of the seven city centre sites where modelled traffic volumes were extracted, 5 of the sites experienced significant traffic relief (traffic flow reduction greater than 15%) in the AM peak period.

Journey Time Assessment

2.6.19. Journey times for a series of routes were extracted from the Hereford SATURN model for the base year and for each scenario for each future year. In doing so it is possible to determine the effect of each infrastructure intervention on journey times and how travel time changes over time in the future years.

2.6.20. Journey times were extracted for four routes in the model and for each direction of the route. Journey times were also extracted for both the AM and PM peak periods.

2.6.21. Shown below in Figure 19 are the four journey time routes for which times were extracted from the model. These routes have been chosen as they represent some of the routes with the heaviest traffic volumes in the model. They also represent the major radial routes into the city and the major cross-river routes. Also described in the figure is the start and finish point for each route.

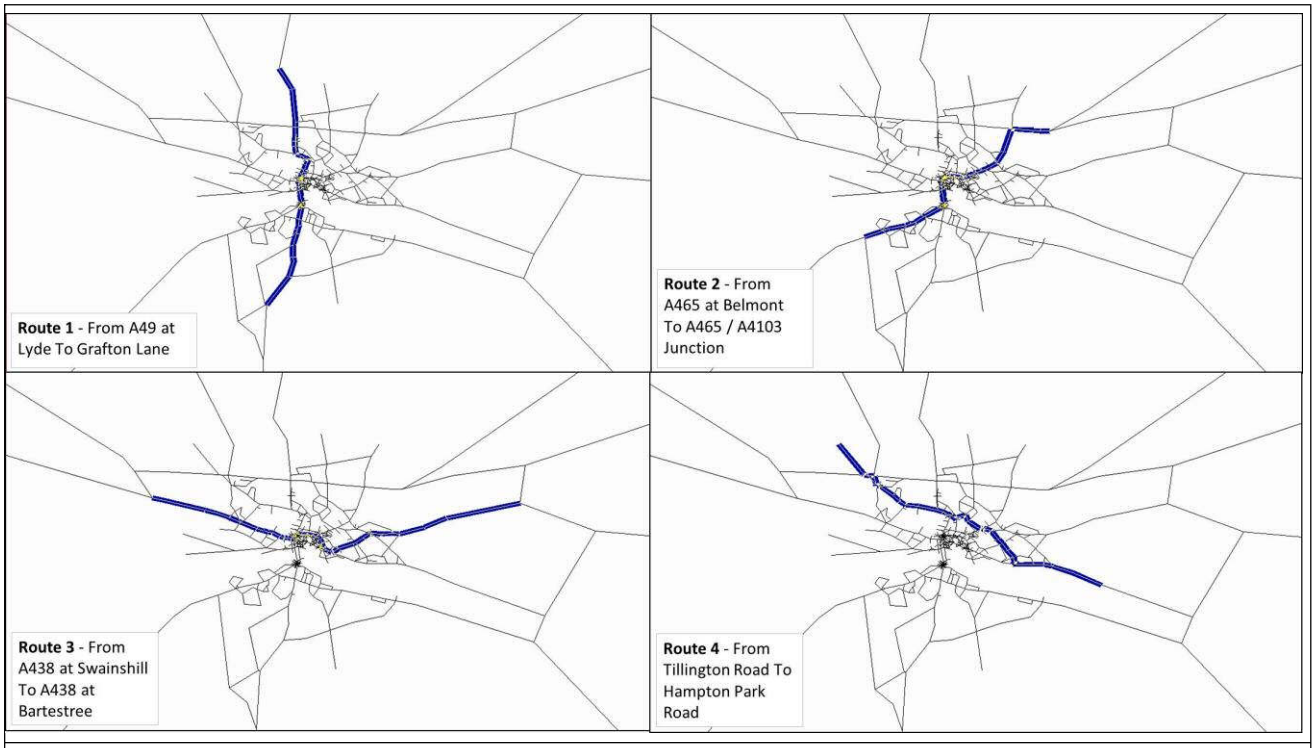

Figure 19: Journey Time Routes from Hereford Model

2.6.22. Journey times for the model were extracted for both directions and for each time period. Shown below are the journey times for the 2008 base year, the scenarios where there is no road infrastructure improvement (scenarios 1 and 4) and the scenarios where the Eastern Link is opened (scenarios 2 and 7). By doing this it is possible to observe directly the impact the opening of the Eastern Link has only journey times for the routes shown above in Figure 19. All times are shown in total seconds.

Table 11: Journey Time Travel data: AM Peak Period (seconds)						
Route no.	Direction	2008 Base	2019 Scenario 1 Base	2019 Scenario 2 EL	2031 Scenario 4 Base	2031 Scenario 7 EL
Route 1	Northbound	1102	1132	1069	1148	1069
Route 1	Southbound	1051	1115	1060	1200	1065
Route 2	Eastbound	863	960	982	954	991
Route 2	Westbound	871	1201	1230	1172	1121
Route 3	Eastbound	993	1108	1077	1160	1100
Route 3	Westbound	1131	1349	1290	1327	1251
Route 4	Eastbound	857	919	918	981	949
Route 4	Westbound	904	971	1048	962	1018

Table 12: Journey Time Travel data: PM Peak Period (seconds)						
Route no.	Direction	2008 Base	2019 Scenario 1	2019 Scenario 2	2031 Scenario 4	2031 Scenario 7
Route 1	Northbound	1073	1188	1093	1239	1108
Route 1	Southbound	1030	1141	1050	1194	1053
Route 2	Eastbound	877	1058	1004	1066	998
Route 2	Westbound	1098	1341	1214	1360	1262
Route 3	Eastbound	968	1098	1057	1098	1062
Route 3	Westbound	1245	1454	1345	1536	1421
Route 4	Eastbound	858	901	932	913	933
Route 4	Westbound	1032	1085	1140	1123	1174

* Pink cell colour indicates where journey travel time has increased with the addition of an Eastern Link

2.6.23. The route which experiences the greatest congestion relief is Route 1 which passes over the Greyfriars Bridge. On this route in the AM, there is a time saving of 5% in 2019 and 9% in 2031. In the PM peak on the same route there is an 8% time saving in 2019 and 11% in 2031.

2.6.24. Route 4 is an exception to the general trend in time savings observed in the journey times. In the AM peak in the westbound direction and in both directions in the PM peak and in all future years, the trend is for journey times along this route to increase with the opening of the Eastern Link. Averaged across all future years and both directions, Route 4 experiences an increase in journey times of 3% in the AM peak and 4% in the PM peak. As this route passes along Hafod Road, Bodenham Road and Hampton Park Road, this increase in journey times is due to the increase in traffic volumes on this route as traffic utilises these roads to access the Eastern Link after the link opens.

2.6.25. Overall as a general trend across all extracted journey time routes, there is greater time savings in the PM peak in comparison to the AM peak. With the opening of the Eastern Link, there is on average a 1% time saving in 2019 and a 4% time saving in 2031 in the AM peak. In the PM peak, there is an average time saving of 5% in both years.

2.7. Lugwardine and Bartestree Area Sensitivity Testing

2.7.1. As noted previously in this report, in the Lugwardine and Bartestree areas the model network is not simulation network but buffer network. In the modelled buffer network, junctions are not modelled in any detail and the network consists of links only. This in effect means that junctions which would experience an increase in delay as the volume of traffic travelling through the junction increases is not properly represented in the model.

2.7.2. Delay as a result of increased traffic is experienced in the model in the buffer network through the use of speed-flow curves. These curves, as they are applied in the model, mean that increases in traffic flow along links does result in slower speeds. The purpose of this section of the report is to see what level of traffic diversion occurs if delay is increased at junctions.

2.7.3. In the model, due to the proximity of the buffer network to the Ledbury road, there could be excessive assignment of traffic to the Ledbury road which does not take account of the increase in delay at the junctions at Bartestree and Lugwardine. The junction at Bartestree with the minor link road to the A4103, which in the model sees a large increase of traffic passing through the junction with the opening of the Eastern Link, is the junction tested in this section to assess the impact of increased delay.

2.7.4. In order to determine what the impact could be of increased delay at this particular junction, a series of sensitivity tests were conducted on the model at the Bartestree junction to assess the impact of increased delay.

2.7.5. Shown below in Figure 20 is a screenshot of the model in the area of Bartestree which indicates approximately the simulation / buffer network and the location of the Bartestree junction on which the sensitivity tests were carried out. The link to the north of the junction which links the Ledbury Road and the A4103 can be clearly seen.

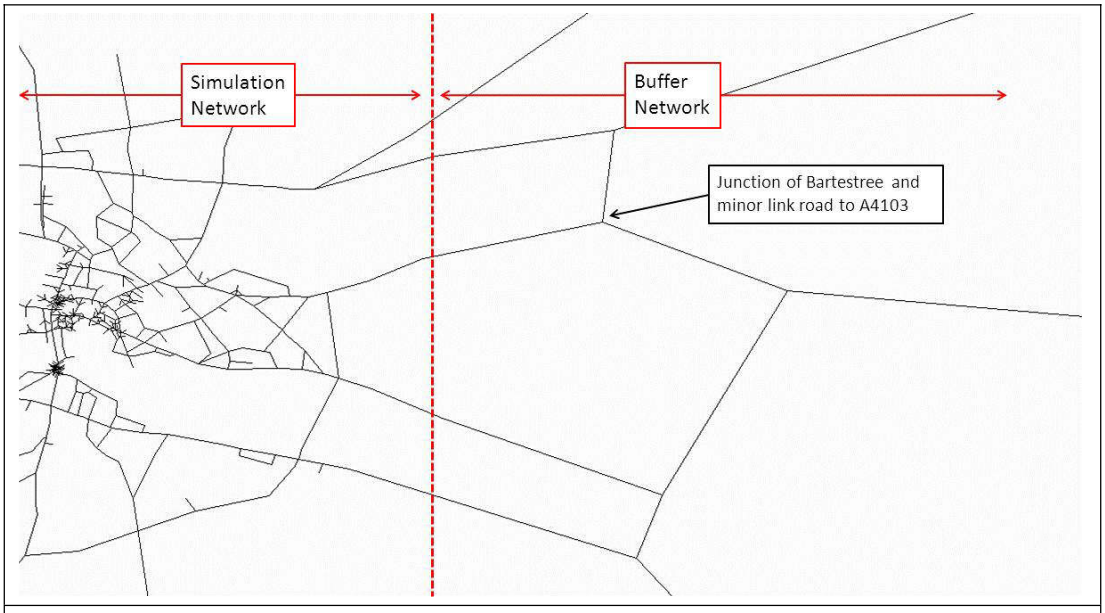

Figure 20: Simulation / Buffer model network and Bartestree junction

2.7.6. In order to test the sensitivity of traffic in this area to delay at the Bartestree junction, an increasing series of delay was inserted into the network. This delay was in the form of a time penalty which was applied to any traffic which approached the Bartestree junction. The initial time penalty was 1 minute and increased incrementally to 2, 3 and 4 minutes. This time penalty serves as a proxy for delay which traffic would normally experience passing through the junction and which would increase as traffic volumes increase.

2.7.7. The sensitivity tests were carried out for 2019 and 2031 for the AM peak only as this time period represents the busiest time period for this area of the network. Scenario 2 for 2019 and scenario 7 for 2031 were used as only the Eastern Link is present in these scenarios and not the WRR.

2.7.8. Shown below in tables 13 and 14 are the results from the sensitivity runs. Flows for a selected number of roads in the Bartestree area are shown in the tables for all runs. All flows shown in the tables are two-directional flows and are in total PCUs. The flows extracted for the Ledbury Road and the Whitestone link road are for flows directly approaching and leaving the junction.

Table 13: 2019 AM Scenario 2 Sensitivity Test Results (PCUs)					
Location	**No Delay**	**1 Minute Delay**	**2 Minute Delay**	**3 Minute Delay**	**4 Minute Delay**
Ledbury Road West	1296	1016	642	486	320
Bartestree - Whitestone Link	1258	1107	862	685	472
Ledbury Road East	736	551	341	241	179
Hampton Park Road	401	552	723	871	958
Eastern Link	1504	1453	1386	1402	1403

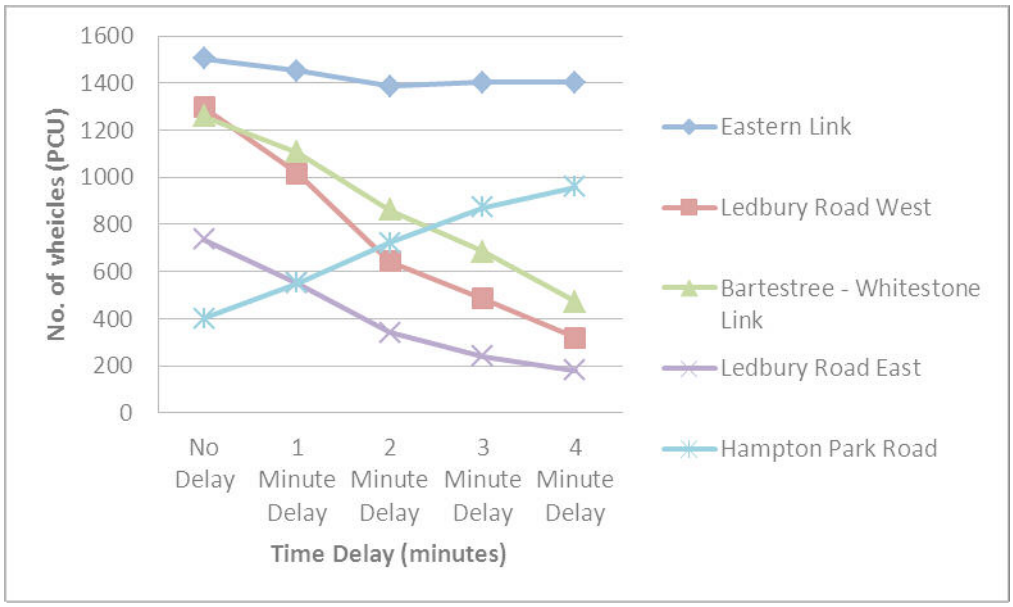

Figure 21: 2019 AM Scenario 2 Sensitivity Test Results (PCUs)

2.7.9. The graph shown in Figure 21 plots the results shown in Table 13 and shows how the traffic volumes change with increasing delay at the A438 Bartestree junction. It shows how the Eastern Link is relatively insensitive to increasing delay at the junction and that if delay is experienced along one route, traffic will re-route around the delay but still route through the Eastern Link.

Table 14: 2031 AM Scenario 7 Sensitivity Test Results (PCUs)					
Location	**No Delay**	**1 Minute Delay**	**2 Minute Delay**	**3 Minute Delay**	**4 Minute Delay**
Ledbury Road West	1283	966	642	453	312
Bartestree - Whitestone Link	1311	1140	868	667	502
Ledbury Road East	765	536	374	296	240
Hampton Park Road	393	554	687	838	894
Eastern Link	1703	1619	1546	1528	1506

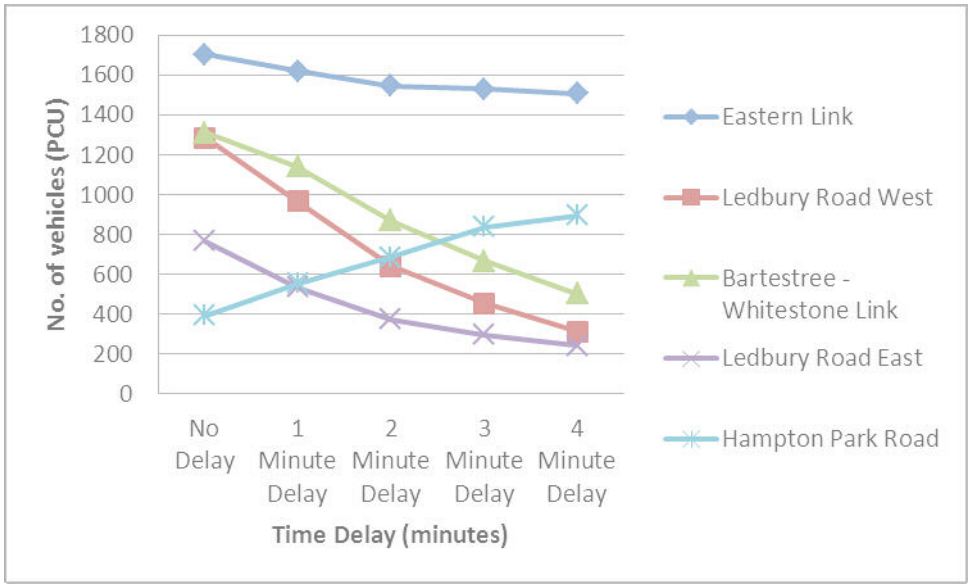

Figure 22: 2031 AM Scenario 7 Sensitivity Test Results (PCUs)

2.7.10. The graph shown in Figure 22 shows similar curves to that shown in Figure 21. The traffic flows react in a similar way to the 2019 test and the traffic distributes along the alternative routes in similar volumes. The graph also demonstrates that the Eastern Link is again insensitive to delay along one route and traffic will re-route around the delay rather than re-route from the Eastern Link altogether.

2.7.11. The flows on the Ledbury Road, in the area of the junction, reduce considerably as the delay at the Bartestree junction increases. When a delay of 2 minutes is inserted into the model, the flows on the Ledbury Road west of the junction drop in both years by 50%. When a delay of 4 minutes is applied, the flows on the Ledbury Road west decrease by 75% and 76% for 2019 and 2031 respectively.

2.7.12. The results above imply that the traffic flow in the buffer network area of Bartestree is sensitive to increased delay, as would be expected. It would not be unreasonable to assume that a delay of 1 – 2 minutes would be experienced at the junction at Bartestree and from this the model reassignments show a decrease of 25% - 50% of flow to the Ledbury Road. At this stage (2 minute delay) the traffic flow on the A438 Ledbury Road had reduced gradually to match the base flows as shown in Tables 3 and 4.

2.7.13. However, the traffic volumes required to create this delay still represent a significant increase in traffic in this area. In the model the traffic is reassigned to parallel city streets as the delay is artificially increased at Bartestree, showing there is a strong correlation between introducing a time delay at Bartestree and the increase in traffic movement on the Hampton Park Road and the A4103 Worcester Road. This demonstrates that the demand for traffic using the Eastern Link remains unchanged even with the introduction of the additional delay, the traffic will route to alternative local roads to access the link.

2.7.14. To demonstrate graphically the change in traffic assignment routes on the A438 Ledbury Road, A4103 Worcester Road and the B4224 Hampton Park Road, the flow difference screen shot presented below in Figure 23 shows the traffic re-routing for the 2031 AM scenario 7 when a time penalty of 4 minutes was applied to traffic passing through the Bartestree junction. As with previous flow difference plots presented before, the green bandwidths indicate an increase in flow while the blue bandwidths indicate a decrease in flow.

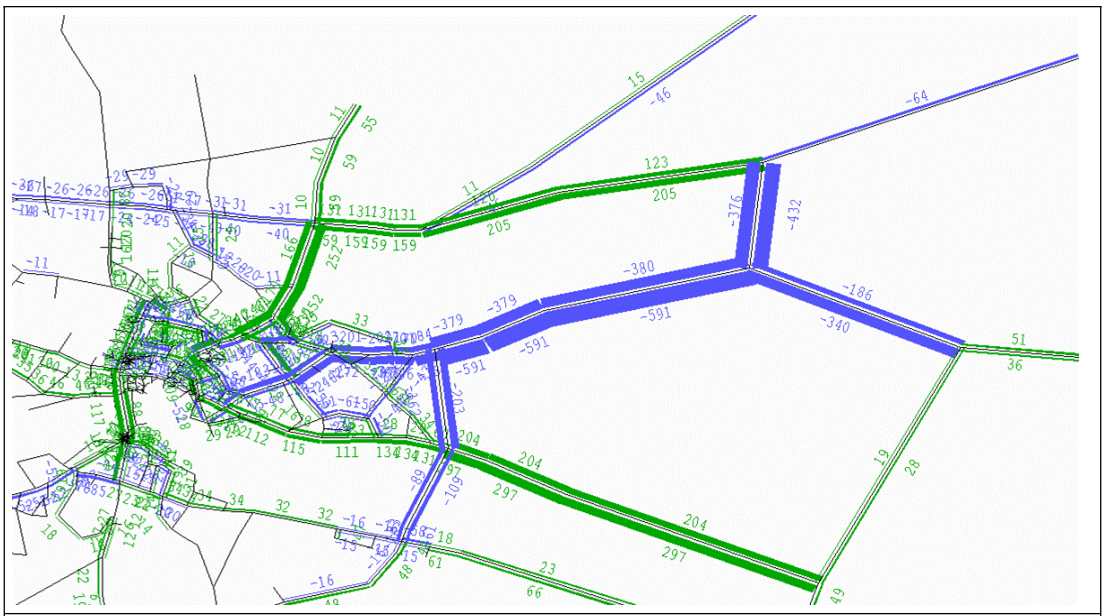

Figure 23: 2031 AM scenario 7: 4 minutes delay minus no added delay

2.7.15. The screenshot in figure 23 above shows the re-assignment of traffic away from the A438 Ledbury Road and assigning the traffic to the A4103 Worcester Road and B4224 Hampton Bishop Road. The B4224 Hampton Bishop Road is shown receiving the majority of the re-assigned traffic as it provides quicker access to the Eastern Link. This would push the traffic through Dormington and Mordiford, and through the eastern parts of the city via Aylestone Hill.

2.7.16. It should be noted that a revised 2012 Hereford City model is under construction and the update will address the issue of buffer network in the Bartestree and Lugwardine areas. In the interim, it can be assumed that the Eastern Link creates a traffic demand through the Bartestree area and traffic will locally travel to the Eastern Link around any delay in the network rather than away from the Eastern Link regardless of the level of delay

2.8. Long Distance Journey Assessment

2.8.1. The aim of the assessment is to consider the possible saving in journey times an eastern link would achieve for a number of commercially important destinations in the West Midlands. The four destinations are:

- Junction 7, M5 Motorway - Worcester
- Junction 8, M5 Motorway / M50
- A49 / A5 Junction - Shrewsbury
- Junction 24, M4 Motorway – Newport (this destination is considered for journeys from the north side of the River Wye)

2.8.2. In order to assess the possible time saving that the new link road would achieve the point of origin for the before and after scenarios was determined as the link road roundabout in Rotherwas Industrial Estate.

2.8.3. The journey times were calculated using the government sponsored and industry recognised www.transportdirect.info website. All journeys started at 8:00am on the 16th March 2012 in a medium sized family car travelling at the appropriate maximum speed limit on all roads.

2.8.4. In order to calculate the time it would take to travel to the specific destinations using the link road, the SATURN model was interrogated to establish mean journey time for the road section, which was 2 minutes 28 seconds (rounded to 2 minutes 30 seconds for this comparison exercise).

2.8.5. The journey time for the new route was established by calculating the time travelled from the intercept point of the A438, using the website, and adding the time for travelling along the new section of road.

2.8.6. The results are shown in the table 15.

Table 15: Journey-time: Comparison of Data – Medium Sized Family Car				
Origin	**Destination**	**Journey-time without Eastern Link Road**	**Journey-time with Eastern Link Road**	**Journey-time Difference**
Rotherwas Industrial Estate	Jct 7, M5	1 hour, 1 min, 30 sec	51 minutes	-10 min, 30 sec
Rotherwas Industrial Estate	Jct 8, M5	46 min, 30 sec	43 min	-3 min, 30 sec
Rotherwas Industrial Estate	A49 / A5 Jct	1 hour, 41 min, 30 sec	1 hour, 25 min	-16 min, 30 sec
A438 intercept point	Jct 24, M4	1 hour, 7 min	53 min, 30 sec	-14 min, 30 sec

2.8.7. For all journeys assessed it can be seen that there is a time saving with the Eastern Link Road in place for passenger cars.

HGV Data

2.8.8. The HGV journey times were calculated using en.mappy.com and the same methodology was used as for the medium sized passenger car.

2.8.9. All journeys are under normal travel conditions in a two axle < 12 tonne truck at the appropriate maximum speed limit on all roads using the fastest route.

Table 16: Journey-time: Comparison of Data				
Origin	**Destination**	**Journey-time without Eastern Link Road**	**Journey-time with Eastern Link Road**	**Journey-time Difference**
Rotherwas Industrial Estate	Jct 7, M5	1 hour, 5 min	57 min, 30 sec	-7 min, 30 sec
Rotherwas Industrial Estate	Jct 8, M5	55 min	51 min, 30 sec	-3 min, 30 sec
Rotherwas Industrial Estate	A49 / A5 Jct	1 hour, 47 min	1 hour, 43 min, 30 sec	-3 min, 30 sec
A438 intercept point	Jct 24, M4	1 hour, 7 min, 30 sec	1 hour, 5 min	-2 min, 30 sec

2.8.10. Table 16 demonstrates that for an HGV travelling between the same destinations as the medium sized family car the time savings are minimal, with the journey to junction 7 of the M5 motorway the only journey showing a time saving of 7.5 minutes which is 11.5% saving on the original journey time.

2.9. Short Distance Trips

2.9.1. This section addresses the changes in the walking and cycling isochrones from Rotherwas Industrial Estate. The Dft consider that it is more time efficient and that it is healthily and economically beneficial for people to complete short journey distances of up to 2km by foot. Walking competes with car use at these distances because of the added time it takes to get into a car and drive it to a destination and then find a parking spot and arrive at the destination within these distances. The DfT also considers that cycling for journeys of 5km also compete well against the use of a car for similar reasons, taking into account government advice on the provision of cycle routes and parking guidance.

2.9.2. When considering the additional opportunities for walking to the industrial estate then the proposed river crossing onto Hampton Park Road is a distance of 1.3 km, this allows an area on the outskirts of Hampton Park to come within walking distance of the industrial estate and new enterprise zone, where no connection existed before.

2.9.3. When considering the additional opportunities for cycling to the industrial estate then the proposed river crossing to Hampton Court Road allows the Hampton Park area, Hampton Bishop and Mordiford easy access by cycle. The further section of link road to the A438 Ledbury Road is again 1.3 km distance, bringing the north east of Hereford and Lugwardine within easy cycling distance of the industrial estate. It should be noted that with the additional traffic on the A438 Ledbury Road, and particularly the potential for increased HGV usage, the Lugwardine Bridge may prove a deterrent to cyclists using this section of the network due to safety concerns, (see section 3.3 for further analysis of this structure).

2.10. Economic Assessment

2.10.1. An economic evaluation is required to judge the economic worth of a scheme by comparing scheme costs with scheme benefits. The most likely effects of both schemes are discussed in this report. Throughout this economic assessment section of the report the Eastern Link only scheme is referred to as Do Something 1 and the Eastern Link and Western Relief Road scheme is referred to as Do Something 2.

2.10.2. The economic evaluation is based on a comparison of the capital costs of providing the improvement scheme with the value of the benefits over a 60 year evaluation period. The costs include the capital cost of building the scheme, land cost and supervision costs. The benefits are assessed by comparing travel time cost and vehicle operating costs with and without the scheme.

2.10.3. The software that was used for the economic assessment of the scheme was the Transport User Benefit Appraisal (TUBA) program version 1.8. TUBA derives the Transport Economic Efficiency (TEE) table for the schemes which is essentially the benefits derived from the scheme in terms of time and vehicle operating cost savings. TUBA assesses the whole life costs and benefits of the two schemes and utilises matrices of costs and trips from the SATURN transport models. The program then calculates user benefits and changes in revenues and produces indicators of the projects worth. TUBA does not include for changes in accident costs or construction delay and maintenance costs.

2.10.4. The costs and benefits are brought to a common evaluation year and the costs deducted from the benefits to derive the Net Present Value (NPV) of the scheme. If this value is greater than zero then the scheme is economically beneficial. The economic evaluation does not take account of environmental benefits or dis-benefits associated with the scheme, however carbon emission benefits are allowed for.

2.10.5. The economic evaluation methods adopted follow accepted Department for Transport procedures and guidelines as set out in WebTAG Units 3.4 and 3.5 and the Design Manual for Roads and Bridges (DMRB) Volumes 13 and 14.

TUBA Inputs

2.10.6. There are three main inputs to the TUBA process, namely;

- Economic Parameters;
- Scheme Specific Control Data;
- Matrix data from the SATURN traffic model.

Economic Parameters

2.10.7. In accordance with WebTAG guidance, the standard TUBA economics file was used. This file provides details of tax rates, values of time (VOT) and vehicle operating cost (VOC) parameters and growth forecasts for VOT and VOC.

Scheme Specific Control Data

2.10.8. The control data file that is entered into TUBA is scheme specific and defines the appraisal period, sets out the scheme costs, provides detail of model specific data (e.g. time slices and user classes) and defines the annualisation factors (i.e. to convert model time periods to their annual equivalent)

2.10.9. For the purposes of the TUBA assessment the current year was taken as 2012, with an opening year of 2019, a design year of 2031, and a Horizon year of 2078, thus providing a 60 year assessment period.

2.10.10. The time periods from the traffic model were:

- AM peak – 0800-0900;
- Inter peak – average hour;
- PM peak – 1700-1800

2.10.11. These model time periods were converted into TUBA time periods using factors to calculate Annual Average Daily Traffic/Annual Average Weekly Traffic. The factors used for these time periods are as follows:

- AM Peak weekday 08.00 – 09.00 to 07.00 – 10.00 (exc. bank holidays): 2.72
- PM Peak weekday 17.00 – 18.00 to 16.00 – 19.00 (exc. bank holidays): 2.78
- AM + PM peak hour weekday to inter peak weekday 10.00 – 16.00 (exc. bank holidays): 5.43
- AM + PM peak hour weekday to off peak weekday 19.00 – 07.00 (exc. bank holidays): 2.37
- AM + PM peak hour weekday to weekend and bank holiday 07.00 – 07.00: 11.27

2.10.12. The total annual hours assessed in the TUBA output equated to 4628 hours.

2.10.13. The following three vehicle mode types were used in the TUBA assessment:

- Cars
- Light Goods Vehicles (up to 3.5 tonnes)
- Heavy Vehicles (Over 3.5 tonnes)

2.10.14. Since the traffic model is highway only, no allowances have been made for benefits to public transport users within the TUBA results.

2.10.15. Since the costs for both schemes were provided in 2010 prices, a Retail Price Index (RPI) value of 223.6 was used as published on the National Statistics Online website. This factor is used to adjust the input scheme costs to the relevant price base used by TUBA (2002). Due to the relative variability of construction costs in relation to other costs, a Relative Price Factor (RPF) was to be applied to adjust construction costs so that they are based on their long run average values. For construction costs, account was taken of any change in the cost of road construction relative to the general price level, not using the RPF, but by the use of inflation rates relevant to the delivery of the transport schemes.

2.10.16. An `Optimism Bias` adjustment has been included in the estimate of scheme capital expenditure, to allow for unexpected costs. The percentage optimism bias used is 44%.

2.10.17. It has been assumed that construction will be phased over a 10 year period beginning in 2010. The following expenditure profile was input to TUBA for the Eastern Link Scheme Do Something 1:

- 0.1% of the costs were attributable to 2010,
- 0.1% to 2011
- 0.1% to 2012
- 0.1% to 2013
- 0.1% to 2014
- 0.1% to 2015
- 0.8% to 2016
- 0.8% to 2017
- 54.6% to 2018
- 39.2% to 2019; and
- 4.2% to 2020

2.10.18. The following expenditure profile was input to TUBA for the Eastern Link and Western Relief Road Scheme Do Something 2:

- 0.1% of the costs were attributable to 2010,
- 0.1% to 2011
- 0.1% to 2012
- 0.1% to 2013
- 0.1% to 2014

- 0.1% to 2015
- 0.8% to 2016
- 0.8% to 2017
- 55.5% to 2018
- 40.9% to 2019 and;
- 1.5% to 2020

2.10.19. TUBA default profiles for land, preparation and supervision costs were used. Table 17 below shows the capital expenditure profiles at 2002 present year values for the Eastern Links Do Something 1 scheme.

2.10.20. Table 17 below shows the capital expenditure profiles at 2002 present year values for the Eastern Links and Western Relief Road Do Something 2 scheme.

Table 17: Capital Expenditure at 2002 Present Year

Eastern Links Only

			Construction		Land
Year of Cost Calculation:	2012				
Year of adjustment factors for RPI:			2010 (AV Q)		2010 (AV Q)
	Corresponding RPI:		223.6		223.6
Present value year:	2002		2002 (Av Q.)		2002 (Av Q.)
	Corresponding RPI:		176.2		176.2
Change in RPI:			0.7880		0.7880
Discount rate:	3.5% p.a.				
Current Year:	2012				
Scheme stage:	Route Selection				
Construction period:	2 Years				
Scheme opening year:	2019				
Occurrence of construction costs:		Constr yr 1.	2018		47.6%
		Constr yr 2.	2019		47.6%
		Scheme yr 1.	2020		4.8%
Occurrence of land cost:		Constr yr 1.	2018		100.0%
Occurrence of preparation costs:	2.07%	of (constr + land) 2010-2017 incl.		2010	3.3%
		Included in overall capital cost		2011	3.3%
				2012	3.3%
				2013	3.3%
				2014	3.3%
				2015	3.3%
				2016	40.0%
				2017	40.0%
Occurrence of supervision costs:	2.07%	of (constr + land) 2018-2020 incl.		2018	40.0%
		Included in overall capital cost		2019	40.0%
				2020	20.0%

Current cost estimates (exc preparation & Supervision):		
construction	£22,090,689	
land	£4,205,607	
total	£26,296,296	

		Market Prices	Factor (Resource) Cost
(Indirect Tax Correction Factor)		1.209	
Costs at 2002 prices (exc preparation & Supervision):	construction	£21,046,005	£17,407,779
	land	£4,006,721	£3,314,079
	total	£25,052,726	£20,721,858
		not used for COBA	

Cost Profile: (£ 2002 prices at factor cost)

Year	Construction	Land	Preparation	Supervision	Total	2002 Discounted	2002 Discounted Market Prices
2010	£0	£0	£14,308	£0	£14,308	£10,866	£13,137
2011	£0	£0	£14,308	£0	£14,308	£10,498	£12,693
2012	£0	£0	£14,308	£0	£14,308	£10,143	£12,263
2013	£0	£0	£14,308	£0	£14,308	£9,800	£11,849
2014	£0	£0	£14,308	£0	£14,308	£9,469	£11,448
2015	£0	£0	£14,308	£0	£14,308	£9,149	£11,061
2016	£0	£0	£171,700	£0	£171,700	£106,073	£128,243
2017	£0	£0	£171,700	£0	£171,700	£102,486	£123,906
2018	£8,290,148	£3,314,079	£0	£171,700	£11,775,927	£6,791,247	£8,210,617
2019	£8,290,148	£0	£0	£171,700	£8,461,849	£4,714,974	£5,700,404
2020	£827,482	£0	£0	£85,850	£913,333	£491,703	£594,469
total	£17,407,779	£3,314,079	£429,251	£429,251	£21,580,359	£12,266,409	£14,830,089
					TUBA (input)		TUBA (output)

Table 17: Capital Expenditure at 2002 Present Year

Eastern Links + Western Relief Road

			Construction	Land
Year of Cost Calculation:	2012			
Year of adjustment factors for RPI:			2010 (AV Q)	2010 (AV Q)
	Corresponding RPI:		223.6	223.6
Present value year:	2002		2002 (Av Q.)	2002 (Av Q.)
	Corresponding RPI:		176.2	176.2
Change in RPI:			0.7880	0.7880
Discount rate:	3.5% p.a.			
Current Year:	2012			
Scheme stage:	Route Selection			
Construction period:	2 Years			
Scheme opening year:	2019			
Occurrence of construction costs:		Constr yr 1.	2018	49.3%
		Constr yr 2.	2019	49.3%
		Scheme yr 1.	2020	1.3%
Occurrence of land cost:		Constr yr 1.	2018	100.0%

Occurrence of preparation costs:	2.19%	of (constr + land) 2010-2017 incl.		2010	3.3%
		Included in overall capital cost		2011	3.3%
				2012	3.3%
				2013	3.3%
				2014	3.3%
				2015	3.3%
				2016	40.0%
				2017	40.0%
Occurrence of supervision costs:	2.19%	of (constr + land) 2018-2020 incl.		2018	40.0%
		Included in overall capital cost		2019	40.0%
				2020	20.0%

Current cost estimates (exc preparation & Supervision):		
construction	£110,815,163	
land	£20,057,602	
total	£130,872,765	

		Market Prices	Factor (Resource) Cost
(Indirect Tax Correction Factor)		1.209	
Costs at 2002 prices (exc preparation & Supervision):	construction	£105,574,637	£87,323,934
	land	£19,109,064	£15,805,677
	total	£124,683,701	£103,129,612
		not used for COBA	

Cost Profile: (£ 2002 prices at factor cost)

Year	Construction	Land	Preparation	Supervision	Total	2002 Discounted	2002 Discounted Market Prices
2010	£0	£0	£75,408	£0	£75,408	£57,266	£69,234
2011	£0	£0	£75,408	£0	£75,408	£55,329	£66,893
2012	£0	£0	£75,408	£0	£75,408	£53,458	£64,631
2013	£0	£0	£75,408	£0	£75,408	£51,650	£62,445
2014	£0	£0	£75,408	£0	£75,408	£49,904	£60,333
2015	£0	£0	£75,408	£0	£75,408	£48,216	£58,293
2016	£0	£0	£904,894	£0	£904,894	£559,027	£675,863
2017	£0	£0	£904,894	£0	£904,894	£540,122	£653,008
2018	£43,078,130	£15,805,677	£0	£904,894	£59,788,701	£34,480,497	£41,686,921
2019	£43,078,130	£0	£0	£904,894	£43,983,023	£24,507,507	£29,629,576
2020	£1,167,675	£0	£0	£452,447	£1,620,122	£872,211	£1,054,503
total	£87,323,934	£15,805,677	£2,262,234	£2,262,234	£107,654,079	£61,275,186	£74,081,700
					TUBA (input)		TUBA (output)

Matrix Data from the traffic model

2.10.21. The Saturn Assignments from the 2019 and 2031 Do Minimum and both Scheme Do Something models were used in the TUBA model.

2.10.22. The last modelled year is 2029 since the scope for the network to accommodate any further traffic growth beyond 2029 was considered to be limited. Beyond 2029, the benefits extrapolated by TUBA remain constant.

2.10.23. In accordance with TUBA guidance, a factor of 0.00028 was convert the time matrices from seconds to hours and a factor of 0.001 was used to convert the distance matrices from metres to km.

2.10.24. The time and distance matrices for TUBA are derived from pure time and distance skims undertaken in SATLOOK. The resultant matrices are weighted average distances or times based on the multi-route flow assignments as stated as a requirement in the TUBA manual.

TUBA Results

2.10.25. The TUBA process is summarised as follows:

- Calculation of costs and benefits for each time period modelled
- Expansion of the time periods to annual totals for the modelled years
- Expansion of the annual totals to appraisal period totals
- Results are then presented in the form of comprehensive output tables including Do Minimum and Do Something total user costs and VOT, VOC benefits by category and year
- Summary data is provided in the form of a Transport Economic Efficiency (TEE) Table which are present value indicators

2.10.26. A breakdown of the road user benefits predicted by TUBA, discounted to present value year 2002, is given below in table 18 for the Eastern Links Do Something 1 scheme. The TEE table is attached in Appendix D.

Table 18: Do Something 1 – 60 Year TUBA Appraisal – Value (£000s) Discounted to 2002	
Benefits	**Central Case**
NON-EXCHEQUER IMPACTS	
Consumer - Commuting User Benefits	
Travel Time	21,100
Vehicle operating costs	4,069
NET CONSUMER - COMMUTING BENEFITS	25,169
Consumer - Other User Benefits	
Travel Time	57,460
Vehicle operating costs	11,502
NET CONSUMER - OTHER BENEFITS	68,962
Business User Benefits	
Travel Time	91,499
Vehicle operating costs	16,178
Subtotal	107,678
Private Sector Provider Impacts	N/A
Other Business Impacts	N/A
NET BUSINESS IMPACT	107,678
CARBON BENEFITS	4,207
WIDER PUBLIC FINANCES (INDIRECT TAXATION REVENUES)	-9,062
NET PRESENT VALUE OF BENEFITS(DS-DM) **(PVB)**	**196,954**
Costs	
LOCAL GOVERNMENT FUNDING	N/A
NET IMPACT	0
CENTRAL GOVERNMENT FUNDING/	
Investment costs	14,831
NET IMPACT	14,831
NET PRESENT VALUE COSTS (DS-DM) **(PVC)**	**14,831**
Net Present Value (PVB – PVC) (60 years)	**182.123**
Benefit / Cost Ratio (PVB / PVC) (60 years)	**13.28**

2.10.27. The TUBA results above demonstrate that the Do Something 1 scheme with the Eastern Link will provide benefits to road users over the 60 year appraisal period, in terms of travel time and vehicle operating cost savings, giving a PVB of £196.954m. This considerably outweighs the PVC to Government (£14.831m)

2.10.28. The Net Present Value of the scheme will be £182.123m. The Eastern Links Do Something 1 scheme will achieve value for money, with a Benefit to Cost Ratio (BCR) of 13.28.

2.10.29. The scheme PVB will be largely composed of road user travel time savings of which, 46% will be experienced by consumer users (£78.560m) and 54% will be experienced by business users (£91.499m).

2.10.30. A small proportion of the scheme PVB will consist of savings, to road users, associated with vehicle operating costs (15%) and carbon benefits (1%).

2.10.31. A breakdown of the road user benefits predicted by TUBA, discounted to present value year 2002, is given below in table 19 for the Eastern Links and Western Relief Road Do Something 2 scheme. The TEE table is attached in Appendix D.

Table 19: Do Something 2 – 60 Year TUBA Appraisal – Value (£000s) Discounted to 2002

Benefits	**Central Case**
NON-EXCHEQUER IMPACTS	
Consumer - Commuting User Benefits	
Travel Time	39,158
Vehicle operating costs	2,164
NET CONSUMER - COMMUTING BENEFITS	41,322
Consumer - Other User Benefits	
Travel Time	101,573
Vehicle operating costs	4,135
NET CONSUMER - OTHER BENEFITS	105,708
Business User Benefits	
Travel Time	154,859
Vehicle operating costs	17,520
Subtotal	172,379
Private Sector Provider Impacts	N/A
Other Business Impacts	N/A
NET BUSINESS IMPACT	172,379
CARBON BENEFITS	3,290
WIDER PUBLIC FINANCES (INDIRECT TAXATION REVENUES	-7,262
NET PRESENT VALUE OF BENEFITS(DS-DM) **(PVB)**	**315,427**
Costs	
LOCAL GOVERNMENT FUNDING	N/A

Table 19: Do Something 2 – 60 Year TUBA Appraisal – Value (£000s) Discounted to 2002	
NET IMPACT	0
CENTRAL GOVERNMENT FUNDING/	
Investment costs	74,082
NET IMPACT	74,082
NET PRESENT VALUE COSTS (DS-DM) **(PVC)**	**74,082**
Net Present Value (PVB – PVC) (60 years)	**241.345**
Benefit / Cost Ratio (PVB / PVC) (60 years)	**4.26**

2.10.32. The TUBA results above demonstrate that the Do Something 2 scheme with the Eastern Links and Western Relief road will provide benefits to road users over the 60 year appraisal period, in terms of travel time and vehicle operating cost savings, giving a PVB of £315.427m. This considerably outweighs the PVC to Government (£74.082m)

2.10.33. The Net Present Value of the scheme will be £241.345m. The Eastern Links and Western Relief road Do Something 2 scheme will achieve value for money, with a Benefit to Cost Ratio (BCR) of 4.26.

2.10.34. The scheme PVB will be largely composed of road user travel time savings of which, 48% will be experienced by consumer users (£140.731m) and 52% will be experienced by business users (£154.859m).

2.10.35. A small proportion of the scheme PVB will consist of savings, to road users, associated with vehicle operating costs (8%) and carbon benefits (1%).

Conclusions

2.10.36. Both economic assessments for the schemes provide benefits to road users with healthy Benefit to Cost Ratios. Reference to the DfT "Guidance on Value for Money" (July 2007) confirms that both schemes will provide strong value for money, since the BCR exceeds the value of 2.0 specified as a threshold by the DfT for a high value scheme.

2.10.37. Comparing both schemes together the eastern links only Do Something 1 scheme has a considerably higher BCR than the Eastern Links with Western Relief Road Do Something 2 scheme. This is not surprising given the low PVC costs attributed to building the eastern link only scheme as compared to the PVC costs associated with the Western Relief Road and the high journey time savings expected after the implementation of the scheme on the eastern links as compared to the Western Relief Road.

2.10.38. Some considerations should be taken into account when inspecting the Benefit to Cost Ratio figure calculated for the Eastern Link only Do Something 1 scheme. This is due to the fact that the SATURN model may not completely capture the dis-benefits associated with the Eastern Link. As the Eastern Link is situated close to the buffer network in the east of the model, the SATURN model might not adequately capture the increased congestion in the area associated with induced trips traveling to the Eastern Link. It is possible to observe from select link analysis assessment that a significant proportion (approx. 30%) of the traffic on the Eastern link comes from the Bartestree and Lugwardine areas. Since these areas are in the buffer network, the model will capture the benefits associated with reduced journey times but might not fully capture the dis-benefits of congestion associated with the increase in traffic. This could lead to an over-estimate of the benefits of the scheme.

2.10.39. Furthermore, it is considered that the model network in the residential areas of Hampton Park Road, Hafod Road and Bodenham Road may have over-stated the capacity of the actual network and of the junctions in these areas. There is a large increase in traffic on these roads with the opening of the Eastern link without a proportionally large increase in congestion effects in largely residential and local roads. This could lead to an over-estimate of the benefits of the Eastern link for traffic using these roads to access the Eastern link.

2.10.40. The economic assessment is only one part of the scheme appraisal process. These results are considered with other WebTAG objectives including Environment, Safety, Accessibility and Integration. The TUBA analysis concludes that both options are considered economically viable.

3. Route Engineering Assessment

3.1.1. The 2010 Study of Options Report has been reviewed and the assessments relating to the Eastern Links between the B4399 and the A438 have been summarised within this study. For more detailed information relating to the environmental impacts, see the Environmental Assessment Report in Appendix B of the 2010 Hereford Relief Road Study of Options.

3.2. Route Description

3.2.1. The Eastern Links between the B4399 and the A438 shown in Figure 1 in Section 1 of this report include the links described in Table 20.

Table 20: Link Description

Link Name	Proposed Speed Limit (mph)	Design Speed (kph)	Link Length (km)	Description
EL2	40	70	1.30	Starting on the A438 Ledbury Rd approximately 250m east of the junction with Hampton Dene Road. Travelling south to connect with the B4224 Hampton Park Rd at the junction with Holywell Gutter Lane. Link leads onto EL3.
EL3	40	70	1.29	Follows on from EL2. Between the B4224 Hampton Park Road at the junction with Holywell Gutter Lane moving south over the River Wye and to the West of the Rotherwas Chapel. Ties into the B4399 the roundabout for Chapel Lane.
EL9	40	70	1.98	Starting on the A438 Ledbury Rd 240m west of the Lugg Bridge travelling south to the connect with the B4224 Hampton Park Rd 700m southeast of the junction with Holywell Gutter Lane. Link leads onto EL12.
EL10	40	70	1.89	Starting on the A438 Ledbury Rd 180m southwest of the Lugg Bridge travelling south to the connect with the B4224 Hampton Park Rd 700m southeast of the junction with Holywell Gutter Lane (as EL9 and EL11). Link leads onto EL12.
EL11	40	70	2.01	Starting on the A438 Ledbury Rd at the Lugg Bridge travelling south to the connect with the B4224 Hampton Park Rd 700m southeast of the junction with Holywell Gutter Lane (as El9 and EL10). Link leads onto EL12.
EL12	40	70	1.38	Follows on from EL9, EL10 and EL11. Between the B4224 Hampton Park Road 700m southeast of the junction with Holywell Gutter Lane moving south to the East of Rotherwas Chapel. Ties into the B4399 the roundabout for Chapel Lane.

3.3. Junctions and Structures

3.3.1. The Eastern Links will require new junctions and Structures as the route intersects key features and existing highways.

3.3.2. The existing roundabout on the B4399 at Rotherwas would require modification. The addition of the Eastern Links would require the addition of one arm to the existing four arm roundabout. This arrangement would require a significant upsizing of the existing roundabout, encroaching upon the development land of the Rotherwas Enterprise Zone. As such it is recommended that the Chapel Road arm be terminated in favour of the Eastern Links and that a separate, alternative access is provided to the northeast areas of the industrial estate, either from the B4399 or directly from the Eastern Links north of the roundabout (Figure 24).

Figure 24: Possible links into the northeast of the Enterprize Zone

3.3.3. The junction of EL2/EL3 on the B4224 Hampton Park Road would be at grade to enable access to the highway network at this point. Due to site constraints, in particular relating to the proposed rugby club (see Figure 25) and associated housing development, a signalised junction rather than a roundabout may be more appropriate.

3.3.4. The junction of EL9, EL10 and EL11 with EL12 on the B2442 is less constrained and more rural in nature and is likely to favour a normal roundabout junction. However, the conflict with the proposed rugby club, particularly for EL9 and EL12, still exists as shown in Figure 25 so if the Rugby club proposal is taken forward then these alignments may need to move further east, onto the floodplain and closer to the designated sites on the River Lugg.

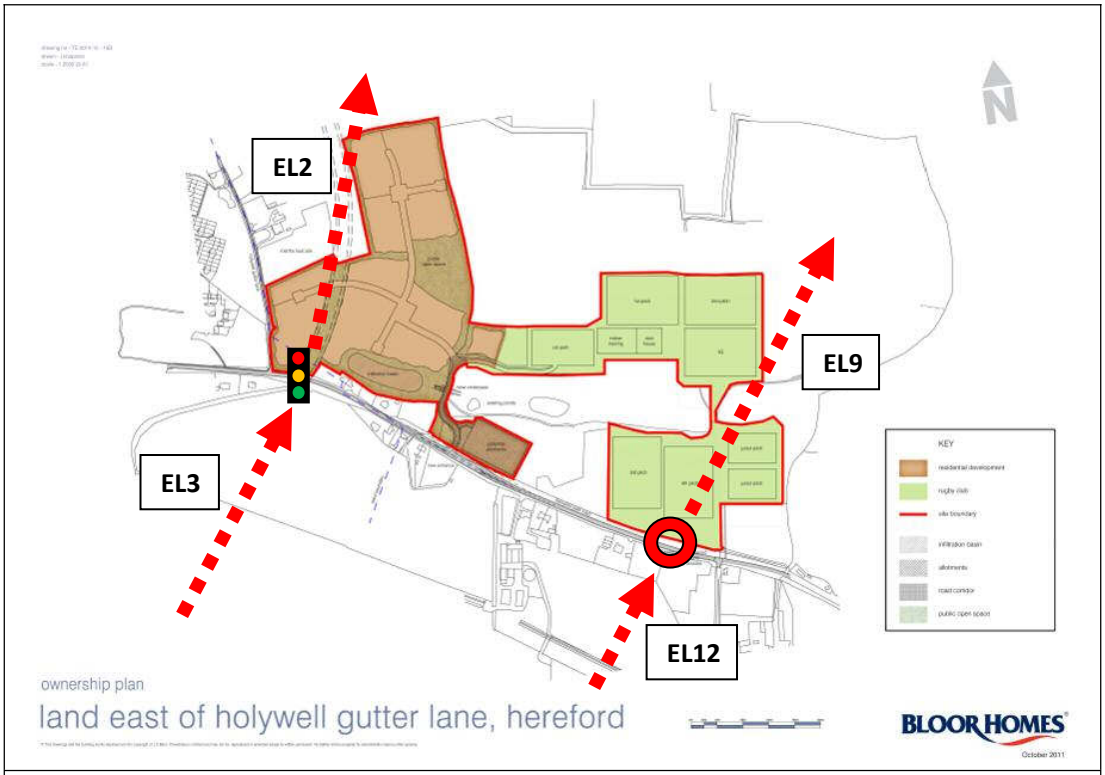

Figure 25: Junction interaction with Rugby Club Proposal

3.3.5. The junction of EL2 with the A438 is in a rural setting but only just beyond the town boundary and a roundabout or a signalised junction would both be feasible. A signalised junction would minimise land take and may therefore be preferable.

3.3.6. The junction of EL9, EL10 and EL11 on the A438 is rural in nature and likely to favour a normal roundabout junction. However, as this junction is situated on the River Lugg floodplain and within the new extent of the SSSI, more compact solutions such as signalised junctions may need to be considered to minimise the impact.

Figure 26: A438 Junction Options

3.3.7. The key new structure on the link is the bridge over the River Wye. The River Wye at the location of the proposed bridge would rise to approximately 49.5m AOD in the 1 in 100 year event including an allowance for climate change (20%). The 2010 Study of Options Report allowed a 7m clearance above normal river levels to enable the River to be navigable. However, recent experience from the Connect2 foot/cycle bridge scheme has established that the underside of any structure across the River Wye would need to be at least 1m above the maximum flood level to account for debris only as the river at this location is no longer navigable. Assuming a 2m construction depth of the structure itself, the surface of the structure would be at approximately 52.5m AOD. Flood modelling would be necessary to confirm the span length, however, based on upstream structures a span of 100m has been assumed. It is likely that stilted or culverted approaches will be required to ensure that the conveyance of flood flows is not interrupted and to prevent any increase in flood levels at Rotherwas. Importantly, it is likely that the levels presented within the 2010 Study of Options report could be reduced such that the impact upon the landscape in the vicinity of the Rotherwas Chapel could be reduced. However, an embankment approximately 2m high would still be required past the Chapel to ensure a flood free road.

3.3.8. Whichever final alignment is selected, there will be significant increases in traffic volumes on the A438 and over existing structures. The Lugwardine Bridge is a 16th Century three span stone arch bridge with an extension to the west (up-stream) to widen the carriageway with steel beams supporting a deck slab built in 1942. This structure was listed in 1967 by English Heritage as Grade II. Any works at this bridge require the Listed Building Consent and liaison with Herefordshire conservation officers. The stone arch structure is assessed at full strength with the steel beam and deck slab extension partially assessed based on steel beams alone due to lack of construction information relating to the concrete slab. The assessment of the widening, undertaken in 1993, identified corrosion and section loss which would have continually deteriorated to date. This extension is capable of carrying highway loading but abnormal loads are directed across the fully assessed arch structure.

3.3.9. The alignment of the highway from the west approach to the structure has a small horizontal radius from west to north at the bridge. Safety fencing, traffic and speed management has been put in place to reduce speeds to the bend after a fatal incident occurred. A number of other incidents have been recorded of vehicles damaging the north parapet wall. Larger vehicles have also been observed struggling to negotiate the bend when meeting at the bridge. The A438 leading to the bridge has footways on the north and south side of the carriageway. Both footways terminate at the structure with no further pedestrian access provided across the bridge for approximately 80m where a single footway on the west of the A438 continues.

3.3.10. The original stone arch bridge will be able to cope structurally with the increase in traffic volume. However, a detailed assessment of the west steel beam and concrete deck slab extension, and the carriageway alignment and layout should be undertaken. From the assessment results, a judgement can be made if the structure needs to be strengthened or widened or both to facilitate the load and frequency of an increase the traffic volume.

3.3.11. An increase in traffic volume on the A438 and across Lugwardine Bridge would increase the likelihood of incidents where vehicles damage the structure, large vehicles meet and potentially collide and increase abnormal load usage. Pedestrians cross the bridge and some years ago there was a request for improved pedestrian safety at the bridge (see full 2004 report in Appendix B). This predicted additional traffic will increase the need for action on pedestrian safety. A review of pedestrian access at the structure should be undertaken to allow safe use of the structure, which could either be a further widening to the structure or a separate pedestrian crossing. Without action on safety, it is likely there will be fewer pedestrians and cyclist traveling towards Hereford should vehicle flows increase.

3.3.12. Along the A438 approach from the west to Lugwardine Bridge, the carriageway is raised on earth embankments. To allow for flood water, twelve flood arches are spaced along this section of road. The original arches have all been assessed as capable of carrying full highway loading. The majority of the flood arches have been widened to the north and south with these extensions having no current assessed capacity due to lack of details, but currently carrying highway loading.

3.3.13. The final structure considered is on the Ledbury Road which will have an increase in city bound traffic. A rail bridge with headroom of 14ft 6in has a protective beam to offer protection against bridge strikes. An increase in traffic is likely to increase the incidents of bridge strikes and also increase traffic on Folly Lane and Aylestone Hill as traffic avoids the lower bridge.

3.4. Topography and Land Use

3.4.1. The Eastern Links alignment of EL3 rises from a level of approximately 49m AOD at the Rotherwas Industrial Estate to cross the River Wye as described in section 3.3. The alignment would continue to rise to meet the B4224 Hampton Park Road at approximately 54m AOD. EL2 then continues to rise to a maximum of 60m AOD before falling back to the A438 where it joins at a level of Approximately 53m AOD.

3.4.2. The Eastern Links alignment of EL12 would cross the River Wye as described in section 3.3 but would then drop back to meet the B4224 Hampton Park Road at approximately 48m AOD. EL9, EL10 and EL11 cross the lower lying Lugg Floodplain at approximately 46m AOD. Road surface levels will be determined by the flood levels to ensure a flood free access and ensuring conveyance of flood water through any necessary stilted or culvert structures.

3.4.3. The Eastern Links alignment EL3 crossing land zoned for employment use within the limits of the Rotherwas Enterprise Zone will result in a net loss of approximately 5,000m2. The route passes close to the Rotherwas Chapel crossing the grazed floodplain and the River Wye. EL2 crosses through some fields, isolated woodlands and areas containing Orchards. EL2 at the B4224 Hampton Park Road crosses through land with proposed housing use associated with the Hereford Rugby Club development.

3.4.4. The Eastern Links alignment EL12 cuts through the Rotherwas Enterprise Zone but following more closely to the alignment of Chapel Road, reducing the impact upon the developable plot areas. The alignment passes close to the residential properties and the Rotherwas Chapel before crossing the grazed floodplain and the River Wye. It passes through a small orchard and close to isolated residential properties to join the B4224 Hampton Park Road. EL9, EL10 and EL11 then cross the Lugg Meadows and floodplain with the loss and severance of some grazing land and orchards.

3.5. Geology and Ground Conditions

3.5.1. Eastern Links alignment EL3 will cross soft alluvial deposits in the vicinity of the River Wye and structures will be likely to require piled foundations. The remainder of the link will be over river terrace deposits of approximately 7m in depth consisting of sands and gravels with areas of made ground in the vicinity of the Rotherwas Industrial Estate. Eastern Link EL2 will predominantly cross silty or clayey loam at shallow depth underlain by bedrock. Pockets of river terrace deposits consisting of poorly graded gravels will be encountered closer to B4224 Hampton Park Road. A small sewerage works at the midpoint of link EL2 may pose a contamination risk.

3.5.2. Eastern Links Alignment EL12 will be similar to EL3 and cross soft alluvial deposits in the vicinity of the River Wye and structures will be likely to require piled foundations. The remainder of the link will be over river terrace deposits of approximately 7m in depth consisting of sands and gravels with areas of made ground in the vicinity of the Rotherwas Industrial Estate. EL9, EL10 and EL12 cross the Lugg floodplains across soft alluvial deposits of silt above river terrace deposits of sands and gravels.

3.5.3. All Eastern Link options require embanked sections exceeding the sections in cut. The inner links of EL2 and EL3 provide the greater opportunity to increase the areas of cut to balance the earthworks and minimise the import of material for embankments. The outer links of EL9, EL10, EL11 and EL12 require large quantities of fill material to be imported to accommodate the significant lengths of embankment.

3.6. Hydrology, Hydrogeology and Drainage

3.6.1. The construction of highways within or near floodplains shall not require retention but demand immediate discharge to the floodplain. This ensures that, throughout the duration of a storm event, the catchment area closest to the floodplain is discharged almost completely before upstream volumes are conveyed to the floodplain, allowing the initial surge to be conveyed downstream.

3.6.2. Eastern Link EL2 is predominantly outside the Lugg floodplains; however, surface run-off from the carriageway is still immediate to the floodplain and should therefore be treated in the same manner. For all links discharging into or near the floodplain, oil interceptors should be provided with alarm systems to ensure water quality is not compromised. Eastern Link EL3 contains the River Wye Crossing and the surrounding area is classified as Flood Zone. The proposed carriageway will therefore be elevated above the maximum flood level. The surface water drainage systems and flood mitigation within the limits of the Enterprise Zone will follow the principles of the drainage strategy already set and approved by the Environment Agency for the area. This will necessitate a SUDs drainage design with compensatory storage for any lost flood volumes on a level for level basis.

3.6.3. Although Eastern Links EL2 and EL3 do not cross the Lugg Floodplain, there will be an increase in traffic volumes along the existing A438 as it crosses the floodplain and the existing Lugwardine Bridge. As a result there will be an increased risk of pollutants entering the surface water systems which currently discharge into the floodplain. A risk assessment will be required and the introduction of new surface water systems and associated oil interceptors is likely to be required for this section of existing road.

3.6.4. The Eastern Link EL12 will require the same consideration as EL3 above. However, Eastern Links EL9, EL10 and EL11 will require particular consideration. The links cross the floodplain, now part of the increased SSSI designation. The surface water outfall will require careful control to minimise pollution through the use of oil interceptors and balancing ponds will not be appropriate. The conveyance of flood water will need to be maintained and extensive stilted or culvert structures will be necessary to reduce any interruption of flows. A more detailed assessment of the ground conditions may raise concerns later in the project delivery relating to the compaction from embankments interfering with groundwater flows. Given the sensitivity of the environment of the Lugg Meadows, this would require mitigation through the greater use of stilted and piled structures at significant cost. The loss of flood plain resulting from the construction of embankments will also require mitigation and may necessitate additional earthworks, to provide complimentary storage remote from the new road.

3.7. Impact Upon Utilities

3.7.1. Eastern Link EL2 will cross 11KV overhead electricity lines, water and gas mains within the existing carriageways, otherwise no significant utilities are present. EL3 will require the local diversion of several utilities at the Rotherwas Enterprise Zone, including Gas, Electricity, telecom and Water. There is also a sewerage pumping station and rising main which would require relocating.

3.7.2. Eastern link EL12 would avoid the sewerage pumping station at Rotherwas but still require several local diversions of gas, electricity, telecom and water. Eastern Link EL9, EL10 and EL11 will be constructed on embankment as they cross beneath 66KV electricity lines reducing the vertical clearances which could necessitate costly and disruptive diversions. A high pressure gas main is also crossed by the scheme although this should be able to be accommodated with smaller scale structural protection measures.

3.7.3. It should be noted that electricity capacity restrictions within Hereford may present an opportunity as the road corridor could be used to provide part of the route for strategic supplies to the Rotherwas Enterprise Zone area from Dormington in the East.

3.8. Additional Alternative Route

3.8.1. All Eastern Links are now further constrained by a revised boundary to the SSSI in the vicinity of the River Lugg as indicated on Figure 27. This strengthens the case for 'inner' eastern routes following EL2 and EL3. Links EL9, EL10, EL11 and EL12 would cut through the newly defined SSSI.

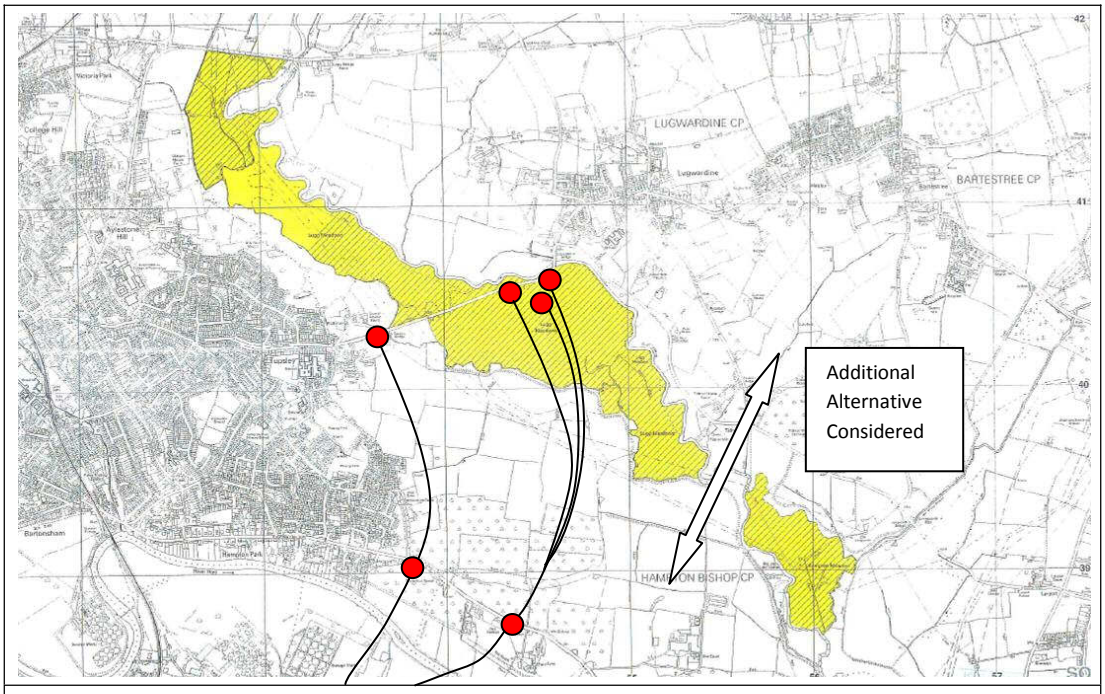

Figure 27: Extent of revised SSSI

3.8.2. A gap does exist within the SSSI further east of the City and a wider alignment has been considered as part of this study. However, there are implications on the SSSI and SAC associated with a crossing in this location. The route would cross the floodplain and, although not directly over the SSSI designated site, impacts on the SAC and neighbouring sites would be significant and would still have a greater impact than a Western route which would avoid the River Lugg altogether.

3.8.3. In addition, the length of road would be greater than the other options and require two bridge structures, with the topography to the North of the River Lugg necessitating significant earthworks. Therefore any route would have significant landscape impacts and significant construction costs. As a route to connect Rotherwas to the A438 and the East of the County there may appear to be advantages of bypassing the village of Lugwardine and Bartestree, however, the demand likely to exist on the additional river bridge crossing would still increase traffic passing through the villages to travel back into the City and onto the A4103.

3.9. Impact upon Lugwardine and Bartestree

3.9.1. The study has considered the following elements and potential impacts and mitigation routes in the villages of Lugwardine and Bartestree between the A438 Ledbury Road and A4103 Worcester Road:

- The carriageway condition
- Road Standards
- Likely / potential congestion
- Junction standards and visibility
- Physical constraints & topography
- Speed limits and speed surveys
- Levels and standards of street lighting
- Signage and junction markings
- Consideration for non-motorised users (cyclists & pedestrians)
- Accident statistics
- Ecological effects
- Environmental – Noise, vibration and dust

3.9.2. Figure 28 provides details of three routes that have been investigated as the traffic modelling shows that vehicles will seek find routes between the A438 and A4103.

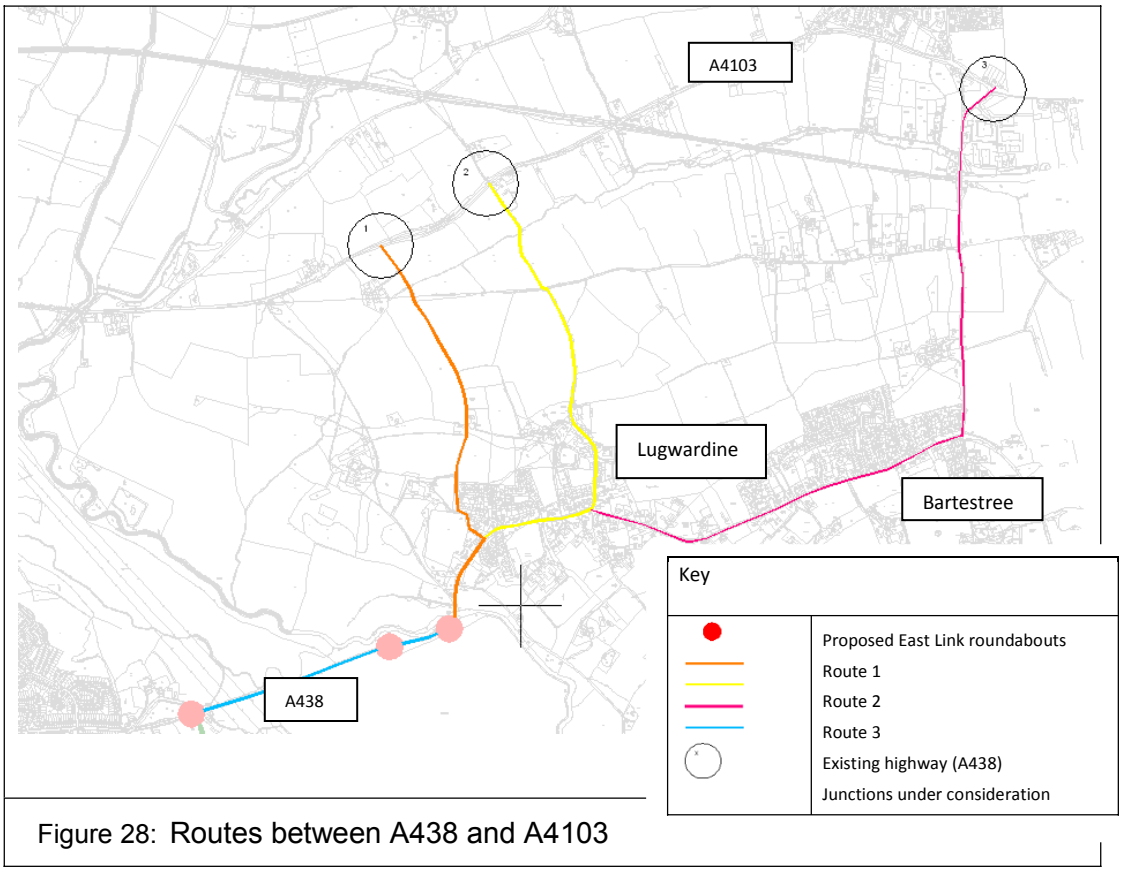

Figure 28: Routes between A438 and A4103

3.9.3. Each of the routes has been assessed separately although it is noted that all routes are unclassified and are currently of unsuitable width to support two-way traffic flows for the volume that is likely to be generated from the introduction of the Eastern Links.

Carriageway Condition

3.9.4. Carriageway condition surveys have been undertaken for each of the routes as part of the investigation process. The carriageways are assessed based around a number of scenarios, namely, texture depth, cracking and rutting.

3.9.5. Texture depth will provide an indication of the residual skid resistance of the carriageway, the presence of cracking will indicate that the sub grade beneath the carriageway has failed or is beginning to fail. In addition, a cracked surface will allow the ingress of water which will freeze during the winter months which in turn will cause the carriageway to fail. In a similar manner, the presence of rutting will indicate that the sub grade of the carriageway is failing under applied wheel loads.

3.9.6. All of the routes under investigation are unclassified routes suitable for only relatively low traffic flows. It should be noted that the design criteria for unclassified highways with low traffic flows would not be able to cater for levels of traffic that could potentially use any of the three routes under investigation and it is likely that the existing carriageways would deteriorate over relatively short periods of time.

3.9.7. The condition surveys have indicated that all three routes are currently experiencing areas of failure and it should be noted that appropriate maintenance regimes will need to be implemented in order to rectify existing defects.

Road Standards

3.9.8. Roads are generally designed to provide adequate resistance to the loadings that are imposed upon them. It is noted that minimum carriageway widths are required to promote safe conditions in order to allow two-way traffic flows.

3.9.9. Routes 1 and 2 would not provide adequate width to allow unhindered two-way vehicle flows and the anticipation that Heavy Goods Vehicles (HGV) could utilise any of the routes considered would not be supported by existing carriageway widths. Table 21 provides details on minimum desirable carriageway widths to allow safe unhindered two-way vehicle flows against actual widths as measured on site:

Table 21: Existing and Desirable Road widths

Route Number	Minimum Desired Road Widths	Actual Road Width
1	7.3m	4.9m
2	7.3m	4.0m
3	7.3m	5.1m

3.9.10. Route 3 would provide marginally improved carriageway widths but, again would not support increased traffic flows or HGV usage.

3.9.11. In addition, it is noted that none of the carriageways are edged with kerbing, and, coupled with sub-standard road widths this factor would accelerate the deterioration of the carriageway edges should vehicle flows increase.

Likely / potential congestion

3.9.12. As discussed previously, the utilisation of any of the three considered routes would not be conducive to free flowing two-way traffic. With the exception of route 3 all carriageways meander and the reduced forward visibility would add to congestion as vehicles would need to slow owing to poor forward visibilities. The visibility issues are mainly due to the topography and routes of the carriageways. However, overgrown hedgerow also decreases forward visibilities.

3.9.13. These issues are likely to cause congestion and the severity will be dependent upon the levels of increased traffic flow should routes EL2 and EL3 be considered as stand-alone elements.

3.9.14. Traffic flows around the buffer zone which include all three of the considered routes are predicted to increase. If current conditions remain then it is likely that vehicle congestion along the three considered routes would deteriorate over time.

Junction standards and visibilities

3.9.15. Each of the 3 routes has been considered in terms of the junction visibilities that exist at the node points for vehicles wishing to travel east or west.

3.9.16. Table 22 provides information on the design standards for the speed classification for each of the 3 considered routes.

Table 22: Desirable and Existing Junction Visibility

Route Number	Design Speed	Desired Visibility	Actual Visibility	
			E	W
1	50mph	160m	88m	95m
2	50mph	160m	97m	218m
3	40mph	120m	185m	120m

3.9.17. With the exception of route 3 none of the junctions under consideration met the design standard requirement.

3.9.18. It should be noted that the actual speeds on the carriageways that meet the route node points are likely to be higher than the design speeds. It is therefore recommended that full 7 day speed surveys are undertaken within the vicinity of the node points of the main adjoining carriageway.

3.9.19. Location 1 is the junction of Cotts Lane with A4103. In Table 23 the junction of Cotts Lane with A4103 Worcester Road has an observed actual visibility that is below the current design standard.

Table 23: Visibility of Cotts Lane Junction with A4103

Speed Limit	Set back distance (m)	Minimum Desired Visibility (m)	Actual Visibility (m)	
			E	W
50mph	4.5 / 2.4	160m	88m	95m

3.9.20. Figure 29 also indicates that there have been a number of accident incidents recorded at the junction in the last 5 year period which is discussed later in the report, and the mapping shows that the junction is on the inside of a shallow bend in the priority road.

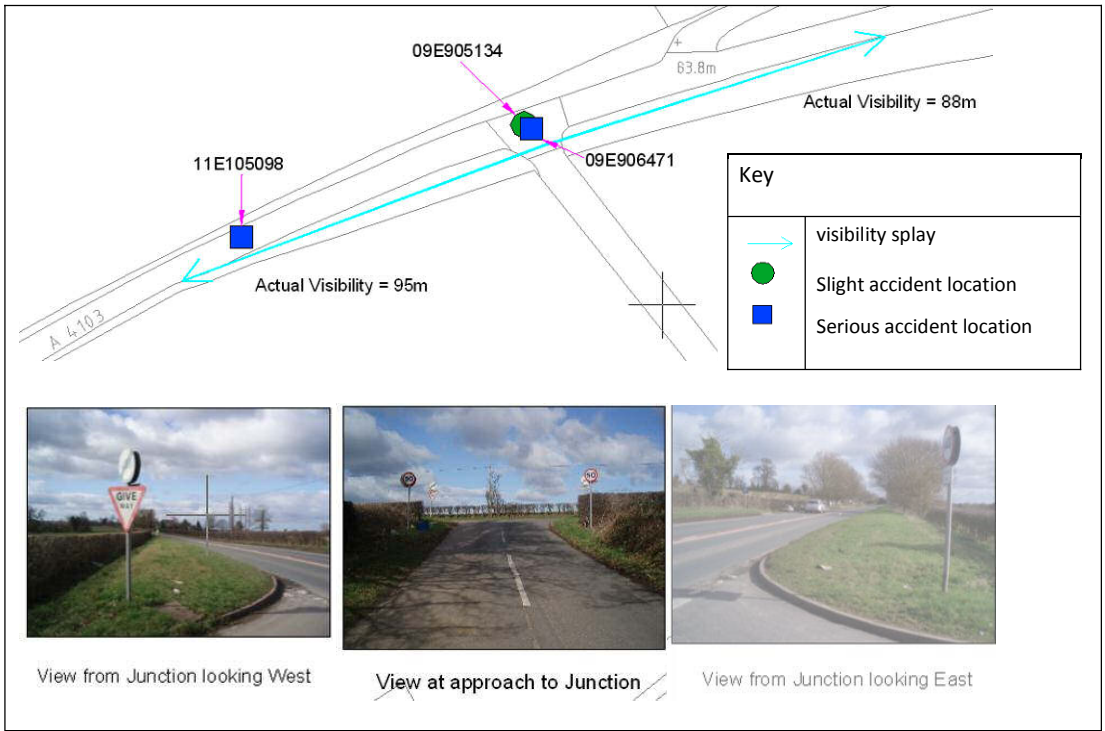

Figure 29: Cotts Lane junction with A4103 Worcester Road

3.9.21. Location 2 is the junction of Lumber Lane with A4103 Worcester Road. In Table 24 the junction of Lumber Lane with A4103 Worcester Road has an observed actual visibility (to the east) that is below the current design standard.

Table 24: Visibility of Cotts Lane Junction with A4103

Speed Limit	Set back distance (m)	Minimum Desired Visibility (m)	Actual Visibility (m)	
			E	W
50mph	2.4	160m	97m	218m

3.9.22. Figure 30 also indicates that there has been a number of accident incidents recorded at the junction in the last 5 year period and this is discussed later in the section.

Figure 30: Lumber Lane junction with A4103 Worcester Road

3.9.23. Location 3 is the junction of C1130 Longworth Lane with A4103 Worcester Road, and in Table 25 the junction of Lumber Lane with A4103 Worcester Road has an observed actual visibility that meets the current design standard.

Table 25: Visibility of Longworth Lane Junction with A4103				
Speed Limit	Set back distance (m)	Minimum Desired Visibility (m)	Actual Visibility (m)	
			E	W
40mph	2.4m	120m	185m	120m

3.9.24. Figure 31 indicates that there has been one accident incident recorded at the junction in the last 5 year period and this is discussed later in the section.

Figure 31: Longworth Lane junction with A4103 Worcester Road

Physical constraints and topography

3.9.25. As discussed previously, with the exception of route 3 all other routes under consideration exhibit a meandering characteristic. Forward visibilities are limited and many areas do not meet the design standards in relation to forward visibility. Reduced forward visibility is also noted at the location where route 3 passes over the railway line via a humped back bridge.

3.9.26. Overgrown hedgerows also reduce forward visibilities.

3.9.27. The routes pass through rural locations and the edges of the carriageway are flanked by elevated banks. Again, these features have a negative effect on forward visibilities.

3.9.28. Carriageway realignment and widening would require considerable land acquisition. It is also noted that the routes pass through areas flanked by private properties and farm buildings. Further constraints are of the location of listed buildings and other heritage assets adjacent to the three routes, which are shown in Figure 32 and addressed in more detail in Section 5.

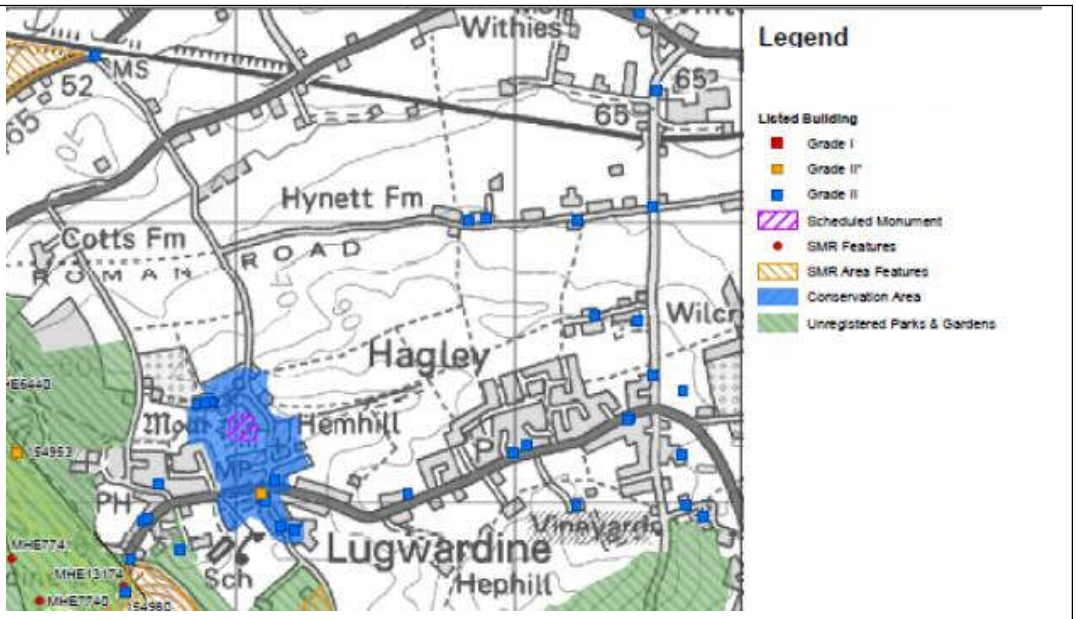

Figure 32: Environmental Assessment

3.9.29. The introduction of appropriate speed limits or weight restrictions along the considered routes may help in reducing conflict although the effects of such measures are likely to be minimal as they would need to be policed.

Speed Limits and speed surveys

3.9.30. It is noted that no actual carriageway speed data is available for any of the considered routes. It would be beneficial to obtain actual speed data to inform potential engineering works that could be undertaken to improve current conditions. Speed data at and around potential junctions would also need to be obtained as it is likely that actual speeds will be greater than the design speeds. This will be particularly important as increased 85th percentile speeds will have a marked effect on the required junction visibilities.

Levels and standards of street lighting

3.9.31. It is noted that street lighting around the considered routes is poor. Should carriageway works be undertaken in order to cater for increased vehicle flows then consideration must be made regarding potential conflict areas and the possible requirement for street lighting. All lighting assessment and design would need to be undertaken in accordance with current ILE guidelines.

Signage and junction markings

3.9.32. It would also be necessary to review existing signage and carriageway markings to warn motorists of potential issues that may not be able to be engineered out during any potential carriageway engineering works.

Consideration of non-motorised users (NMU`s)

3.9.33. Although there were no observations of non-motorised users during the site visit it is likely that cyclists / horse riders etc. may use the route albeit infrequently. Any changes to the vehicle make up and flow rate would need to be considered in respect to the effect on NMU`s. This is likely to have a marked effect on any costs associated with potential engineering works.

Accident statistics

3.9.34. Accident statistics have been optioned for each of the junctions under consideration for the last 5 years. The following table provides details accordingly:

Table 26: Accident Statistics

Route Number	Accident Severity		Casualty Severity		Casualty KSi	
	Serious	Slight	Serious	Slight	Adult KSi	Slight
1	2	1	2	3	2	3
2	2	6	2	12	2	12
3	1	1	1	1	1	1

3.9.35. Location 2, A4103 Worcester Road junction with Lumber Lane, has been identified as a cluster site and appears within the Herefordshire Councils Sustainable Communities Directorate Accident Cluster Site List 2011. The location will also appear within the 2012 Accident Cluster Site List.

3.9.36. The introduction of additional traffic volumes within the areas mentioned above is likely to have a detrimental effect on accident statistics at these locations.

3.9.37. Engineering measures would need to be introduced in conjunction with investigations that have previously been undertaken by Herefordshire Council.

Rural Roundabouts

3.9.38. The management of traffic flow at the node points for all three locations would need to be modelled to consider projected flow rates along each of the considered routes.

3.9.39. Flow rates may demonstrate that there could be a requirement to manage vehicle flows appropriately through the junction. The use of roundabouts may provide an appropriate vehicle flow management system.

3.9.40. The use of roundabouts may be beneficial in particular as they allow a facility for heavy right turn flows. It is likely that a large proportion of vehicles travelling along any of the routes under investigation would be turning right at the node points. The use of roundabouts may also facilitate a significant change in road standard such as dual carriageway to single carriageway.

3.9.41. Major engineering work would need to be undertaken to allow the introduction of an appropriate roundabout at any of the three junctions under consideration.

3.9.42. None of the three approach routes would meet the design requirements in terms of road widths, and land take would be required in order to provide sufficient widths to accommodate an appropriate roundabout that meets the design standards.

3.9.43. The choice of roundabout type would be dependent on the following factors:

- Whether the approach roads are single or dual carriageway
- The speed limit on the approach road
- The level of traffic flow
- Other constraints such as land-take

3.9.44. Roundabout design must also include consideration and design of appropriate kerbed approaches including splitter islands to effectively manage vehicles at the entry points to the roundabout.

3.9.45. Visibilities at and around the roundabout as well as the approaches to the feature must also be considered and the design must be undertaken to ensure that minimum requirements regarding visibilities are met.

3.9.46. Approach gradients and carriageway cross falls must also meet the requirements contained within TD 16/07 and this may entail engineering works to re-profile the carriageway. In addition, the cross falls around the roundabout must also consider Heavy Goods Vehicles to ensure that the vehicles do not become unstable whilst negotiating the roundabout.

3.9.47. Skid resistance on the approaches to the roundabout must also be measured to ensure adequacy. The use of anti-skid material on the approaches to the roundabout may be required.

3.9.48. The provision for lighting the roundabout will be dependent upon a number of factors and the requirements and type of lighting required is provided within DMRB 8.3.

3.9.49. Adequate signage must also be provided as highway users may not expect to encounter speed interruptions.

3.9.50. The following information will be required in order to determine the category of roundabout required;

- Highest class of road on any approach
- Highest speed limit on any approach
- Highest 2 way AADT on any approach

3.9.51. The level of land take required in order to make provision for the introduction of roundabouts at any of the node points under consideration may prove to be costly. If it is determined that the feature needs to be illuminated then a suitable power source would also need to be determined.

4. Link Cost Estimates

4.1. Construction Costs

4.1.1. These cost estimates have been prepared using the road alignment design information output from the 2010 Study of Options Engineering Assessment.

4.1.2. The cost estimate was developed in line with the guidelines given in HM Treasury Green Book. The Green Book provides a step by step estimation process that utilises available current construction rates. In this report we have used rates from cost estimates for other Authorities, the Rotherwas Access Road scheme, other schemes in Herefordshire completed recently, the industry at large, and SPON's 2007 (Civil Engineering and Highway Works Price Book).

4.2. Inflation

4.2.1. The scheme estimate currently has an allowance for inflation of 2.7% per year. An estimated construction time based on the works is in the region of two years. It has been assumed that land costs and statutory undertakers' costs will be incurred during the first year of construction. The preparation and supervision costs could be spread over several years. The spread of expenditure assumed can be seen on Table 27. However, for the purposes of this report the figures presented are all in 2010 prices.

Table 27: % Expenditure by Year

	2010-15	2016	2017	2018	2019	2020
Prelims				50	50	
Roadworks – Links				50	50	
Roadworks –Junctions				50	50	
Structures				50	50	
Service Diversions				100		
Land Acquisition				100		
Part 1 Claims						100
Preparation/Supervision	10	20	20	20	20	10

4.3. Optimism Bias

4.3.1. The approach to adjusting for optimism bias has been based on the Highways Agency's Chief Highway Engineer Memorandum 121/03 "HM Treasury's New Green Book on appraisal and Evaluation in Central Government".

4.3.2. The Eastern Links are deemed to be a standard/non-complex scheme at conception stage; therefore optimism bias is applied at 44% as no risk assessment has been carried out.

4.3.3. The optimism bias adjustment has been applied to the total costs comprising construction, statutory undertakers, land, preparation and supervision. Optimism Bias has been added to the total figures in Table 28.

4.4. Preliminaries

4.4.1. Preliminaries have been estimated at 10% of the total construction cost.

4.5. Roadworks – Links

4.5.1. The estimate for the road construction assumes a dual two lane carriageway following consideration of the traffic flow figures within the Hereford Multi Modal Study. The cost estimate includes for the following highway features:

- Earthworks
- Kerb & gully drainage and filter drainage in central reservation
- Pavement and road foundation construction
- Kerbs and footways on outer carriageway edge
- Traffic signs and road markings
- Double sided safety fencing in central reservation
- Provision of retention ponds (based on 5.5% of new hard surface area)
- Landscaping

4.5.2. The purpose of the cost estimates is to differentiate between the alternative Corridors and the associated Corridor Links that could potentially combine to provide the optimum affordable and economical scheme corridor alignment. This cost estimate does not aim to set out the scheme budget. The rates used for pricing are consistent for each section and no consideration has been given to potential value engineering savings. Table 28 below outlines total costs taking into account various engineering factors.

4.5.3. The following design information was utilised;

- General plan and cross section drawings for each corridor link
- Earthworks cut and fill volumes and percentage reusable material (70%)
- Road construction details
- Structures type and deck area

- Land-take area
- Locations and types of strategic junctions

4.5.4. The cost estimate for each link includes for each associated 'end of link' junction type. To avoid double counting of proposed junctions, each subsequent corridor link is assigned its associated single junction type and value located at the end of the link.

Table 28: Cost of Roadworks

Eastern Corridor	Length of Corridor Link (Km)	Total Cost (£M)	Cost £(M)/km
EL2	1.296	7.345	5.667
EL3	1.293	16.066	12.425
EL9	1.982	13.264	6.692
EL10	1.887	13.192	6.991
EL11	2.012	11.716	5.823
EL12	1.381	18.173	13.159

4.6. Roadworks – Junctions

4.6.1. The estimate for the construction of junctions assumes roundabout and signalised junctions of a similar standard maintained throughout the scheme corridor links concept designs as detailed in the Design Booklet accompanying the Stage 2 Engineering Assessment. The cost estimates include for the following highway features as item costs necessary for the relief road:

- Earthworks
- Drainage using SUDS principals
- Pavement and road foundation construction
- Kerbs and footways including drainage kerbs
- Traffic signs, signals and road markings
- Street lighting on new approach lengths

4.6.2. A cost estimate has been generated for a roundabout and signalised junctions based on the recent construction projects, tender submissions and current construction estimates. This was then applied to the number of junctions necessary on each alignment. Due to the similar concept throughout the entire design of providing a roundabout or signalised junction between a proposed dual carriageway and existing single carriageways the following item sums have been assigned

- Roundabout - £700,000
- Signalised junction - £750,000

4.7. Structures and Features

4.7.1. Potential structures have been identified for each of the corridor link options. The structures fall into the following categories;

Table 29: Standard Structure Designation

Structure Code	Structure Description	Basis for Estimate
A	New dual carriageway road over existing live railway line (dual track railway line, dual carriageway)	Recent scheme cost estimate, previous and current construction projects and SPONs 2007
B	New road (dual carriageway) under single carriageway road	Recent scheme cost estimate, previous and current construction projects and SPONs 2007
C	New road (dual carriageway) over single carriageway road	Recent scheme cost estimate, previous and current construction projects and SPONs 2007
D	New road dual carriageway river crossing (dual carriageway viaduct with piers)	Recent scheme cost estimate, previous and current construction projects and SPONs 2007
E	Culverts for minor watercourses including head wall and wing wall construction at both ends	Recent scheme cost estimate, previous and current construction projects and SPONs 2007

4.7.2. All major structures will be estimated based on structure deck area and type. Each crossing over the River Wye will be allocated an individual costing based on the number of supporting piers and associated piling envisaged within the floodplains. All other minor structures, for example drainage features, are included in the Roadworks.

Table 30: Cost Estimate for Eastern Corridor Structures

Corridor Link	A	B	C	D	E	Cost (£M)
EL2	-	-	-	-	2	0.024
EL3	-	-	-	1	1	4.068
EL9	-	-	-	1	10	0.805

EL10	-	-	-	1	10	0.805
EL11	-	-	-	1	10	0.805
EL12	-	-	-	1	-	4.038

4.7.3. It should be noted that additional structures may be required across the River Wye and Lugg flood plains to the East of the City, either in the form of an elevated carriageway on viaduct or regular flood relief culverts. The cost of a viaduct is likely to be prohibitively expensive so we have assumed flood relief culverts (as structure E in Table 30) at a spacing of 50m through any areas of floodplain. Other additional structures such as footbridges are dependent upon existing footfall numbers, statutory and non-statutory advice and guidance and proposed development or amenity areas planned in proximity to the corridor links. No allocation has been given to the estimation of these structures due to the lack of supporting data and confirmation of the proposed 'growth point' region location.

4.8. New Utilities and Service Diversions

4.8.1. There has been no detailed assessment of the impact of the route options on statutory undertakers. The Rotherwas Access Road has required considerable diversions to both local services and also strategic apparatus. The percentage cost for Statutory Undertakers has therefore been estimated as 10% of construction costs based on the Rotherwas Access Road.

4.9. Land

4.9.1. Using the design information to calculate the footprint it is possible at this stage to make an assessment of land costs. The corridor link design has been developed to avoid any impact on high value property; however this cannot be assessed at this stage.

4.9.2. For the purpose of the cost estimate a cost per km of road has been assumed based on the cost incurred on the Rotherwas Access Road (Cost per km = £1,022k)

Table 31: Land Costs for Eastern Alignment

Alignment	Length of Link (Km)	Cost of Land (£M)
EL2	1.296	1.329
EL3	1.293	1.329
EL9	1.982	2.024
EL10	1.887	1.932
EL11	2.012	2.054
EL12	1.138	1.411

4.10. Part 1 Claims

4.10.1. Due to the construction of a new road there will be the potential for compensation from local residents to accommodate noise disturbance during construction and traffic noise after completion. Under Compulsory Purchase Order (CPO) compensation guidelines, houses within 300m proximity of the new construction should be considered. However the payment of compensation is at the discretion of the Highway Authority.

4.10.2. Table 32 below highlights the value that may be involved when the above compensations are considered based on the scheme costs from the Rotherwas Access Road.

Table 32: Anticipated Compensation Sums

Alignment	Total No. of Houses within 300m of Alignment Option	Compensation Amount (£5k per house) £/k
EL2	100	500
EL3	25	125
EL9	4	20
EL10	2	10
EL11	2	10
EL12	5	25

4.11. Preparation and Supervision

4.11.1. Preparation and supervision costs have been based on 10% of the construction cost; this is an indicative rate that is industry standard and comparable with recent completed construction projects in the region.

4.12. Scheme Cost Estimate Summary

4.12.1. The cost estimates have been compiled in accordance with the methodology above. Table 33 gives the total cost for each link proposed. To enable a comparison of total Eastern Links costs, the Inner Eastern and Outer Eastern costs are presented in Table 34. Note, all costs are given in 2010 prices.

Table 33: Total Costs by Link			
Link	**Sub Total**	**Part1 Claims**	**Total**
EL2	£7,344,869	£500,000	£7,844,869
EL3	£16,065,656	£125,000	£16,190,656
EL9	£13,264,326	£20,000	£13,284,326
EL10	£13,191,720	£10,000	£13,201,720
EL11	£11,715,887	£10,000	£11,725,887
EL12	£18,172,729	£25,000	£18,197,729

Table 34: Link Combinations			
Eastern Inner	EL2	EL3	Total
Construction Costs	£2,756,048	£7,414,588	£10,170,636
Land Costs	£1,328,600	£1,328,600	£2,657,200
Land Inflation Allowance	£272,363	£272,363	£544,726
Works for Statutory Bodies	£275,605	£741,459	£1,017,064
Preliminaries	£275,605	£741,459	£1,017,064
Preparation and Supervision	£275,605	£741,459	£1,017,064
Optimism Bias	£2,161,043	£4,825,728	£6,986,771
Sub-Total	£7,344,869	£16,065,656	£23,410,525
Part1 Claims	£500,000	£125,000	£625,000
Total	£7,844,869	£16,190,656	£24,035,525
		Total	**£24,035,525**
Eastern Outer	EL9	EL12	Total
Construction Costs	£5,307,462	£8,467,417	£13,774,879
Land Costs	£2,023,560	£1,411,386	£3,434,946
Land Inflation Allowance	£414,829	£289,333	£704,162
Works for Statutory Bodies	£530,746	£846,741	£1,377,487
Preliminaries	£530,746	£846,741	£1,377,487
Preparation and Supervision	£530,746	£846,741	£1,377,487
Optimism Bias	£3,926,234	£5,464,370	£9,390,604
Sub-Total	£13,264,325	£18,172,728	£31,437,053
Part1 Claims	£20,000	£25,000	£45,000
Total	£13,284,325	£18,197,728	£31,482,053
		Total	**£31,482,053**

4.12.2. The Inner Eastern Link has the lower delivery cost, primarily due to lower construction costs as the outer route requires more embankments and structures to cross the floodplain.

4.12.3. The costs are very early stage estimates with significant contingency figures (optimism bias) to account for currently unknown costs.

5. Route Environmental Assessment

5.1. Noise

5.1.1. Introduction

5.1.1.1 This chapter assesses the potential impact of the Eastern Links on the local ambient noise environment. A Scoping Assessment has been undertaken in line with the Design Manual for Roads and Bridges (DMRB) HD 213/11: Noise and Vibration.

5.1.2. Legislative Background

5.1.2.1 An overview of the relevant noise legislation has been undertaken in order to provide some context for this chapter of the report.

Environmental Noise Directive (END) 2002/49/EC

The Environmental Noise Directive (END) concerns noise from road, rail and air traffic and from industry. It focuses on the impact of such noise on individuals, complementing existing EU legislation which sets standards for noise emissions from specific sources.

Land Compensation Act 1973

5.1.2.2 Part I of the Land Compensation Act provides a means by which compensation can be paid to owners of land or property which has experienced a loss in value caused by the use of public works, such as new or improved roads. Noise and vibration are two of the factors which would be considered in any claims for compensation, but the claim must consider all changes and effects, including betterment. Claims can be made under Part I of the Act from 1 to 7 years after the opening of a road project. However, consideration of the likely extent of claims may be made during detailed design following the completion of statutory processes.

The Control of Pollution Act 1974

5.1.2.3 Sections 60 and 61 of the Control of Pollution Act generally relate to construction and demolition work, road works and maintenance works and are often used in conjunction with other standards such as BS 5228 (see below). These sections relate to control of noise on construction sites and prior consent for work on construction sites respectively.

The Noise Insulation Regulations 1975 (as amended 1988)

5.1.2.4 The Noise Insulation Regulations were made under Part II of the Land Compensation Act 1973. Regulation 3 imposes a duty on authorities to provide, or make a grant towards the installation of, noise insulation at eligible buildings. This is subject to meeting certain criteria given in the relevant Regulations. Regulation 4 provides authorities with discretionary powers to provide noise insulation at other buildings, in situations where existing carriageways are altered, such as additional lanes provided. Advice on the use of this discretionary power should be sought from the Overseeing Organisation.

Environmental Protection Act 1990

5.1.2.5 Under Part III of the Environmental Protection Act 1990 local authorities have a duty to investigate noise complaints from premises (land and buildings) and vehicles, machinery or equipment in the street. It does not apply to road traffic noise but may be applicable to some construction activities. The Noise and Statutory Nuisance Act 1993 amended Part III of the Environmental Protection Act 1990 by placing additional definitions in the list of statutory nuisances in Section 79 of the Environmental Protection Act. The definitions relate to nuisance caused by vehicles, machinery and equipment in the road. If a local authority's Environmental Health Officer is satisfied that a complaint amounts to a statutory nuisance then the authority must serve an abatement notice on the person responsible or in certain cases the owner or occupier of the property. The notice could require that the noise or nuisance must be stopped altogether or limited to certain times of the day.

The Highways Noise Payments and Movable Homes (England) Regulations 2000

5.1.2.6 These regulations provide highway authorities with a discretionary power to provide a noise payment where new roads are to be constructed or existing ones altered. The relevant regulations set out the criteria which should be applied in assessing eligibility for making such payments. Advice on the use of this discretionary power should be sought from the Overseeing Organisation.

Herefordshire Council UDP- Policy DR13 Noise

5.1.2.7 Development with the potential for generating significant levels of noise or for exposing a noise sensitive use to an existing noise source will be required to include appropriate measures within the proposal to mitigate the noise impact to an acceptable level. Development which, after taking account of mitigation measures proposed, would still have an unacceptable noise impact or result in unacceptable exposure to noise will not be permitted. Development which would adversely affect the quiet enjoyment or the special interest of designated areas will not be permitted. The quiet enjoyment and tranquillity of the wider countryside, landscape and wildlife areas and historic features will also be considered. The UDP also states that noisy development near a SSSI will need special consideration.

Planning Policy Guidance 24 – Planning and Noise

5.1.2.8 PPG 24 gives guidance to local authorities in England on the use of planning powers to minimise the impact of noise. PPG 24 states that a change of 3dB(A) is the minimum perceptible under normal conditions and a change of 10dB(A) corresponds roughly to the halving or doubling the loudness of a sound. From this it can be considered that the perceived benefit or disbenefit arising from a 1dB(A) change is dependent on non-acoustic factors such as a visible change in traffic flow. Paragraph 10 states “Much of the development which is necessary for the creation of jobs and the construction and improvement of essential infrastructure will generate noise. The planning system should not place unjustifiable obstacles in the way of such development. Nevertheless, local planning authorities must ensure that development does not cause an unacceptable degree of disturbance. They should also bear in mind that a subsequent intensification or change of use may result in greater intrusion and they may wish to consider the use of appropriate conditions”.

DMRB Volume 11 Section 3 HD 213/11

HD 213/11 provides the procedure for assessing the impact of noise from road schemes. HD 213/11 states ‘A road project has the potential to cause both increases and decreases in traffic noise on an existing road by altering the traffic composition. In the case of a new road, for example a bypass, a completely new noise source can be created.’

World Health Organisation (WHO) Guidelines

5.1.2.9 WHO guidelines state “general daytime outdoor noise levels of less than L_{Aeq} 55dB are desirable to prevent any significant community annoyance”. An aspirational target was also set for dwellings of L_{Aeq} 50dB for day and L_{Aeq} 45dB for night.

BS 5228:2009 Code of practice for noise and vibration control on construction and open sites (Part 1: Noise, Part 2: Vibration, and Part 4: Code of practice for noise and vibration control applicable to piling operations).

5.1.2.10 BS5228:2009 describes a method for predicting noise levels from construction activities. It provides typical source noise levels and takes account of the different types of activity that can occur in predicting the consequential noise level. The method takes account of the distance between sources and receptors, the durations of activities, and the effect of natural or purpose-built barriers and screens.

5.1.3. Consultation

5.1.3.1 Consultation with Herefordshire Council (HC) as part of the Stage 1 Environmental Assessment Report for Hereford Relief Road (Amey, 2010) highlighted there are numerous noise sensitive receptors in the vicinity and that a full assessment will need undertaken prior to any development. HC also stated that they are not aware of any existing sources of noise or complaints about traffic noise in the area of the proposed route corridors.

5.1.4. Methodology

5.1.4.1 The assessment follows along the lines of the Scoping Assessment methodology in DMRB HD 213/11: Noise and Vibration. In summary, scoping requires the:

- Identification of sensitive receptors and main noise sources in the study area;
- Consultation with the Environmental Health Officer;
- Identification of the likelihood of significant effects;
- Summary of any known noise levels within the study area;
- Identification of any limitations of the assessment; and
- A view if the scheme should proceed to Simple or Detailed Assessment.

5.1.4.2 DMRB HD 213/11 states that for each link an assessment should be made:

- Whether there is likely to be a change in noise level of 1 dB $L_{A10,18h}$ or more in the short-term or 3 dB $L_{A10,18h}$ in the long-term at any sensitive receptor within the study area; and
- Whether these is likely to be a change in noise level of 3 dB $L_{night,\ outside}$ or more in the long term at any sensitive receptor within the study area where an $L_{night,\ outside}$ greater than 55 dB is predicted.

5.1.4.3 Determining whether the above changes will likely occur is undertaken in line with DMRB, which states:

i. A change in noise level of 1 dB $L_{A10,18h}$ is equivalent to a 25% increase or a 20% decrease in traffic flow, assuming other factors remain unchanged and a change in noise level of 3 dB $_{LA10,18h}$ is equivalent to a 100% increase or a 50% decrease in traffic flow;

ii. Changes in traffic speed or proportion of heavy vehicles on the existing roads or new routes may cause a change in noise level of 1 dB $L_{A10,18h}$ in the short-term or 3 dB $L_{A10,18h}$ in the long-term either during construction, including temporary diversion routes, or when the road project is completed;

iii. If sufficient traffic flow information is available, then it is acceptable to use this to determine whether there is likely to be a change of 1 dB $L_{A10,18h}$ in the short-term or 3 dB $L_{A10,18h}$ in the long-term which will result from a combination of traffic flow, speed and composition, instead of using i) and ii) above in isolation.

5.1.4.4 Traffic data from the traffic model developed for this report was reviewed as part of this assessment. Traffic data was provided for the base year 2008, and opening year 2019 Do-Minimum and Do-Something scenarios. Traffic data included Annual Average Weekly Traffic flows, traffic composition and speed limit.

5.1.4.5 Properties were identified throughout a study area of up to 600m from each Eastern Link. It was determined that any properties over 600m from the scheme would not impacted significantly.

5.1.4.6 It is appropriate to assess the noise and vibration impacts of construction at a later date when more detailed construction methodologies and detailed route alignments are known.

5.1.5. Limitations of Assessment

5.1.5.1 The traffic model does not differentiate between the different links or an inner or outer Eastern Link option. Predicted traffic flows are available for the Eastern Link as a scheme, therefore it is assumed that the flows are applicable to all the Eastern Links.

5.1.5.2 The properties identified within the study area have not been categorised by property type or sensitivity to noise and vibration effects.

5.1.6. Baseline Environment

5.1.6.1 The study area includes both the suburbs of Hereford and the local rural environment, dominated by the local road network and villages around the eastern outskirts of Hereford City Centre. There are a number of locally designated nature conservation sites within the study area that could potentially be impacted from the scheme; River Wye SAC/SSSI and the proposed Lugg and Hampton Meadows SSSI.

5.1.6.2 Noise mapping in line with the Environmental Noise Directive is not available for Herefordshire County, therefore an understanding of noise levels in the vicinity is not known. Based on the information available for the study area, the major noise sources are from traffic travelling on the local road network. There are three major routes which transverse the study area in a general east-west direction, namely A438 Ledbury Road, B4224 Hampton Park Road and B4399 Holme Lacy Road (as illustrated on Figure 33 and 34: Receptor Plans for Eastern Links). Rotherwas Access Road is located immediately south of the Eastern Links and a railway line located approximately 1Km to the west

5.1.6.3 In addition to residential housing, other noise sensitive receptors identified within 600m include schools, hospice, nursing homes, youth centres, doctors surgeries, educational accommodation, village halls, libraries, places of worship, graveyards, day nurseries for children, listed buildings and Scheduled Monuments.

5.1.7. Potential Impacts

5.1.7.1 In line with DMRB HD 213/11, properties are identified which may experience a change in noise as a result of the scheme, either directly from a new noise source or from additional traffic on the adjacent road network. Table 35 provides an overview of property numbers within the study area in relation to each Eastern Link.

Table 35: Receptors within 600m of the Eastern Links

Eastern Links	Buffer Zones						
	0-50m	50-100m	100-150m	150-200m	200-300m	300-600m	Total
EL2	0	11	21	63	188	657	**940**
EL3	1	4	17	28	149	624	**823**
EL9	0	1	2	2	5	65	**75**
EL10	0	1	2	2	8	72	**85**
EL11	0	1	3	5	11	120	**140**
EL12	6	26	17	21	99	141	**310**

5.1.7.2 Figures 33 and 34 provide an overview of the receptor locations within distance bands from each of the link roads. Traffic flow data is available for the scheme for Base Year 2008 and for Do-Minimum and Do-Something scenarios for the Opening Year 2019. The data is only available for the Eastern Link as an overall scheme with no specific breakdown available for each of the links. Therefore, the extent of the affected roads is not mapped as at this stage this detailed information is not available for each route.

5.1.7.3 Based on the available traffic data the affected roads in proximity to the overall scheme include Hampton Park Road, Holme Lacy Road and Rotherwas Access Road. Other affected roads within the city centre include ESG Link Road, Edgar Street, Eign Street, Victoria Street and Ross Road.

5.1.7.4 It is predicted that the noise levels along the route of each Eastern Link will likely increase by at least 3 dB $L_{A10,18h}$ during daytime and by 3 dB $L_{night,\ outside}$ during the night. Based on traffic data provided for the Opening Year 2019, the Eastern Link scheme will likely result in an increase in noise level of 1 dB LA10,18h along the following routes:

- Hampton Park Road;
- Holme Lacy Road; and
- Rotherwas Access Road.

5.1.7.5 Predicted traffic flows for the Eastern Link scheme show that noise levels along the following routes will likely result in a decrease in noise levels of 1 dB $L_{A10,18h}$:

- A49 Ross Road; and
- A49 Victoria Street.

5.1.7.6 In practice noise effects would tend to be limited to the houses closest to the scheme, and noise changes would not be felt by houses which are further away, where they are shielded by intervening properties, in particular in the eastern Hereford urban area.

5.1.7.7 EL9, EL10 and EL11 are shown to be within 600m of the lowest number of receptors, with EL9 and EL10 located to similar low numbers. The southern extension of these links (EL12) is located within 600m of the highest number of receptors within the Outer Links (310 receptors), however nearly half of these receptors are located within the 300-600m band.

5.1.7.8 It should also be noted that the Outer Eastern Links (EL9, EL10, EL11 and EL12) though having a lesser impact on receptors, as there are fewer, would have a greater impact on the tranquillity of the countryside around Hereford as the proposal would introduce noise into an otherwise quiet and tranquil area.

5.1.7.9 EL2 is located within 600m of three times the number of receptors as EL12, however nearly two thirds of this number are located within the 300-600m band. EL3 is located within 600m of a significant number of receptors also, with three quarters of the receptors located within the 300-600m band.

5.1.7.10 Vibration sensitive receptors are likely to be within 40m of the proposed link roads and vibration sensitive receptors will be considered further along the assessment process. Heritage sites, archaeological sites and ecological sites can be adversely affected by vibration and particular attention will need to be given to the location of the link road. Ideally no sites that can be adversely affected by vibration should be within 40m of the link road.

5.1.7.11 The River Wye SAC/SSSI and proposed Lugg and Hampton Meadows SSSI are both crossed by the proposed scheme. The River Wye SAC is designated for species which may be potentially impacted by the noise and vibration from the construction of a new road and/or additional traffic during its operation. The Lugg and Hampton Meadows SSSI contain lowland meadows, which is not constrained in terms of potential noise and vibration impact from the proposed scheme.

5.1.8. Conclusions

5.1.8.1 Based on this Scoping Assessment it is predicted that the Eastern Link will result in significant change to the noise environment of receptors located along the following routes:

- All Eastern Link routes (EL2, EL3, EL9, EL10, EL11 and EL12);
- Hampton Park Road;
- Holme Lacy Road;
- Rotherwas Access Road;
- A49 Ross Road; and
- A49 Victoria Street.

5.1.8.2 The Inner Eastern Links (EL2 and EL3) are located within 600m of the greatest number of receptors, in comparison with the Outer Eastern Links (EL9, EL10, EL11 and EL12). However, the existing noise environment of the Outer Eastern Links will likely be quieter due to its rural locality therefore any new road will result in a new noise source and significant impact.

5.1.8.3 Based on the information available, there is no preferred Eastern Link as all of the options are constrained in terms of noise. It is recommended that a Detailed Assessment be undertaken should this scheme progress to the next stage.

5.2. Air Quality

5.2.1. Introduction

5.2.1.1 This chapter assesses the potential impact of the Eastern Links on local air quality. A screening assessment has been undertaken utilising the Design Manual for Roads and Bridges (DMRB) Air Quality Screening Model.

5.2.2. Legislative Background

5.2.2.1 An overview of the relevant air quality legislation has been undertaken in order to provide some context for this assessment.

EU Air Quality Directive (Directive 2008/50/EC)

5.2.2.2 This Directive consolidates existing air quality legislation (apart from the 4th Daughter Directive) and provides a new regulatory framework for PM2.5. It also makes provision for Member States to postpone attainment deadlines. The obligation to meet the requirements of the Directive falls primarily upon the Secretary of State for the Environment in England, and appropriate Ministers in the Devolved Administrations, who are designated as the appropriate "competent authority".

National Air Quality Strategy

5.2.2.3 The Strategy was last updated in 2007 and continues to provide the framework for local government to assess ambient air quality in their locality against specific health-based standards for nine pollutants (nitrogen dioxide, PM10, sulphur dioxide, benzene, lead, 1,3-butadiene, carbon monoxide, PAH and ozone). Seven of which (excluding ozone and PAH) are regulated through the Air Quality Regulations 1997 (HM Government 1998), 2000 (HM Government 2000), Air Quality (England) (Amendment) Regulations 2002 (HM Government 2002) and 2007 (OPSI 2007). The National Objectives are shown below in Table 36.

Table 36: Summary of Current Air Quality Objectives (AQOs) for Protection of Human Health

Pollutant	Objective		Date to be Achieved By
	Concentration	Measured as	
Benzene	16.25 µg/m^3	Running annual mean.	31 December 2003
	3.25 µg/m^3	Annual mean.	31 December 2010
Carbon Monoxide.	10 mg/m^3	Maximum daily running 8-hour mean.	31 December 2003.
Lead (Pb).	0.25 µg/m^3	Annual mean.	31 December 2008.

Table 36: Summary of Current Air Quality Objectives (AQOs) for Protection of Human Health			
Pollutant	**Objective**		**Date to be Achieved By**
	Concentration	**Measured as**	
Sulphur dioxide (SO_2).	266 µg/m^3 not to be exceeded more than 35 times a year.	15 minute mean.	31 December 2005.
	350 µg/m^3 not to be exceeded more than 24 times per year.	1 hour mean.	31 December 2004.
	125 µg/m^3 not to be exceeded more than 3 times a year.	24 hour mean.	31 December 2004.
Nitrogen dioxide (NO_2).	200 µg/m^3 not to be exceeded more than 18 times a year.	1-hour mean.	31 December 2005.
	40 µg/m^3	Annual mean.	31 December 2005.
PM_{10}	50 µg/m^3 not to be exceeded more than 35 times a year	24 hour mean	31 December 2004
	40 µg/m^3	Annual mean	31 December 2004

Local Air Quality Management: Technical Guidance 09 (LAQM.TG09)

5.2.2.4 TG09 is designed to support local authorities in carrying out their duties under the Environment Act 1995. These duties require local authorities to review and assess air quality in their area. These Review and Assessments form the cornerstone of the system of Local Air Quality Management (LAQM). LAQM itself forms a key part in the UK Government's strategies to achieve the Air Quality Objectives.

Herefordshire and Worcestershire Air Quality Planning Protocol

5.2.2.5 This protocol ensures that air quality is considered as a material planning consideration within development control planning processes of the Councils, through the implementation of the Supplementary Planning Document for Herefordshire and Worcestershire. Where deteriorations in air quality due to a development (or developments) are predicted, the following measures to mitigate the effects are put in place;

- Require modelling and/ or monitoring to be undertaken to accurately assess the impacts of proposed development on local air quality;

- Ensuring that air quality is properly considered within planning policy processes, in particular within the LDF process, with the inclusion of a specific air quality policy where applicable.

Herefordshire and Worcestershire Air Quality Strategy 2009

5.2.2.6 This Strategy supports the achievement of Air Quality Objectives and aims to raise air quality as an issue for consideration within a wide range of local government and regional planning frameworks.

UDP Policy DR9

5.2.2.7 This policy states that development proposals which could contribute to the deterioration of air quality below acceptable levels, either locally or on a more widespread basis, will not be permitted unless adequate air quality enhancements or mitigation measures can be accommodated and demonstrated as part of the development. In assessing schemes regard will be had to both their operational impacts and to associated traffic generation. Where developments are sensitive to air quality are proposed, regard will be had to local air quality as a material consideration.

Development Control: Planning for Air Quality EPUK 2010

5.2.2.8 This guidance aims to ensure that air quality is properly accounted for in the Development Control and Local Development Framework processes. The guidance clarifies when an air quality assessment is required and what it should contain. It sets out how impacts should be described and assessed. Importantly it sets out a recommended approach that can be used to assess the significance of the air quality impacts, taking account of the advice issued by the Institute of Air Quality Management. An important focus of this guidance is on minimising the air quality impacts of all developments

5.2.2.9 This guidance defines a number of criteria that can trigger the requirement for an air quality assessment;

- Proposals that will generate or increase traffic congestion, where 'congestion' manifests itself as an increase in periods with stop start driving;
- Proposals that will give rise to a significant change in either traffic volumes, typically a change in annual average daily traffic (AADT) or peak traffic flows of greater than ±5% or ±10%, depending on local circumstances (a change of ±5% will be appropriate for traffic flows within an AQMA), or in vehicle speed (typically of more than ±10 kph), or both, usually on a road with more than 10,000 AADT (5,000 if 'narrow and congested').

5.2.3. Consultation

5.2.3.1 Consultation with Herefordshire Council (HC) as part of the Study of Options Environmental Assessment Report (Amey, 2010) highlighted the key area of concern as the AQMA. Herefordshire Council reported that the AQMA will be extended in the near future.

5.2.3.2 Diffusion tube monitoring data for the pollutant Nitrogen Dioxide was provided by HC Environmental Health Department.

5.2.4. Methodology

5.2.4.1 The assessment follows along the lines of the Scoping Assessment methodology in DMRB HA 207/07 Air Quality. It involves identifying properties and designated sites within 200m of roads affected by the scheme. Affected roads are defined in DMRB as those for which:

- Road alignment will change by 5m or more;
- Daily traffic flows will change by 1000 AADT or more;
- Heavy duty vehicle flows will change by 200 AADT or more;
- Daily average speed will change by 10km/h or more;
- Peak hour speed will change by 20km/h or more.

5.2.4.2 The road network within the study area was divided into sections where traffic conditions (flow, composition and average speed) were reasonably homogeneous. The road network was divided into as few continuous roads as possible to avoid overestimation by including contributions separately from different parts of the same road.

5.2.4.3 Traffic data was provided from the traffic model developed for this report for input into the DMRB Air Quality Screening Model and used to identify affected roads. Traffic data was provided for the base year 2008, and opening year 2019 Do-Minimum and Do-Something scenarios. Traffic data included Annual Average Daily Traffic flows, traffic composition, speed limit and road type.

5.2.4.4 The DMRB Air Quality Screening Model is used as an indicative screening tool to gauge the level of air quality impact in terms of the Air Quality Objectives. Background concentration levels were estimated using the year adjustment calculator from the national air quality archive website and shown in Table 37 below. The usual procedures were followed when obtaining background rates for predictions near a road, i.e. background concentrations were obtained for 1 km squares up to 4 km away from the road so that the road contribution is not double counted. The Department of Environment and Rural Affairs (DEFRA) spreadsheet was also used in the assessment which calculates the nitrogen dioxide concentration from the modelled oxides of nitrogen concentrations (available from http://www.airquality.co.uk/archive/laqm/tools.php).

5.2.4.5 Representative properties were identified throughout the study area; only residential dwellings were assessed using the screening model. In the majority of instances the residential properties were located over 200m from the affected roads and thus were excluded from the assessment.

5.2.4.6 A qualitative assessment of the different link road options is undertaken to provide some comparison of the different Eastern Link options. As the traffic data is only available for a Do-Something scenario, not for each Do-Something scenario for the six Eastern Link roads, the DMRB model could not be run for each Eastern Link.

5.2.4.7 The River Wye Special Area of Conservation (SAC)/ Site of Special Scientific Interest (SSSI) and Lugg and Hampton Meadows SSSI are both located within 200m of roads affected by the proposed scheme. In line with Annex F of DMRB HA 207/07 only certain designated sites contain ecosystems that are sensitive to nitrogen deposition. As the Lugg and Hampton Meadows SSSI contains lowland meadows that are sensitive to nitrogen deposition a review of the Eastern Links was undertaken.

5.2.5. Limitations of Assessment

5.2.5.1 In terms of data availability no average speed values were available for the affected roads and therefore speed limits were used instead. Background concentrations were estimated for the opening year of 2019 for two scenarios; with and without the scheme. Future predictions for background concentrations are not available past 2020 and therefore the opening year 2019 was the only future year modelled as part of this screening assessment.

5.2.5.2 The DMRB Air Quality Screening Model is an indicative tool used to estimate exceedance of Air Quality Objectives and significance of impact of a scheme on local / regional air quality. It cannot model the effect the proposed eastern link will have on the wider road network, outside of the affected roads.

5.2.5.3 As outlined, the Air Quality Screening Model was used to model pollutant levels for a base year (2008) and the opening year (2019). No modelling was undertaken between these years to assess the validity of the model, as no traffic flows were available for any intervening year. The model results for the base year were compared with monitoring data collected by Herefordshire Council in order to provide some level of validation of the model.

5.2.5.4 The traffic model does not differentiate between the different links or an inner or outer Eastern Link option. Therefore, the Air Quality Screening Model will only assess the significance of the Eastern Link as a scheme in comparison to the existing road network. As distance between the road link and receptor is required for input to the screening model, it was assumed that the scheme followed the route of the inner Eastern Link (EL2 and EL3).

5.2.5.5 There are other general limitations to the Air Quality Screening Model, which are outside the scope of this assessment however further information is available on the Highways Agency website

(http://www.highways.gov.uk/knowledge_compendium/publications/BFBA6E600BDE4E79B0A3190D462A918E.aspx).

5.2.6. Baseline Environment

5.2.6.1 The study area includes both the suburbs of Hereford and the local rural environment, dominated by the local road network and villages around the eastern outskirts of Hereford City Centre. There are a number of locally designated nature conservation sites within the study area that could potentially be impacted from the scheme; River Wye SAC/SSSI and the proposed Lugg and Hampton Meadows SSSI.

5.2.6.2 The nearest continuous monitoring station is located within the Air Quality Management Area (AQMA) on Edgar Street in Hereford City Centre. Hereford City AQMA has been designated within the City of Hereford, covering the A49 from Blackmarstone to Widemarsh and part of the A438 joining the A49. The AQMA is linked to road traffic emissions and is for exceedance of the annual mean nitrogen dioxide (NO2) objective. Herefordshire Council report that the AQMA is likely to be extended soon as a result of diffusion tube monitoring showing exceedance of the annual mean NO2 objective along the A438. It is noted that the boundary of the AQMA is due to be extended along Whitecross Road, site number 65 on Figure 35: Air Quality Constraints Map

5.2.6.3 Herefordshire Council have approximately 80 no. NO2 diffusion tubes placed at various locations around the City Centre. Most diffusion tubes are located at house facades to correspond to relative public exposure, however some are adjacent to the roadside.

5.2.6.4 Figure 35: Air Quality Constraints Map shows the location of the diffusion tube monitoring locations and a summary of the latest round of nitrogen dioxide results for 2010. The nearest diffusion tube monitoring site for NO2 to the scheme is diffusion tube site no. 5 (Heywood Avenue) within the eastern suburbs of Hereford, approximately 500m northwest of the proposed roundabout with A438 Ledbury Road. NO2 concentration for 2010 (annual mean) was measured as 14.22µg/m3, the results of the tubes have been adjusted for bias using a national correction factor derived from UWE of 0.92.

5.2.6.5 Background concentrations were obtained for 1 km squares up to 4 km away from the proposed inner Eastern Links and the levels were averaged to produce the estimates in Table 37.

Table 37: Background Average Air Quality data from 1x1km grid estimates produced by Defra

	Carbon Monoxide (CO) µg/m^3	Benzene µg/m^3	1,3-butadiene µg/m^3	Nitrogen Oxides (NOx) µg/m3	Nitrogen Dioxide (NO_2) µg/m^3	PM_{10} Annual Mean µg/m^3
2008	0.126	0.176	0.056	17.865	12.965	14.879
2019	0.101	0.132	0.040	11.203	8.515	13.257

5.2.6.6 The background average data (Table 37) for 2008 is consistent with the 2008 monitoring data for Heywood Avenue (13.9µg/m3).

(See http://www.herefordshire.gov.uk/docs/Env_Nitrogen_Dioxide_Data_2008.pdf).

5.2.7. Potential Impacts

Eastern Links

5.2.7.1 In line with DMRB HA 207/07, properties are identified which may experience a change in air quality from the affected roads. Affected roads in proximity to the scheme include Hampton Park Road, Holme Lacy Road and Rotherwas Access Road. Other affected roads within the city centre include ESG Link Road, Edgar Street, Eign Street, Victoria Street and Ross Road.

5.2.7.2 At this stage, there is no traffic flow data available for each specific Eastern Link, therefore the extent of the impact on the affected roads is not known. Properties have only been identified within 200m of each proposed link, as illustrated on Figure 33 and 34: Receptor Location Plan and summarised in Table 38.

5.2.7.3 EL9, EL10 and EL11 are shown to be within 200m of the lowest number of receptors, with the southern extension of these links (EL12) located within 200m of 70 receptors. In terms of potential impact on receptors from the proposed link road the Outer Eastern Links would be preferred over the Inner.

Local Air Quality Assessment

5.2.7.4 Twelve representative properties were chosen throughout the study area around the proposed Inner Eastern Link and affected roads. Concentration levels were screened for the base year 2008, and the opening year 2019 and two scenarios were compared for the opening year; Do-Minimum (without the link road) and Do-Something (with the link road).

5.2.7.5 Table 39 provides a summary of the concentration levels estimated at each of the 12 no. properties for the base year 2008.

Table 38: 2008 Base Year Data

Receptor (X,Y)	Carbon Monoxide (CO) µg/m^3	Benzene µg/m^3	1,3-butadiene µg/m^3	Nitrogen Dioxide (NO_2) µg/m^3	PM_{10}	
					Annual Mean µg/m^3	Days >50µg/m^3
Hazelmere (353894, 237722)	0.16	0.21	0.07	14.87	15.50	0.19
Woodlands Farm (352933, 237281)	0.12	0.17	0.05	12.97	14.79	0.00
1 The Straight Mile (353657, 237816)	0.16	0.22	0.08	15.65	15.60	0.21
Church Farm Cottage (353586, 238262)	0.12	0.17	0.05	12.97	14.82	0.00
6 Hampton Park Road (353630, 239063)	0.14	0.19	0.06	13.89	15.10	0.13
Grimsworth Cottage (353754, 239061)	0.15	0.20	0.07	14.73	15.31	0.16
18 Eleanor Avenue (353730, 239173)	0.13	0.18	0.06	13.34	14.97	0.00
1 Wye Cottage (353898, 239049)	0.15	0.20	0.07	14.73	15.31	0.16
1 Stanley Cottages (353998, 238931)	0.15	0.20	0.07	14.99	15.37	0.17
Highfield House (353829, 239296)	0.13	0.18	0.06	13.00	14.89	0.00
Tupsley Court (353549, 240173)	0.13	0.18	0.06	13.28	14.98	0.00
Lower House Farm (353567, 240380)	0.13	0.18	0.06	13.40	15.01	0.13

5.2.7.6 The diffusion tube monitoring data for 5 Heywood Avenue (13.9µg/m3) is consistent with results for Tupsley Court and Lower House Farm, which are the closest receptors to this monitoring point.

5.2.7.7 Table 40 and 41 provides a summary of the concentration levels estimated at each of the 12 no. properties for the opening year 2019 for the Do-Minimum and Do-Something scenarios.

Table 39: 2019 Opening Year Do Minimum Data

Receptor	Carbon Monoxide (CO) µg/m^3	Benzene µg/m^3	1,3-butadiene µg/m^3	Nitrogen Dioxide (NO_2) µg/m^3	PM_{10}	
					Annual Mean µg/m^3	Days >50µg/m^3
Hazelmere	0.14	0.17	0.06	10.48	13.75	0
Woodlands Farm	0.10	0.12	0.04	8.51	13.18	0
1 The Straight Mile	0.14	0.18	0.06	11.19	13.91	0
Church Farm Cottage	0.10	0.13	0.04	8.51	13.20	0
6 Hampton Park Road	0.11	0.14	0.05	9.18	13.42	0
Grimsworth Cottage	0.12	0.15	0.06	9.79	13.58	0
18 Eleanor Avenue	0.11	0.14	0.04	8.78	13.32	0
1 Wye Cottage	0.12	0.15	0.06	9.79	13.58	0
1 Stanley Cottages	0.12	0.16	0.06	9.99	13.63	0
Highfield House	0.10	0.13	0.04	8.54	13.26	0
Tupsley Court	0.10	0.14	0.04	8.76	13.30	0
Lower House Farm	0.11	0.14	0.04	8.86	13.36	0

Table 40: 2019 Opening Year Do Something Data

Receptor	Carbon Monoxide (CO) µg/m^3	Benzene µg/m^3	1,3-butadiene µg/m^3	Nitrogen Dioxide (NO_2) µg/m^3	PM_{10}	
					Annual Mean µg/m^3	Days >50µg/m^3
Hazelmere	0.14	0.17	0.06	10.262	13.72	0
Woodlands Farm	0.10	0.12	0.04	8.54	13.23	0
1 The Straight Mile	0.15	0.18	0.06	11.18	13.92	0
Church Farm Cottage	0.10	0.13	0.04	8.51	13.24	0
6 Hampton Park Road	0.12	0.15	0.06	10.47	13.60	0
Grimsworth Cottage	0.14	0.18	0.08	12.83	14.05	0
18 Eleanor Avenue	0.11	0.14	0.05	9.53	13.42	0
1 Wye Cottage	0.15	0.18	0.08	13.27	14.14	0
1 Stanley Cottages	0.14	0.17	0.08	12.53	13.97	0
Highfield House	0.11	0.14	0.05	9.38	13.44	0
Tupsley Court	0.11	0.14	0.04	8.95	13.37	0
Lower House Farm	0.11	0.14	0.04	8.84	13.36	0

5.2.7.8 Table 41 provides a summary of the comparison of concentration levels for each of the 12 no. properties for the opening year 2019 for the Do-Minimum and Do-Something scenarios.

Table 41: Comparison of 2019 Opening Year Data						
Receptor	Carbon Monoxide (CO) µg/m^3	Benzene µg/m^3	1,3-butadiene µg/m^3	Nitrogen Dioxide (NO_2) µg/m^3	PM_{10}	
					Annual Mean µg/m^3	Days >50µg/m^3
Hazelmere	0	0	0	-0.218	-0.03	0
Woodlands Farm	0	0	0	0.03	0.05	0
1 The Straight Mile	0.01	0	0	-0.01	0.01	0
Church Farm Cottage	0	0	0	0	0.04	0
6 Hampton Park Road	0.01	0	0.01	1.29	0.18	0
Grimsworth Cottage	0.02	0.03	0.02	3.04	0.47	0
18 Eleanor Avenue	0	0	0.01	0.75	0.10	0
1 Wye Cottage	0.03	0.03	0.02	3.48	0.56	0
1 Stanley Cottages	0.02	0.01	0.02	2.54	0.34	0
Highfield House	0.01	0.01	0.01	0.84	0.18	0
Tupsley Court	0.01	0	0	0.19	0.07	0
Lower House Farm	0	0	0	-0.02	0	0

5.2.7.9 In summary, the Air Quality Screening Model indicates there will be no exceedance of Air Quality Objectives at any of the 12 no. properties modelled in this assessment.

5.2.7.10 Table 41 shows that the proposed link road will contribute to the concentrations of pollutants at a local level, thereby resulting in a slight degradation of air quality. It would therefore be recommended, based on this screening assessment, that a detailed assessment is undertaken in line with DMRB involving air quality dispersion modelling.

Regional Air Quality Assessment

5.2.7.11 A full quantitative assessment on the regional air quality has not been undertaken at this stage. An overview of journey times for each of the scenarios outlined above are provided in Section 2: Network Assessment of this report. There is a minimal difference in journey times between the predicted Do-Minimum and Do-Something scenarios, therefore impact on the regional air quality will be limited. It is also noted that a marginal deterioration as a result of the extra distance travelled resulting in extra emissions, may be more than offset by the reduction in congestion and idling within the city centre.

Assessment of the Air Quality Management Area

5.2.7.12 A limited assessment of the impact of the Eastern Link in terms of the Air Quality Management Area has been undertaken.

5.2.7.13 For the pollutant of most concern NO_2 within the AQMA an assessment was undertaken using the DMRB Air Quality Screening Model. Base conditions for 2008 were taken from monitoring result for the diffusion tube monitoring points Edgar/ Moor St (site number 21/22) and Victoria St (site number 8/9). Both sites contain duplicate diffusion tubes and the average monitoring results are summarised below

(See http://www.herefordshire.gov.uk/docs/Env_Nitrogen_Dioxide_Data_2008.pdf)

Table 42: Comparison of background data and monitoring data for two localities within the AQMA

	Nitrogen Dioxide (NO_2) $\mu g/m^3$	
	Victoria St (site no 8/9) 350688 239864	**Edgar/ Moor St** (site no 21/22) 350860 240615
Corrected diffusion tube monitoring data for 2008	49.0	39.9
2019 Do-Minimum	22.2	20.85
2019 Do-Something	21.32	20.33

5.2.7.14 It is noted that the background monitoring data based on the 2008 DEFRA background maps is significantly lower than the monitoring data for the two sites; Victoria St (16.02µg/m^3) and Edgar/Moor St (19.37µg/m^3).

5.2.7.15 NO_2 levels were predicted for the Opening Year 2012 Do-Minimum and Do-Something scenarios for the two AQMA sites. The predicted pollutant levels show levels of NO_2 are well within the Air Quality Objective, however it is likely that the predicted levels are underestimated. The existence of the Eastern Link is predicted to result in a minimal reduction in NO_2 levels within the AQMA, due to the predicted reduction in traffic flows within the city centre.

Assessment of the Designated Site

5.2.7.16 Air pollutants can adversely affect sensitive habitats, as highlighted in the report of the National Expert Group on Transboundary Air Pollution (2001). The critical load forms the basis of the effects-based approach, used to guide policy on reducing the environmental impacts of transboundary air pollutants, such as sulphur dioxide, nitrogen oxides and ammonia. The critical load is defined as:

> *'A quantitative estimate of the exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge. The amount of deposited pollutant above the critical load is termed the exceedance.'*

5.2.7.17 NOx is composed of nitric oxide (NO) and its oxidation product nitrogen dioxide (NO_2). The latter is known to be taken up by plants and concentrations of NO_2 are higher close to roads so vegetation in these areas is exposed to a larger source of nitrogen.

5.2.7.18 Traffic flows are available for different scenarios over different assessment years for a generic Eastern Link route. Using the traffic flow data available a limited qualitative assessment of impact on the Lugg and Hampton Meadows SSSI was undertaken.

5.2.7.19 The Inner Eastern Links (EL2 and EL3) would not result in significant volumes of additional traffic being directed through the proposed Lugg and Hampton Meadows SSSI, as the traffic model does not predict Ledbury Road will be an affected road in terms of DMRB HA 207/07 and the route itself does not transverse the designated site.

5.2.7.20 The northern end of the Outer Eastern Links (EL9, EL10 and EL11) will require the road being constructed directly through the designated site resulting in an additional source of NO_2. In terms of EL9, EL10 and EL11 there is potential for exceedance of critical load, which would indicate that there is potential for adverse effects of nitrogen pollution on the most sensitive elements of the meadow habitat of the SSSI.

5.2.7.21 It is not possible to state unequivocally either the timescale, or to quantify the extent, of the change that is likely to occur in the majority of habitats (Status of UK Critical Loads, UK National Focal Centre 2003). These constraints reflect the highly complex functions of nitrogen in habitats and ecosystems.

5.2.7.22 Currently, there is a lot of active research in the UK and elsewhere aimed at detecting and predicting the ecological impacts of future reductions in nitrogen emissions. Even with potential future reductions in nitrogen emissions there has been an extensive lead in time of rising nitrogen levels and little change in NH_3 releases.

5.2.8. Conclusions

5.2.8.1 The DMRB Air Quality Screening Model provides an indicative and limited overview of existing local air quality and predicted change in air quality with the link road scheme in place. It is predicted that there will be no exceedance of Air Quality Objectives within the study area due to the scheme. However, the scheme will result in changes to the local air quality environment of receptors located in proximity to the main road network.

5.2.8.2 In terms of location in proximity to receptors, the Outer Eastern Links would be preferred over the Inner Eastern Links. There is no significant difference between EL9, EL10 and EL11 in terms of receptor numbers.

5.2.8.3 The Eastern Link as an overall scheme is predicted to result in slight improvement in the levels of the pollutant of most concern NO_2 within the Air Quality Management Area in Hereford City Centre.

5.2.8.4 The Inner Eastern Links are preferred in terms of potential nitrogen pollution on the most sensitive elements of the meadow habitat of the Lugg and Hampton Meadows SSSI.

5.2.8.5 Based on the information available, there is no preferred Eastern Link as all of the options are constrained in terms of air quality.

5.3. Greenhouse Gases

5.3.1. The 2010 Study of options report considered the impacts upon climate change, looking particularly at the link lengths and therefore the likely differences in overall emissions resulting from increased journey distances. The traffic modelling shows a negligible effect upon overall journey distance (within 1%) as a result of the implementation of the Eastern Links. This would require a more detailed study to include an analysis of traffic speeds and modal share, however the results indicate that the introduction of the links would have a neutral impact upon climate change relating to vehicle emissions.

5.4. Landscape

5.4.1. Introduction

5.4.1.1 This section considers the impacts the Eastern Links will have on the landscape to the east of Hereford. Visual impacts are considered on receptors closest to the proposed links, but this is not a comprehensive visual impact assessment. Additional detailed visual assessment will be undertaken if the scheme progresses.

5.4.2. Legislative and Planning Overview

5.4.2.1 **Herefordshire Unitary Development Plan** (Herefordshire Council, 2007) sets out policies for guiding development in the Herefordshire area. A number of studies and documents have been published as part of the planning process, one of which is the **Herefordshire Landscape Character Assessment**. This categorises the landscape into different Landscape Types and Sub-regional Character Areas.

5.4.2.2 As part of the Local Development Framework, Herefordshire Council have also produced **The Urban Fringe Sensitivity Analysis: Hereford and the Market Towns** (Herefordshire Council, 2011). This document assesses the sensitivity of the landscape to housing development as part of the Local Development Framework.

5.4.2.3 The UK Government's **National Planning Policy Framework** (2012) includes guidance for *'protecting and enhancing valued landscapes'* and states that '*local planning authorities should set criteria based policies against which proposals for any development on or affecting protected … landscape areas will be judged'.*

5.4.3. Methodology

5.4.3.1 A review of the Study of Options Environmental Assessment Report (Amey, 2010) was undertaken to inform the baseline for this study. A limited walkover was undertaken by a landscape architect in March 2012 focusing on the Eastern Links and this is included within this chapter.

5.4.3.2 Landscape character was identified for each link under consideration and was derived from the Herefordshire Landscape Character Assessment as prepared by Herefordshire Council. Visual receptors were identified where it is considered that impacts would be significant. Figure 36 provides an overview of the landscape constraints and location of visual receptors identified in this chapter.

5.4.4. Baseline Conditions

Landscape

5.4.4.1 On a national scale, Hereford is situated within the 'Herefordshire Lowlands' Countryside Character Area. This is a large area, stretching from Ludlow in the north to Hereford in the south. Key characteristics of this landscape include wide river valleys, steep wooded hills, frequent orchards and hop yards, large farmsteads and frequent hamlets.

5.4.4.2 On a local scale, the Herefordshire Landscape Character Assessment (HLCA) identifies a number of Landscape Types in the county. The eastern links traverse the Principal Settled Farmlands and Riverside Meadows Landscape Types.

5.4.4.3 The Principal Settled Farmlands extends around much of the area to the east and north of Hereford. The HLCA describes this Landscape Type as follows.

'The rolling, lowland area of Central Herefordshire is dominated by this Landscape Type. These are settled agricultural landscapes of dispersed, scattered farms, relic commons and small villages and hamlets. The mixed farming land use reflects the good soils on which they are typically found. Networks of small winding lanes nestling within a matrix of hedged fields are characteristic. Tree cover is largely restricted to thinly scattered hedgerow trees, groups of trees around dwellings and trees along stream sides and other watercourses. The composition of the hedgerow tree cover differs from that of Timbered Farmlands in its lower density and lack of oak dominance. This is a landscape with a notably domestic character, defined chiefly by the scale of its field pattern, the nature and density of its settlement and its traditional land uses. Hop fields, orchards, grazed pastures and arable fields, together make up the rich patchwork which is typical of Principal Settled Farmlands.'

5.4.4.4 Riverside Meadows Landscape Type runs along the Rivers Wye and Lugg and the flat, seasonally waterlogged meadows running alongside the rivers are characteristic features. This Landscape Type is described in the HLCA as follows.

These are linear, riverine landscapes associated with a flat, generally well defined, alluvial floodplain, in places framed by steeply rising ground. They are secluded pastoral landscapes, characterised by meandering tree lined rivers, flanked by riverside meadows which are defined by hedge and ditch boundaries. Settlement is typically absent. Throughout these landscapes, the presence of extensive areas of seasonally grazed waterside meadows has in the past provided a strong sense of visual and ecological unity. These are landscapes that accommodate a degree of annual flooding, a factor which has been reflected in the traditional patterns of land use, the lack of settlement and development (except for the occasional water mill), and the representation of species and habitats tolerant of such waterlogged conditions. The natural fertility of Riverside Meadows has often been maximised by employing devices such as sluices to control and direct the silt laden flood waters. The unique Lammas Meadows bordering the River Lugg at Hereford are an excellent example of traditionally managed riverside meadows where the historic pattern of cutting and grazing has been continued for centuries. Tree cover is a notable element of Riverside Meadows, usually in a linear pattern along the hedge and ditch lines and to the banks of watercourses.'

5.4.4.5 The Herefordshire Unitary Development Plan contains no local designations for landscape quality, rather it emphasises the protection of the landscape as an overall resource, based on landscape character.

5.4.4.6 The landscape around the A438 from Lugwardine Bridge to Tupsley Bridge is generally flat and dominated by the Lugg Meadows grasslands. Trees are confined to the roadside hedgerow, occasionally in boundary hedgerows and along the banks of the River Lugg. There are no houses along this stretch of the A438 and the area is generally tranquil away from the road. New Court is an unregistered Historic Park and Garden and is located just north of the A438 at Lugwardine. From the A438 the parkland at New Court is visible to drivers and pedestrians. Tupsley West Open Space is a large open space north of the houses at Hampton Park and is located south west of the A438. This area is comprised of playing fields and a playground.

5.4.4.7 The landscape around the B4224 from its junction with Holywell Gutter Lane to Hampton Bishop is dominated by the orchard to the north of the B4224. There are scattered houses along this section of the B4224, along both sides of the road. Roadside hedges are mature and restrict views for travellers along the B4224, with only occasional glimpses to the River Wye corridor to the south.

5.4.4.8 The landscape around Chapel Road is more variable. This road is on the northern extent of Rotherwas Industrial Estate, and although the industrial units are prominent in the local landscape, the large undeveloped areas of grassland and occasional stand of trees make views for travellers along Chapel Road more pleasant. At the northern end of Chapel Road is a large commercial property, which is a single storey building constructed of stone with a car park adjacent to the building. The western side of Chapel Road has an area of planted trees which are mature and effectively screen the buildings around Rotherwas Chapel from the industrial complex.

5.4.4.9 Along the banks of the River Wye the landscape is more rural and the Scheduled Monument of Rotherwas Chapel and its associated buildings are a prominent feature. Rotherwas Chapel is a stone building, located within a stone wall enclosure. It has many specimen trees and mature shrubs within the extensive garden around it. The residential property of Rotherwas House is constructed of red brick and is a two storey dwelling. It is set within extensive grounds and has mature specimen trees within the estate.

5.4.4.10 Recreational facilities are found along the banks of the River Wye, with the Wye Valley Walk along the northern bank, while a path is shown on Ordnance Survey maps along the southern bank. This does not appear to be a registered Public Right of Way and may be a permissive path.

Visual Receptors

5.4.4.11 There are a large number of dwellings on the eastern outskirts of Hereford at Hampton Park, between the B4224 and A438. Houses most likely to be affected by the proposed link road are those on A438, B4224 and along Holywell Gutter Lane. Holywell Gutter Lane is a narrow, single carriageway road, and is likely to be used by residents whose properties access this road directly, and by those who have an allotment along the road. Holywell Gutter Lane is also a registered bridleway and likely to be used by recreational walkers.

5.4.4.12 There are a few scattered dwellings along the B4224 between the eastern outskirts of Hereford and the village of Hampton Bishop. These are generally two storey buildings, set slightly back from the road and with gardens around them.

5.4.4.13 Lugwardine village is located to the east of Hereford along the A438. There is potential for the eastern outer links to impact visually on houses on the western edge of Lugwardine. Those most likely to be affected would be located along Tidnor Lane and along the A438 into the village.

5.4.5. Potential Impacts

EL2

Landscape

5.4.5.1 The Landscape Type in the vicinity of EL2 is Principal Settled Farmlands. The route introduces a new feature into the agricultural landscape and will result in the loss of some hedgerows and mature trees. It will disrupt the local field pattern and sever the arable land to the west of the route from the lowland hay meadows to the east. Orchards are a principal landscape feature of this Landscape Type and the southern section of the link road will result in the loss of orchard at the junction of the B4224.

5.4.5.2 As this route runs south from the junction with the A438 it passes through farmland and an area of orchard to the junction with B4224. The detailed design of the link road at this stage is not known, but it is likely that the road will be in areas of cut as well as on sections of embankment. The topography along the route for EL2 provides an opportunity for the road to be designed to integrate with the existing landform. Due to the relatively flat landscape east of EL2, any sections on embankment would be visible in the landscape for travellers along the A438 and B4224.

Visual Impacts

5.4.5.3 This route passes close to a large number of houses at Hampton Park. Due to the undulating nature of the topography along the route, views from individual receptors are variable. Those properties most likely to be impacted visually include Tupsley Court, Tupsley Court Cottage, houses at Queenswood Drive, Highfield House, Coach House, Corporation Farm and houses along Holywell Gutter Lane and the B4224. The two houses at Wye Cottages on the B4224 will be particularly adversely affected as the junction of EL2 and B4224 will be within 50m of the properties.

5.4.5.4 There is also potential for adverse impacts on recreational facilities in the vicinity of EL2. Users of the facilities at Tupsley West Open Space would potentially have a view of the proposed link road, and the traffic moving on the road. Associated with this would be impacts from noise and vehicle emissions. Users of the allotments along Holywell Gutter Lane and walkers and equestrians along the bridleway would also have a view of the proposed road.

EL3

Landscape

5.4.5.5 The main landscape feature along the route of EL3 is the river corridor of the River Wye. The Landscape Type is Riverside Meadows, and land on both sides of the River Wye in this area is generally flat. Tree cover is a feature along the river corridor. The Stank flood embankment is a noticeable feature in the generally flat agricultural land to the north of the River Wye. South of the River Wye the most significant landscape feature is Rotherwas Chapel and its associated buildings. The commercial properties of Rotherwas Industrial Estate and the sewage treatment works are also a feature in the southern section of the link road.

5.4.5.6 As EL3 crosses a large area of floodplain, the road will likely be on embankment for most of its length. This will make the road a significant feature in the surrounding flat landscape. The most significant landscape impact will be the bridge over the River Wye. It will be a prominent feature in the landscape at this point. The provision of the road and bridge is likely to lead to a reduction in the amount of tree cover along the river bank, having an adverse impact on the Landscape Type. The intrusion of the road with its associated traffic will also have an adverse impact on the tranquillity of the existing landscape.

5.4.5.7 South of the River Wye the route passes through the northern part of Rotherwas Industrial Estate which is largely undeveloped here due to the presence of the floodplain. There are blocks of woodland planted along the boundary of the sewage works and to the west of Rotherwas Chapel. There is potential for the road to have an adverse impact on the setting of Rotherwas Chapel and this is considered more fully in the Cultural Heritage section. However, the road is over 100m from the Chapel and there is a block of plantation woodland between the route and the Chapel. Retention of this woodland would aid in the minimisation of impacts to the building.

Visual Impacts

5.4.5.8 Receptors along this link road that have the potential to be affected visually by a new road include dwellings at 2, 3 and 4 Church Farm, Rotherwas House, Garden Cottage, Grimsworth Cottage, Wye Cottages, Green Gables, houses along Hampton Park Road and Braemar Gardens. The most adverse impacts are likely to be experienced by houses at Wye Cottages and Green Gables as they are within 50m of the proposed junction with the B4224. The route passes within 100m of Garden Cottage and this receptor is also likely to experience significant adverse impacts. This receptor may also have visual impacts from the bridge over the River Wye.

5.4.5.9 There will be visual impacts on commercial properties at Rotherwas Industrial Estate where the road connects to the roundabout on the B4399. This is likely to be limited to the effects of additional traffic as EL3 will connect to the existing road layout at the Chapel Road roundabout.

5.4.5.10 The Wye Valley Walk recreational route is located along the north bank of the River Wye in this area and travels through Braemar Gardens to the river bank. Currently this section of the walking route is likely to be relatively tranquil due to the rural and residential nature of the area. The provision of a traffic route will introduce a new feature into the landscape. Provision would have to be made to allow the Wye Valley Walk to continue uninterrupted, either on a footbridge over the road or more likely, in an underpass. Moving traffic will have an adverse impact on the amenity of the route and there will be associated impacts from noise and vehicle emissions. Impacts will be the same for recreational walkers on the south bank of the River Wye.

EL9

Landscape

5.4.5.11 The majority of EL9 falls within the Landscape Type Riverside Meadows. The landscape along much of this route is flat with few field boundaries in the hay meadows. The orchard at the southern end of the road is a prominent feature in the landscape around the B4224. The northern section of this road will be carried on embankment to carry the road above the level of the floodplain. This will make the road highly visible in an otherwise generally flat area and have a negative impact on the Landscape Type.

Visual Impacts

5.4.5.12 The northern section of this road is not located in close proximity to any residential receptors, but there may still be visual impacts on dwellings on the western edge of Lugwardine. Impacts will be exacerbated by the need to carry the road on embankment, making it more visible to receptors, even from a distance. Receptors most likely to experience adverse visual impacts will be located along Tidnor Lane, along the A438 in the vicinity of Lugwardine Bridge and houses along the eastern edge of Hereford.

5.4.5.13 For the southern section of the road, the most adverse impacts will be on receptors along the B4224, particularly The Lodge and Pantglas which are within 100m of the proposed junction of EL9 and B4224. There is limited potential for visual impacts on properties at Hampton Park due to distance from the link road and the intervening orchard.

EL10

Landscape

5.4.5.14 This route follows a slightly more easterly alignment than EL9 and crosses the same Landscape Type. Impacts from this alignment would be the same as that for EL9.

Visual Impacts

5.4.5.15 EL10 follows the same alignment as EL9 in the southern section of the route and impacts on visual receptors would be very similar.

EL11

Landscape

5.4.5.16 This is the most easterly of the Eastern Links and follows a more easterly alignment than EL9 and EL10. It will have the same impacts as these routes on landscape. This route is the closest of the Eastern Links to the river corridor of the River Lugg and therefore most likely to have adverse impacts on the landscape setting of the river corridor.

Visual Impacts

5.4.5.17 As the most easterly of the link roads, this is the closest to the village of Lugwardine. There is potential for adverse visual impacts on receptors on the western edge of the village, particularly along Tidnor Lane, B4224 and at Bridge House, Lower Lodge and New Court.

5.4.5.18 The southern section of the road follows the same alignment as EL9 and EL10 and will have the similar impacts.

EL12

Landscape

5.4.5.19 Most of this road travels through the Landscape Type of Riverside Meadows. The land is generally flat from the junction with B4224 to the junction with B4399. As most of the route is in floodplain, the road will be carried on embankment and a bridge will carry the road over the River Wye. The road will be a prominent feature in the landscape due to being carried on embankment. The most significant impact on the landscape will be the bridge structure, which will also be a prominent feature in the generally flat landscape. The provision of the bridge is likely to lead to a reduction in tree cover along the banks of the River Wye at the crossing point.

5.4.5.20 The route is also likely to be carried on embankment south of the River Wye through Rotherwas Industrial Estate, making it a prominent feature in the landscape. It passes within 80m of Rotherwas Chapel and its associated buildings. Unlike EL3, there is no screening vegetation between the proposed route and the Chapel and there is potential for an adverse impact on the setting of the Chapel. However, there are buildings between the Chapel and the proposed alignment, providing some degree of screening.

Visual Impacts

5.4.5.21 The dwellings at Pontglas and the Lodge will experience the most severe visual impacts as they are within 100m of the junction of EL12 and B4224. Dwellings at Field Farm House and along the B4224 will have a view of the route as it travels south towards the River Wye.

5.4.5.22 The houses at Church Farm and Rickyard Cottages at Rotherwas will also experience adverse visual impacts due to the proximity of the road. Commercial properties along Chapel Road have potential to suffer adverse impacts, as the construction of the road is likely to result in the removal of the screening belt of trees along the western edge of Chapel Road.

5.4.5.23 This alignment will have the same impacts on recreational walkers on the Wye Valley Way as EL3.

5.4.6. Townscape

5.4.6.1 The historic core of the city is contained within the inner ring road (the A49 as it crosses the River Wye and the loop around the north of the cathedral), which in turn follows the line of the city walls, parts of which can still be seen. The city walls are a Scheduled Ancient Monument, the entire city centre is a Conservation Area and there are many individual listed buildings. The more attractive and historic elements of the city centre tend to be set back from the main through traffic routes and would not therefore be directly affected by relief of traffic flows and congestion.

5.4.6.2 The main routes within the city of Hereford used to access the Eastern Links are shown to be Hafod Road and Bodenham Road with a decrease in traffic in the city centre, particularly along the A49 and Edgar Street. The reduction in traffic through the city centre will have beneficial impacts on the central Conservation Area by reducing congestion and traffic emissions. There may also be indirect impacts as the provision of the link road would assist with the proposed redevelopment of parts of the city centre with long term beneficial townscape effects.

5.4.7. Conclusions

5.4.7.1 The inner Eastern Links are preferred over the outer Eastern Links as the opportunities for reducing landscape effects are greater. The more undulating topography along the inner Eastern Links will make it easier to design the road to integrate into the landscape. There is limited opportunity to reduce landscape impacts along the outer Eastern Links due to the requirement to carry the road on embankment and the generally flat nature of the surrounding landscape.

5.4.7.2 At this stage of assessment, it is not possible to fully assess any potential visual impacts without a more detailed site walkover. From aerial photographs and from Google Streetview, it is considered that views from some of the above receptors will be largely ameliorated by intervening hedgerows and areas of tree planting. Landscape design in conjunction with the detailed design of any route can also help to allow visual impacts to be minimised.

5.5. Biodiversity

5.5.1. Introduction

5.5.1.1 This section will consider the potential impacts each of the Eastern Links will have on the ecology and biodiversity of the area.

5.5.2. Legislation and Planning Policy Overview

5.5.2.1 **The Wildlife and Countryside Act 1981** and amendments, provides for the designation of Sites of Special Scientific Interest (SSSIs) and protects fauna and flora.

5.5.2.2 **The Countryside Rights of Way Act 2000** gives greater protection to SSSIs and introduces 'reckless disturbance' as an offence. It also requires Government Departments to have regard to biodiversity and conservation.

5.5.2.3 **The National Environment and Rural Communities Act 2006** places a duty on public bodies to consider enhancement of biodiversity during all their actions. It also provides for species identified in the UK Biodiversity Action Plan (UKBAP) and Local Biodiversity Action Plans (LBAPs) to be considered as conservation priorities.

5.5.2.4 **The Conservation of Habitats and Species Regulations 2010** implements the Habitats Directive and provides for the designation of Special Protection Areas (SPAs) and Special Areas of Conservation (SACs). The Regulations also protect European Protected Species (EPS) from deliberate capture, killing or disturbance. It is also an offence to destroy or damage the resting site or breeding site of an EPS.

5.5.2.5 **The National Planning Policy Framework** was published in 2012 by the Government and aims to streamline the planning process. Section 11 of this document deals with conserving and enhancing the natural environment and states that:

'*when determining planning applications, local planning authorities should aim to conserve and enhance biodiversity by applying the following principles:*

- *Proposed development on land within or outside a Site of Special Scientific Interest likely to have an adverse effect on a Site of Special*

Scientific Interest (either individually or in combination with other developments) should not normally be permitted. Where an adverse effect on the site's notified special interest features is likely, an exception should only be made where the benefits of the development, at this site, clearly outweigh both the impacts that it is likely to have on the features of the site that make it of special scientific interest and any broader impacts on the national network of Sites of Special Scientific Interest…'

5.5.2.6 The Framework also states *'the presumption in favour of sustainable development does not apply where development requiring appropriate assessment under the Birds or Habitats Directives is being considered, planned or determined.'*

5.5.2.7 **The United Kingdom Biodiversity Action Plan** (UKBAP) describes the UK's biological resources and sets out a plan for the protection of these resources. At a local level, local authorities produce Local Biodiversity Action Plans (LBAP) for habitats and species of particular importance in their area. Herefordshire Biodiversity Action Plan has plans for 14 species and 16 habitat types.

5.5.2.8 **The Herefordshire Unitary Development Plan** has a number of policies with regard to preserving biodiversity through the planning process. Of particular relevance to this assessment is Policy NC3 Sites of National Importance, which states *'development in or likely to affect Sites of Special Scientific Interest or National Nature Reserves will be subject to special scrutiny…'*

5.5.2.9 Policy NC4 Sites of Local Importance states *'development proposals which could directly or indirectly affect a Special Wildlife Site, Site of Importance to Nature Conservation, Local Nature Reserve, a Regionally Important Geological/Geomorphological Site or a site subject to an agreement under section 39 of the Wildlife and Countryside Act will not be permitted unless it can be demonstrated that there would be no harm to the substantive nature conservation value of the site.'*

5.5.3. Methodology

5.5.3.1 A review of the following was undertaken to inform this report:

- Study of Options Environmental Assessment Report (Amey 2010);
- Hereford Relief Road Habitats Regulations Assessment - Route Corridor Options Screening Report (Hyder Consulting 2011); and
- Consultation response from Natural England from the 2012 consultation process (see Appendix D for all consultation responses).

5.5.3.2 Designated sites and habitats of local importance within 2km of the Eastern Links were identified while records of protected species or species of conservation concern within 1km of the route options were sought as part of the 2010 Study of Options EAR. This data was used as the baseline for this report, as illustrated in Figure 37.

5.5.4. Baseline Conditions

Designated Sites

5.5.4.1 The River Wye SAC is the only European Protected site that would be affected by the Eastern Links. The River Wye SAC is designated for its habitats and the species it supports. The Annex I habitat, Watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation, is a primary reason for selection of this site. The site is also designated for a number of Annex II species such as white-clawed crayfish, sea lamprey, brook lamprey, river lamprey, twaite shad, Atlantic salmon, bullhead, otter and allis shad. Included within the SAC designation is the River Lugg which is a tributary of the River Wye. The River Lugg flows east of Hereford and the river and its floodplain lies within the Eastern Links study area.

5.5.4.2 Both the River Wye and River Lugg are designated as a Sites of Special Scientific Interest (SSSI), with the boundary of the SSSIs designation largely overlapping with that of the SAC. As well as the biological features for designation, the River Lugg SSSI is partly designated for its geological interest due to its relatively natural fluvio-geomorphic regime. The flow, substrate and variations in geology are cited as a contributory factor to the aquatic communities present. The site overlaps with the River Lugg Meanders SSSI selected under the Geological Conservation Review.

5.5.4.3 The Lugg and Hampton Meadows SSSI was proposed for designation in December 2011 and includes the area of Lugg Meadows SSSI along with an additional area of lowland grassland habitat south of A438. This proposed Lugg and Hampton Meadows SSSI extends from the boundary with the A4103 Roman Road south to Hampton Meadows and runs adjacent to the River Lugg. This site is a large area of lowland hay meadow, a habitat which is increasingly rare in the UK and Lowland Meadow is a UK Priority Habitat within the UK Biodiversity Action Plan (UKBAP) and also within Hereford LBAP.

5.5.4.4 Broadlands Local Nature Reserve (LNR) is located west of Lugg Meadows and runs adjacent to housing at Aylestone Hill. This reserve is an area of open grassland and meadows.

5.5.4.5 Hereford Nature Trust has a number of reserves located to the east of Hereford. These include Hampton Meadows Hereford Nature Trust Reserve (HNTR), Lugg Meadows HNTR and Lower House Farm HNTR. Sites of Importance for Nature Conservation (SINCs) are designated in Hereford UDP and include: land north of Hampton Road SINC, Litley Court Hampton Park Road SINC, Hampton Park Road SINC, Hampton Grange Nursing Home SINC and Lugg Rhea SINC. Lugg Meadows, River Lugg, River Wye, Pool at Rotherwas and Rotherwas Park Wood are designated as Special Wildlife Sites.

Habitats

5.5.4.6 The Herefordshire LBAP has a number of habitats which are targeted for action to conserve and protect them. Within the vicinity of the Eastern Links, the following LBAP habitats are likely to be present: cereal field margins, floodplain grazing marsh, hedgerows, lowland meadows, managed green space, orchards, rivers and streams, and woodlands.

5.5.4.7 Much of the land which the Eastern Links pass through is agricultural, comprising either arable or pasture grassland. There is an extensive hedgerow network within the agricultural land and this provides links for wildlife to move between and within habitats.

5.5.4.8 There is an area of ancient woodland at Rotherwas which includes Rotherwas Park Wood Special Wildlife Site as well as two additional blocks of woodland. It is located approximately 800m east of the junction of Chapel Road and B4299 at Rotherwas.

Protected Species

5.5.4.9 At this stage of the assessment, targeted surveys for particular species have not been undertaken. However, from the habitats present in the study area and from records obtained from the local Hereford Biological Records Centre for the Study of Options EAR (Amey, 2010), it is possible to predict species likely to be found within the study area.

5.5.4.10 A number of protected species and species of conservation concern will be present within the Eastern Links study area. European Protected Species that may be present in the area include otter, dormice, bats and great crested newts. These species require habitats with good connectivity to move between feeding and breeding areas and would be particularly vulnerable to any habitat severance due to loss of hedgerows or water features.

5.5.4.11 There are records of otters along the Lugg Rhea tributary north of the A438. There is a record of a bat roost near Broadlands LNR and another at New Court, both north of A438. There are records of roosting lesser horseshoe bats around the northern section of the Rotherwas Access Road, as well as a record of a maternity colony of lesser horseshoe bats in one of the buildings in the business park. Great crested newts are known to be present in ponds to the west of the access road in the industrial estate.

5.5.4.12 Legally protected species and species of conservation concern that are present in the study area include badger, water vole, reptiles, fish and invertebrates associated with the River Wye, and birds listed on Schedule 1 of the Wildlife and Countryside Act 1981 and amendments.

5.5.4.13 The citations for the River Lugg and River Wye SSSI and River Wye SAC stress the importance of these sites for otters, with other mammals such as water vole and bats also found along the rivers.

Eastern Links

5.5.4.14 EL2 runs south from the A438 to the B4224, passing through predominantly agricultural farmland. At the junction of EL2 with the A438 this link passes within 50m west of the proposed Lugg and Hampton Meadows SSSI. As the link travels south to the junction with the B4224 it passes through a mixture of arable, pasture grassland and orchard.

5.5.4.15 EL3 starts at the junction with the B4224 and travels south to cross the River Wye and connect to the B4399 at Rotherwas. From the junction of the B4224 to the banks of the River Wye the link passes through agricultural land and also bisects the Stank, a flood defence embankment. Along the banks of the River Wye are areas of scrub and mature trees while *Ranunculus* beds are found in the river channel. The habitat is deemed suitable for nesting kingfishers. The river corridor also provides valuable foraging and commuting habitat for otters and bats. From the south bank of the River Wye to the junction at Rotherwas, the habitat is primarily grassland with occasional stands of trees and scrub.

5.5.4.16 EL9 starts at the junction with A438 and travels south to the junction with the B4224. Much of the northern section of this link passes through the proposed Lugg and Hampton Meadows SSSI and crosses Lugg Rhea. It bisects an earth embankment just south of the boundary of the SSSI, and it is assumed this is a flood relief embankment. The southern section of the link passes through orchard to its junction with the B4224.

5.5.4.17 EL10 starts at the junction with A438, slightly further east than the intersection point for EL9. Like EL9 the northern part of the link crosses the proposed Lugg and Hampton Meadows SSSI and crosses the Lugg Rhea and the flood embankment. It then follows the same alignment as EL9 in the southern section of the link passing through orchard.

5.5.4.18 EL11 is the most easterly of the Eastern Links and starts at the junction with A438 near Lugwardine Bridge. The proposed junction with the A438 is directly adjacent to the River Lugg at this point. As with EL9 and EL10, this link passes through the proposed Lugg and Hampton Meadows SSSI and crosses the Lugg Rhea and flood embankment. It then follows the same alignment as EL9 and EL10 through the orchard to the junction with the B4224.

5.5.4.19 EL12 is the connecting link for EL9 – EL11 from the B4224 to the junction at B4399. This link passes through arable farmland and crosses the River Wye. Where the link crosses the River Wye, the banks have areas of scrub and mature trees. *Ranunculus* beds are found in-channel at the proposed crossing point. There is suitable habitat for nesting kingfishers and swifts. The river corridor provides valuable foraging and commuting habitat for otters and bats. This link also bisects the Stank flood embankment.

5.5.5. Consultations

5.5.5.1 The consultation response from Natural England (Appendix D) highlights their concern that an eastern route option for the Hereford Relief Road is still being assessed

'The Study of Options (Amey, 2010) identified engineering and environmental advantages and disadvantages associated with a range of western and eastern relief road options. The Study was clear about the environmental risks associated with an eastern route and recommended the inner western route. On balance, Natural England agreed with this recommendation. It therefore gives us some concern that an eastern route option is still being pursued.'

5.5.5.2 Consultation with Natural England has highlighted that there are likely to be complex hydrological relationships between the River Wye SAC, the River Lugg part of the SAC, the proposed Lugg and Hampton Meadows SSSI, the Lugg Rhea tributary of the River Lugg and the wider floodplain. In assessing the Eastern Links these relationships need to be taken into account.

5.5.5.3 The correspondence states that Natural England are currently consulting on the notification of the proposed Lugg and Hampton Meadows SSSI and that states that:

'The Wildlife and Countryside Act 1981 (as amended) imposes a general and overarching duty under Section 28G that requires an authority to take reasonable steps, consistent with the proper exercise of its functions, to further the conservation and enhancement of the features for which sites are of special interest. In addition, specific obligations under Section 28H apply to planning authorities, when having considered their general duty, they neverless propose to carry out or authorise operations likely to damage the special interest features of SSSIs (whether or not these will take place on land included in the SSSI). A planning authority proposing to carry out operations likely to damage the special features of a SSSI must notify Natural England under section 28H of the Act'.

5.5.6. Potential Impacts

Eastern Link 2

5.5.6.1 The junction for EL2 with the A438 will involve the removal of a section of highway boundary hedge and scrub vegetation. The boundary of the proposed Lugg and Hampton Meadows SSSI extends as far as Tupsley Bridge on the A438 and this is within 50m of the proposed junction of EL2 with the A438. Potential impacts on the SSSI include pollution, changes in hydrology and increased nitrogen deposition from traffic and works machinery. There is potential to impact on the Lower House Farm Nature Trust Reserve through landtake, as the boundary of the HNTR is adjacent to the A438.

5.5.6.2 As the link moves south to the junction with the B4224, it passes through agricultural land and orchards. The link will effectively sever the agricultural land and result in the loss and severance of boundary hedgerows. Given the habitats in the area, there is high potential for badgers to be found in the area, with setts in hedgerows or using the area for foraging. If the new road crosses established badger trails, there is an increased risk of mortality to badgers as they try to cross the new road to move between setts and/or foraging areas.

5.5.6.3 Linear features such as hedgerows and watercourses are important commuting and foraging routes for bats. Bat roosts have been recorded in buildings along the A438 and B4224 and it is highly likely that the fields and meadows to the east of Hereford are used for foraging. Loss of hedgerows or breaks in the connectivity in the habitat can adversely impact on their ability to commute between roost sites and foraging areas.

5.5.6.4 The link also crosses over a minor watercourse/drainage ditch which would likely be culverted under the road. This watercourse is part of the River Lugg catchment and forms part of the drainage system of the lowland meadow. Any change in the hydrology of the catchment will impact on the River Lugg which forms part of the River Wye SAC designation. Changes in hydrology will also impact on the species composition of the hay meadows and can result in a reduction in species diversity. The vegetation types are a primary reason for the selection of the proposed Lugg and Hampton Meadows SSSI.

5.5.6.5 Lowland hay meadows are sensitive to nitrogen deposition and increases in nitrogen deposition can lead to an increase in grass species at the expense of wildflowers and a reduction in species diversity. The roads within the study area that would contribute to nitrogen levels include the A438 and the proposed Eastern Link roads. The A438 borders the proposed SSSI on both sides of the road, while EL2 is within 50m of the western boundary of the proposed SSSI at its northern most point before diverging away from the SSSI. It is likely that any impacts on the proposed SSSI from nitrogen deposition will be more significant along the A438 due to predicted increased traffic flows.

5.5.6.6 Orchards are a BAP habitat within the Herefordshire LBAP and the route would result in the loss of some of this habitat through landtake from the existing orchards to the north of the B4224. One of the actions in the LBAP is to maintain the extent of orchards in Herefordshire, and the loss of orchard due to construction of the eastern links would be in conflict with the aims of the LBAP.

5.5.6.7 Construction works for the junction with B4224 have potential to impact on the land north of Hampton Park Road SINC through landtake. There is also a record of a bat roost in the vicinity of the proposed junction and further surveys will be required to ascertain if works will impact on the roost site, should the route be taken forward.

Eastern Link 3

5.5.6.8 This link will result in the loss of agricultural land between B4224 and the north bank of the River Wye. The route cuts across two large fields and will result in minimal loss of hedgerows. From the south bank of the River Wye to the junction with B4399 the route will result in the loss of grassland and a small area of plantation woodland north east and east of the sewage works at Rotherwas.

5.5.6.9 The features for which the River Wye SAC is designated are all vulnerable to impacts from sediment and pollution runoff. Increased silt in the river channel can cause localised enrichment of nutrients which can favour the growth of benthic algae, inhibiting the growth of channel vegetation. Silt deposition can also smother the substrate required for spawning fish species, reducing egg survival and reproductive success. Pollution can cause a reduction in water quality and many of the species for which the Wye is designated, particularly salmon and white-clawed crayfish, require good water quality. A serious pollution incident has potential to result in large scale mortality of fish species, and this can have a knock on effect on wildlife dependant on fish such as otter.

5.5.6.10 A bridge will be required to carry the route over the River Wye. Bridge works have potential to result in damage or disturbance to holt sites, and further surveys will be required to ensure no holts are likely to be impacted by works, should the Eastern Links be progressed. Construction of the bridge also has potential to result in pollution of the River Wye from sediments and fuels.

5.5.6.11 There are records of bat roosts in Rotherwas Industrial Estate. It is likely that bats use the open space to the north of Rotherwas and the river corridor for foraging and commuting. Construction works have potential to impact on bats through lighting for working at night and site clearance works disrupting commuting routes. There are small areas of plantation woodland in Rotherwas estate, and some mature trees in the area may have potential for roosting bats. Site clearance will result in the loss of some of these wooded areas, and may result in the loss of roost sites. Further survey work will be necessary if the scheme is progressed to determine if roost sites will be impacted.

5.5.6.12 There are records of great crested newts in the ponds throughout Rotherwas estate and the provision of the link road has potential to provide a barrier to migration of this species between breeding and foraging habitat.

Eastern Link 9

5.5.6.13 Works will take place within 50m of the River Wye SAC as the River Lugg north of the A483 is part of the SAC designation. Construction works have potential for sediments and pollutants to be washed into the River Lugg, which can have adverse impacts on fish species and in-channel vegetation. The River Lugg is an important habitat for otters and works have the potential to cause disturbance or cause damage to holts or resting sites. Works will also impact on Lower House Farm HNTR and Lugg Meadows SWS as the boundary of these sites borders the A438 where the proposed EL9 intersects with the A438. There are also records of Schedule 1 birds in the vicinity of the route within Lower House Farm HNTR.

5.5.6.14 The northern section of this link crosses the proposed Lugg and Hampton Meadows SSSI. This will result in loss of lowland hay meadow habitat, which is a primary feature for the designation of the SSSI. As the link lies within floodplain, the new road would have to be carried on embankments to prevent flooding of the road. The subsoils underlying the route through the SSSI are soft alluvial silts over sands and gravels. The alluvial silts would be subject to compression under the embankments to support the road, and this has potential to change the hydrology in the vicinity of the proposed route. As mentioned before, Natural England have indicated that the River Lugg, River Wye and Lugg Meadows have complex hydrological relationships and any changes in hydrology are likely to have impacts on all these sites. Changes in hydrology can impact on floral species composition and this can lead to a change in the species composition of the remaining lowland meadow. The introduction of a road across the site would also lead to severance of the remaining lowland habitat.

5.5.6.15 Lowland hay meadows are sensitive to nitrogen deposition and there is potential for localised changes in species composition along the EL9 alignment close to the road due to small increases in nitrogen. The proposed SSSI is currently in a favourable condition but changes in species composition would be a contributory factor to any decline of favourable condition or change to unfavourable condition.

5.5.6.16 Lowland hay meadows are also a Herefordshire LBAP habitat and a target in the LBAP is to 'maintain the known extent of lowland meadows in Herefordshire by preventing any loss of known habitat'. The construction of EL9 is contrary to the aims of the LBAP as it would result in the loss of this habitat. The National Planning Policy Framework also stresses that development in SSSIs that would damage their features for designation should not be permitted.

5.5.6.17 The earthworks associated with road construction have potential to result in sediments and pollutants being washed into the River Lugg, and hence downstream into the River Wye. The features for which the River Wye SAC are designated are all vulnerable to impacts from sediment and pollution runoff. Increased silt in the river channel can cause localised enrichment of nutrients which can favour the growth of benthic algae, inhibiting the growth of channel vegetation. Silt deposition can also smother the substrate required for spawning fish species, reducing egg survival and reproductive success. Pollution can cause a reduction in water quality and many of the species for which the Wye is designated, particularly salmon and white-clawed crayfish, require good water quality. A serious pollution incident has potential to result in large scale mortality of fish species, and this can have a knock on effect on wildlife dependant on the fish such as otter.

5.5.6.18 The proposed link crosses the Lugg Rhea tributary of the River Lugg and it is proposed to provide a bridge over the tributary. Associated impacts include the potential to result in pollution of the watercourse and further downstream from sediments and fuels.

5.5.6.19 The southern section of this route will result in the loss of arable farmland and orchard. The route will sever the agricultural habitat and result in the loss of boundary hedgerows. The orchard habitat will also be effectively severed. Both orchard and cereal field margins are LBAP habitats within Hereford, and the route will have adverse impacts on these habitats.

Eastern Link 10

5.5.6.20 This link has a slightly more easterly alignment than EL9 but will have the same impacts as it cuts across the proposed Lugg and Hampton Meadows SSSI and a bridge over the Lugg Rhea tributary. This link will also impact on Lower House Farm HNTR and Lugg Meadows SWS.

Eastern Link 11

5.5.6.21 This link is the most easterly of the proposed links and intersects with the A438 near Lugwardine Bridge, which carries the A438 over the River Lugg. Construction works for the roundabout or signalised junction have potential to impact directly on the River Lugg and it is possible that works may have to be undertaken on Lugwardine Bridge to allow the structure to cope with increased traffic flows along the A438 should the Eastern Links be progressed. This increases the risk of sediments and pollutants being washed into the River Lugg, adversely impacting on in-channel vegetation and fish habitat.

5.5.6.22 There are records of otters along the River Lugg at Lugwardine Bridge. Construction works have potential to result in disturbance to otters as they commute and forage along the Lugg. The banks of the River Lugg in the vicinity of the bridge have extensive tree cover and there is potential for holts or resting sites to be located along the banks. There is potential for works to result in loss of or damage to these sites.

5.5.6.23 This link also runs adjacent to Lugg Meadows HNTR and has potential to adversely impact on the integrity of the site.

5.5.6.24 This link will have the same impacts as EL9 and EL10 with respect to the proposed Lugg and Hampton Meadows SSSI as it cuts through the designated site and will involve a crossing over the Lugg Rhea tributary.

Eastern Link 12

5.5.6.25 This link will involve the provision of a bridge crossing over the River Wye. Where the route crosses the River Wye, there is suitable habitat for otter holts and nesting birds. The construction of the bridge has potential to result in increased sediment loading into the River Wye which will have adverse impacts on fish spawning habitat. Works can also impact on otters through disturbance.

5.5.6.26 This link will have similar impacts to EL3 and will result in the loss of agricultural land, boundary hedgerows and some mature trees in Rotherwas Industrial Estate.

5.5.7. Summary of Impacts

5.5.7.1 All the Eastern Links have potential to adversely affect River Lugg SSSI, proposed Lugg and Hampton Meadows SSSI and River Wye SAC (River Lugg is part of this designation). Impacts include loss of habitat, pollution of watercourses, changes to hydrological relationships between the designated sites and disturbance to protected species.

5.5.7.2 A Habitats Regulations Assessment Screening Report for the Hereford Relief Road (Hyder Consulting, 2011) compared the impacts on the River Wye SAC from the western and eastern corridor options. The screening matrix concluded that there is much greater potential for the eastern route corridor options to have significant adverse effects on the integrity of the SAC relative to the western corridor options. It also concludes that *'Sufficient Uncertainty remains as to the potential for significant impacts on the qualifying features and conservation objectives of the River Wye SAC'*, and *'that there is much greater potential for the eastern route corridor options to have significant adverse effects on the integrity of the SAC relative to the western route corridor options'*.

5.5.7.3 The inner Eastern Links would not involve direct landtake from the Lugg and Meadows SSSI and is preferred over the outer Eastern Links.

5.5.8. Conclusions

5.5.8.1 The provision of an Eastern Link road would have significant adverse impacts on the designated features of River Wye SAC, River Lugg SSSI and the proposed Lugg and Hampton Meadows SSSI. The inner Eastern Links would have less of an impact on the designated sites and are preferred over the outer links.

5.6. The Heritage of Historic Resources

5.6.1. Introduction

5.6.1.1 This report includes an overview of the following areas: known and suspected heritage sites and features potentially affected by the Eastern links EL2-3, 9-12, the archaeological potential of those Eastern links and the effects of those options on the wider historic landscape.

5.6.1.2 The Study has taken account of the various relevant statutory documents and guidelines, such as:

- Design Manual for Roads and Bridges, vol.11
- Planning Policy Statement 5: Planning for the Historic Environment
- The Herefordshire Unitary Development Plan

5.6.2. Historic Sites and Landscapes

5.6.2.1 In reviewing archaeological sites within the Study Area, it is important to note that the passage of time has ensured that often only fragmentary evidence survives for human settlement, economic activity and ritual practice. None the less, continuity can be seen from earliest times, reflecting phases of occupation and land use over a period of 6,000 years or more.

5.6.2.2 Whilst many of the archaeological sites referred to in this report have visible above-ground elements, some have left barely discernible traces, and it is possible that the remains of other, previously unknown sites wait to be revealed below the ground surface. These are usually discovered only after development commences and can be investigated, recorded and interpreted only through careful archaeological excavation.

5.6.3. NATIONAL LEGISLATION AND GUIDELINES

5.6.3.1 Legislative frameworks provide protection to the historic environment while planning policy guidance provides advice concerning how the historic environment should be addressed within the planning process.

5.6.3.2 Statutory protection for archaeology is principally enshrined in the *Ancient Monuments and Archaeological Areas Act (1979)* amended by the *National Heritage Act (1983)* and *National Heritage Act (2002)*. Nationally important archaeological sites are listed in a Schedule of Monuments and are accorded statutory protection. The city of Hereford is one of only five cities in England in which an Area of Archaeological Importance has been designated under the terms of the 1979 Act.

5.6.3.3 For other components of the historic environment, the *Planning (Listed Buildings and Conservation Areas) Act (1990)* and the *Town and County Planning Act (1971)* provide statutory protection to listed buildings and their settings and present measures to designate and preserve the character and appearance of Conservation Areas.

5.6.3.4 In 1990, *Planning Policy Guidance 16: Archaeology and Planning* (PPG16) was issued to incorporate protection of archaeological resources into the planning process. The 1991 Government White paper, *This Common Inheritance*, tasked English Heritage with developing a register of historic landscapes. The following year the Historic Landscape Project proposed a methodology for assessing landscape character and identified the need for a broad, integrated and holistic approach to landscape issues.

5.6.3.5 In 1994, an appreciation of the significance of the historic landscape was also incorporated into the planning process through *Planning Policy Guidance 15: Planning and the Historic Environment* (PPG15), which were combined with PPG16 to create *Planning Policy Statement 5: Planning for the Historic Environment in 2010*. It is in keeping with the European Landscape Convention (Florence Convention) 2000 which came into force in 2007.

5.6.3.6 *The Hedgerow Regulations (1997)* includes guidelines that aim to protect hedgerows that have been assessed as important in terms of criteria that incorporate historical components. One of the criteria relates to the documented date of a hedgerow. A hedgerow can be deemed 'important' if it can be shown to be of pre-enclosure date, which for the purposes of the Regulations is currently taken (by case law precedent) to mean prior to 1845 when the earliest Act of Enclosure was recorded in the *Small Titles Act (1896).*

5.6.3.7 Proposed amendments to the *Hedgerow Regulations* (DEFRA 2003) states that:

> …hedgerows should be regarded as important if they mark a boundary of pre-1850 historic administrative unit (parish, township, hundred, wapentake, cantref or maerdref) or pre-1600 manorial estate, ecclesiastical estate, or the outer limits of a field system, park, wood or common land'. These amendments, however, have not been agreed as statute law.

5.6.3.8 *Planning Policy Statement 5: Planning for the Historic Environment* (PPS5; March 2010) provides advice concerning the safeguarding of the historic environment within the planning process. It states that those parts of the historic environment that have significance because of their historic, archaeological, architectural or artistic interest should be called heritage assets, and goes on to recognise that heritage assets are a non-renewable resource.

5.6.3.9 Policy HE6.1 of PPS5 directs local planning authorities to:

> …require applicants to provide a description of the significance of the heritage assets affected and the contribution of their setting to that significance……Where an application site includes, or is considered to have the potential to include, heritage assets with archaeological interest, local planning authorities should require developers to submit an appropriate desk-based assessment and, where desk-based research is insufficient to properly assess the interest, a field evaluation.

5.6.3.10 *The National Planning Policy Framework* (NPPF) sets out the Government's planning policies for England and how these are expected to be applied; it also provides a framework within which local people and their accountable councils can produce their own distinctive local and neighbourhood plans, reflecting the needs and priorities of their communities. It states:

> 128. In determining applications, local planning authorities should require an applicant to describe the significance of any heritage assets affected, including any contribution made by their setting. The level of detail should be proportionate to the assets' importance and no more than is sufficient to understand the potential impact of the proposal on their significance. As a minimum the relevant historic environment record should have been consulted and the heritage assets assessed using appropriate expertise where necessary. Where a site on which development is proposed includes or has the potential to include heritage assets with archaeological interest, local planning authorities should require developers to submit an appropriate desk-based assessment and, where necessary, a field evaluation.
>
> 129. Local planning authorities should identify and assess the particular significance of any heritage asset that may be affected by a proposal (including by development affecting the setting of a heritage asset) taking account of the available evidence and any necessary expertise. They should take this assessment into account when considering the impact of a proposal on a heritage asset, to avoid or minimise conflict between the heritage asset's conservation and any aspect of the proposal.

5.6.3.11 In the Setting of Heritage Assets, English Heritage recommends the following steps to assess the impacts of proposed developments on cultural heritage resources:

- Step 1: identify which heritage assets and their settings are affected;
- Step 2: assess whether, how and to what degree these settings make a contribution to the significance of the heritage asset(s);
- Step 3: assess the effects of the proposed development, whether beneficial or harmful, on that significance;

- Step 4: explore the way maximising enhancement and avoiding or minimising harm;
- Step 5: make and document the decision and monitor outcomes.

5.6.4. LOCAL PLANNING POLICY

5.6.4.1 The NPPF also states:

> 126. Local planning authorities should set out in their Local Plan a positive strategy for the conservation and enjoyment of the historic environment, including heritage assets most at risk through neglect, decay or other threats. In doing so, they should recognise that heritage assets are an irreplaceable resource and conserve them in a manner appropriate to their significance. In developing this strategy, local planning authorities should take into account:
>
> - the desirability of sustaining and enhancing the significance of heritage assets and putting them to viable uses consistent with their conservation;
> - the wider social, cultural, economic and environmental benefits that conservation of the historic environment can bring;
> - the desirability of new development making a positive contribution to local character and distinctiveness; and
> - opportunities to draw on the contribution made by the historic environment to the character of a place.

5.6.4.2 The following policies are laid out in the Herefordshire Unitary Development Plan, which was adopted in March 2007:

> ***LA2 Landscape character and areas least resilient to change***
> Proposals for new development that would adversely affect either the overall character of the landscape, as defined by the Landscape Character Assessment and the Historic Landscape Characterisation or its key attributes or features, will not be permitted.
>
> Proposals should demonstrate that landscape character has influenced their design, scale, nature and site selection. Where appropriate, developers will be encouraged to restore degraded or despoiled landscapes to their inherent character.

LA4 Protection of historic parks and gardens
Development which would destroy, damage or otherwise adversely affect the historic structure, character, appearance, features or setting (including the designed visual envelope) of a registered park or garden will not be permitted.

Development proposals that would affect an historic park or garden should be accompanied by an historic landscape appraisal report and a restoration scheme, which may include or comprise a management plan, commensurate to the scale of the proposal that affects them.

Unregistered parks and gardens recognised and identified by the Council as currently of local importance will be afforded similar protection.

HBA4 Setting of listed buildings
Development proposals which would adversely affect the setting of a listed building will not be permitted. The impact of the proposal will be judged in terms of scale, massing, location, detailed design and the effects of its uses and operations.

HBA8 Locally important buildings
Development proposals which would adversely affect the appearance or setting of locally important buildings of architectural or historic interest, or buildings that make a valuable contribution to the character and appearance of the area, will not be permitted.

ARCH1 Archaeological assessments and field evaluations
Prior to the determination of applications for development on sites where there is reason to believe there are remains of archaeological importance, an archaeological field evaluation may be required. In addition where proposals are put forward within Archaeologically Important Urban Areas that may affect the integrity of the historic character of such settlements a historic landscape appraisal will be expected.

ARCH3 Scheduled Ancient Monuments
Development proposals and works which may adversely affect the integrity, character or setting of Scheduled Ancient Monuments will not be permitted.

ARCH4 Other Sites of National or Regional Importance
Planning permission for development which would destroy or seriously damage unscheduled, nationally important remains or sites of regional importance, or their character or setting, will not be permitted.

ARCH5 Sites of Lesser Regional or Local Importance
Development proposals which adversely affect a site of lesser regional or local importance that is unlikely to merit full preservation in situ will be permitted where the impact on the archaeological interest of the site can be shown to have been adequately mitigated.

Recording of archaeological remains
Where preservation in situ is not feasible, conditions on planning permissions will be imposed to ensure that, where appropriate, sites of archaeological interest including standing structures are excavated and/or recorded before alteration, demolition, site clearance or development commences, or are alternatively subject to a limited recording action project during development. The results of any recording project or excavation should be made available to the public.

ARCH8 Enhancement and improved access to archaeological sites
Proposals affecting sites of archaeological interest will be required to show how the interest will be protected and where feasible, can be enhanced. Favourable consideration will be given to development schemes which emphasise the original form and function of the sites and where appropriate improve public access to them. Such measures will be secured by use of conditions, planning agreements and management plans.

5.6.4.3 Herefordshire Council's Archaeology & Development Supplementary Planning Document (2010) states:

> 1.3 …it is not always possible to indicate where important archaeological deposits or features may be encountered. Consequently a heavy emphasis has to be placed upon investigating whether any archaeological remains (above or below ground) might be present when development is proposed. The pre-application stage is often crucial to determining whether both the principle and detail of any proposal will be acceptable.

5.6.5. HERITAGE RESOURCES IN THE STUDY AREA

Introduction

5.6.5.1 The Study Area for heritage resources on this Scheme is a corridor measuring 2km to each side of the Eastern Corridor links EL2-3, 9-12, to provide a dataset to facilitate the analysis of the historic landscape (i.e. the types, ages, locations and numbers of individual sites) in an attempt to identify those known sites which could be directly or indirectly impacted by the Eastern Scheme, and to anticipate the potential presence of unknown sites along each of those links.

5.6.5.2 From this information, a picture of the overall historic landscape can be generated and the wider impacts of the Eastern links upon the historic landscape considered. To further assess the potential impacts of the scheme route options upon the historic landscape, the Study Area for Scheduled Ancient Monuments has been extended to 4km.

5.6.5.3 The heritage resources are presented in cartographic form (see Figures 38-41),

5.6.5.4 There are a number of possible variations on the Eastern Corridor; this report will discuss the assessed impacts on the heritage receptors for each of the corridors (Eastern Inner and Outer), including Scheduled Ancient Monuments (SAMs), other archaeological sites, Listed Buildings, Conservation Areas, and Historic Landscape Characterisation areas. There are no Historic Parks and Gardens in the Study Area.

Baseline Data

5.6.5.5 The primary data source was supplied by Herefordshire County Archaeological Services, supplemented by the on-line Herefordshire Sites and Monuments Record (HSMR) and English Heritage's on-line National Heritage Lists, as available in September 2011.

5.6.5.6 The study area for each of the corridor options was defined as being the corridor and land immediately adjacent. Each corridor is itself a buffer zone established around a number of actual road options. Data relating to designated heritage assets of High value (e.g. Scheduled Monuments, Grade I and II* listed buildings) was obtained for a greater area around each corridor if it was considered that significant effects on the settings of such assets could result from the proposed link.

5.6.5.7 Within the defined study areas the following additional data were obtained:

- World Heritage Sites, Registered Parks and Gardens of Special Historic Interest, Registered Battlefields and Scheduled Monuments – locational information was retrieved from the Multi-Agency Geographic Information for the Countryside (MAGIC) website.
- Scheduled Monuments – the detailed descriptions of all relevant Scheduled Monuments was obtained from the National Monuments Record;
- Listed Buildings – the full short listing information for all relevant listed buildings was obtained from English Heritage's Images of England database;
- Conservation Areas – location plans for each of the relevant Conservation Areas was obtained from the Herefordshire County Council website;
- Historic Landscape Characterisation (HLC) – information was provided by Herefordshire County Council, including the appendices that describe the numbers of each area type within the county and the total percentage of the county covered by those areas;

- Sites and Monuments Record - the Herefordshire Sites and Monuments Record (HSMR) provided an up to date GIS plot of data so that and entries subsequent to the Stage 1 data search could be added and assessed; and
- Unpublished information – a number of unpublished documents relating to previous archaeological and historical studies were examined.

5.6.6. Consultations

5.6.6.1 Consultations were conducted with archaeologists from English Heritage and Hereford Council Archaeological Services. Feedback and discussions with officials from those bodies have been included in the report.

5.6.7. Limitations and Assumptions

5.6.7.1 With regard to the potential effects of the scheme on the settings of designated heritage assets of High Value located beyond the defined study areas, this will need to be assessed during the walkover survey.

5.6.7.2 With regard to listed buildings, it is assumed that the grades and descriptions recorded on English Heritage's Images of England database are correct.

5.6.7.3 With regard to the information on buried archaeological remains, the available information is skewed as it is primarily the result of previous investigations targeted at specific sites and linear corridors. The resulting distribution, extent and nature of known archaeological remains cannot be taken as a direct and accurate representation of the location and / or total amount of buried archaeological remains within any of the route corridors. Further archaeological sites are likely to be identified as a result of further data collection and fieldwork.

5.6.7.4 Examination of the data acquired for the Study of Options Stage indicated that there are no World Heritage Sites, Registered Parks and Gardens of Special Historic Interest or Registered Battlefields within or directly adjacent to any of the route corridors.

5.6.8. GENERAL METHODOLOGY

Introduction

5.6.8.1 The methodology for the assessment of potential impacts on the known and potential cultural heritage assets has been to collate all available information for the six corridors in order to examine the extent of the potential effects of each option. The importance of each identified asset has been assessed and the degree of impact upon them has been considered using recognised methodologies where such exist. An assessment of resources has been prepared for each scheme option showing the known and potential cultural heritage assets and the effects upon them.

Importance of the Assets

5.6.8.2 The methodologies that have been used for assessing the importance of cultural heritage assets, and hence the scale of potential impacts on these assets that may result from the implementation of each of the scheme options, are based on the procedures set out in the Design Manual for Roads and Bridges, Volume 11, Environmental Assessment (DMRB, DoT, June 1993, as updated) and Guidance on the New Approach to Appraisal (NATA, DETR, July 1998).

5.6.8.3 For cultural heritage assets, the DMRB Vol. 11 (Section 3, Part 2, HA 208/07 Table 5.1) identifies six levels of value shown in Table B8.1:

Archaeological Remains

5.6.8.4 There are no national government guidelines for evaluating the importance or significance (and hence the 'value') of all types of heritage asset. For archaeological remains, English Heritage has proposed a series of recommended (i.e. non-statutory) criteria for use in the determination of national importance when scheduling ancient monuments and these are expressed in Scheduled Monuments - Identifying, protecting, conserving and investigating nationally important archaeological sites under the Ancient Monuments and Archaeological Areas Act 1979 (DCMS March 2010). The criteria include period, rarity, documentation, group value, survival / condition, fragility / vulnerability, diversity and potential, and can be used as a basis for the assessment of the importance of historic remains and archaeological sites. The document also states that:

> …these criteria should not be regarded as definitive… rather they are indicators which contribute to a wider judgement based on the individual circumstances of a case.

5.6.8.5 The criteria described above could be used as a basis for the assessment of the importance of archaeological remains of less than national significance; however, the categories of regional and district / local importance are less clearly established than that of national, and implicitly relate to local, district and regional priorities which themselves will be varied within and between regions. Local, district and regional research agenda may be available and local or structure plans may also help.

5.6.8.6 Clearly a high degree of professional judgement is necessary, guided by acknowledged standards, designations and priorities. It is also important to understand that buried archaeological remains may not be well-understood at the time of assessment, and can therefore be of uncertain value.

Historic Buildings

5.6.8.7 For historic buildings assessment of importance is usually based on the designations used in the Listed Building process. Where historic buildings are not listed, or where the listing grade may be in need of updating, professional judgement will be required.

5.6.8.8 The criteria used in establishing the value of historic buildings within the listing procedure are set out in *Principles of Selection for Listing Buildings*, which are applied by the Secretary of State when deciding whether a building is of special architectural or historic interest and should be added to the list of buildings compiled under the *Planning (Listed Buildings and Conservation Areas) Act 1990* (DCMS March 2010). They include architectural interest, historic interest, close historic association (with nationally important people or events), and group value. Age and rarity are also taken into account; in general (where surviving in original or near-original condition) all buildings of pre-1700 date are listed, most of 1700-1840 date are listed, those of 1840-1914 date are more selectively listed, and thereafter even more selectively. Specific criteria have been developed for 20th-century buildings.

5.6.8.9 At a local level, buildings may be valued for their association with local events and people or for their role in the community. Guidance Note 208/07 provides the following table (table 44) as a guide for evaluating the value of historic buildings:

Historic Landscapes

5.6.8.10 The sub-topic of Historic Landscape is recognised as having significant overlaps with other topics such as Landscape and Townscape, and a multi-disciplinary approach to assessment is required. This is partially to avoid double-counting, and also to avoid duplication of effort. There are also significant overlaps with the other Cultural Heritage sub-topics, i.e. Archaeological Remains and Historic Buildings. The elements that are considered within those two sub-topics can make significant contributions to the historic landscape, and this latter subtopic should concentrate on the overall historic landscape character and its value rather than the individual elements within it.

5.6.8.11 All landscapes have some level of historic significance, as all of the present appearance of the urban and rural parts of England is the result of human or human-influenced activities overlain on the physical parameters of climate, geography and geology.

5.6.8.12 There are number of designations that can apply to historic landscapes, including World Heritage Sites (inscribed for their historic landscape value), Registered Parks and Gardens of Special Historic Interest, Registered Historic Battlefields, and Conservation Areas. Some local plans include locally designated Historic Landscape Areas, and Historic Parks and Gardens (or similar).

5.6.8.13 A model has been produced by the Council for British Archaeology whereby the historic landscape can be divided up into units that are scaled, from smallest to largest, as follows:

Elements - individual features such as earthworks, structures, hedges, woods etc

Parcels - elements combined to produce, for example farmsteads or fields

Components - larger agglomerations of parcels, such as dispersed settlements or straight-sided field systems

Types - distinctive and repeated combinations of components defining generic historic landscapes such as ancient woodlands or parliamentary enclosure

Zones - characteristic combinations of types, such as Anciently Enclosed Land or Moorland and Rough Grazing

Sub-regions - distinguished on the basis of their unique combination of interrelated components, types and zones

Regions - areas sharing an overall consistency over large geographical tracts

5.6.8.14 The model described above can be used as the principal part of the overall assessment usually known as Historic Landscape Characterisation (HLC). However, although HLC has been undertaken for much of England, there is no significant guidance or advice regarding the attribution of significance or value to identified historic landscape units.

5.6.8.15 Guidance Note 208/07 provides the following table (Table 44) as a guide for evaluating the value of historic landscape units:

5.6.8.16 None of the links and corridor options considered in this report would impact on any World Heritage Sites, parks and gardens registered on English Heritage's Register of Parks and Gardens of Special Historic Interest, or battlefields registered on English Heritage's Register of Historic Battlefields.

5.6.8.17 There is no national historic landscape designation in England, and no formal government policy advice available to assist in assessing the importance of historic landscapes. Additional guidance specifically regarding the potential effects of highway design on the historic landscape is provided in *Assessing the Effect of Road Schemes on Historic Landscape Character* (Highways Agency 2007). This document was prepared as supplementary guidance to support the approach set out in the revised DMRB Guidance Note 208/07 on cultural heritage.

5.6.8.18 General methodologies have been developed for characterising historic landscapes and Herefordshire has been fully surveyed as part of the national Historic Landscape Characterisation (HLC) project.

5.6.8.19 The Herefordshire Unitary Development Plan (adopted March 2007) identifies historic parks and gardens that are not included on English Heritage's Register of Parks and Gardens of Special Historic Interest as 'Unregistered Parks and Gardens'.

Table 43: Importance / Value of Assets

	Archaeological Remains	Historic Buildings	Historic Landscapes
Very High	- World Heritage Sites - Assets of acknowledged international importance - Assets that can contribute significantly to acknowledged international research objectives	- Standing buildings inscribed as of universal importance as World Heritage Sites - Other buildings of recognised international importance	- World Heritage Sites inscribed for their historic landscape qualities - Historic landscape of international sensitivity, whether designated or not - Extremely well-preserved historic landscapes with exceptional coherence, time-depth, or other critical factor(s)
High	- Scheduled Monuments - Undesignated assets of schedulable quality and importance - Assets that can contribute significantly to acknowledged national research objectives	- Scheduled Monuments with standing remains - Grade I and II* Listed buildings - Other listed buildings that can be shown to have exceptional qualities in their fabric or historical association not adequately reflected in the listing grade - Conservation Areas containing very important buildings - Undesignated structures of clear national importance	- Designated historic landscapes of outstanding interest - Undesignated landscapes of outstanding interest - Undesignated landscapes of high quality and importance, and of demonstrable national sensitivity - Well-preserved historic landscapes exhibiting exceptional coherence, time-depth, or other critical factor(s)

Medium	- Designated or undesignated assets that contribute to regional research objectives	- Grade II Listed Buildings - Historic (unlisted) buildings that can be shown to have exceptional qualities in their fabric or historical association - Conservation Areas containing important buildings - Historic Townscape or built-up areas with historic integrity in their buildings, or built settings (e.g. including street furniture and other structures)	- Designated special historic landscapes - Undesignated historic landscapes that would justify special historic landscape designation, landscapes of regional sensitivity - Averagely well-preserved historic landscapes with reasonable coherence, time-depth, or other critical factor(s)
Low	- Undesignated assets of local importance - Assets compromised by poor preservation and/or poor survival of contextual associations - Assets of limited value, but with potential to contribute to local research objectives	- 'Locally listed' buildings - Historic (unlisted) buildings of modest quality in their fabric or historical association - Historic Townscape or built-up areas of limited historic integrity in their buildings, or built settings (e.g. including street furniture and other structures)	- Robust undesignated historic landscapes - Historic landscapes with specific and substantial importance to local interest groups, but with limited sensitivity - Historic landscapes whose sensitivity is limited by poor preservation and/or poor survival of contextual associations
Negligible	- Assets with very little or no surviving archaeological interest	- Buildings of no architectural or historic note; buildings of an intrusive character	- Landscapes with little or no significant historical interest
Unknown	- The importance of the resource cannot be ascertained	- Buildings with some hidden (i.e. inaccessible) potential for historic significance	- World Heritage Sites inscribed for their historic landscape qualities - Historic landscape of international sensitivity, whether designated or not - Extremely well-preserved historic landscapes with exceptional coherence, time-depth, or other critical factor(s)

5.6.9. Assessment of Magnitude of Impacts

5.6.9.1 The methodologies that have been used for assessing the magnitude of impacts on cultural heritage assets are based on the procedures set out in the Design Manual for Roads and Bridges, Volume 11, Environmental Assessment (DMRB, DoT, June 1993, as updated HA208/07). They range from comprehensive changes to the key elements or settings of an asset to no changes to either elements or settings (see Table 45)

Archaeological Remains

5.6.9.2 The magnitude of impact is assessed without regard to the value of the heritage asset. In terms of the judgement of the magnitude of impact, this is based on the principle (established in PPS5) that preservation of the asset and its setting is preferred, and that total physical loss of the asset and/or comprehensive changes to its setting is the least preferred.

5.6.9.3 It is not always possible to assess the physical impact in terms of percentage loss, and therefore it can be important in such cases to try to assess the capacity of the heritage asset to retain its character following any impact.

Historic Buildings

5.6.9.4 The magnitude of impact is assessed without regard to the value of the asset, so the total destruction of an insignificant building has the same degree of impact magnitude as the total loss of a high value building. In terms of the judgement of the magnitude of impact, this is based on the principle that preservation of the asset and its setting is preferred, and that total physical loss of the asset and/or total change to its setting is the least preferred.

5.6.9.5 Impacts on the setting of historic buildings may include vibration, noise and lighting issues as well as visual impacts, and may be reversible.

Historic Landscapes

5.6.9.6 Historic landscapes cannot be destroyed or damaged but impacts on them can change their character. Impacts should be assessed using evaluated historic landscape character units, not the elements/parcels/components that contribute towards the character (see above). There may be impacts on the setting of identified units, especially with regard to designated historic landscapes.

5.6.9.7 The DMRB states that:

> 2.6 Historic Landscapes are defined by perceptions that emphasise the evidence of the past and its significance in shaping the present landscape. The definition encompasses all landscapes, including the countryside, townscapes and industrial landscapes as well as designed landscapes, such as gardens and parks."

5.6.9.8 The relevant characterised and delimited HLC areas and their descriptions are depicted in 42.

5.6.9.9 Those characterisations expressed in the HLC, however, concentrate on current and relatively recent land use, described in general terms, e.g. 'Former Common Arable Fields', 'Urbanisation', 'Early Meadow Enclosure'. They do not identify the visible evidence of medieval agricultural practices such as ridge-and-furrow, concentrations of features and artefact discoveries, Listed Building clusters, etc. which have been outlined in the sections above.

Table 44: Magnitude of Impacts			
	Archaeological Remains	**Historic Buildings**	**Historic Landscapes**
Major	Change to most or all key archaeological elements, such that the asset is totally altered Comprehensive changes to setting	Change to key historic building elements, such that the asset is totally altered. Total change to the setting	Change to most or all key historic landscape elements, parcels or components; extreme visual effects; gross change of noise or change to sound quality; fundamental changes to use or access; resulting in total change to historic landscape character unit.
Moderate	Changes to many key archaeological elements, such that the asset is clearly modified. Considerable changes to setting	Change to many key historic building elements, such that the asset is significantly modified. Changes to the setting of an historic building, such that it is significantly modified	Changes to many key historic landscape elements, parcels or components; visual change to many key aspects of the historic landscape; noticeable differences in noise or sound quality; considerable changes to use or access; resulting in moderate changes to historic landscape character.
Minor	Changes to key archaeological elements, such that the asset is slightly altered. Slight changes to setting	Changes to key historic building elements, such that the asset is slightly different. Change to setting of an historic building, such that it is noticeably changed.	Changes to few key historic landscape elements, parcels or components; slight visual changes to few key aspects of historic landscape; limited changes to noise levels or sound quality; slight changes to use or access; resulting in limited changes to historic landscape character.
Negligible	Very minor changes to elements or setting.	Slight changes to historic buildings elements or setting that hardly affect it	Very minor changes to key historic landscape elements, parcels or components; virtually unchanged visual effects; very slight changes in noise levels or sound quality; very slight changes to use or access; resulting in a very small change to historic landscape character
None	No change	No change to fabric or setting	No change to elements, parcels or components; no visual or audible changes; no changes arising from amenity or community factors

5.6.10. Significance of Impacts

5.6.10.1 The potential impact of the proposed development would be assessed by comparing the land-take needed for the development against the location and importance of the known heritage resources. The grading of the value of sites is based on the criteria of quality and rarity of the remains and on their legal protection, though this is often subjective and, therefore, potentially problematic. The magnitude of impact of the scheme on the known heritage resources has been graded depending upon the degree of destruction to the known, suspected or potential remains.

5.6.10.2 The significance of the impact of the scheme on the known, suspected or potential heritage resources depends upon the degree of destruction to and the importance of the resources, as set out in Table 45 (based on the DMRB).

5.6.10.3 It should also be borne in mind that, where the nature or even existence of a site within the development area is unknown, the magnitude of impact will be uncertain. This cannot be represented graphically but needs to be taken into consideration, especially during ground clearance.

Table 45: Significance of Impacts

V	**Very High**	**Very large**	**Very Large / Large**	Large / Moderate	Slight	Neutral
A	**High**	**Very Large / Large**	Large / Moderate	Moderate / Slight	Slight	Neutral
L	**Medium**	Large / Moderate	Moderate / Slight	Slight	Slight / Neutral	Neutral
U	**Low**	Moderate / Slight	Slight	Slight / Neutral	Slight / Neutral	Neutral
E	**Negligible**	Slight	Slight / Neutral	Slight / Neutral	Neutral	Neutral
		Major	**Moderate**	**Minor**	**Negligible**	**None**
		MAGNITUDE OF IMPACT				

5.6.11. GENERAL COMMENTS

Scheduled Ancient Monuments

5.6.11.1 There are 14 Scheduled Ancient Monuments (SAMs) within an extended Study Area of 4km from the Eastern route options, detailed in Table 46 and depicted in Figure 38. The potential indirect impacts on the settings of these monuments, i.e. the views to and from the monuments, all of which are of **High** heritage value, have been assessed.

5.6.11.2 Prior to site visits, estimations of the conditions of monuments and intervening landscapes between them and the proposed road corridors have been gleaned from OS maps and Google Maps.

5.6.11.3 Five of the SAMs within the extended study area (1005357, 1016124-5, 1016344-5) are crosses within church grounds adjacent to roads, none of which are within 1km of the proposed Eastern Corridor and would have little, if any, potential view of any of the relevant road options. Therefore, they would have a **negligible impact** upon those monuments.

5.6.11.4 Three of the SAMs (1005320, 1005323-4) are the sites of deserted medieval villages (DMVs) with no substantive upstanding elements, and none is within 1km of any of the relevant Eastern links. Therefore, they would have a **negligible impact** upon those monuments.

5.6.11.5 A Scheduled standing stone called the Wergin's Stone (1005346) lies 2km north of the Eastern Corridor. Lying closer to the Northern Corridor and separated from all routes options by railway lines, the relevant Eastern links would have **no impact** upon the monument or its setting.

5.6.11.6 The Scheduled hillfort at Dinedor (HE12) is 1.5km from the south end of the Eastern Corridor and half that distance from the new Rotherwas Road. Therefore, the Eastern route options would have a **negligible impact** upon the monument or its setting.

5.6.11.7 The Scheduled Mortiford Bridge (HE31) is sited almost 3km from the closest approach of the Eastern link E12, separated from it by the village of Hampton Bishop. As such, the Eastern links would have **no impact** upon the structure or its setting.

5.6.11.8 The Scheduled manor house, Freen's Court, and its grounds (13693) lie almost 4km to the north of the Eastern Corridor, separated from it by railway lines and woodlands flanking the River Lugg. As such, the relevant Eastern links would have **no impact** upon the structure or its setting.

5.6.11.9 Considering the lack of any discernible impact upon those SAMs, consideration of the impacts will be restricted to those designated monuments which may suffer impacts from any of the relevant Eastern links.

Table 46: Scheduled Ancient Monuments within 4km of Eastern Corridor

Nat. Her. List No.	SAM No.	HSMR No.	Description	Name of Site/Location
1005320	HE 219	1002	Deserted Medieval Village	Lower Bullingham
1005323	HE 223	1026	Deserted Medieval Village	Sutton St Michael
1005324	HE 224	1001	Deserted Medieval Village	Dinedor
1005346	HE 186	929	Standing Stone	The Wergins Stone
1005348	HE 190	226	BA Cropmark Complex	Tupsley
1005357	HE 130	7221	Churchyard Cross	Bullingham Old Church
1001758	HE 12	1278	Hillfort	Dinedor Camp
1001770	HE 31	915	Bridge	Mordiford Bridge
1001771	HE 32	914	Bridge	Lugg Bridge
1010392	13693	314	Manor House	Freen's Court
1014883	27523	926	Moat	Old Court Farm
1014880	27543	547/548	House, Chapel	Rotherwas
1016124	29845	6490	Churchyard Cross	St Andrew's Church
1016125	29846	6492	Churchyard Cross	Holy Rood Church
1016344	29883	6508	Churchyard Cross	St Peter's Church
1016345	29884	6507	Churchyard Cross	St Bartholomew's Church

5.6.12. Undesignated Cultural Heritage Features

5.6.12.1 Sites have been graphically distinguished to reflect very general archaeological periods (Prehistoric, Roman, Medieval and Post-medieval), and to identify those sites which make a visible contribution to the landscape (e.g. upstanding monuments) and those which do not (e.g. findspots). This is not to say that those without visible traces are less worthy of consideration, but is merely an attempt to quantify the visual elements of the historic landscape.

5.6.12.2 Certain entries have been excluded from consideration, on the grounds that they can offer no insight into the character of the historic landscape. They consist of:

- natural features;
- duplicate and revoked records; and
- investigated sites which produced no relevant material.

5.6.12.3 It must be stressed that the lack of significant information forthcoming from an investigation does not mean that there is nothing of archaeological or historic value in that area, but merely that to date none had been forthcoming, i.e. 'absence of evidence is not evidence of absence'.

5.6.12.4 The remaining sites range in age from Palaeolithic artefacts to 20th century military defences, and in scale from finds of single coins to occupation complexes.

5.6.12.5 To permit a suitable assessment of the range of recorded HSMR sites, Post-medieval entries (Figure 39) have been presented separately from earlier sites (Figure 38). Their significance is not to be undervalued, and the entries are taken into account in the consideration of impact; however, such is the volume of those entries that they tend to numerically overwhelm the earlier sites. They include:

- Herefordshire Historic Farmstead Characterisation Project entries;
- quarries and gravel and clay pits identified from 1st edition OS maps; and
- industrial and transportation sites, including factories, canals and railways, etc.

5.6.12.6 Those categories of Post-medieval site mentioned in 4.2.5 have been distinguished in Figure 39 to permit other sites in that date range (e.g. manor houses, ponds, landscape parks) to be more easily identifiable.

5.6.13. EASTERN INNER CORRIDOR

Route

5.6.13.1 The links EL2 and EL3 start at the A438 (Ledbury Road) where the land rises slightly to the east of Hampton Park.

5.6.13.2 The corridor then crosses the B4224 (Hampton Park Road) and the River Wye before joining with the new B4399 Rotherwas Road at Rotherwas.

Scheduled Ancient Monuments

5.6.13.3 Just to the east of link EL2 is a Scheduled Monument comprising an area of cropmarks recorded on aerial photographs and including double-ditched enclosures and rectilinear features (1005348); it is flanked by stretches of EL9, EL10 and EL11 links. Assessment of the risk to the setting of the monument, however, is not concerned with the views to and from the site, which has no upstanding remains, but rather that previously undiscovered features associated with the complex could survive beyond the scheduled area, especially to the east. Therefore, the Easter Outer Corridor would potentially have a major direct impact upon this site, of **large or very large** significance

5.6.13.4 To the south of the River Wye is the site of Rotherwas House (27543). The scheduled area includes the earthwork and buried remains of the 16th-century Rotherwas House and the 18th century house that succeeded it, as well as the earthwork and buried remains of its formal gardens and the standing remains of the Chapel of Our Lady of Assumption (see 8.3.1, below). There are documentary references to a chapel at Rotherwas from 1304, although this may not have been in exactly the same location. The 18th-century house was demolished in 1926. Due to the designated status of the site it is of high value, and the significant changes to the setting would impart a moderate impact, of **moderate to large significance**.

5.6.13.5 Two Deserted Medieval Villages (1005230 and 1005234) flank the B4399 Rotherwas Access Road, and are at least 1km from the southern extent of the Eastern links EL3 and EL12; several existing roads traverse the area between the sites and the links. Therefore, while both are of high value, the links would have **no discernible** impact on those monuments.

Listed Buildings

5.6.13.6 Across the River Wye is a group of listed buildings located immediately east of the corridor; these include the Grade II* Rotherwas Chapel (see 5.2.2 above) along with a former stable block (Grade II) and a barn (Grade II). The chapel is of high value, whereas the Grade II listed buildings are of medium value. Due to their designated status they are of moderate to high value, and the significant changes to their settings would impart a moderate impact, of **moderate to large significance**.

5.6.13.7 The site of Picric Acid Expense Store (1393937) lies 900m northwest of the Eastern link EL3, in Rotherwas Industrial Estate; there would be **no discernible impact** to the site.

Conservation Areas

5.6.13.8 There is a Conservation Area within Hereford which could be tangentially impacted by the Eastern Inner link EL3 (Figure 40). The east edge of Hampton Park Conservation Area (6265) would experience a slight adverse impact from EL3 where it crosses the B4224 Hampton Park Road. Of low heritage value, the impact would be of **neutral or slight significance**.

Unregistered Historic Parks and Gardens

5.6.13.9 The corridor link EL2 passes just to the east of the Unregistered Historic Park and Garden of Hampton Dene. This is a large suburban house still within its grounds. Early 19th century mapping shows the house surrounded by orchards and pasture.

5.6.13.10 Just to the south of the River Wye link EL3 passes through the Unregistered Historic Park and Garden at Rotherwas House. The original park associated with the house extended to the northern end of Dinedor Hill and elements of the park pale are still present in that area. When the new house was built in 1732 the park was abandoned and smaller pleasure gardens were established around the house. A new garden was created c.1800 towards the River Wye featuring a sunken lawn and a walled garden, and it is this area that falls within the Unregistered Historic Park and Garden.

5.6.13.11 Both of these Unregistered Historic Parks and Gardens are considered to be of low value, and the impacts would be of **slight significance**.

Non-Designated Cultural Heritage Features

5.6.13.12 Just to the north of Hampton Park are two findspots relating to prehistoric material (MHE2558; MHE2559). The material includes two fragments of polished stone axe, one reused as a scraper, as well as flint scrapers and chips of flint. Just to the east of this location the fieldwalking undertaken as part of the evaluation of the previous road scheme in 1990 found four flint flakes and one core (MHE4344). An overall unknown value has been assigned to remains of the prehistoric period within this corridor.

5.6.13.13 The fieldwalking finds described above were found within an extensive area of cropmarks seen on aerial photographs (MHE103). This includes the Scheduled Ancient Monument (1005348) and overall comprises a series of agglomerated ditched enclosures which either underlies or overlies at least five ring ditches – probably the remains of a Bronze Age barrow cemetery. Given the presence here of the Scheduled Monument a high value has been assigned to this area of cropmarks.

5.6.13.14 Just to the east of or even within the corridor and link EL2 are the surviving common meadows of the parishes of Lugwardine, Hampton Bishop and Holmer (MHE4156). These are occupied in severalty for half the year and on common for the other half. The owners hold their land in strips with boundaries marked by stones. The grass is grown for hay and each owner crops their own strip. The Lugg Meadows are unique within the county and are of high value.

5.6.13.15 A bridge carrying the A438 road over a side channel of the River Lugg at Tupsley was constructed in 1807 (MHE16922). At the northern end of this corridor is the route of a toll road leading from Hereford towards Bodenham Moor (MHE15356), possibly on the line of the current A465. All of these are of negligible value.

5.6.13.16 Examination of early mapping has located several small former quarries to the north of Tupsley (MHE11956; 11976; MHE11999). These are all of negligible value.

5.6.13.17 At Rotherwas there are a number of other features of historic importance in addition to the scheduled monument, listed buildings and the Undesignated Historic Park and Garden described above. Earthworks to the west of the chapel here could be related to the documented medieval settlement of Rotherwas (MHE4336) and a fishpond is indicated on the tithe map for the area (MHE1631; MHE4337). A gravel pit was noted on the 1st edition Ordnance Survey map (MHE12906), whilst a set of cropmarks probably relates to the Royal Ordnance Factory that was located here during the First World War (MHE4009). Taken together as a group these features have been assigned a medium value, although the chapel and the house are of high value through their level of designation.

5.6.13.18 The Eastern Inner corridor traverses concentrations of Prehistoric findspots (EL2) and Medieval sites (EL3), and a scattering of industrial sites (EL3).

Historic Landscape Character

5.6.13.19 The links pass briefly through a block of U1.1 – unenclosed meadows, before passing back into another block of L1.1. They are the Lugg Meadows which are unique within the county and considered to be of **high value**.

5.6.13.20 To the north of the River Wye the corridor passes through a block of G2.7 – this represents small compass enclosure involving multiple planned entities created through the reconfiguration and drainage of early meadow enclosures. To the south of the River Wye the corridor is within a block of Z1 – urbanisation.

5.6.13.21 With the exception of the Lugg Meadows (high value), an overall **low value** has been assigned to the historic landscape along this corridor.

5.6.14. EASTERN OUTER CORRIDOR

Route

5.6.14.1 This corridor extends from the River Lugg and the A438 (Ledbury Road) to the west of Lugwardine Bridge, within the wide floodplain south of the River Lugg at less than 50m aOD. Tthe land rises over a low ridge and descends into the valley of the River Wye. Here it crosses the B4224 (Hampton Park Road) and the River Wye before joining with the new B4399 Rotherwas Road at Rotherwas. The relevant links are EL9, EL10, EL11 and EL12.

Scheduled Monuments

5.6.14.2 Just to the west of the corridor is a Scheduled Monument comprising an area of cropmarks recorded on aerial photographs and including double-ditched enclosures and rectilinear features (1005348); it is flanked by stretches of EL9, EL10 and EL11 links. Assessment of the risk to the setting of the monument, however, is not concerned with the views to and from the site, which has no upstanding remains, but rather that previously undiscovered features associated with the complex could survive beyond the scheduled area, especially to the east. Therefore, the Easter Outer Corridor would potentially have a major direct impact upon this site, of **large or very large significance**.

5.6.14.3 To the south of the River Wye is the site of Rotherwas House (1014880). The scheduled area includes the earthwork and buried remains of the 16th-century Rotherwas House and the 18th century house that succeeded it, as well as the earthwork and buried remains of its formal gardens and the standing remains of the Chapel of Our Lady of Assumption (see 5.7.14.6, below). There are documentary references to a chapel at Rotherwas from 1304, although this may not have been in exactly the same location. The 18th-century house was demolished in 1926. Due to the designated status of the site it is of high value, and the significant changes to the setting would impart a moderate impact, of **moderate to large significance**.

5.6.14.4 Two Deserted Medieval Villages (1005230 and 1005234) flank the B4399 Rotherwas Access Road, and are at least 1km from the southern extent of link EL12; several existing roads traverse the area between the sites and the link. Therefore, while both are of high value, the links would have **no discernible impact** on those monuments.

5.6.14.5 The moated site (27523) in Lugwardine is 650m east of link EL11. The features still upstanding are surrounded by trees within the village, with no line of sight to the corridor. Therefore there would have **no discernible impact** on the monument.

Listed Buildings

5.6.14.6 The Grade II Lugwardine Bridge (1179669), close to link EL11, is probably of early 17th century date. All the links, particularly EL11, would have a minor to moderate impact upon a medium vale asset, of **slight to moderate significance**.

5.6.14.7 Just to the north of this bridge is the Grade II Lower Lodge (1099846), the closest to the links of 15 Grade II Listed Buildings in Lugwardine. As the visual impact on their settings would be minor at most, it would be of **neutral or slight significance**.

5.6.14.8 To the west of the links EL9, EL10 and EL11, where they cross the B4224 (Hampton Park Road) is a Grade II listed house known as Whistle Field House (1179162). After crossing the River Wye a group of listed buildings is located within the corridor. These include the Grade II* Rotherwas Chapel (1180032) along with a Grade II former stable block (1348886) and a Grade II barn (10996020). Due to the designated status of the site it is of high value, and the significant changes to the setting would impart a moderate impact, of **moderate to large significance.**

5.6.14.9 Four listed buildings are located in Hampton Bishop. Eightlands (1099866), Upper House (1179238) and Willow Cottage (1348714) are residences between 600m and 1.05km southeast of the links EL9-12. The fourth site is a milepost (1179173) on the B4224, 1.05km from the same links. Eightlands and Upper House would be closest to the Eastern Outer corridor, though their views are at least partly screened by borders of mature trees, resulting in minor or negligible impact of **neutral or slight significance**.

5.6.14.10 North of Hampton Bishop is Tidnor Cross Cottage (1099848), around 850m east of link EL11. Its views to the west are screened by a border of mature trees and farm buildings, resulting in **no discernible impact**.

Conservation Areas

5.6.14.11 The northern edge of the Aylestone Hill Conservation Area is just within this corridor, which also passes to the west of the Hampton Bishop Conservation Area. Both of these Conservation Areas are of medium value, and there would be **no discernible impact**.

Unregistered Historic Park and Gardens

5.6.14.12 The links pass just to the west of the Unregistered Historic Park and Garden of Lugwardine Court. The existing house here dates from c.1810 but almost certainly replaced an earlier one. Early 19th-century mapping shows some parkland and a walled garden. The grounds are now mostly filled with new houses and a school.

5.6.14.13 Just to the south of the River Wye the links pass to the east of the Unregistered Historic Park and Garden at Rotherwas House. The original park associated with the house extended to the northern end of Dinedor Hill and elements of the park pale are still present in that area. When the new house was built in 1732 the park was abandoned and smaller pleasure gardens were established around the house. A new garden was created c.1800 towards the River Wye featuring a sunken lawn and a walled garden, and it is this area that falls within the Undesignated Historic Park and Garden.

5.6.14.14 All of the Unregistered Historic Parks and Gardens are of low value and there would be **no discernible impact** by the links.

Non-Designated Cultural Heritage Features

5.6.14.15 The links traverse the southern edge of a large area of water meadow located to the north of the A4103 (MHE18935). This is on the floodplain of the river Lugg and is represented as an interlocking series of ditches, while traces of ridge-and-furrow earthworks may suggest that these earthworks were subsequently remodelled to establish the water meadows. They are of **negligible value**.

5.6.14.16 Ridge-and-furrow earthworks are also known at several other locations within or adjacent to this corridor (MHE3682; MHE7740; MHE7741; MHE7742; MHE2939). The water meadows and the ridge-and-furrow earthworks are of **negligible value**.

5.6.14.17 Examination of early mapping has located several sites or features including the former location of a building to the north of New Court (MHE6440), a pound (MHE13174), a boundary stone and possible relict stream channels (MHE7738) and a clay pit (MHE12907). All of these are of **negligible value**.

5.6.14.18 To the south of the A438 road the links EL9, EL10 and EL11 pass through an extensive area within which there is considerable evidence for post-medieval water management in the form of water meadows and herringbone pattern drainage (MHE21885). There features are of **negligible value**.

5.6.14.19 In the area of land between the River Wye and the B4224 road is a substantial linear earthwork flood defence that was constructed in the 1960s (MHE9104). This is of **negligible value**.

5.6.14.20 At Rotherwas there are a number of other features of historic importance in addition to the scheduled monument, listed buildings and the Undesignated Historic Park and Garden described above. Earthworks to the west of the chapel here could be related to the documented medieval settlement of Rotherwas (MHE4336) and a fishpond is indicated on the tithe map for the area (MHE1631; MHE4337). The chapel and the house are of **high value** through their level of designation.

5.6.14.21 A gravel pit was noted on the 1st edition Ordnance Survey map (MHE12906), whilst a set of cropmarks probably relates to the Royal Ordnance Factory that was located here during the First World War (MHE4009). There features are of **negligible value**.

Historic Landscape Character

5.6.14.22 The links pass briefly through a block of U1.1 – unenclosed meadows, before passing back into another block of L1.1. They are the Lugg Meadows which are unique within the county and considered to be of **high value**.

5.6.14.23 To the north of the River Wye the corridor passes through a block of G2.7 – this represents small compass enclosure involving multiple planned entities created through the reconfiguration and drainage of early meadow enclosures. To the south of the River Wye the corridor is within a block of Z1 – urbanisation.

5.6.14.24 With the exception of the Lugg Meadows (high value), an overall **low value** has been assigned to the historic landscape along this corridor.

5.6.15. CONCLUSION

5.6.15.1 Having assessed the wider impacts of the various corridors on the cultural heritage resources, both known sites and heritage potential based on concentrations of sites in the area, the conclusions are as follows.

- The Eastern Inner links EL2 and EL3 would have a **moderate adverse impact** on the known resources and a **potentially major adverse impact** on unknown resources, given the concentration of sites in the area.
- The Eastern Outer corridor would have a **moderate adverse impact** upon the known resources and a **potentially major adverse impact** on unknown resources, given the concentration of sites in the area.

5.6.16. RECOMMENDATION

5.6.16.1 Given the number and range of known archaeological and architectural sites, both designated and undesignated, on or adjacent to both of the Eastern corridors, it is considered that both of those options would have an **adverse impact** of **moderate to major significant** upon the cultural heritage of the area.

5.6.16.2 It is therefore recommended that alternative routes are considered.

5.7. Road Drainage and the Water Environment

5.7.1. Introduction

5.7.1.1 This section gives an overview of the water environment to the east of Hereford, and considers the surface water and groundwater environments, and flood risk in terms of the proposed Eastern Links.

5.7.2. Methodology

5.7.2.1 The baseline information used for the Study of Options Environmental Assessment Report (Amey 2010) and the Addendum to Study of Options Environmental Assessment Report (Amey 2011), was reviewed as a basis for this report. The study area was taken to be an area of 500m from the centreline of the proposed Eastern Links.

5.7.3. Legislative and Planning Overview

5.7.3.1 The Water Framework Directive (WFD) is transposed into law in England through the implementation of the **Water Environment (Water Framework Directive) (England and Wales) Regulations 2003.**

5.7.3.2 **The Land Drainage Act (1991)** requires consent for any development within 8m of a watercourse. A Flood Defence Consent is required from the Environment Agency (EA) for any permanent or temporary works within the floodplain. Consent from the EA is also required for any proposed discharges to controlled waters.

5.7.3.3 **The Water Resources Act 1991** requires licences for abstraction and impoundment of water and establishes flood defence committees.

5.7.3.4 **The Water Act 2003** sets out a framework of abstraction licensing, regulates impoundments and includes measures for drought management and flood defence work in England and Wales.

5.7.3.5 **The Groundwater (England and Wales) Regulations 2009** allows the EA to grant permits to prevent the pollution of groundwater.

5.7.3.6 **The National Planning Policy Framework 2012** replaces **Planning Policy Statement 25: Development and Flood Risk** and **PPS 23: Planning and Pollution Control**. Section 10 of the NPPF states *'local planning authorities should adopt proactive strategies to mitigate and adapt to climate change, taking full account of flood risk, coastal change and water supply and demand considerations'*. It also states '*inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere'*. Paragraph 101 also states *'development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding'.*

5.7.3.7 At a national level, the central government strategy document 'A Better Quality of Life – A Strategy for Sustainable Development for the United Kingdom' recognises the fundamental importance of good water quality to health and the environment. It identifies the major challenges to water quality which it states are; growing demand for water supplies, pollution pressures from new development, diffuse pollution inputs, changed weather patterns and loss of habitats.

5.7.3.8 Regional policies relating to hydrology include:

- Herefordshire Unitary Development Plan, 2007 – Policies S1, DR4, DR6, DR7;
- Local Development Framework – Outline Water Cycle Study 2009; and
- Herefordshire Council's Core Strategy Place Shaping Paper 2010.

5.7.4. Baseline Conditions

Surface Water Environment

5.7.4.1 The study area falls within the Wye Catchment located within the Severn River Basin District. The principle water courses in the vicinity of the Eastern Links are the River Wye, River Lugg, and Withington Brook.

5.7.4.2 The River Wye is designated as a Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI) and is important for its riverine habitats and the species they support. The River Wye rises in the Cambrian Mountains in Wales and discharges into the River Severn to the south.

5.7.4.3 The River Lugg is a major tributary of the River Wye and is included in the SAC designation. The River Lugg is also designated as a SSSI and flows into the Wye south east of Hereford. A flood relief channel (Lugg Rhea) runs parallel to the River Lugg between Hampton Bishop and Aylestone Hill.

5.7.4.4 Withington Brook discharges to the River Lugg approximately 200m north of the A438, within the northern end of the study area.

5.7.4.5 Up until 2010 the Environment Agency assessed water quality using the General Quality Assessment Scheme (GQA) which provided a method for classifying rivers across the UK. The scheme used four main parameters:

- chemical content – assessed using 3 determinands of organic pollution, ammonia, biochemical oxygen demand (BOD) and dissolved oxygen (DO). The river is classified according to the lowest grade achieved by any of the determinands and range from Very Good (A) to Bad (F).
- biological content – the range of species found in a length of river is compared to the range of species that would be expected in the river if it was not polluted or physically damaged. Grades range from Very Good (A) to Bad (F).
- nutrient content – based on samples analysed for nitrate and phosphate levels and a grade assigned against the concentration of each; and
- aesthetics.

5.7.4.6 This assessment scheme has now been superseded by the Water Framework Directive classification, which is a risk based classification with over 30 parameters grouped into ecological and chemical status.

5.7.4.7 Monitoring of the Wye upstream of the study area under the GQA scheme was undertaken at the confluence of Eign Brook and Cage Brook, where water quality in 2009 was recorded as Very Good in terms of chemical and biological content and containing low levels of nutrients. Under the WFD classification the River Wye is designated as having Good Ecological and Chemical quality.

5.7.4.8 Monitoring of the Wye downstream of the study area under the GQA scheme was undertaken at two monitoring points: the first near Dinedor Court and southwest of Hampton Bishop and the second at the confluence of the River Wye and River Frome. The first monitoring point recorded similar water quality as the upstream monitoring point, and the further downstream monitoring point recorded higher nutrient levels with Good chemical content.

5.7.4.9 Monitoring of the River Lugg within the study area showed water quality in 2009 as generally Good with moderate to high levels of nutrients. However, under the WFD classification the River Lugg from the confluence of River Arrow to confluence with River Wye has Poor Ecological Quality based on Poor classification for its fish populations.

5.7.4.10 Under the terms of the WFD, it is a requirement for water bodies to maintain or improve their status to Good by 2015. It is predicted that the River Wye will maintain its Good status in 2015, with the River Lugg expected to remain as Poor (River Basin Management Plan: Severn River Basin District, Environment Agency 2009).

5.7.4.11 Herefordshire Council has developed an Outline Water Cycle Study (Herefordshire Council, 2009) which outlines the requirement for a sustainable water environment by assessing the capacity for water resources and supply, sewage disposal and treatment and surface water drainage and flood risk management.

5.7.4.12 The Study highlights the River Lugg as being principally adversely affected by current discharges from waste water treatment works. Pollution from agricultural run-off is also a significant problem with high levels of nitrates and phosphates entering surface waters. With the proposed housing requirements for in and around Hereford and the history of flooding, the Study has recommended a Surface Water Management Plan is urgently required for northwest and southeast Hereford.

Fisheries

5.7.4.13 Records from the Department for Environment, Food and Rural Affairs (DEFRA) indicate that none of the water courses within the study area are classed as Cyprinid Waters under the EC Freshwater Fisheries Directive. The River Wye and Lugg are designated as Salmonid Waters under this Directive, which means these waters are identified as having water quality suitable for sustaining fish populations and therefore requiring protection.

5.7.4.14 There are no known fisheries within the study area. The River Wye fishery is located approximately 20km downstream, between Ross-on-Wye and Monmouth.

Groundwater

5.7.4.15 The Groundwater Body in the study area is classed as Wye Minor and currently has Good Status under the WFD monitoring regime. The study area is designated as a drinking water protected area, water abstraction management area and is also protected under the Nitrates Directive.

5.7.4.16 A review of the Hydrogeological Map of England and Wales (scale 1:625 000) indicates that the Raglan Mudstone Formation underlying the Eastern Links is a minor aquifer of limited potential where the bedrock is generally impermeable and without groundwater except at shallow depth.

5.7.4.17 The recent deposits located along the course of the banks of the River Wye and Lugg are classed as a concealed aquifer with limited or local potential.

5.7.4.18 The Groundwater Vulnerability Map of Worcestershire (Sheet 29, 1:100 000) and Groundwater Vulnerability Map of Powys (Sheet 28, 1:100 000) were reviewed to ascertain the groundwater vulnerability below the Eastern Links. These indicate that the drift deposits which overlie the Raglan Mudstone Formation are either of high or intermediate leaching potential.

5.7.4.19 Secondary aquifers include a wide range of rock layers or drift deposits with an equally wide range of water permeability and storage. Secondary aquifers are subdivided into two types:

- Secondary A – permeable layers capable of supporting water supplies at local rather than strategic scale, and in some cases forming source of base flow to some rivers.
- Secondary B – predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.
- Secondary undifferentiated – has been assigned in cases where it has not been possible to attribute either category A or B to a rock type, due to the variable characteristics of the rock type.

5.7.4.20 The lands around the River Lugg are underlain by a Secondary A aquifer with high leaching potential. The urban fringe of Hereford, where most of the Eastern Links would encroach, is a Secondary A aquifer with intermediate leaching potential.

5.7.4.21 A review of the 2010 Groundsure EnviroInsight report for the Hereford Relief Road (Report Reference HMD-404-826563) indicates there are a number of groundwater and surface water abstractions recorded in the study area as shown on Figure 42. There is a groundwater abstraction licence for a borehole at GR354740, 240810 near Lugwardine Court for farming, horticultural and residential use, which includes use for potable water. There are two groundwater abstraction licences for a reach of the River Wye; one well located in Field Farm (GR354490, 238600) and the other well near Field Farm (GR353820, 239200). Both wells are used for general farming and domestic use.

5.7.4.22 There is a surface water abstraction licence at GR353800, 240710 for the River Lugg at Newcourt Farm for irrigation purposes and another for the River Lugg near Lugg Bridge Farm for irrigation at GR353110, 241590. There is a surface water abstraction licence for the River Wye near Field Farm for irrigation at GR353540, 238860.

5.7.4.23 There are also a number of authorised industrial discharge consents, mostly within Rotherwas Industrial Estate discharging into the River Wye as illustrated in Figure 42.

5.7.4.24 Figure 42 shows the location of all licenced abstractions within the study area, however of these only six located within 200m of the Eastern Links are still operational as listed in Table 47 below.

Table 47: Operational groundwater and surface water abstractions within 200m of Eastern Links			
Grid Reference	**Location**	**Specified Use**	**Type of abstraction**
354740, 240810	Borehole near Lugwardine Court	General farming and domestic. Horticultural watering. Drinking, cooking, sanitary, washing, small garden. Potable water.	Groundwater
354490, 238600	Well at Field Farm	General farming and domestic	Groundwater
353820, 239200	Well near Field Farm	General farming and domestic	Groundwater
353800, 240710	River Lugg at Newcourt Farm	Spray irrigation	Surface water
353110, 241590	River Lugg near Lugg Bridge Farm	Spray irrigation	Surface water
353540, 238860	Reach on River Wye near Field Farm	Spray irrigation	Surface water

Flood Risk

5.7.4.25 Herefordshire Council has developed a Strategic Flood Risk Assessment (SFRA) which addresses the risk of fluvial flooding and focuses on catchment dynamics and the importance of catchment hydrology in an appreciation of flood risk management. Hereford has a significant history of flooding and any future development proposals need to take particular regard to avoidance of increased flood risk.

5.7.4.26 The SFRA identified three categories of catchment scale flood risk; general surface water flooding, fluvial flooding by floodplains and historical flooding. Fluvial flooding from adjacent floodplains is prevalent for properties adjacent to the River Wye in Hereford and the River Lugg at Hampton Bishop.

5.7.4.27 The Environment Agency Flood Zone Map has identified areas at risk of flooding in the study area. Most of the land between the A438 and B4399 lies within Flood Zone 2 area, i.e. greater than 0.1% flood risk from river/sea, with some areas classed as Flood Zone 3 area, i.e. greater than 1.0% flood risk from river. Mapped areas of flood risk are shown on Figure 42 Water Constraints.

5.7.4.28 There are flood defences located in the study area. The Lugg Rhea flood relief channel runs parallel to the River Lugg from Aylestone Hill to Hampton Bishop. A flood relief embankment runs adjacent to this channel from the A438 to Hampton Bishop and runs just west of the boundary of the Lugg and Hampton Meadows SSSI. A flood relief embankment (the Stank) is located north of the River Wye, between the north bank of the Wye and the B4224.

5.7.4.29 Review of the 2010 GroundSure FloodInsight report for Hereford Relief Road (Report Reference HMD-404-828218) indicates the extent of flood events recorded by the Environment Agency and other bodies. This data does not take into account flood management schemes or improved flood defences, such as Belmont and Hampton Bishop. An overview of any site within the study area which has been subject to historic flooding is provided in Table 48 below.

Table 48: Historical Flooding events recorded by the Environment Agency (Source 2010 Groundsource FloodInsight report)

Event Name	Date of Flood	Flood Source	Flood Cause	Type of Flood	Environment Agency Comments
HamptonBishop 01 April 1947	Start:01-04-1947 End:01-04-1947	River Lugg	Channel capacity exceeded (no raised defences)	Fluvial	Historical records do not indicate date/year of flood, or include a detailed 'key' showing which line was the extreme flood outline. Records assumed to be that of the April 1947 flood. Polygon includes the Lugg Rhea & Back Brook - HamptonBishop.
Lugwardine 01 April 1947	Start:01-04-1947 End:01-04-1947	River Lugg	Channel capacity exceeded (no raised defences)	Fluvial	Historical records do not indicate date/year of flood, or include a detailed 'key' showing which line was the extreme flood outline. Records assumed to be that of the April 1947 flood. Polygon also includes flooding from the Lugg Rhea & Little Lugg.

Hereford 01 December 1960	Start:04-12-1960 End:04-12-1960	River Wye	Channel capacity exceeded (no raised defences)	Fluvial	Peak flow measured at Belmont occurred on 4th December 1960. No start or end date of flood recorded
LuggBridge 01 April 1947	Start:01-04-1947 End:01-04-1947	River Lugg	Channel capacity exceeded (no raised defences)	Fluvial	Historical records do not indicate date/year of flood, or include a detailed 'key' showing which line was the extreme flood outline. Records assumed to be that of the April 1947 flood. Polygon also includes the Sutton Rhea.
Breinton Common to BroomyHill 01 April 1947	Start:01-04-1947 End:01-04-1947	River Wye	Channel capacity exceeded (no raised defences)	Fluvial	Historical records do not indicate date/year of flood, or include a detailed 'key' showing which line was the extreme flood outline. Records assumed to be that of the April 1947 flood.
HamptonBishop 02 April 1947	Start:01-04-1947 End:01-04-1947	River Lugg	Channel capacity exceeded (no raised defences)	Fluvial	Historical records do not indicate date/year of flood, or include a detailed 'key' showing which line was the extreme flood outline. Records assumed to be that of the April 1947 flood.

5.7.5. Potential Impacts

5.7.5.1 EL2 does not cross any significant water courses and the start of this route passes within 50m of land designated as floodplain. The route is located within 200m of one groundwater abstraction near Field Farm and two surface water abstractions on the River Lugg.

5.7.5.2 EL3 crosses the River Wye, classed as Good Ecological Potential at the proposed crossing point. This link crosses approximately 1,200m of floodplain, and in terms of infrastructure requirements would require the construction of a bridge and road on embankment within the floodplain resulting in loss of flood storage capacity. EL3 is located within 200m of one groundwater abstraction near Field Farm and one surface water abstraction on the River Wye.

5.7.5.3 The first 1,350m of EL9 and the last 212m cross floodplain, totalling 1,562m. EL9 crosses the Lugg Rhea flood relief channel and it is proposed to cross this channel with a bridge. The route will be mainly on embankment to carry it above the floodplain and this will result in the loss of flood storage capacity. The northern end of EL9 crosses the proposed Lugg and Hampton Meadows SSSI and the joining point of the link road with the A438 is located within 50m of the River Lugg. EL9 is located within 200m of two groundwater abstractions at Lugwardine and Field Farm and no surface water abstractions. The abstraction at Lugwardine is used for potable water supply.

5.7.5.4 EL10 crosses 1,470m of floodplain and the Lugg Rhea flood relief channel. It is proposed to cross the channel with a bridge. The route will be mainly on embankment and will result in the loss of flood storage capacity. The northern end of EL10 crosses the proposed Lugg and Hampton Meadows SSSI and the joining point of the link road with the A438 is located within 50m of the River Lugg. EL10 is located within 200m of two groundwater abstractions at Lugwardine and Field Farm and no surface water abstractions. The abstraction at Lugwardine is used for potable water supply.

5.7.5.5 EL11 crosses 1,612m of floodplain and the Lugg Rhea flood relief channel. It is proposed to cross the channel with a bridge. The route will be mainly constructed on embankment and will result in loss of flood storage capacity. The northern end of EL11 crosses the proposed Lugg and Hampton Meadows SSSI and the joining point of the link road with the A438 is located within 50m of the River Lugg. It is located within 200m of two groundwater abstractions at Lugwardine and Field Farm and no surface water abstractions. The abstraction at Lugwardine is used for potable water supply.

5.7.5.6 The full 1,381m length of EL12 is located within floodplain. The route crosses the River Wye and the river is designated as Good Ecological Potential at the crossing point. It is proposed to cross the river with a bridge constructed with a minimal number of spans. The road will be on embankment and this will result in the loss of flood storage capacity. The route is located within 200m of one groundwater abstraction at Field Farm and one surface water abstraction on the River Wye.

5.7.5.7 The urban area of Hereford and the lands around the River Lugg are underlain by a Secondary A aquifer with high leaching potential. All of the Eastern Links cross these areas and any excavations will leave the groundwater susceptible to pollution.

5.7.6. Mitigation Measures

5.7.6.1 At this stage of the assessment process only general mitigation measures can be discussed at a high level.

5.7.6.2 All of the Eastern Links would require some level of Flood Risk Assessment to be undertaken as part of the preliminary design process, with measures for control of road drainage such as Sustainable Urban Drainage Systems included in the design.

5.7.6.3 Particular measures will need to be in place when excavating within the floodplain, due to the strong link between the high water table and the ecological well-being of the River Wye SAC. Further consultation with the Environment Agency will need to be undertaken in order to confirm such suitable measures.

5.7.7. Summary and Conclusions

5.7.7.1 Of the two inner Eastern Links (EL2 and EL3), EL3 requires a bridge to be constructed to cross the River Wye and will result in loss of flood plain.

5.7.7.2 All the outer Eastern Links (EL9, EL10, EL11 and EL12) cross floodplain, with all four links crossing more than 1km of floodplain. Thereby extensive areas of excavation in ground with a high water table will be required, potentially resulting in detrimental impacts to the groundwater regime. As the groundwater in the area contributes to the baseflow of the surface watercourses, there is potential for adverse indirect impacts to the ecologically important and designated sites in the study area namely the River Wye SAC and SSSI, River Lugg SSSI and the proposed Lugg and Hampton Meadows SSSI. The River Wye is designated for its riverine habitats and the species it supports and any impact to water quality or flow would be significant.

5.7.7.3 Consultation with Natural England has highlighted that there are likely complex hydrological relationships existing between the River Wye SAC, the River Lugg, proposed Lugg and Hampton Meadows SSSI, Lugg Rhea and the wider floodplain (See Appendix D). Therefore, impacting one of these features will have direct/ indirect impacts on the rest.

5.7.7.4 For all of the outer Eastern Links and EL3, the road would be carried on embankment above the floodplain. Given the nature of the superficial deposits in the floodplain, there is potential for localised compaction beneath the embankments, which can alter the hydrology in the area.

5.7.7.5 Outer Eastern Links EL9, EL10 and EL11 cross the proposed Lugg and Hampton Meadows SSSI, thus directly impacting the designated site.

5.7.7.6 Due to the extent of floodplain and associated impact on groundwater regime and ecologically designated sites, the inner Eastern Links are the preferred options for any eastern route. However, even EL3 crosses a large area of floodplain and flood risk assessments and compensation flood relief measures are likely to be required.

5.8. Physical Fitness

5.8.1. The A438 Ledbury Road has a footway to the eastbound carriageway between the district of Tupsley and the village of Lugwardine and is an important community link. Cycling and pedestrian movements should not be inhibited by the proposals the opportunity for enhancement should be included within any scheme design. However, increased traffic volumes on B4224, A438 and on other links within the City are likely to reduce their use by non-motorised users (NMUs). In addition, the currently quiet lanes between the A438 and the A4103 would experience increase in rat-running of vehicles impacting upon their use by NMUs including equestrians.

5.8.2. The provision of footway/cycleway adjacent to the new link could improve connectivity between communities and encourage use by NMU if well designed.

5.9. Journey Ambience

5.9.1. Views from all routes over the River Lugg floodplain comprise meadowland, farmland, and small villages. Views along the River Wye include some high quality views for southbound vehicles towards Dinedor Hill to the south and the meandering river valley to the east.

6. Addendum

6.1. Summer Briefings

6.1.1. Two briefings were delivered to key stakeholders in June 2012 and August 2012.

6.1.2. The initial briefing (22nd June 2012) was intended primarily as a means of information dissemination. The briefing presentation was delivered by representatives from Herefordshire Council, Amey, and SQW.

6.1.3. Following this briefing, it was agreed that a second briefing would be beneficial to provide more detailed information.

6.1.4. The second briefing (16th August 2012) was well attended by a number of key stakeholders. Details of attendees and a copy of the presentation are included in Appendix E.

6.1.5. The August briefing included a "questions and answers" section. These questions and responses (including post briefing responses) are included in Appendix E.

6.2. Further work

6.2.1. Following the summer briefings a number of questions were raised; the answers to which could only be determined by further modelling / assessment.

6.2.2. There would be the need to refine the existing 2008 Hereford Multi-Modal Model (HMMM) in the north eastern areas of the City.

6.2.3. Due to time and financial constraints, it was decided not to carry out this work, but it should be noted that the HMMM is currently being updated and that the opportunity to further assess could become available in the future.

6.2.4. It should be noted, however, that this work would be beyond the scope of the brief for this report and would be unlikely to lead to a change in the recommendations set out in this report

7. Conclusions

7.1. The introduction of a link between the B4399 at Rotherwas and the A438 only, without a new link to the A4103, has a number of significant impacts upon the routing of traffic through the City.

7.2. The report has considered the impacts of a new route between the B4399 from Rotherwas to the A438 Ledbury Road and the resulting traffic flow through the city centre and eastern city limits. The engineering and environmental assessments within the 2010 Study of Options have been considered and used for each of the eastern links only in isolation with respect to the eastern routes assessed as part of the Eastern Relief Road reviewed with the 2010 report.

- Eastern Links EL2 and EL3 form an 'inner' eastern route, passing to the west of Rotherwas Chapel and joining the B4224 at the Junction with Holywell Gutter Lane and the A438 250m east of the junction with Hampton Dene Road
- Eastern Links EL9, EL10, EL11 and EL12 form options for the 'outer' eastern routes, passing east of Rotherwas Chapel and joining the B4224 700m southeast of the junction with Holywell Gutter Lane and the A438 in the vicinity of the Lugwardine bridge.

7.3. The report considers the impacts and benefits describing in detail:

- The Network and Economic Assessment
- Route Engineering
- Link Costs
- Route Environmental Impact

7.4. Of the Eastern Links considered, the inner links closest to the City, EL2 and EL3, have the least impact upon the Environment, primarily due to the increased distance from the Lugg Floodplain. This is further reinforced by the recent extension of the SSSI designation associated with the River Lugg, floodplains and meadows.

7.5. The economic assessment demonstrates that the Eastern Link represents good value for money. However, the purely economic assessment is only a part of the overall appraisal process.

7.6. The economic assessment demonstrates that both scenarios provide healthy BCRs, exceeding 2 which the DfT would consider to be the threshold for demonstrating good value for money. The Eastern Link in isolation produces a BCR of 13 and assessed with the Western Relief Road BCR of 4. This is not surprising given that the Eastern Link can be delivered for a lower cost than Full Western Relief Road.

7.7. Care should be taken however with these BCR figures as it is considered that the traffic model will not be capturing all of the dis-benefits associated with congestion in the east of the City, Lugwardine and Bartestree. Therefore actual reduced journey time and reduced economic benefits are likely to reduce the BCR following more detailed modelling of this area of the City.

7.8. There are benefits of implementing the Eastern Links with reduced flows, pollution and noise on the A49 through the City however, the traffic impact upon a lower than desirable design standard road network in residential areas of Tupsley and Aylestone and the impact upon the villages of Lugwardine and Bartestree should also be considered.

7.9. The Eastern Links and subsequent dispersal of through traffic will also have an adverse traffic impact upon Lugwardine, Bartestree and the low alignment design standard of highways between the Ledbury Road and the Worcester Road.

7.10. The effect of the reassignment of traffic, which has destinations within the City or to the north, is to transfer trips onto a lower classification, mainly to residential roads to the East of the City. This results in a significant increase in traffic flow along Hampton Park Road, Hafod Road and Bodenham Road which provides connectivity with the A465 Aylestone Hill to use the proposed new Link Road to get back to the A49.

7.11. The reassignment of traffic represents a doubling of traffic in the region of 500 additional vehicles on Hampton Park Road in each of the peak hours, most of which is routed down Hafod Road and Bodenham Road. Whilst this result of the traffic modelling is considered to be broadly correct, it is considered more likely that the increase in traffic will also be spread across other minor roads within this area as traffic distributes to avoid newly congested junctions.

7.12. Although not highlighted in the modelling, it is likely that these increases in traffic flow will also occur across a number of routes including Ledbury Road past the College, Folly Lane and Venns Lane, Ayestone Hill and the Roman Road. The status of this part of the City as a Conservation area should also be considered.

7.13. It is also considered that a route for northbound traffic may be created via Lugwardine and using the narrow country lanes of Cotts Lane or Lumber Lane before turning left onto the A4103 to continue the northbound journey. This would have a detrimental effect on the local environment through the volume of traffic using the lanes and forcing progressive road widening by encroaching into the verges.

7.14. The effect of traffic with destinations to the east, via Ledbury or Worcester, is to transfer trips to the A438 through the villages of Lugwardine and Bartestree. This represents an increase of approximately 50% in traffic volumes on Ledbury Road though Lugwardine, in the region of 400 additional vehicles in each of the peak hours.

7.15. The Eastern Links also create a demand between the A438 and the A4103, using lanes which are currently unsuitable for large volumes of traffic and heavy goods vehicles. An additional 230 vehicles in each of the peak hours are anticipated to cross between the Ledbury Road and the Worcester Road via Lumber Lane, Cotts Lane or Via Whitestone. It should be noted that this part of the traffic model is less accurate than the network within the limits of the City and is known as the buffer network. Sensitivity tests have shown that the assignment of traffic in this area is sensitive to the amount of delay experience at junctions.

7.16. The main benefit of an Eastern Link is the significant reduction in flows on the A49 at Greyfriars Bridge by 23% and on Edgar Street by 24%. With the inclusion of the Southern Core link between the A49 at Grafton and the A465, further benefits are created for the A49 (reduction on Greyfriars Bridge of 26% and on Edgar Street by 29%), but also the A465 at Belmont by 17%.

7.17. A further conclusion from the traffic modelling is the effect upon the traffic assigned to the Western Relief Road and the phasing of the delivery of these pieces of infrastructure. The Eastern Links and Southern Core are assumed to be in place by 2019 and the Western Relief Road by 2031. Much of traffic relief benefit to the City Centre would have been provided by the Eastern Links but with the result of transferring these trips to less suitable, residential and low standard routes as described above. These problems are then not mitigated by the Western Relief Road, as much of the traffic continues to favour the routes described.

7.18. All the Eastern Links have potential to adversely affect River Lugg SSSI, proposed Lugg and Hampton Meadows SSSI and River Wye SAC, as well as adversely impacting on local habitats. Impacts include loss of habitat, pollution of watercourses, changes to hydrological relationships between the designated sites and disturbance to protected species. The Outer Eastern Links would involve direct landtake from the proposed Lugg and Hampton Meadows SSSI. Both the Inner and Outer Eastern Links would have significant adverse impacts on the designated features of the River Wye SAC, River Lugg SSSI and proposed Lugg and Hampton Meadows SSSI. The Inner Eastern Links would have less of an impact on the designated sites and are preferred over the Outer Eastern Links.

7.19. The SSSI in the vicinity of the Lugg has been extended beyond the boundary at the time of the 2010 Study of Options. This further favours eastern routes on an ‘inner’ alignment. A further new route has been considered which would pass through a gap in the SSSI, even though no gap exists in the SAC. However, this has been dismissed as impacts upon designated sites including the SAC, and particularly hydrological, would remain and the topographic constraints to the north are prohibitive.

7.20. The conclusions relating to the impact upon the Western Relief Road may raise calls for considering whether a full Eastern route connecting up to the A4103 would provide a more favourable long term solution. However, the conclusions from the 2010 Study of Options should be considered at this point as they address the matter of crossing over or adjacent to the highly sensitive Lugg Meadows. The designation of the River Wye SAC is such that a scheme could not be progressed unless:

'there are no alternative solutions regardless of economic considerations, there are imperative reasons of over-riding public interest and that any mitigation measures are taken.'

The Western Relief Road would still represent an overall lower impact scheme on the environmentally designated sites. In any case, there would be a significant time lapse between the phasing of the schemes and as such the impact upon links on the East of the City would still be great.

8. Recommendations

8.1. While there are benefits of implementing the Eastern Link for the through and local traffic to the city centre, the report concludes that with the traffic and environmental implications on the lower standard of highway network in the residential areas of Tupsley and Aylestone and the impact on the villages of Lugwardine and Bartestree, an eastern link between the B4399 and the A438 is not pursued.

9. References

9.1. Biodiversity & Water

9.1.1. GROUNDSURE (2010) GroundSure EnviroInsight Hereford Route. Produced for Amey.

9.1.2. AMEY (2010) Study of Options Environmental Assessment Report Hereford Relief Road. Report produced for Herefordshire Council.

9.1.3. DEPARTMENT FOR COMMUNITIES AND LOCAL GOVERNMENT (2012) National Planning Policy Framework. Available to access at http://www.communities.gov.uk/publications/planningandbuilding/nppf

9.1.4. HYDER CONSULTING (UK) LIMITED (2011) Hereford Relief Road Habitats Regulations Assessment, Route Corridor Options Screening Report. Report produced for Amey.

9.1.5. AMEY (2011) Hereford Relief Road Addendum to Study of Options Environmental Assessment Report.

9.2. Cultural Heritage

9.2.1. Council of Europe (2000) *European Landscape Convention* (Florence Convention)

9.2.2. Department of the Environment (1990) This Common Inheritance: Britain's Environmental Strategy. HMSO

9.2.3. English Heritage The Setting of Heritage Assets

- National Heritage List for England (accessed 28th September 2011)

(http://www.english-heritage.org.uk/professional/protection/process/national-heritage-list-for-england/)

9.2.4. Herefordshire Council (2010) *Archaeology & Development Supplementary Planning Document*

9.2.5. Herefordshire Unitary Development Plan

9.2.6. Herefordshire Sites and Monuments Database (accessed 28th September 2011) *(http://www.herefordshire.gov.uk/htt/27.aspx)*

9.2.7. Highways Agency (2009) *Design Manual for Roads and Bridges, vol.11: Environmental Assessment*

LEGISLATION & GUIDELINES

- Ancient Monuments and Archaeological Areas Act (1979)
- Hedgerow Regulations (1997)
- National Heritage Act (1983)
- National Heritage Act (2002)
- National Planning Policy Framework
- Planning (Listed Buildings and Conservation Areas) Act (1990)
- Planning Policy Statement 5: Planning and the Historic Environment
- Planning Policy Guidance 15: Planning and the Historic Environment
- Planning Policy Guidance 16: Archaeology and Planning
- Town and County Planning Act (1971)

Figures

Appendix A

Traffic Flow Difference Plots and Select Link Analysis Plots

A.1. Shown below are the traffic flow difference plots for Hereford City area for all scenarios and all time periods.

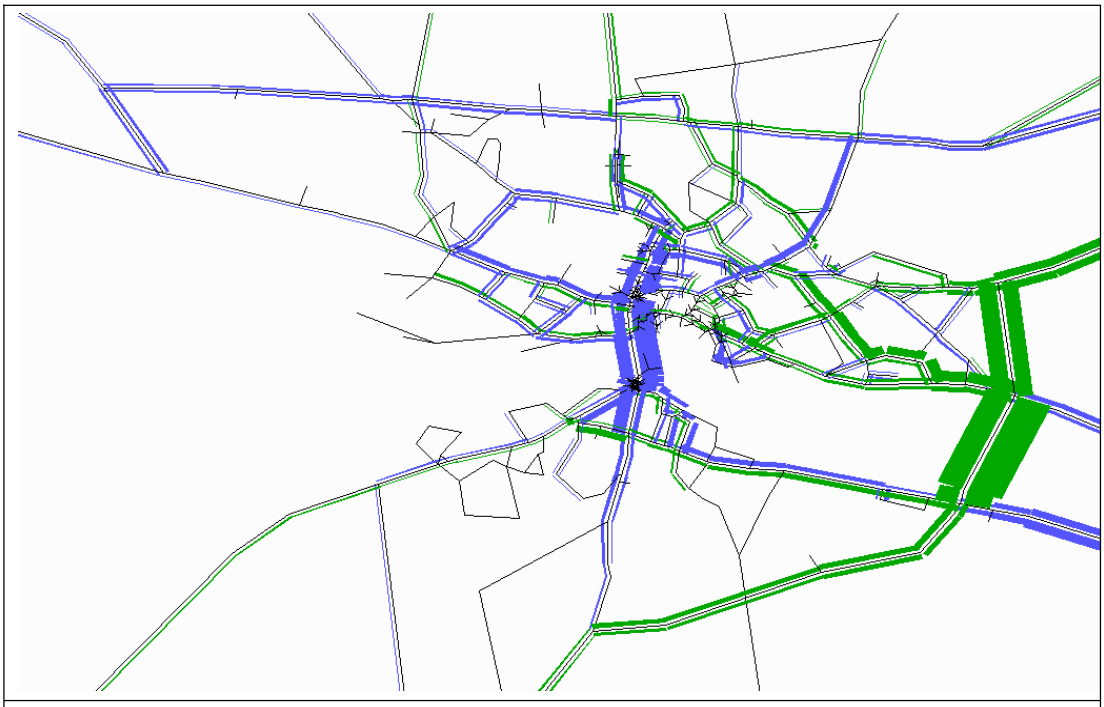

Figure 1: AM 2019 Traffic flow difference plot: Scenario 2 vs Scenario 1

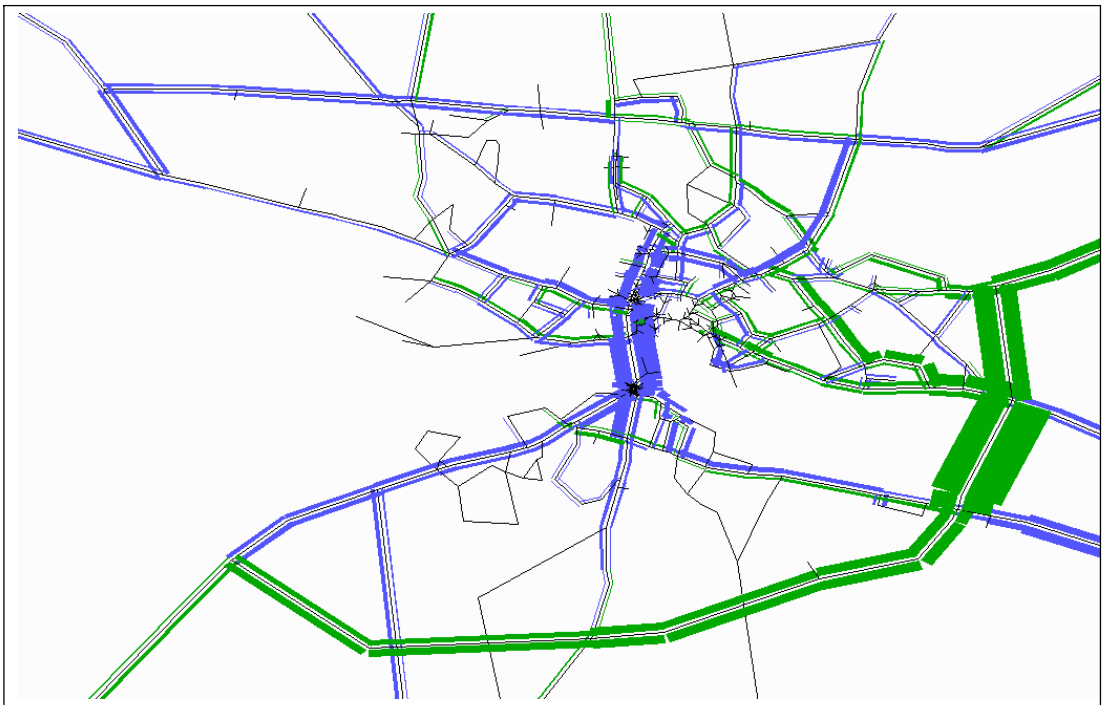

Figure 2: AM 2019 Traffic flow difference plot: Scenario 3 vs Scenario 1

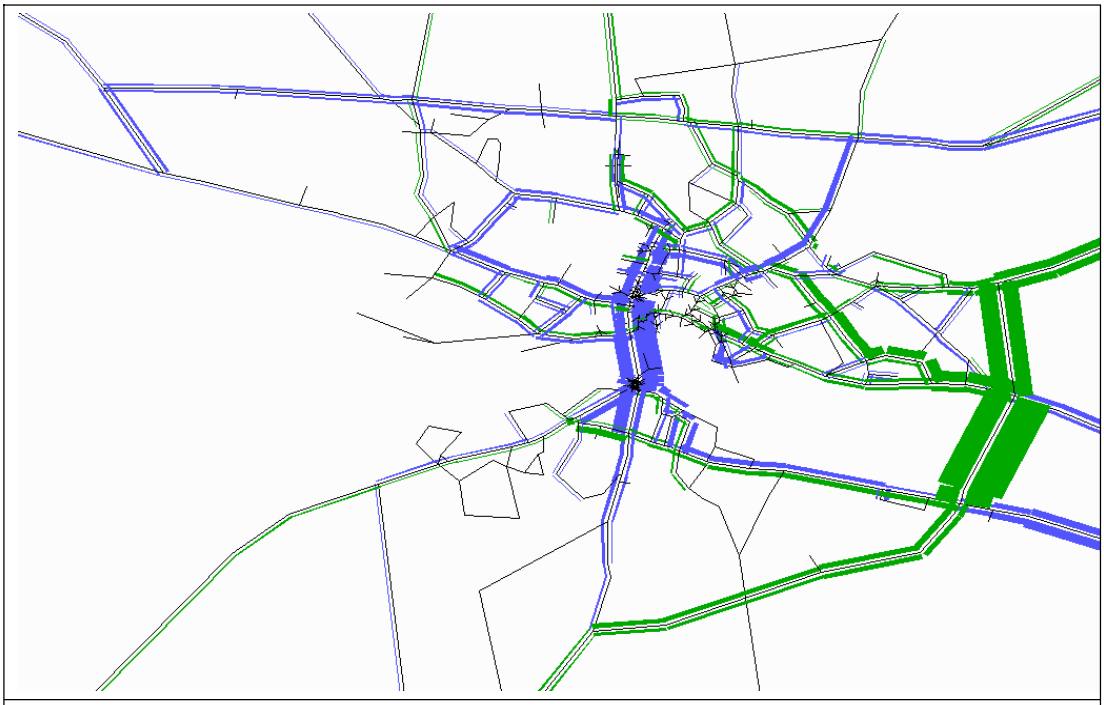

Figure 3: PM 2019 Traffic flow difference plot: Scenario 2 vs Scenario 1

Figure 4: PM 2019 Traffic flow difference plot: Scenario 3 vs Scenario 1

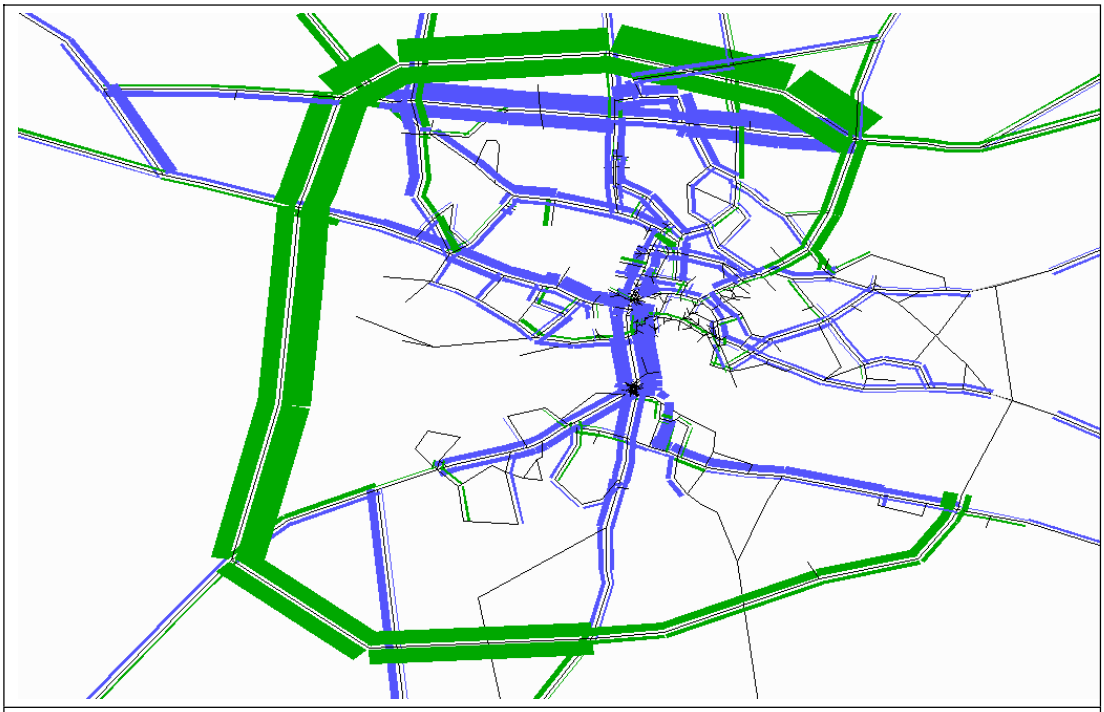

Figure 5: AM 2031 Traffic flow difference plot: Scenario 5 vs Scenario 4

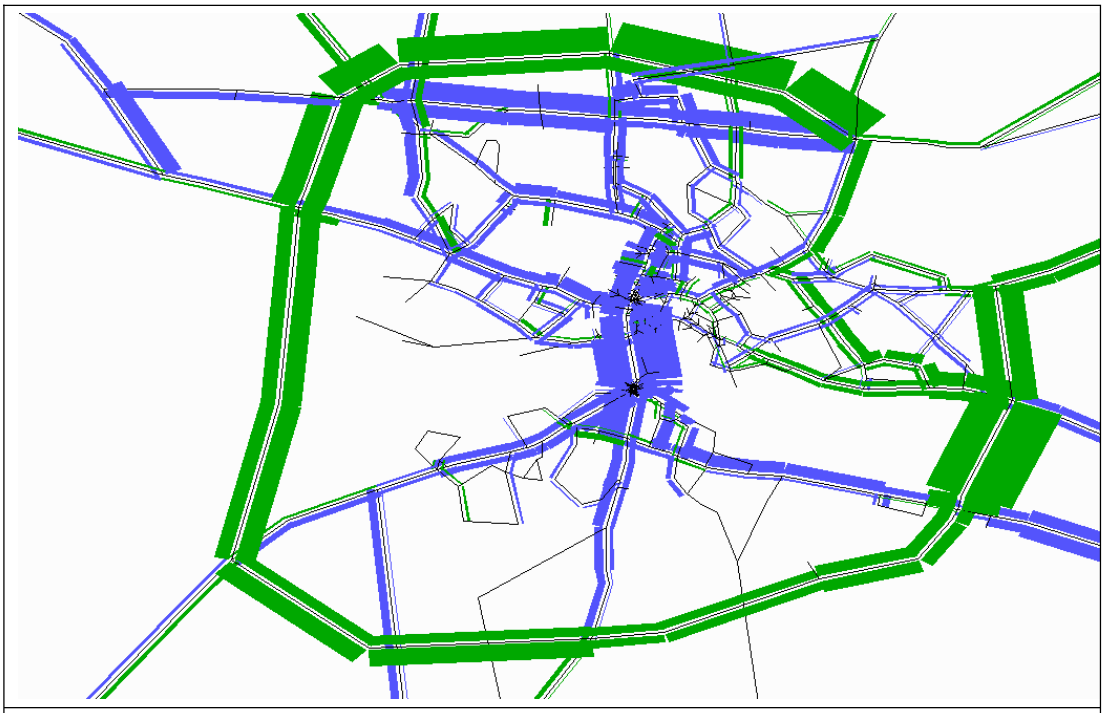

Figure 6: AM 2031 Traffic flow difference plot: Scenario 6 vs Scenario 4

Figure 7: AM 2031 Traffic flow difference plot: Scenario 6 vs Scenario 5

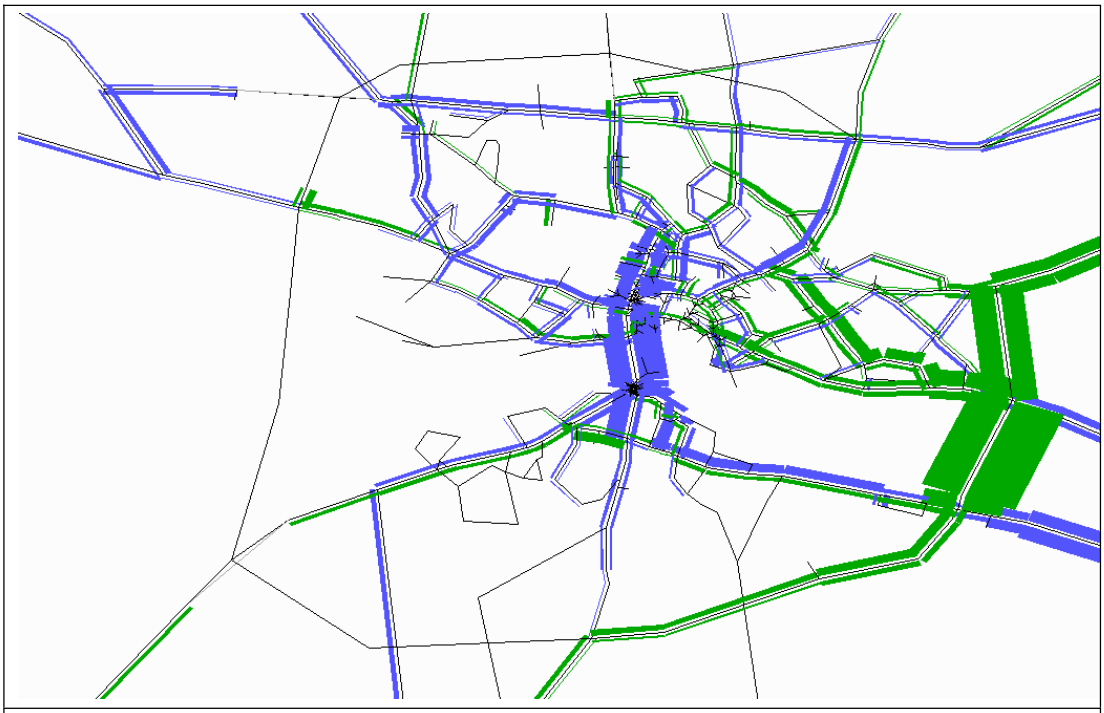

Figure 8: AM 2031 Traffic flow difference plot: Scenario 7 vs Scenario 4

Figure 9: PM 2031 Traffic flow difference plot: Scenario 5 vs Scenario 4

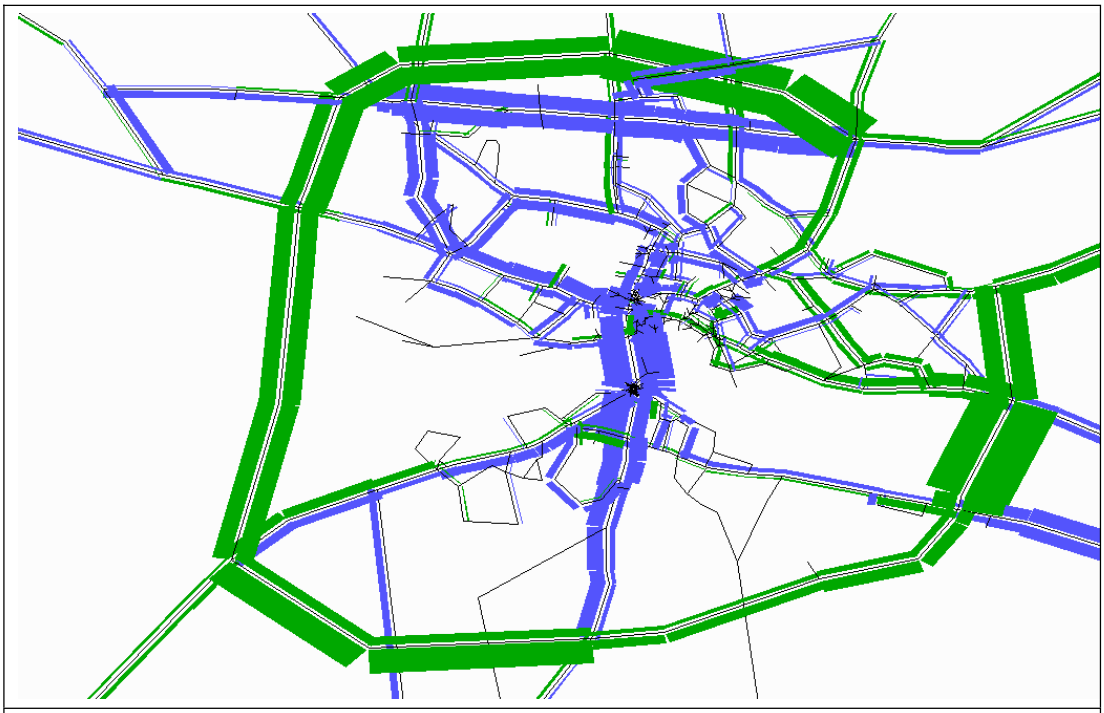

Figure 10: PM 2031 Traffic flow difference plot: Scenario 6 vs Scenario 4

Figure 11: PM 2031 Traffic flow difference plot: Scenario 6 vs Scenario 5

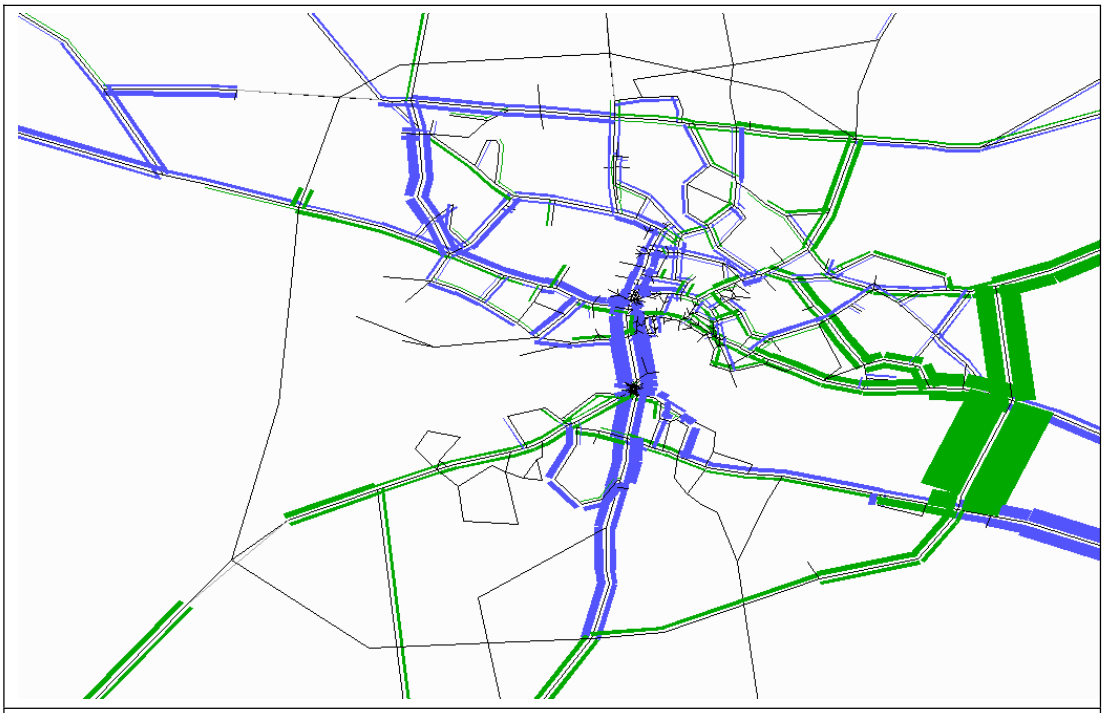

Figure 12: PM 2031 Traffic flow difference plot: Scenario 7 vs Scenario 4

A.2. Shown below are traffic flow difference plots for the Bartestree and Lugwardine areas. The plots are shown for scenarios 2 and 6.

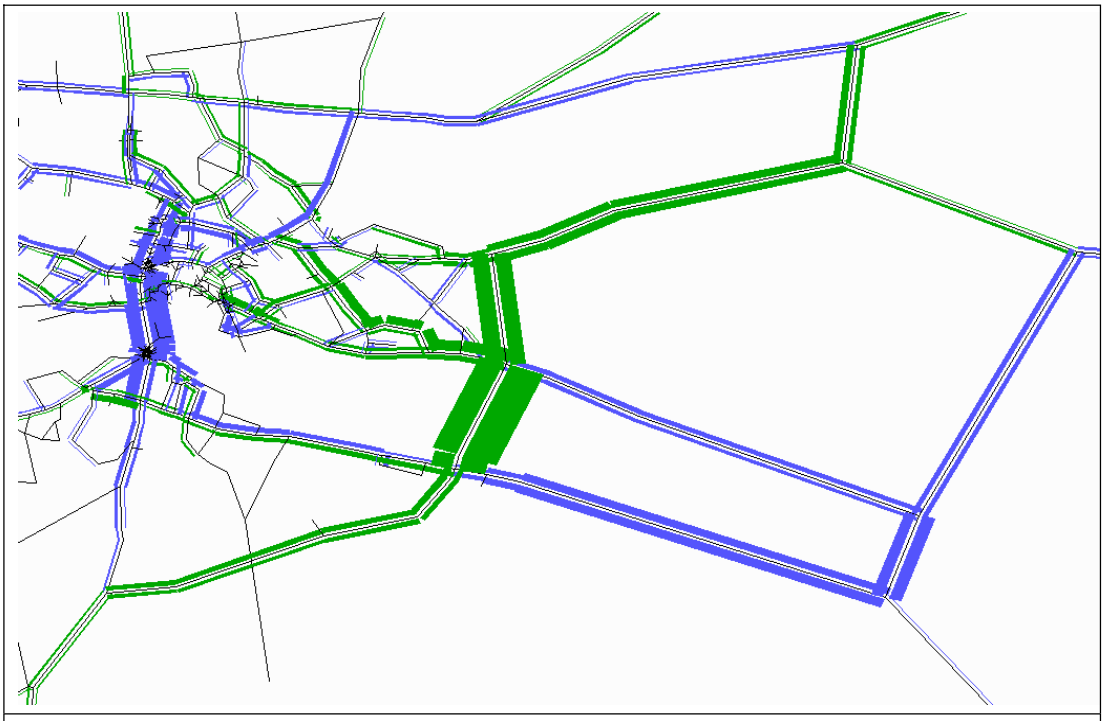

Figure 13: AM 2019 Traffic flow difference plot: Scenario 2 vs Scenario 1

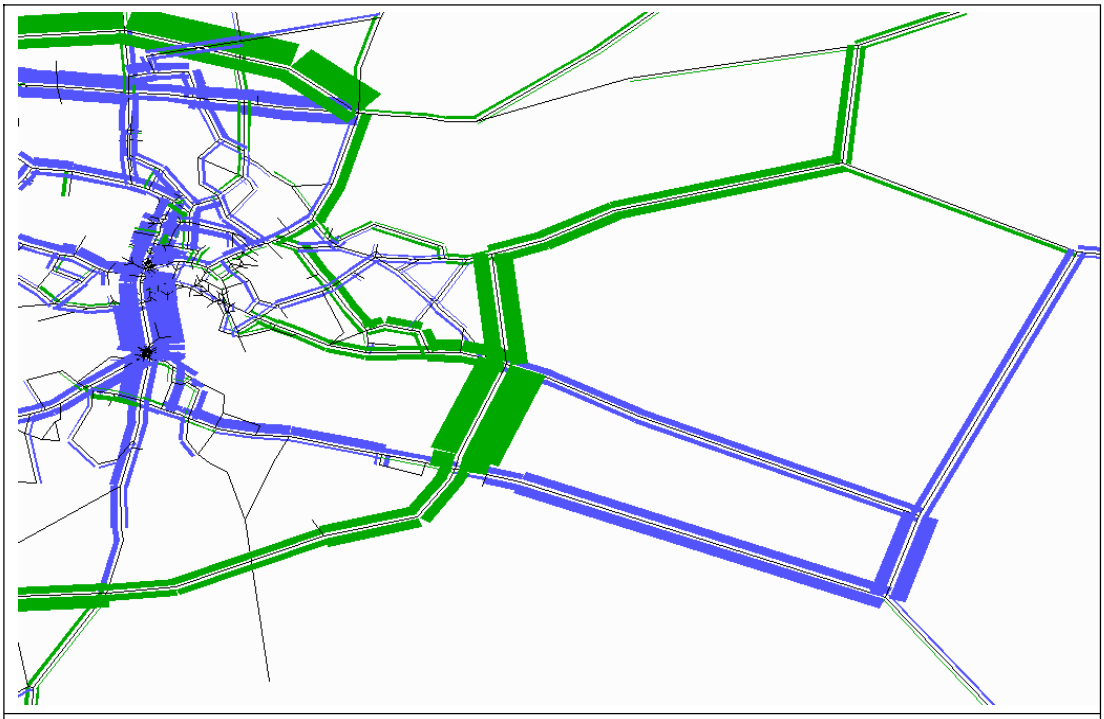

Figure 14: AM 2031 Traffic flow difference plot: Scenario 6 vs Scenario 4

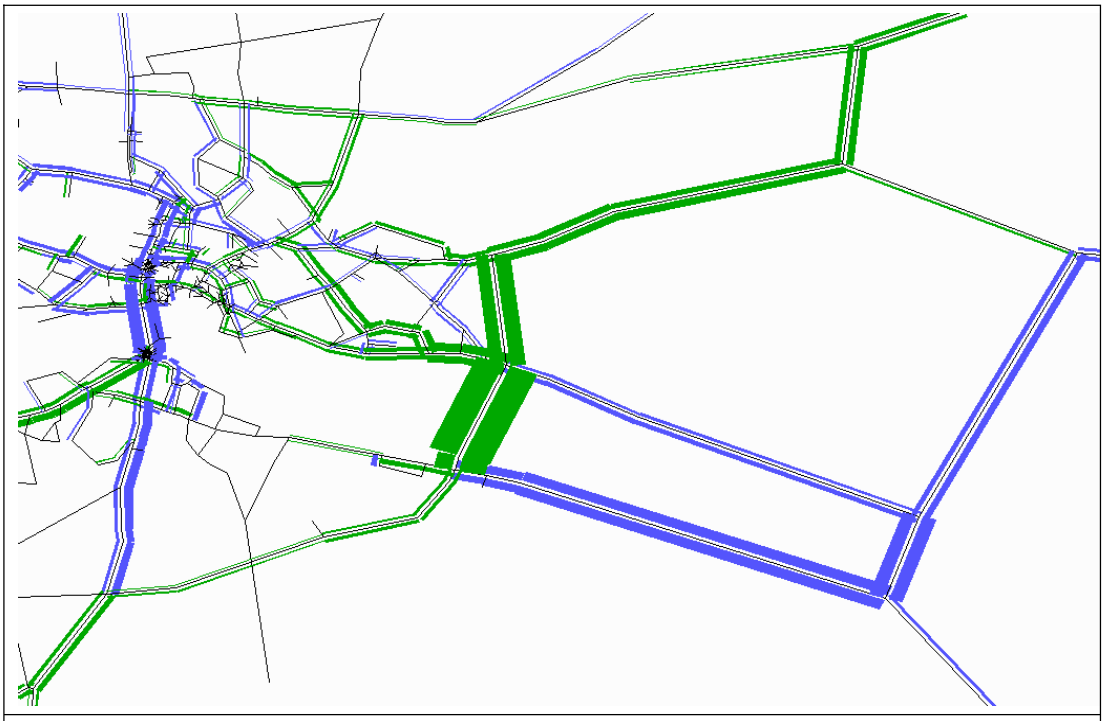

Figure 15: PM 2019 Traffic flow difference plot: Scenario 2 vs Scenario 1

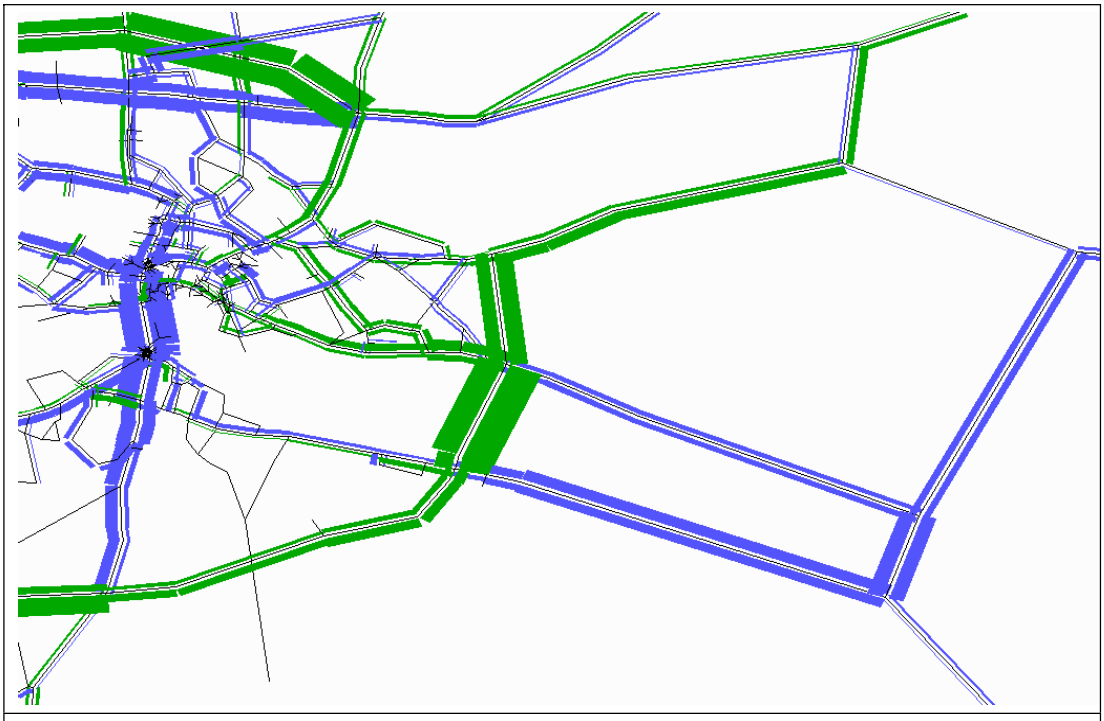

Figure 16: PM 2031 Traffic flow difference plot: Scenario 6 vs Scenario 4

A.3. Shown Below are the select link analysis for the Eastern Links.

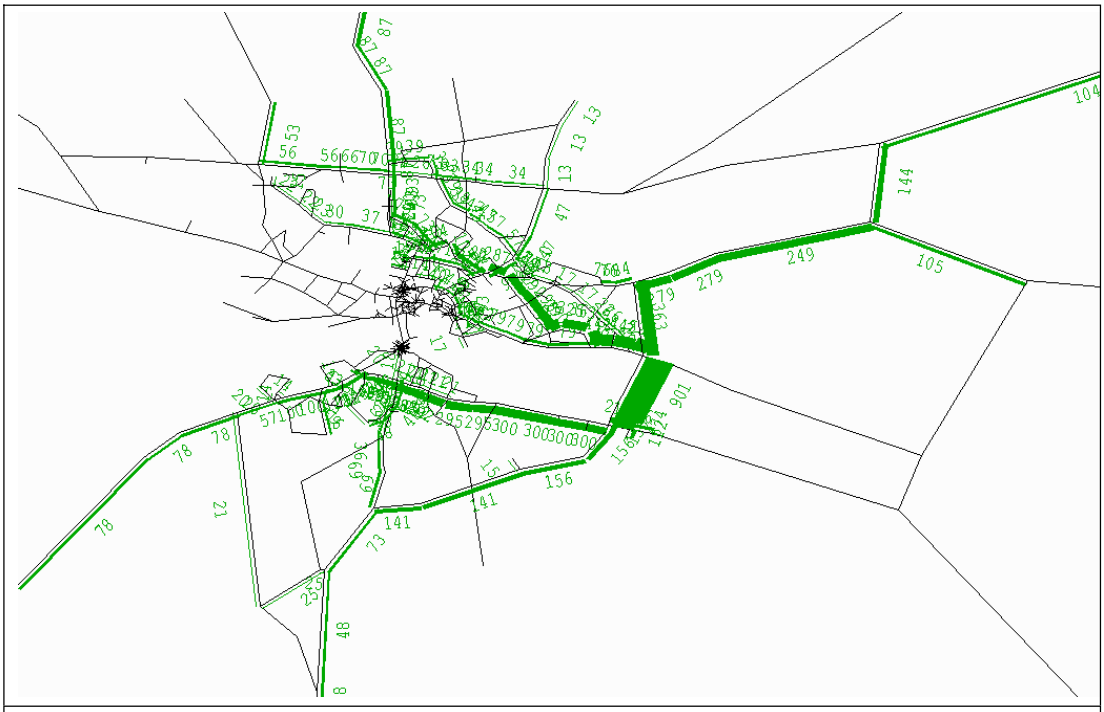

Figure 17: AM 2019 Select Link Analysis, Scenario 2 southbound

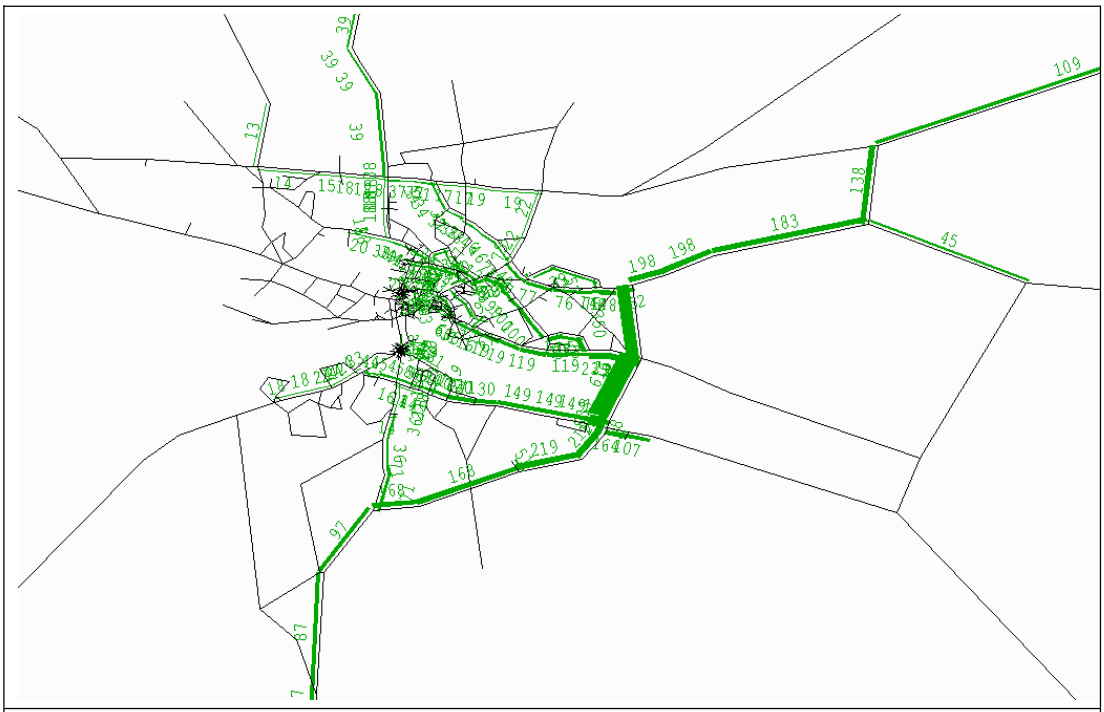

Figure 18: AM 2019 Select Link Analysis, Scenario 2 northbound

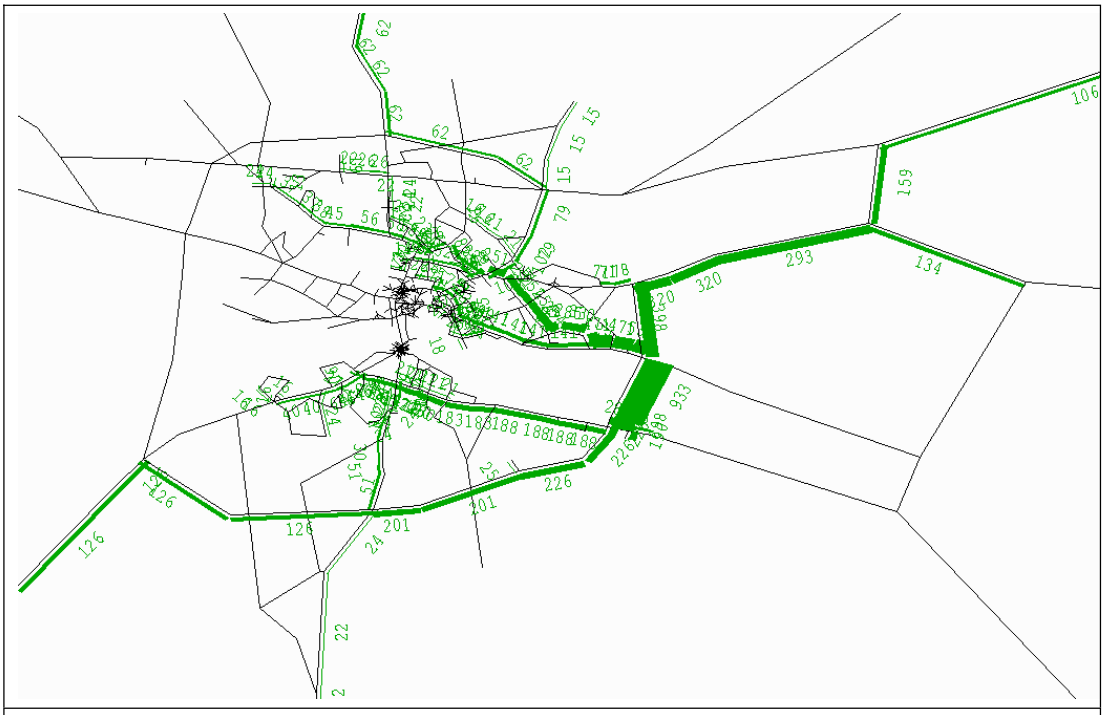

Figure 19: AM 2031 Select Link Analysis, Scenario 6 southbound

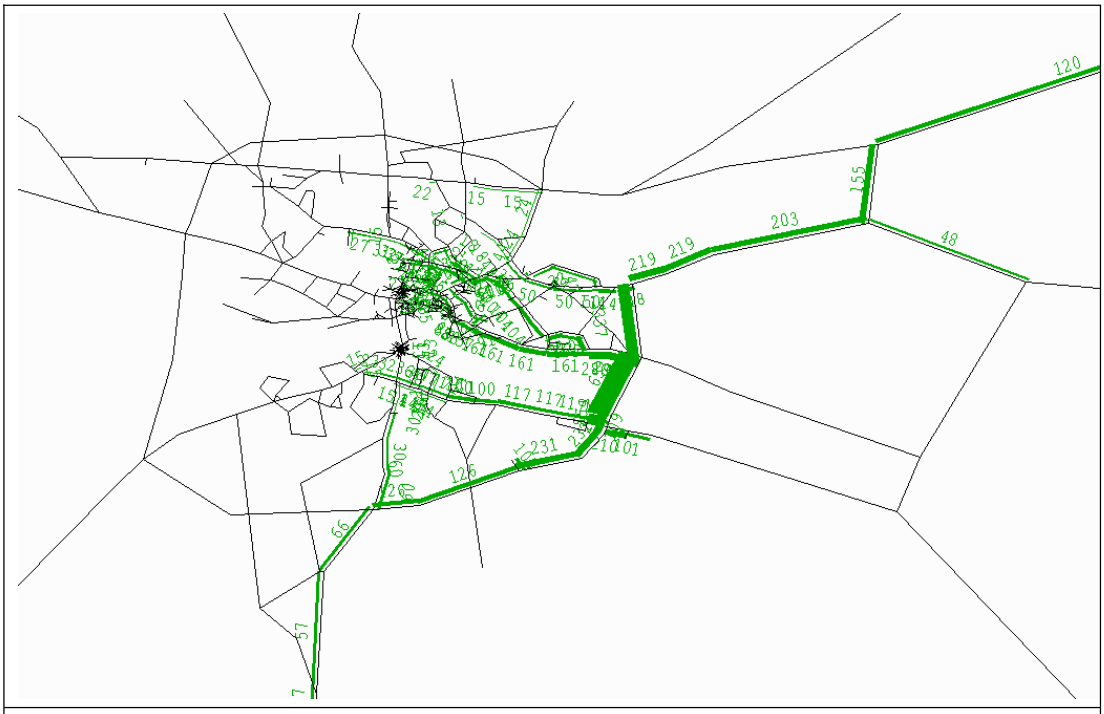

Figure 20: AM 2031 Select Link Analysis, Scenario 6 northbound

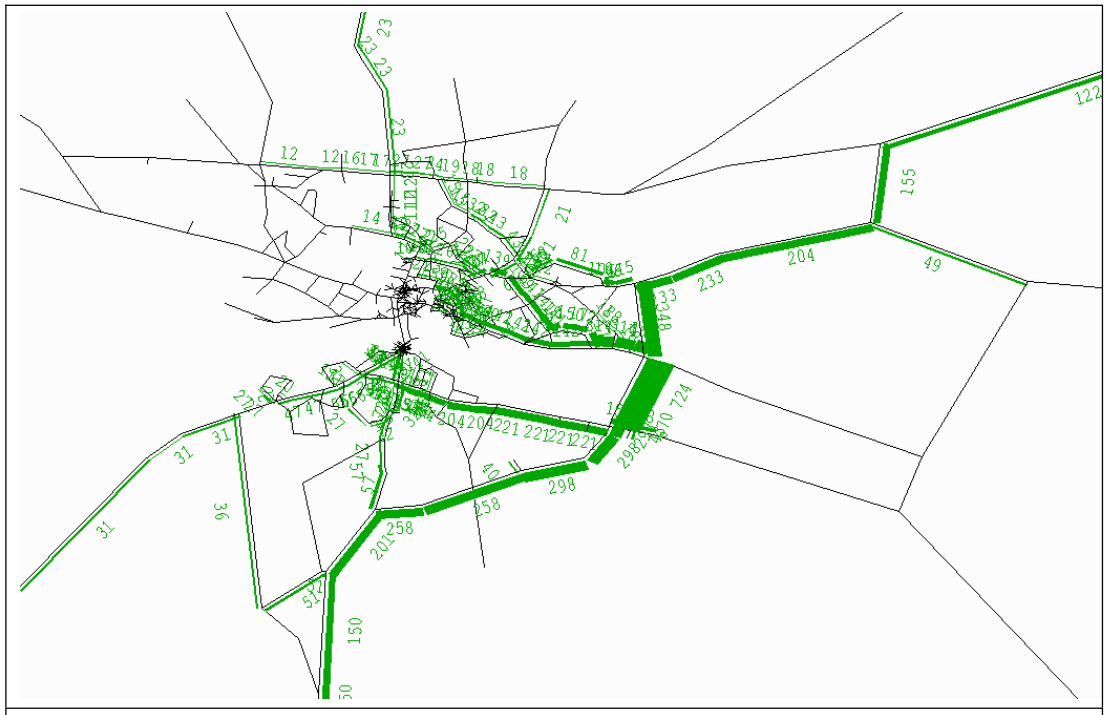

Figure 21: AM 2019 Select Link Analysis, Scenario 2 southbound

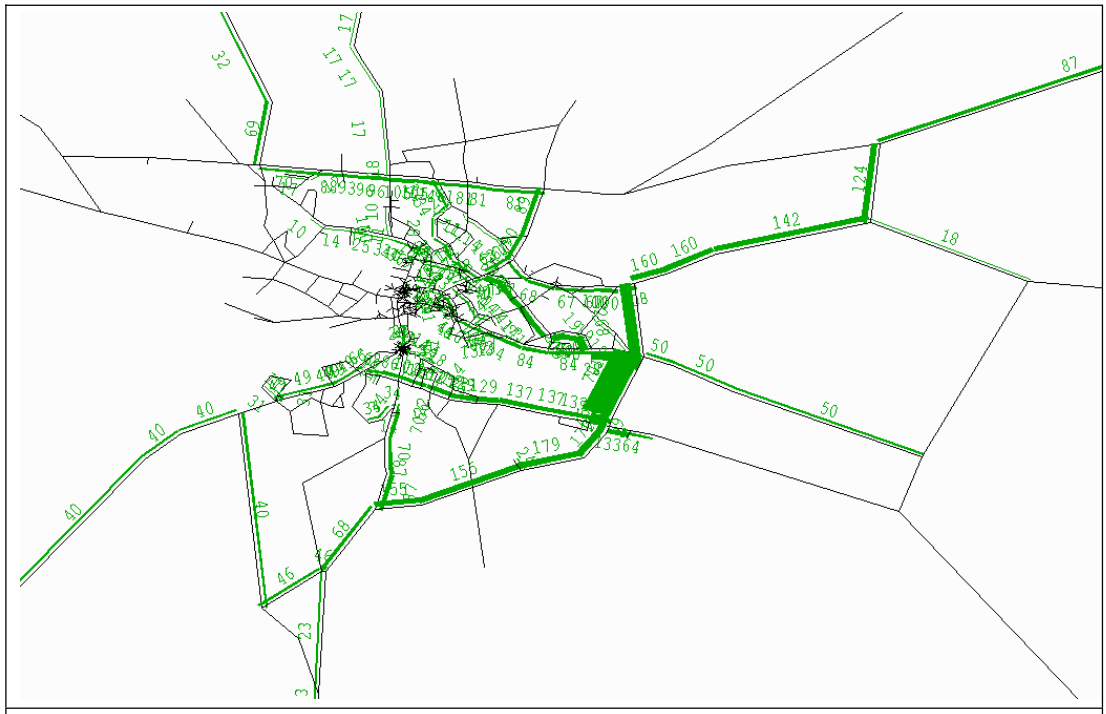

Figure 22: AM 2019 Select Link Analysis, Scenario 2 northbound

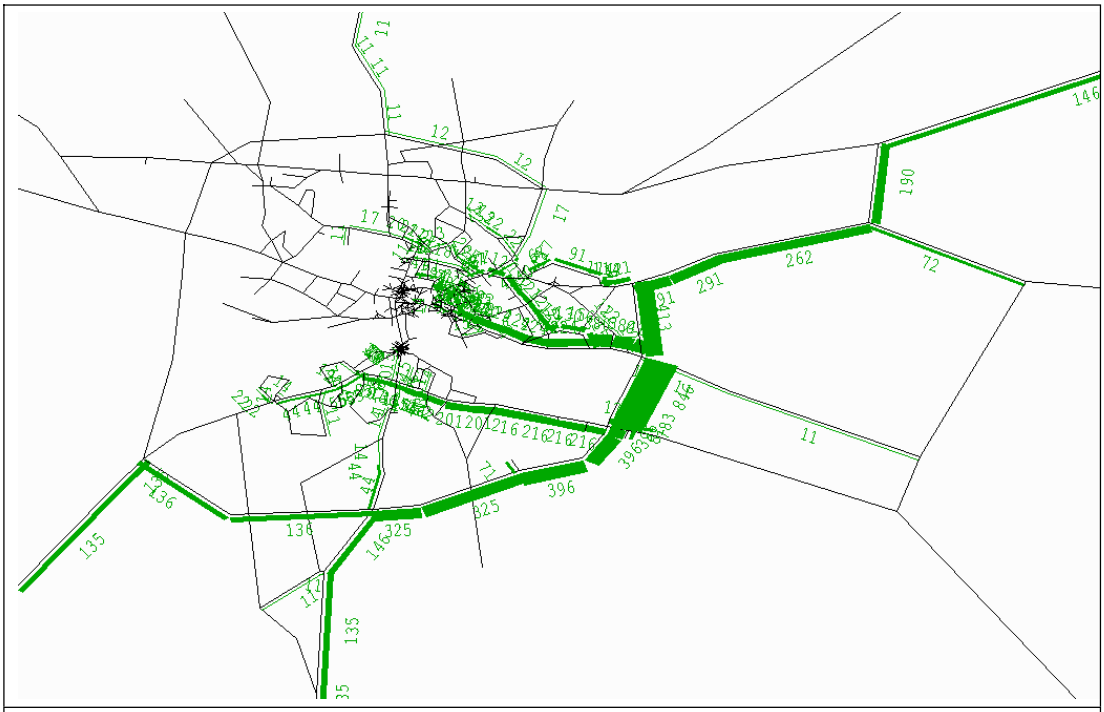

Figure 23: AM 2031 Select Link Analysis, Scenario 6 southbound

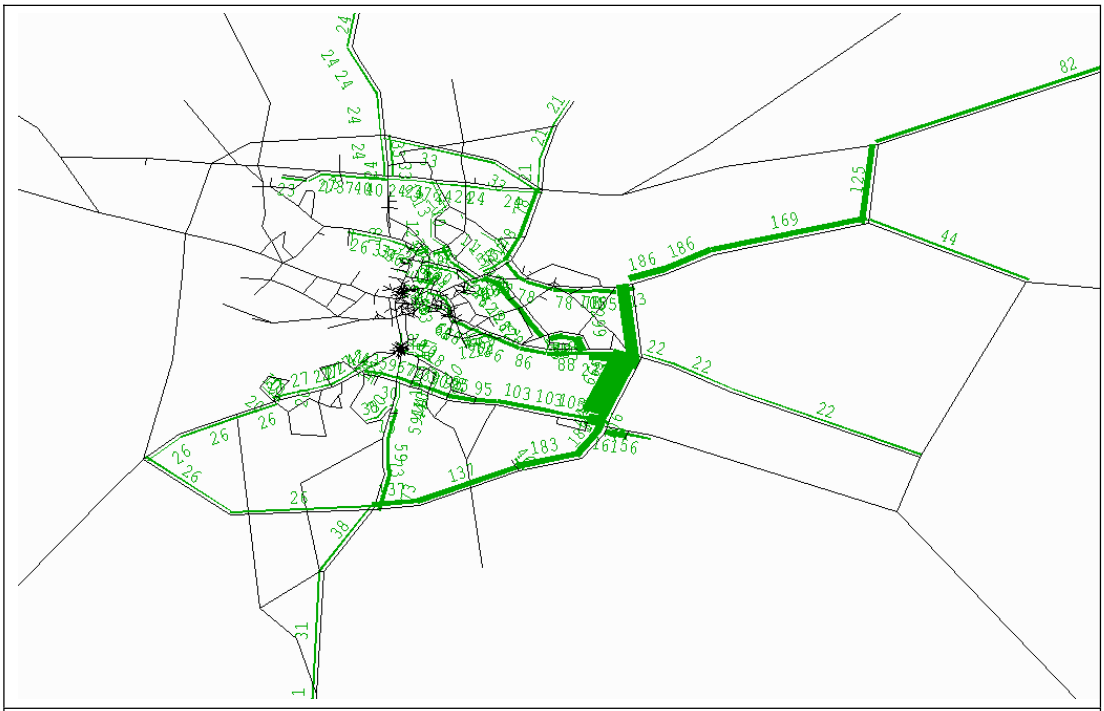

Figure 24: AM 2031 Select Link Analysis, Scenario 6 northbound

Appendix B

Lugwardine Bridge

Pedestrian Access Feasibility Study

Job No. 550220/005

Herefordshire Council
Lugwardine Bridge (BB010), Pedestrian Access

Feasibility Study

Report Number 550220/005/001
Version No 1
November 2004

Owen Williams
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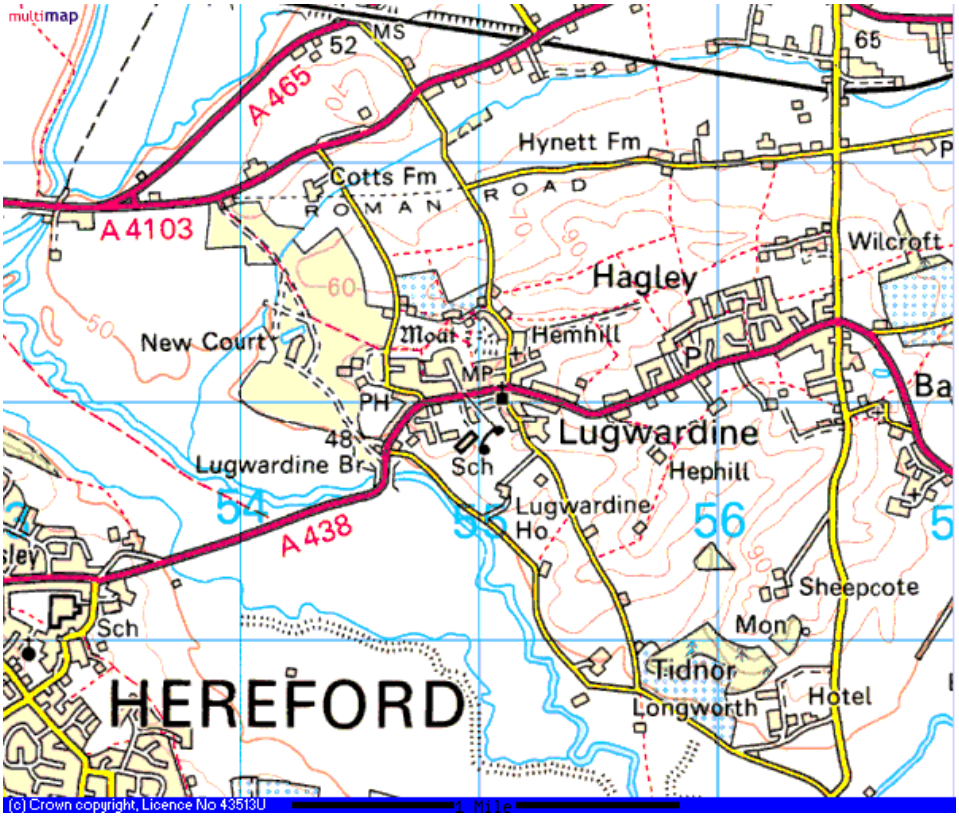
Contents



Location (plan not to scale)

1 Introduction

1.1 Lugwardine Bridge, BB010, carries the A438 between Tupsley and Lugwardine over the River Lugg (see location plan at the front of this report and detailed plan included in Appendix B.

1.2 This report by Owen Williams consultants discusses the feasibility of providing pedestrian access across the river at this location. The study was carried out under the Technical Services Consultancy Contract and Order No HBD 00464.

2 Current conditions

2.1 The structure comprises three stone masonry arches with stone masonry parapets and wing walls. It is a grade 2 listed structure and was listed in January 1967. It was built in the 16th century as a masonry arch bridge and in 1824 it was widened, by public subscription, using similar masonry arches. The bridge was further widened on its SW corner by steel beam and reinforced concrete deck in 1942.

The clear spans are 4.43 m, 5.18 m, and 4.43 m with 1.68 m wide piers. To the north each of the masonry block parapets join to masonry walls. The west and south east walls provide a top to a retaining wall. The start point of the parapet walls are staggered in plan by approximately 17 m with the east parapet starting to the south of the west.

Due to its status as a listed structure listed building consent, which is obtained from the local planning authority for grade 2, is required for the demolition of or any internal or external alterations affecting the special architectural or historic interest of any listed building from its time of inclusion on the Schedules. This is only normally granted for repairs to maintain structural integrity and must be 'in keeping' with the materials, appearance and form of the structure at the time of inclusion on the Schedules. For substantial changes this may be referred to English Heritage and the Secretary of State for approval.

See Appendix A, photographs Nos. 1, 2 and 3.

2.2 The River Lugg and the immediate area is a SSSI and SAC. There is one tree that could be affected by any proposed offline footway that has a Preservation Order (TPO T78). The tree is located approximately 10m north of the river and approximately 1m behind the wall which runs along the back of the western verge between the bridge and the access by Threepenny Bit Cottage. See location plan included in Appendix B, together with Appendix A, photograph No. 4.

The river approaches are on open flood plain at a lower level than the road, the river banks also being lined by trees. See Appendix A, photographs Nos. 5 and 6.

Any works within a flood plain will require consent from the Environment Agency. They usually require that there are no obstructions to water flow and any loss of 'storage area' for flood water is mitigated by additional provision elsewhere on the local area of flood plain. Any new crossing will need to have its soffit at least 1m above the 100year flood level at mid span.

2.3 The bridge carries the road on a north/south axis with the road approach from the south following a sharp left hand bend immediately before the bridge and exiting to the north on a straight alignment followed by a gentler right hand curve. The route of the A438 generally carries traffic in an east/west direction.

See location plan included in Appendix B together with photographs Nos. 7 to 13.

2.4 Prohibatory non-overtaking road markings prevail on the approaches to the bridge with double white lines on the northern approach that are released over the bridge for northbound vehicles only.

2.5 The square width between the inner faces of the masonry parapets varies from 7.15 to 7.01 m. The marked distance between white lines at carriageway edges is 5.69m.

2.6 The road width, away from the structure, on the south approach is 7.2 m (between white lines) and the north approach is 7.7 m between kerbs.

2.7 On the southern approach there is a paved footpath on the north/west side of width 1.5 m. This tapers to a finish at the masonry parapet. On the east side (outside of the curve) there is a un-kerbed soft verge with an open box beam safety barrier protecting the masonry wall/parapet on the approach to the structure.

2.8 Over the structure there is no provision for pedestrians. The masonry parapet is approximately 0.9 m in height above the road surface. See Appendix A, photograph No.10.

2.9 On the northern approach there is no provision for pedestrians on the immediate approach to the structure however a paved footpath of width approximately 1.3 m is provided on the west verge, north of the turning to Threepenny Bit Cottage. On the north approach to the structure there is a masonry wall to the west and a kerbed soft verge to the east backed by a masonry wall. See Appendix A, photographs Nos. 11 to 13.

2.10 Herefordshire Council carried out a pedestrian survey on 25/6/02 between 7am and 7pm. This observed a total of 5 adults and 6 children travelling northbound and 2 adults and 6 children travelling southbound. There are no available records on suppressed usage of this route by pedestrians because of the lack of a dedicated pedestrian route.

2.11 Herefordshire Council carried out a further survey on 22/1/04 but this was only at the junction of the A438 between Rhystone Lane and Lumber Lane. This is to the east end of the village near the church (see location plan at front of this report) and is not relevant to this study, as the movements would be influenced by the presence of village facilities in this area.

2.12 Herefordshire Council carried out a vehicle count on 18/4/02 (Thursday), between 7am and 7pm. This observed a total of 3779 vehicles travelling northbound and 4077 southbound in this period.

A more recent vehicle count was carried out over 24hrs of the dates 31/3/04 to 5/4/04. This observed an average total per 24 hr of 4297 vehicles northbound and 4458 southbound. This is summarised in the following table:

Date	Day	Total (24hr) eastbound (north over bridge)	Total (24hr) westbound (south over bridge)
31/3/04	Wednesday	4850	5000
1/4/04	Thursday	4727	5018
2/4/04	Friday	4865	5098
3/4/04	Saturday	3797	4008
4/4/04	Sunday	2974	2979
5/4/04	Monday	4569	4645

2.13 The speed limit between Tupsley and Lugwardine is signed at the national speed limit (60mph), which includes the structure. The speed limit of 40 mph for Lugwardine commences north of the access to Threepenny Bit Cottages. See Appendix A, photographs No. 12. Advisory signs on the northbound approach to the structure recommend a speed of 25 mph for the road.

Herefordshire Council undertook a vehicle speed survey at Middle Court, within Lugwardine approximately 0.5 km from the bridge and the 85% percentile speeds were recorded as per the following table. The signed speed limit for the section of road within the village, where the survey was carried out, was 40mph. No speed survey has been undertaken in the proximity of the bridge.

Date	Day	Eastbound (north over bridge)		Westbound (south over bridge)	
		85 Percentile	Percentage exceeding signed limit of 40mph	85 Percentile	Percentage exceeding signed limit of 40mph
31/3/04	Wednesday	41.71	21	39.63	14
1/4/04	Thursday	41.40	20	39.45	13
2/4/04	Friday	42.08	24	40.19	16
3/4/04	Saturday	42.48	26	40.82	18
4/4/04	Sunday	43.38	23	41.90	23
5/4/04	Monday	42.2	24	39.62	14

This indicates that vehicle speeds are generally high through this area as evidenced by approximately 20% exceeding the speed limit.

2.14 Due to the horizontal alignment of the highway at this structure, vehicles were observed during a site visit crossing the centre line as shown on Appendix A, photograph No. 14.

2.15 A number of incidents of damage to the masonry parapets have been recorded. The most recent being to the safety fence on the SE corner. The bridge parapets, the safety fence on the SE corner and all other approach walls all exhibit evidence of distress/damage caused by vehicle impact.

2.16 The length without adequate pedestrian refuge over the bridge (from end of taper in the footpath at the south west approach to a point where there is 1.5 m gap between the 'white lines' and the wall at the northwest) is approximately 38 m.

3 Options for provision of a pedestrian access at this river crossing are as follows (see Drawing No. 550220/005/001 in Appendix C)

Option 1 a) Provision of a separate footbridge over the river at a nearby location.

Option 1 b) Provision of a separate footbridge over the river attached to the existing bridge. On the west by extension of the existing widening and on the east the wing walls may be utilised to protect the required new end supports.

Option 2 a) Widen the existing bridge and maintain appearance as existing.

Option 2 b) Widen the existing bridge using materials/from other than masonry arches e.g.steel or timber.

Option 3 Provide a footpath on the existing structure with no change to the structural fabric of the bridge by: -

3a) Reducing road width but maintaining 2 way traffic flow at all times, and provide a footpath to one side only. Raise parapet height as required.

3b) Reducing road width and provide a footpath to one side only. Road width restricted by a chicane combined with a give way to oncoming traffic sign.

3c) Reducing road width and provide permanent traffic lights allowing vehicles to cross one way only at any one time.

3d) Maintaining road width but with traffic lights set at green both ways until pedestrian access required and activated by push button on approaches then both set to red for a suitable period (e.g. a longitudinal ‘pelican crossing’).

For all of the above it should be noted that the existing post and rail parapets on the southwest corner of the bridge do not meet the current standards for parapets in this situation.

Consideration of options	Advantages	Disadvantages	Comments
Option 1 – Provision of separate access			
Option 1 a) Provision of a separate footbridge over the river at a nearby location	Separate pedestrians from traffic.	High financial cost. A sympathetic design required. Damage to SSSI/SAC. Loss of visual amenity. New footpath to new crossing required. New footpath on southbound approach needed from access to Threepenny Bit Cottages. Additional land required.	Significant damage to the environment with a high financial cost. Access to the new bridge will require extensive works in a flood plain. Bridge will be obtrusive due its required height to be above flood levels.
Option 1 b) Provision of a separate footbridge over the river but supported off the existing bridge.	As 1a	As 1a plus Damage to the structural fabric and appearance of a listed structure. This will probably not be allowed by English Heritage/Conservation Interests. Requires removal of trees with tree preservation orders in place to west. To east extensive lengths of footpath required to provide access/safe crossings to existing footpaths.	Significant damage to the environment and changes to a listed structure with high planning and construction financial costs.
Option 2 – Widen the existing bridge			
2a) Demolish existing parapet and spandrel and widen arch and rebuild	As 1a	As 1b plus Pedestrians may be subject to vehicles mounting a verge unless significant improvement to road alignment is also included. High cost and disruption to route while works carried out. Removal and replacement of retaining wall at NW required allowing construction of additional footpath off the structure. This is specialist construction work and will require extensive work within the SSSI/SAC. The potential for environmental damage is very high.	
2b) Demolish existing parapet and spandrel and widen using 'modern' materials.	As 1a	As 2a plus Loss of appearance to a listed structure. This will probably not be allowed by English Heritage/Conservation Interests.	

Option 3 - Provide a footpath on the existing structure with no change to the structural fabric of the bridge by introduction of traffic management measures.			
3a) Reduce road width, maintain 2 way traffic flow at all times, provide a footpath to one side only and raise the parapet height	Separate pedestrians from traffic Lower financial cost and environmental impact than options 1 or 2. Does not damage the fabric of a listed structure.	Current maximum width is only 7.15 m (between faces of parapets) compared to the recommended width of 7.3 m for a road of this class, with a 1 m hardstrip and 1.5 m raised verge. Note the road width off the structure is 7.7 m in width New footpath on southbound approach needed from access to Threepenny Bit Cottages. The parapet height will require to be increased from 0.9 m (road level to top of masonry) to meet current standards (1m required above footpath level.) As an alternative to a raised verge an open box beam fence could be used to separate pedestrians from vehicles.	This option is unsafe as vehicles already cross the road centreline markings and vehicle collision accidents due to this have been recorded.
3b) Reduce road width and provide a footpath to one side only. Road width restricted by a chicane combined with a give way to oncoming traffic sign.	As 3a	Would cause traffic delays. Extensive approach signing required as bends on approaches particularly from the west. Poor visibility on northbound approach together with high speeds could increase vehicle conflicts and make option unsafe. New footpath on southbound approach needed from access to Threepenny Bit Cottages	Lack of visibility between approaches due to road alignment precludes this option.
3c) Reduce road width and provide permanent traffic lights allowing vehicles to cross one way only at any one time.	Lower financial cost and environmental impact than options 1 or 2. Does not damage the fabric of a listed structure. Removes vehicle & pedestrian conflict Calms vehicle speeds	Would cause traffic delays. Extensive approach signing required as visibility is restricted due to bends on approaches particularly from the west. New footpath on southbound approach needed from access to Threepenny Bit Cottages. The parapets are not code compliant for height Provides a safe route for pedestrians but does not provide a separation of routes.	Unsafe without significant improvement in visibility on northbound approach. Consider extending 40 mph limit and/or advance signal heads or matrix signing.

3d) Maintain road width but with lights at green both ways until pedestrian access required when both set to red (e.g a longitudinal 'pelican crossing').	Less disruption to traffic flow than option 3b.	Would cause traffic delays. Extensive approach signing required as bends on approaches particularly from the west. An unusual approach that may confuse drivers with local drivers becoming complacent if used to receiving 'All Green'. Long length for pedestrians to travel and time at red difficult to determine. New footpath on southbound approach needed from access to Threepenny Bit Cottages. Potential for anti-social behaviour by vandals causing traffic delays by inappropriate use of lights.	Unsafe without significant improvement in visibility on northbound approach. Consider extending 40 mph limit and/or advance signal heads. Extreme difficulty in determining time at red for safe passage by pedestrians.

4 Conclusions

4.1 The provision of a new pedestrian crossing to carry a pedestrian access route by construction of a new structure or modifying the existing structure (Options groups 1 and 2) is not considered feasible due to the high cost in environmental, heritage, land and financial terms.

4.2 The options in group 3 need to be considered with the prevailing conditions of poor road alignment, visibility, the width available between fixed features (e.g. walls/parapets) as well as the current below standard carriageway width, high approach speeds and the current accident statistics.

4.2.1 These options are considered feasible in that they have less potential impact on the environment and lower financial cost. However it is considered that they would cause significant disruptions to traffic flows both during construction and in use thereafter.

4.2.2 Option 3a cannot be provided due lack of road width available.

4.2.3 Option 3b would allow the minimum disruption but would be unsafe and possibly impossible to provide due to the poor visibility on approaches and between stop lines combined with the high approach speeds. The length of the one-way traffic would also be too long for a give way system for the length of footpath required.

4.2.4 Option 3d would be unsafe without significant cost, signage and use of unfamiliar technology to the road user. The intermittent nature of the use of the lights, due to low expected use by pedestrians, may also encourage motorists to assume they will always be at green. The determination of time at red will be difficult for this length of distance for the pedestrians to travel and the lack of visibility would exclude a proceed at caution interval. This option is therefore not recommended.

4.2.5 Only option 3c is considered practical, safe and economic to take forward as a potential solution. This has a number of difficulties including

- it would probably cause traffic delays
- Extensive approach signing required as bends on approaches particularly from the west.
- New footpath on southbound approach needed from the access to Threepenny Bit Cottages.
- The parapets are not code compliant for height
- Provides a safe route for pedestrians but does not provide a separation of routes

However, as the only feasible option it is further developed as below.

4.3 Preliminary design of option 3c indicates that the provision of a reduced width road with appropriate verges and hardstrips could be provided. The footpath would be on the west side of the bridge and the footpath extended to Threepenny Bit Cottage access.

The bridge parapet would not provide the adequate recommended height for pedestrian safety if a raised footway were provided. The pedestrians could be protected by posts or the existing road level maintained and a raised kerb barrier with transverse holes to allow drainage of the road provided, the footpath being at the current road level. The better solution would be to raise the parapet height but as this structure is listed this may not be allowed.

An initial assessment of the road signals shows that there would be adequate capacity for signals and the maximum queue would be acceptable. The table below summarises the analysis of the signals within Linsig, a computer modelling software package which analyses the likely impact of traffic signals on traffic flow and capacity:

Single Way Signals over bridge	PRC % (am)	Max Q (pcu)	PRC % (pm)	Max Q (pcu)	Cycle Time (s)
	+17.2	8	+50.8	6	75

PRC – Practical Reserve Capacity where a positive result indicates signals within capacity,

Max Q - Maximum queue following cycle of lights and pedestrian phase

To further improve the road safety the 40mph speed limit that currently starts at the access to Threepenny Bit Cottage should be extended westwards over the bridge and to include the northbound approach to the traffic signals. Advance signing will be required to further warn of the change in speed limit and to warn of the signals.

Advance matrix signing could be used to either warn drivers exceeding the speed limit to slow down or they can be used in conjunction with the signals to warn of signals on red and / or possible queues. If no improvement in the visibility can be achieved, then matrix signing should be linked with the signals to warn approaching vehicles of queues ahead.

4.4 There have been three recorded injury crashes within the last three years (to July 2004). One crash was recorded as serious and two recorded as slight. Two of the crashes resulted in drivers losing control and their vehicles crossed the double white lines colliding with oncoming vehicles.

Single-way working under traffic signal control will calm vehicle speeds and remove these vehicle conflicts. Similarly, although none have been recorded, the provision of a paved footpath will also reduce the likelihood of vehicle / pedestrian conflicts.

Damage only crashes resulting in significant damage to the parapets, approach walls and safety fence will also be reduced as vehicle speeds are slowed.

For the above it should be noted that the existing post and rail parapets on the southwest corner of the bridge do not meet the current standards for parapets in this situation.

4.5 The estimated cost to provide a simple 4/5 pole installation with triple speed loops on the approaches is £65k. This includes an estimate of £5k each for say 3 no vehicle matrix signs to provide advance warning.

The estimated cost does not include Design Fees or envisaged costs for any works to Statutory Undertakers Apparatus.

Appendix A

Photographs

Photograph 1 East elevation, downstream face.

Photograph 2 West elevation north span.

Photograph 3 West elevation south span and widening.

Photograph 4 West elevation view to north from end of widening.

Shows tree with preservation order in place.

Photograph 5 View east from bridge.

Photograph 6 View west from bridge.

Photograph 7 South approach, view west, from curve on approach to bridge.

Photograph 8 View south of road from bridge.

Photograph 9 South approach to the bridge, view to north.

Photograph 10 View north over the bridge.

Photograph 11 View to north, from bridge, of the north approach. Access to Threepenny Bit Cottage on left of photograph.

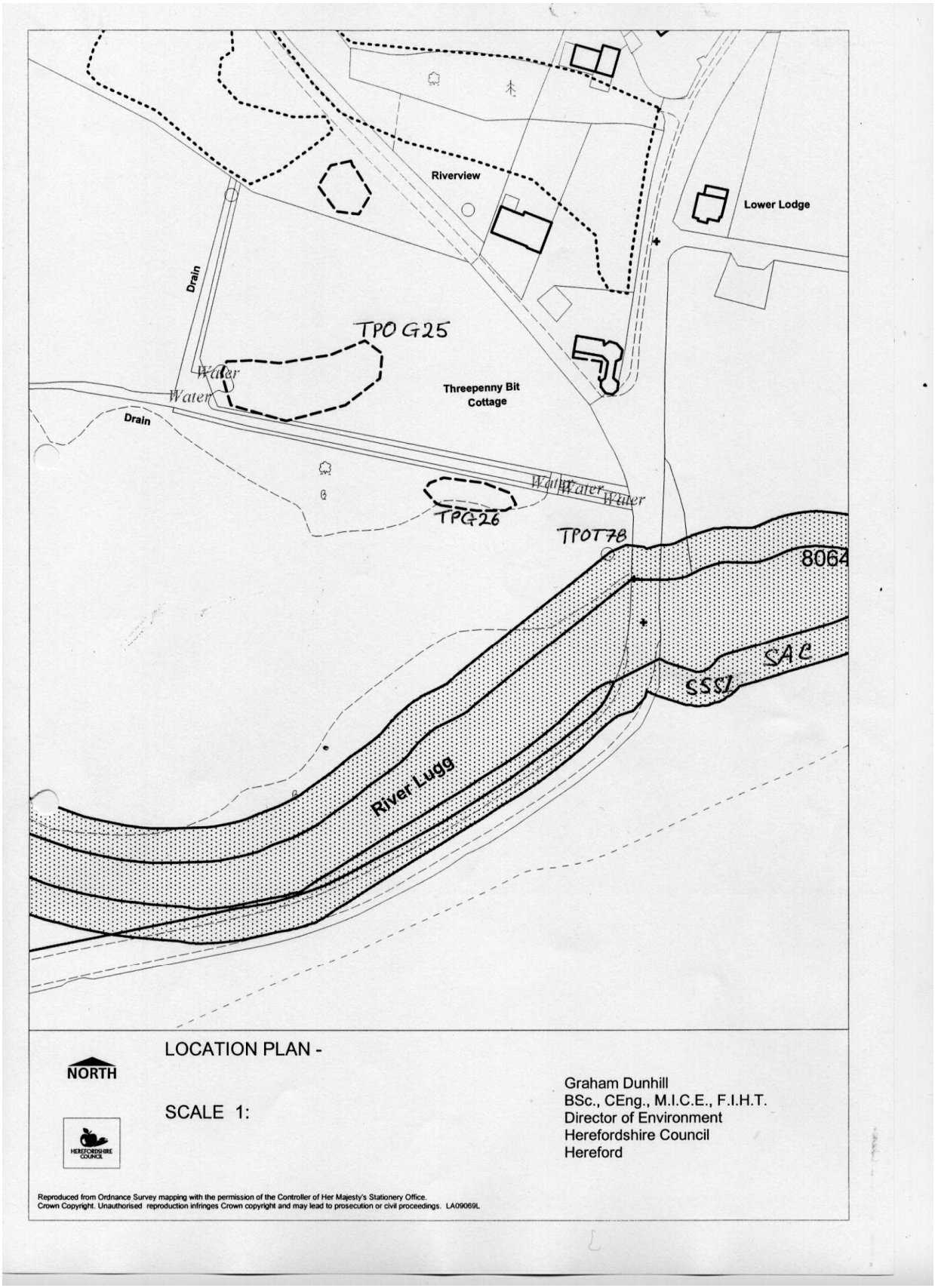
Photograph 12 View to north of the north approach from the turning to Threepenny Bit Cottages.

Photograph 13 North approach to the bridge, view looking south, bridge is at the crest in the road.

Photograph 14 Lorry south bound over structure.(Crossing centreline markings)

Appendix B

Location plan showing TPO's and SSI/SAC



4.6 Location plan showing TPO's and SSSI/SAC

Appendix C

Drawing No. 550220/005/001
Proposed Options

Appendix C

Transport Economic Efficiency (TEE) Tables

Economic Efficiency of the Transport System (TEE) - DO SOMETHING 2 SCHEME Eastern Link and Western Relief Road

Non-business: Commuting	**ALL MODES**	**ROAD**		**BUS and COACH**	**RAIL**	**OTHER**
User benefits	**TOTAL**	**Private Cars and LGVs**		**Passengers**	**Passengers**	
Travel time	21100	21100				
Vehicle operating costs	4069	4069				
User charges	0	0				
During Construction & Maintenance	0	0				
COMMUTING	25169	25169				

Non-business: Other	**ALL MODES**	**ROAD**		**BUS and COACH**	**RAIL**	**OTHER**
User benefits	**TOTAL**	**Private Cars and LGVs**		**Passengers**	**Passengers**	
Travel time	57460	57460				
Vehicle operating costs	11502	11502				
User charges	0	0				
During Construction & Maintenance	0	0				
NET NON-BUSINESS BENEFITS: OTHER	68962	68962				

Business							
User benefits		**Goods Vehicles**	**Business Cars & LGVs**	**Passengers**	**Freight**	**Passengers**	
Travel time	91499	57495	34004				
Vehicle operating costs	16178	3809	12369				
User charges	0	0	0				
During Construction & Maintenance	0	0	0				
Subtotal	107678	61305	46373				
Private sector provider impacts					**Freight**	**Passengers**	
Revenue	0						
Operating costs	0						
Investment costs	0						
Grant/subsidy	0						
Subtotal	0	*(3)*					
Other business impacts							
Developer contributions	0	*(4)*					
NET BUSINESS IMPACT	107678	*(5) = (2) + (3) + (4)*					

TOTAL

Present Value of Transport Economic Efficiency Benefits (TEE)	201809	*(6) = (1a) + (1b) + (5)*

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.
All entries are discounted present values, in 2002 prices and values

Economic Efficiency of the Transport System (TEE) - DO SOMETHING 1 SCHEME Eastern Link Only

Non-business: Commuting	**ALL MODES**		**ROAD**	**BUS and COACH**	**RAIL**	**OTHER**
User benefits	**TOTAL**		**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	39158		39158			
Vehicle operating costs	2164		2164			
User charges	0		0			
During Construction & Maintenance	0		0			
COMMUTING	41322	*(1a)*	41322			

Non-business: Other	**ALL MODES**		**ROAD**	**BUS and COACH**	**RAIL**	**OTHER**
User benefits	**TOTAL**		**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	101573		101573			
Vehicle operating costs	4135		4135			
User charges	0		0			
During Construction & Maintenance	0		0			
NET NON-BUSINESS BENEFITS: OTHER	105708	*(1b)*	105708			

Business							
User benefits			**Goods Vehicles**	**Business Cars & LGVs**	**Passengers**	**Freight**	**Passengers**
Travel time	154859		104072	50787			
Vehicle operating costs	17520		3474	14046			
User charges	0		0	0			
During Construction & Maintenance	0		0	0			
Subtotal	172379	*(2)*	107546	64833			

Private sector provider impacts			**Freight**	**Passengers**	
Revenue	0				
Operating costs	0				
Investment costs	0				
Grant/subsidy	0				
Subtotal	0	*(3)*			

Other business impacts						
Developer contributions	0	*(4)*				
NET BUSINESS IMPACT	172379	*(5) = (2) + (3) + (4)*				

TOTAL		
Present Value of Transport Economic Efficiency Benefits (TEE)	319409	*(6) = (1a) + (1b) + (5)*

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.
All entries are discounted present values, in 2002 prices and values

Appendix D

Consultation Responses

ENGLISH HERITAGE

WEST MIDLANDS

Mr A Palmer
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Hereford
HR2 6JT

Our ref: HD/P 6032/03
Your ref: 551594/AP

Telephone 0121 625 6851
Fax 0121 625 6820

3 April 2012

Dear Mr Palmer

re: **HEREFORD RELIEF ROAD EASTERN CORRIDOR LINKS ASSESSMENT**

Thank you for your letter of 22 February and the invitation to provide comments on the assessment of further options for road infrastructure in the context of the Hereford Enterprise Zone. As explained in your letter and email, the assessment at this stage is considering the implementation of links EL2 and EL3 which were originally identified in the Study of Options Report (2010).

We acknowledge that the stated scope of the present investigation is to review the routes assessed in the Study of Options Report, consider any additional routes available and identify potential impacts on the local and wider network. We also acknowledge that the study is not intended to provide a preferred, detailed route alignment as these will be assessed in more detail in the next stages of the assessment.

This pre-defined scope of the study serves as the context for our comments at this stage. Although we welcome the opportunity to comment on the information provided for this element of the assessment, it should be noted that English Heritage was not consulted directly in the development of the Study of Options Report (2010), this including assessing the environmental aspects of the route corridor options. We subsequently made comments on the Report and its environmental assessment as part of our response to the Core Strategy Preferred Option (2010) and the Revised Hereford Preferred Option (2011). In March 2012 we also submitted detailed comments on the consultation for the Local Development Order for the Hereford Enterprise Zone.

We have previously highlighted a number of issues with respect to the environmental assessment and its treatment of the historic environment and heritage assets and their settings. It should be noted that national planning policy guidance for the historic environment is now set out in the National Planning Policy Framework (NPPF) (particularly

paragraphs 126-141) and this should serve as the context for the assessment of any proposals. With regard to the Eastern Links Assessment we wish to reiterate the importance of addressing the following.

Designated Heritage Assets

Link EL3 is likely to have direct and indirect impacts on the group of designated heritage assets centred on Rotherwas Chapel (listed Grade II*); the scheduled site of Rotherwas House, earthwork remains of the formal garden and Rotherwas Chapel; and the extant buildings of Rotherwas House comprising a barn and former stable block (both listed Grade II). Rotherwas Chapel is also in the Guardianship of English Heritage.

As presented in the plan (Map A0.04), the link EL3 could have a direct impact on these designated assets. We draw you attention to the NPPF (paragraph 132) in that *substantial harm to or loss of designated assets of the highest significance, notably scheduled monuments grade I and II* listed buildings .should be wholly exceptional* and *substantial harm to or loss of a grade II listed building should be exceptional*.

The alignment of any potential road infrastructure in this area is also likely to have an impact on the significance of these heritage assets by virtue of the impact(s) on their setting. The NPPF reaffirms that *significance can be harmed or lost through alteration or destruction of the heritage asset or development within its setting*. The NPPF also recognises that *significance derives not only from a heritage asset s physical presence, but also from its setting* (page 56) and as such *local planning authorities should identify and assess the particular significance of any heritage asset that may be affected by a proposal (including by development affecting the setting of a heritage asset*) .

We recommend that the English Heritage guidance on *The Setting of Heritage Assets* is used to inform the assessment of potential implications for the setting of heritage assets (applicable to designated and non designated heritage assets). The guidance is available at: http://www.english-heritage.org.uk/publications/setting-heritage-assets/.

Other designated assets that could be affected by the operation of links EL3 and EL2 include:

> Conservation areas located along the existing main roads that would link to and from EL3 and EL3, including Hampton Park in Hereford and conservation areas in the surrounding villages such as Lugwardine and Hampton Bishop. Potential impacts in these areas are likely to be associated with increased levels of traffic and consequential issues related to congestion, noise and visual intrusion, air quality and the effects of any related highway improvements and traffic calming measures.
> The grade II listed bridge at Lugwardine and the potential implications for its fabric as a result of increased traffic levels and or works to improve its capacity.

Undesignated Heritage Assets and Archaeological Potential

The assessment should also consider potential impacts on the significance of undesignated heritage assets as well as the potential for assets of archaeological interest (e.g. NPPF paragraph 128). This is particularly relevant for links EL3 and EL2 due to the archaeological sensitivity of the wider Rotherwas area, a possible crossing of the River Wye, and the low-lying floodplains of the Rivers Wye and Lugg.

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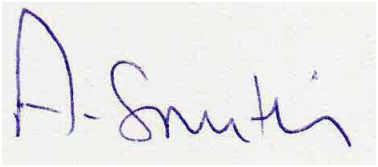
In recognition of the heritage interest of the Rotherwas area (encompassing the existing industrial estate, adjoining areas and wider hinterland), and the number of recent studies which have extended the evidence base on the area s archaeological interest, English Heritage has funded the Council s Archaeological Service to prepare a heritage Conservation Management Plan (CMP). The full heritage CMP is in preparation, however, in response to the priority of the successful Enterprise Zone bid, the Council s Archaeological Service has prepared a Heritage Management Strategy for the Enterprise Zone. That latter document identifies a number of undesignated heritage assets (e.g. the Lawn Pool) and areas of archaeological sensitivity and potential archaeological sensitivity. We recommend that the Council s historic environment team is consulted with regard to these documents and the available evidence base for the area. Our comments on the draft Local Development Order and recommendations are also pertinent for this area and any proposals for road infrastructure.

A crossing of the River Wye and construction of a bridge could have implications for palaeoenvironmental deposits associated with water logged deposits such as buried peats, palaeochannels and other buried wet features. These have the potential to preserve significant evidence of human activities and should be protected under the same principles as other heritage assets. Similar considerations are also relevant to link EL2 due to its proximity to the floodplains of the River Wye and River Lugg and the network of smaller streams and brooks. We hence recommend that the Council s historic environment team is consulted with regard to the available evidence base for the area and their expert advice on an appropriate archaeological assessment and evaluation strategy.

Please contact me if you require any further information at this stage. We would be happy to discuss our comments in greater detail subject to the outcome of the assessment of the options.

Yours sincerely



Amanda Smith
Planner (West Midlands)
E-mail: amanda.smith@english-heritage.org.uk

Date: 16 March 2012
Our ref: 47310-C00551595_AP-Hereford Relief Road Eastern Links Assessment
Your ref: C00551995/AP

Andrew Palmer
Amey Herefordshire

Andrew.Palmer@amey.co.uk

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Dear Mr Palmer,

Hereford Relief Road Eastern Links Assessment

Thank you for your consultation on the above, which was received by Natural England on 1 March 2012.

Natural England is a non-departmental public body. Our statutory purpose is to ensure that the natural environment is conserved, enhanced, and managed for the benefit of present and future generations, thereby contributing to sustainable development.

We have considered the proposal against the full range of Natural England's interests in the natural environment. Based on the information provided with the application, our comments are as follows:

We understand that Herefordshire Council is considering the development of an eastern link road, from Rotherwas to the A438, including a crossing over the River Wye. It is not clear whether this eastern link would be a standalone proposal or included within the Core Strategy. It is also not clear whether this link would be instead of or in addition to the proposed Western Relief Road.

Our detailed comments are as follows:

Evidence base to date

The Local Planning Authority had reached an evidence-based decision to pursue a western relief road. The Study of Options (Amey, 2010) identified engineering and environmental advantages and disadvantages associated with a range of western and eastern relief road options. The Study was clear about the environmental risks associated with an eastern route and recommended the inner western route. On balance, Natural England agreed with this recommendation. It therefore gives us some concern that an eastern route option is still being pursued.

The River Wye SAC

As you are aware, the River Wye is a Special Area of Conservation (SAC), protected under the *Conservation of Habitats and Species Regulations 2010* (the Habitats Regulations).

The Local Planning Authority (LPA), as the Competent Authority, is required to undertake a Habitat Regulations Assessment (HRA) before deciding to give any consent to a project which is (a) likely to have a significant effect on a European site (either **alone or in combination** with other plans or projects), and (b) not directly connected with or necessary to the management of the site. This proposal is not directly connected with or necessary to the management of the site.

Considerable further work may be required to identify potential impacts and appropriate mitigation for an eastern link road. In particular, there are likely to be complex hydrological relationships between the River Wye SAC, the River Lugg part of the River Wye SAC, the Lugg and Hampton Meadows Site of Special Scientific Interest (SSSI), tributaries including the Lugg Rhea and the wider floodplain, and these will need to be taken into account.

It is worth noting that if both the Western Relief Road and the eastern link are being progressed, the in combination effects on the River Wye SAC will need to be assessed.

Lugg and Hampton Meadows SSSI

As you are already aware, Natural England is currently consulting on its notification of the Lugg and Hampton Meadows SSSI. I attach a map of the SSSI boundary for your information.

The *Wildlife and Countryside Act 1981* (as amended) imposes a general and overarching duty under Section 28G that requires an authority to take reasonable steps, consistent with the proper exercise of its functions, to further the conservation and enhancement of the features for which sites are of special interest. In addition, specific obligations under Section 28H apply to planning authorities, when, having considered their general duty, they nevertheless propose to carry out or authorise operations likely to damage the special interest features of SSSIs (whether or not these will take place on land included in the SSSI). A planning authority proposing to carry out operations likely to damage the special features of a SSSI must notify Natural England under section 28H of the Act. Natural England then has 28 days within which to indicate whether or not we assent to the operation (with or without conditions). For further information please refer to ODPM Circular 06/2005 Biodiversity and Geological Conservation – Statutory Obligations and their Impact within the Planning System.

The inner eastern route would not require direct land take from the SSSI and is therefore preferable to the outer eastern route. However, there may still be impacts as a result of hydrological interference or possibly other as of yet unforeseen impacts, which will need to be investigated.

For any correspondence or queries relating to this consultation only, please contact Hayley Pankhurst using the details given below. For all other correspondence, please contact the address above or by email to consultations@naturalengland.org.uk.

Yours sincerely,

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Land Use Operations Team
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HIGHWAYS AGENCY

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19 March 2012

Mr Andrew Palmer
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Dear Mr Palmer

HEREFORD RELIEF ROAD EASTERN LINKS ASSESSMENT

Thank you for your recent consultation on the above named assessment, which we received on 23rd of February 2012.

The Highways Agency understands that due to the grant of Enterprise Zone status Herefordshire Council (HC) is considering further infrastructure improvements. Amey Herefordshire has been commissioned to explore the implications of a new River Wye crossing and road links between Rotherwas and the A438. These proposals form the basis of the current 'Eastern Links Assessment' consultation. We understand that any eastern link should be considered both as a proposal in its own right and in conjunction with the Western road corridor.

Amey Herefordshire have requested the Highways Agency's view on their scheme assessment and appraisal methodology. We offer the following observations:

Proposed Methodology

It is understood from the letter, which cross references the 'Study of Options' report, that the following schemes are being proposed for assessment:

i. A new River Wye crossing and a road links to the East of Hereford to connect Rotherwas and A438 (S1);
ii. A link from A49 to A465 (southern core) (S2); and
iii. Western Relief road (S3).

For convenience of reference they have been labelled as S1, S2 and S3. It is proposed that the study will consider TEMPRO growth with housing option 5. The assessment will be undertaken for the following years:

a. Base year 2008
b. Opening Year 2019
c. Forecast year 2031

2019 has been considered as the opening year for the proposed schemes and the following scenarios have been proposed for assessment:

i. 2019 model with Linear growth based on 2031 forecast;
ii. 2019 model with Linear growth based on 2031 forecast with S1; and
iii. 2019 model with Linear growth based on 2031 forecast with S1 and S2.

Areas of clarification

The above scenario analysis will enable us to understand the impact of S1 and S2 separately. However, the definition of Linear Growth should be provided. Currently it is unclear if the definition implies that the 2019 demand will be derived by interpolating between 2008 and 2031, where the 2031 demand comprises of TEMPRO growth and housing option 5.

It is understood that the following scenarios will be tested for 2031

i. Forecast year 2031 with Western Relief road (S3); and
ii. Forecast year 2031 with S3 and S1;

Reviewing the scenario, it is understood that there is no do minimum scenario (without WRR) for 2031. Therefore, we have assumed that this study will not assess the impact of the western relief road as it has been considered in the earlier study. In addition it is also unclear if the western relief road is being considered as a committed scheme.

After reviewing the information provided it is unclear why the link from the A49 to the A465 (S2) is not being considered for assessment in 2031. Amey Herefordshire may wish to clarify this point.

The letter mentions that the revised model will be used for this assessment. The Highways Agency would suggest using the revised model to undertake a do minimum scenario test for the year 2013. This would reassess the impact of the western relief road and allow the impact of the proposed schemes to be assessed individually.

Summary

In light of the above the Highways Agency considers the proposed modelling outputs satisfactory. However, results that relate to the A49 trunk road will need to be reported separately.

The Highways Agency recognises that Herefordshire Council/ Amey Herefordshire are the promoters of the report and offer the above comments on an advisory basis.

Yours sincerely

Stephen Williams
NDD West Midlands
Email: stephen.williams@highways.gsi.gov.uk

Palmer, Andrew

From: Cotton, Julian <jcotton2@herefordshire.gov.uk>
Sent: 12 March 2012 16:35
To: Palmer, Andrew
Subject: Hereford Relief Road, southern and eastern corridor options

Dear Andrew,

I enclose my initial comments on the above consultation.

My apologies for the slight delay with this, I had some significant I.T. problems at the end of last week.

SOUTHERN CORRIDOR

A brief early-stage assessment has been made of various suggested route options between the junction of the A 49 Ross Road / B4399 Rotherwas Access Road, and the A 465 Abergavenny Road near Hayleasow/Abbey Farm.

General comments Whilst it is acknowledged that the particular assessment undertaken is not intended to be a 'ull assessment, I am concerned about the way the historic environment 'constraint' information has been generated/depicted. The only constraints apparently indicated are the currently known and designated sites (ie the listed buildings and scheduled monuments) directly en-route. This approach neglects other known sites, which, although not designated at present, have sufficient interest and sensitivity to be considered for such. The approach does not take into account the potential for impact on further currently undiscovered sites, nor the possible impact on the 'setting' of sites generally. Issues of this kind were directly raised in the Independent Review of Hereford Relief Road Technical Studies (Parsons Brinckerhoff, July 2011)

SC1 This option commences at a junction on the A465 Abergavenny Road, just to the south west of Belmont Abbey (HSM 9431). After passing by Spring Grove, and crossing the Hereford - Cardiff rail line, near to the find-spot of prehistoric flints (HSM 6281), the option curves round well to the south near to The Green, and through Grafton Wood to the Ross Road.

SC2 This option is similar to SC1 over most of its alignment, but the western third is different. This third commences from a point some 400m further south west on the Abergavenny Road, and follows a more southerly course for about a kilometre. The course curves gently round the south of Hayleasow Wood and Spring Grove, and crosses the Belmont - Haywood road before re-joining the SC1 alignment as above. Little is currently known about the archaeology of the western third here.

SC3 This option bisects the narrow join between Hayleasow Wood and Newton Coppice, before crossing fields to the Belmont - Haywood Road. Prehistoric flints and Romano-British pottery have been found in these fields, which may be indicative of a wider interest. After crossing the former alignment of the historic Hereford – Abergavenny tramway (1829AD), near to the current Cardiff line, the option passes to the south of Grafton village. At this point, the option appears to suggest a direct impact on a peculiar - but significant - archaeological site - the 'Grafton Enclosure' (HSM 10467). Further to the east, the option passes through Grafton Wood and joins the roundabout on the Ross Road, close to an area of prehistoric interest.

SC4 This option is very similar to option 3, the only difference being the junction arrangements at the far eastern end.

SC5 This option differs from SC3 / 4 in respect of its western half, which cuts across to the south of (the listed) Merry Hill Farm, close to Beech Grove and Spring Grove. The route is set comparatively high in the landscape here, and may impact on crop-mark features of likely archaeological origin to the north east of Beech Grove.

SC6 This option follows a more sinuous course than SC3 /4, thus enabling the avoidance of sensitive locations such as Grafton Wood, and the Grafton Enclosure referred to above. However, it is understood that there are a number of engineering and road standards issues relating to this option.

EASTERN CORRIDOR

A brief early-stage assessment has been made of what appears to be a single suggested route option between the junction of the 'straight mile' Holme Lacy Road / B4399 Rotherwas Access Road, and the A 438 Ledbury Road north east of Tupsley Court.

General Comments Additional to the general comments made in relation to the southern corridor - which are also applicable here - I also have a concern that the lack of consideration of alternatives may represent a weakness in the

process undertaken for the eastern corridor. This is particularly so south of the River Wye, where an extensive and significant grouping of heritage assets (The scheduled former location of Rotherwas House and gardens, and Rotherwas Chapel and associated features) is present. This grouping is situated in a challenging location as regards the preferred alignment of EL3, and I do wonder whether a variant of EL12 (i.e. a route passing to the *east* of the chapel, within the suggested north west boundary of the Enterprise Zone, before swinging back towards Hampton) might be more appropriate from the historic environment point of view.

EL3 (southern element of option) This part of the option is constrained by the difficulty of accommodating a significant new road in the comparatively narrow gap between the Rotherwas SAM as discussed above, and the sewage works to the west. The option as depicted on available mapping suggests an alignment very close to the western boundary of the SAM. This is far from being ideal. If this option is to be pursued, I would strongly recommend that the actual alignment here be moved as far as possible to the West (ie much closer to the sewage works if possible)

EL2 (northern element of option) This part of the option comes up from the River Wye, close to the *Franchise Stone*, and passes through the proposed Hampton 'rugby club' site. This area has been demonstrated to have some potential for Medieval, Roman and Prehistoric Finds. Further to the north, the route option keeps slightly above the clearly sensitive floodplain. A number of finds have previously been made to the south of Tupsley Court (HSM 6500, 6501 etc).

I hope the above comments are helpful.
Regards,

Julian

Julian Cotton, Archaeological Advisor, Herefordshire Council

Appendix E

Summer Briefings

Hereford Relief Road – Eastern Links Presentation

Thursday 16th August 2012

Contents

Introduction

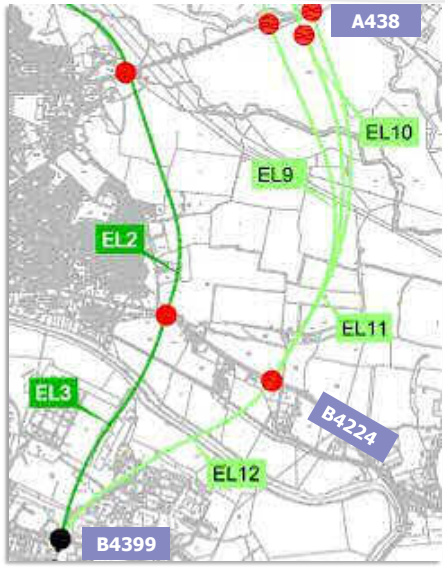
- Study of Options Report identified Western Relief Road as preferred corridor for inclusion into LDF Core Strategy
- Enterprise Zone status granted to Hereford in August 2011
- Study objective to consider a link between the B4399 at Rotherwas and the A438 Ledbury Road
- Seven modelled scenarios tested effects on highway network when Eastern Link considered alongside a full Western Relief Road and the A49-A465 Link
- Environmental, Engineering & Economic appraisals reviewed

Study Methodology

- Links previously identified in Study of Options Report
- Study Methodology
  - Evaluate the objectives set
  - Update traffic model to assist in the appraisal of potential solutions
  - Assess the engineering constraints
  - Appraise the environmental constraints
  - Make recommendations on the feasibility and routes
- Conclusions reported

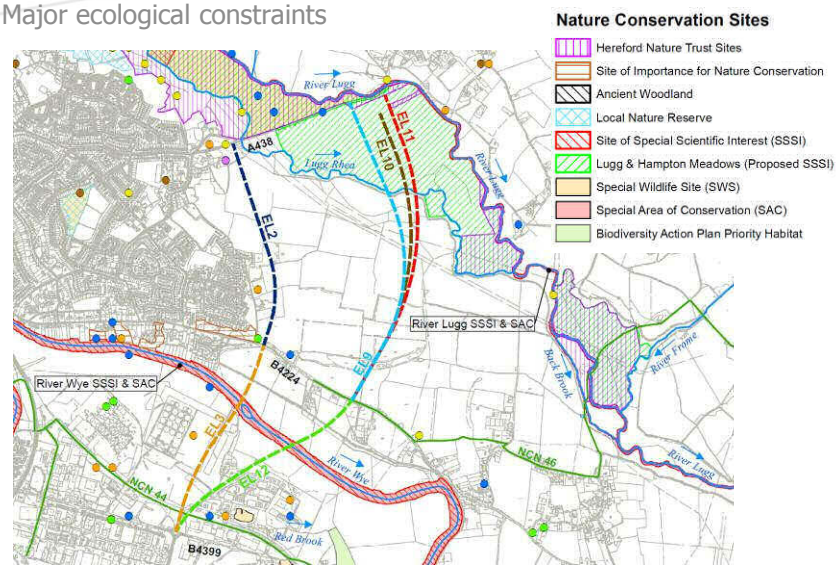
Options

- Section of link road from the B4399 to the A438 considered
- Junction with B4224 proposed
- Link options as defined in Study of Options Report
- Major constraints previously defined alignments
- 'Inner' and 'Outer' corridors assessed
- Road assumed to be a dual two lane carriageway

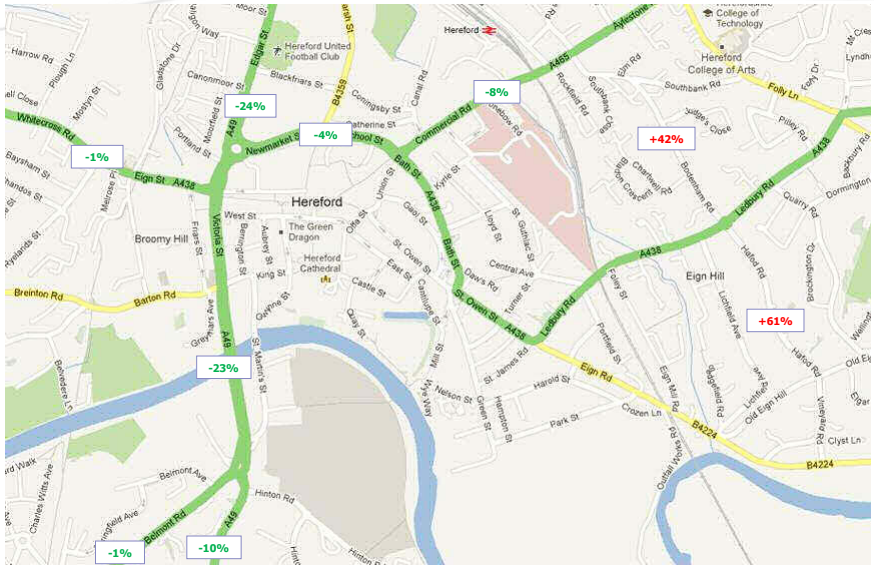


Scheme Assessment

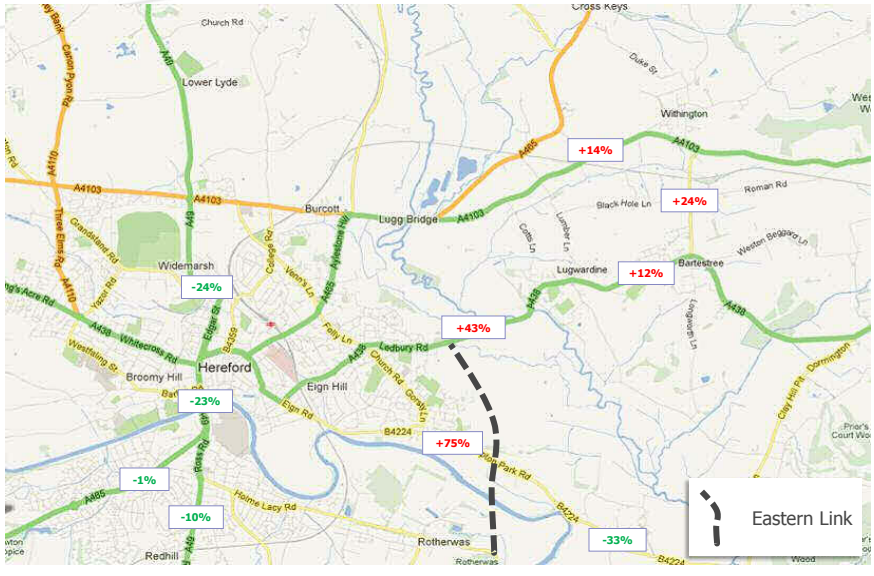
- Major ecological constraints



Change in City Centre Traffic Flows with Introduction of Eastern Link [2019 AM Peak Period]



Change in Traffic Flows to East of City with Introduction of Eastern Link [2019 AM Peak Period]



Benefits

- Economic appraisal provides a positive Benefit to Cost Ratio (BCR = 13.28; NPV = £14.8M)
- Average reduction in traffic volumes through key City Centre routes of 10% [AM peak period]
- Reduction in traffic on Greyfriars Bridge of 23% [AM peak period]
- Noise impacts lessened in City Centre due to re-assignment of traffic
- Slight improvement in Air Quality Management Area
- Townscape – potential for improved urban character
- Journey times improved
  - Rotherwas to Junction 7 of the M5 (Worcester) reduced journey time by 7 to 10 minutes
  - Rotherwas to Junction 8 of the M5 (M50) reduced journey time by 3 minutes
  - Strategic trips through the City reduced by 16 minutes on the less congested A49

Dis-benefits

- Reassignment of eastbound traffic through Lugwardine and Bartestree
- Average increase in traffic on local access roads (Hampton Park Road, Hafod Road and Bodenham Road) of 60% [AM peak period]
- 23% increase in traffic using minor roads (A438 to A4103) [AM peak period]
- Impact on River Wye Special Area of Conservation (SAC) & Site of Special Scientific Interest (SSSI) and River Lugg SSSI
- Loss of significant areas of floodplain (intricately linked to SAC & SSSI)
- Impact on the setting of the Scheduled Ancient Monuments

Conclusions

- The Eastern Link Road provides a positive return on investment with a predicted benefit to cost ratio of 13.28
- The proposed scheme also provides benefits in terms of traffic flow with a predicted reduction on Greyfriars bridge of 23% in the AM peak
- These benefits do, however, come at a cost with an adverse environmental and safety impact upon residents to east of City and upon the Villages of Lugwardine and Bartestree
- There is also a predicted increase in traffic flow on the between A438 and A4103 due to increased traffic
- Construction of an Eastern Link would most likely result in a loss of areas of floodplain – this would need to be extensively mitigated
- The scheme could be challenged under Conservation Regulations due to impact on River Wye SAC & SSSI unless:

'there are no alternative solutions regardless of economic considerations, there are imperative reasons of over-riding public interest and that any mitigation measures are taken.'

Article 6 of the 'Habitats' Directive 92/43/EEC

Herefordshire Council

NHS Herefordshire

Working in partnership for the people of Herefordshire

HEREFORD EASTERN LINK STUDY

16 AUGUST 2012

ATTENDANCE SHEET

NAME	ORGANISATION	SIGNATURE
Dave Green	HFD Coun	[signature]
Russell S. Hawkins	"	[signature]
William Lyons	HSN CHAMCOM	[signature]
Angela Fitch	FSB	[signature]
J. Jones	Philip Morris	[signature]
J. Bickleton	Futures	[signature]
R. STONE	HBB	[signature]
[illegible]	HBR	[signature]
S ECCLEY	HBB	[signature]
S. SPEIGHT	CHAMBER OF COMMERCE	[signature]
T. GOODWIN	PRIVATE	[signature]
B. N GILL	VH	[signature]
NEIL [illegible]	HBB	[signature]
Phil Colbe	CDB	[signature]
David Glyn	DS+A.	[signature]
ANDY EDWARDS	THORNE WIDGERY	[signature]
Richard Aughes-[illegible]	FSB	[signature]
Richard Garrett	HBB.	[signature]
[signature]	MP	[signature]

GLYN MORGAN CATHEDRAL

Questions/Comments from meeting:

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1. A copy of the Eastern Links report was requested following the meeting in June, raising concerns about the lack of information.

It was advised that the report was currently still in draft and that there was further work to be done. A full copy of the final report is to be made available when it is completed.

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2. A query was raised on the predicted cost of the Eastern Relief Road and the Western Relief Road.

It was advised that the options are not an either/or and that details of the cost of the Eastern Relief Road can be made available.

All the information about the Western Relief Road is in the public domain and is based on estimation/assumptions.

It was explained that the Eastern Relief Road (inner) was £24m and Western Relief Road £110m (both based on dual carriageways).

Post Meeting Response: Scheme Cost Estimate Summary contained within section 4.12 of Eastern Links Assessment Report

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3. Why are the costings based on a dual carriageway? It is possible to do recalculations based on single carriageways and compare.

It was explained that the dual carriageway was based on increased traffic flow. A single carriageway (Eastern Relief Road) would be in the region of £17m. There would be reduced benefits and less impact on journey times with a single carriageway.

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4. It was queried if the Eastern Relief Road route only creates 243 jobs? Clarification sought on which route best supports the EZ.

It was commented that the do-minimum option covers this option, 243 jobs are on top of the 6,500 which will happen with the EZ.

The EZ application did not highlight the need for any new roads in the bid

It was confirmed that it is possible to produce a profile of jobs and land use over a time profile under each option.

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5. A concern was raised over the assumption for a dual carriageway from the A438, noting that this is not a minor road. It was stated that a dual carriageway distorts the costs and

gives more strength to the resistors and should be dropped. How was the benefit/cost ratio of 13.28 derived?

It was explained that benefit/cost ratios are based on the associated cost of travel time and distance, based on types of trip (business and personal) and uses a base year figure in the calculation (following guidance from DFT).

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6. The credibility of the figures were questioned.

It was commented that supporting information could be provided.

Post Meeting Response: Economic Assessment contained within section 2.10 of Eastern Links Assessment Report.

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7. Clarification was sought on which route was used in the journey time calculations to the M5 (that which reduced journey time by 7 minutes to 10 minutes).

It was explained that the route was along the Ledbury Road and then across to the Worcester Road by any one of three junctions. It was pointed out that the infrastructure of these junctions were not accommodating to such route selection.

It was acknowledged that this would be deleterious to the route and would affect journey times due to the type of lanes off the A438. Query raised if the Worcester Ring Road had been factored in.

It was pointed out that there is detail in the report about journey time reliability.

It was confirmed that other routes had been looked at, and that the timings in the presentation were just one example.

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8. It was noted that the Western Relief Road provides both housing and development land with the view expressed that the Eastern Relief Road was an addition. It was stated that the benefits of the Eastern Relief Road are understated – the 6,500 jobs and new businesses have been underestimated in their impact. It was explained that it is critical to improve the infrastructure for the Enterprise Zone and £17m is not a lot of money. It was pointed out that there was also the need to improve access to the M5. The key being phasing; first the Ross on Wye Road to the Abergavenny Road Link; Eastern Relief Road and then Western Relief Road. Clarification was sought on the procedures for approvals and how the funding worked.

It was explained that this was a political issue but based in a business environment. The first thing to do is progress the LDF.

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9. A question was raised on costing. It was noted that Lugwardine and Bartestree do not have suitable road infrastructure at present so the £17m did not reflect the whole figure, such as the link to the Worcester Road.

It was explained that the costs included a large contingency to cover things such as additional infrastructure needed in addition to Eastern Relief Road scheme and knock on work. This contingency is in region of 44% (following guidance taken from the HM Treasury Green book).

It was commented that journey savings/return on investment potentially did not relate to a reduction in cost – but explained that there was more work to be done and further evaluation. It was explained that there were issues with the timings in relation to the school at Lugwardine that caused delays of an hour in the morning and an hour and a half in the evenings.

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10. It was stated that the main development of jobs will be from the EZ and that Rotherwas needs to link in to give an option of routes e.g. an accident in the city centre closes down the major routes – we need options for other journeys.

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11. A point of information was raised: at the last presentation the Eastern Relief Road indicated a 25% reduction on Greyfriars and 30% on Edgar Street.

It was noted that whilst the traffic reductions are significant, the traffic is being moved into other areas.

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12. It was commented that the environmental impact cannot be ignored. What has been done to mitigate the impact? Reductions of impacts are shown, but has there been a review of the impact? What assumptions have been made of 6,500 jobs and development?

It was explained that the figures are based on 2019 and that the proposals were based on the LDF with Eastern Relief Road and average car flows.

Post Meeting Response: High level mitigation measures have been discussed at this stage of assessment.

Post Meeting Response: The 2019 model assumed that development was fully implemented and that all 6500 jobs had been created.

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13. A query was raised in relation to the city centre developments (Hereford Futures), stating that if the traffic was wrong the whole scheme "could be doomed". It was acknowledged that the model showed support to the scheme and would help its success. It was asked if this was predicted, before commenting that the city centre would have more life if this was acted on now.

14. Clarification was sought on what the NPV or cost benefit ratio of the Eastern Relief Road was versus the Western Relief Road. It was noted that as a stand-alone scheme, the Eastern

Relief Road is a good scheme but it doesn't have the scale of economic development benefits to support it.

It is important to look at both Eastern Relief Road and Western Relief Road.

It was explained that there was difficulty in the delivery, especially for the Core Strategy and there needed to be a long term solution.

It was commented that that other elements should be looked at: mitigation of a thinner road; doing the necessary infrastructure work at Lugwardine and Bartestree etc., and adding in weight limits to the route.

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15. It was commented that route EL2 did not appear to have many ecological constraints (barring the River Wye) and did not hit any other SSSI.

Post Meeting Response: The alignments shown were indicative. It should be noted that elements of the route design may have impacts outside of the construction footprint (i.e. drainage).

It was explained that notes of the points raised (and their responses) had been taken and would be included in the final report as an appendix.

The briefing was then closed and attendees thanked for attending.