Hereford Relief Road

Engineering Assessment

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A1. Introduction

A1.1. Background

'Growth Point' Status

A1.1.1. Hereford is the main service centre and largest urban area in Herefordshire County, with a population of 54,850. The city of Hereford is the county's main centre for employment, administration, health, education and shopping. 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 (Figure A1.1).

A1.1.2. The West Midlands Regional Spatial Strategy (RSS) has identified Hereford as a 'Settlement of Significant Development' and advocates the integration of local, regional and national planning and transport policies, as set out in the overarching 'Study of Options' Report, for the provision of proposed developments.

A1.1.3. The RSS also recognises that the A49 in Hereford is subject to increasing congestion and that this has a number of implications for sub-regional land use, development and regeneration. In order to address this issue, a local multi-modal study, the Hereford Transport Review (2003) was carried out. This major study drew together work from previous studies, engaged key stakeholders, developed effective partnerships and identified long-term solutions.

Fig A1.1 Hereford City Major Road Network

A1.1.4. The solutions identified include;

- Release travel capacity to accommodate development and regeneration
- Provide for and encourage the use of public transport
- Provisions to encourage walking and cycling

A1.1.5. In general, Hereford sits in a natural valley formed by the River Wye and the River Lugg. The land around the rivers tends to be relatively low lying and rises gradually to the hills around the outskirts of the town essentially creating a 'bowl' effect. Distinctive sloped hills to the north, west and south of the city provide views across the city towards rural high ground, characteristic of Herefordshire. The topography surrounding Hereford provides both the landscape setting and the city's local distinctive character. Fig A1.2 below illustrates the surrounding topography and natural formations within and around the city.

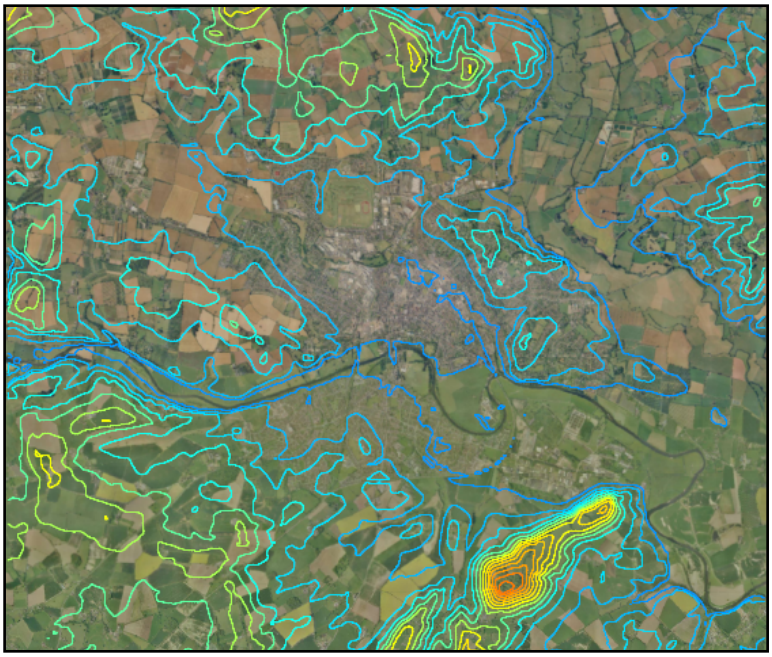

Fig A1.2 Indicative Topography of Hereford

A1.1.6. Herefordshire Council has commissioned Amey to undertake a Scheme Assessment in accordance with the Highways Agency Design Manual for Roads and Bridges Scheme Assessment Reporting to provide the necessary supporting information and problem identification for future analysis.

A1.1.7. The Stage 1 Engineering Assessment provided an overview of the current problems experienced by local traffic and informed upon the constraints that proposed corridors, as those shown in Fig A1.3 and A1.4 below, would encounter. The assessment findings forms a basis to inform the Appraisal Summary Tables in line with Department for Transport WebTAG process, a process required to adequately support a Major Scheme Business Case funding submission for the provision of a relief road around Hereford City.

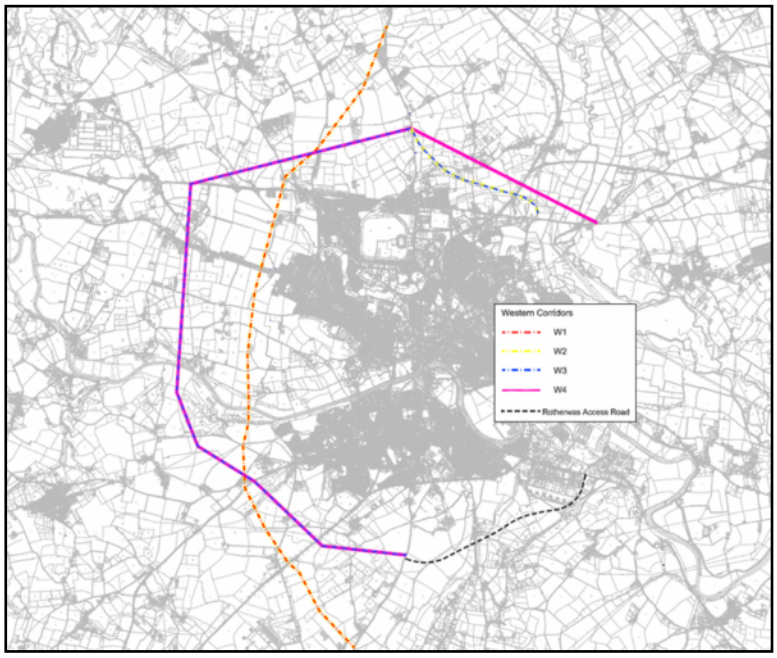

Fig A1.3 Stage 1 Western Route Corridors

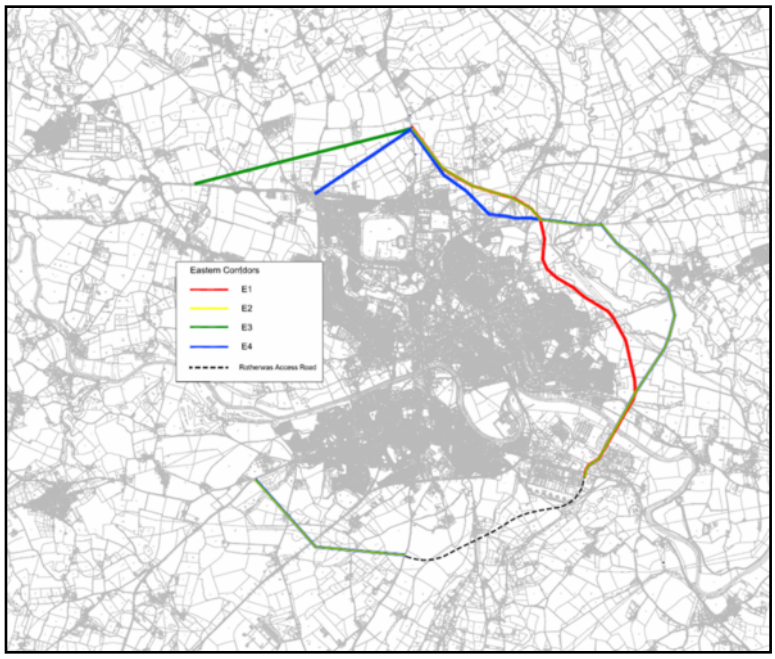

Fig A1.4 Stage 1 Eastern Route Corridors

A1.1.8. The 'Hereford Relief Road' has been identified as a key strategic transport proposal to both relieve the city of its current congestion levels and to ensure the proposed housing growth can be accommodated. This report aims to assess the anticipated engineering constraints and impacts encountered by the proposal of identified corridors defined using information and findings collated during the Stage 1 Assessment process, as detailed in Section A1.3. These corridors serve to illustrate the most feasible options brought forward using the knowledge gained throughout the Stage 1 Scheme Assessment process and as part of this Engineering Assessment are further assessed in greater details as described in Chapter 2.

A1.1.9. Figures A1.5 and A1.6 overleaf show the full extent of the Scheme Assessment study area and illustrates the conflicts with the existing road and rail networks, including areas over the major rivers, the River Wye and the River Lugg, which are definitive characteristics of Hereford, as well as posing major restrictions on existing and future traffic provisions.

A1.1.10. The development of the scheme corridors have been identified by eastern and western corridors linked to the existing road networks via southern and northern corridors which are common to both sides.

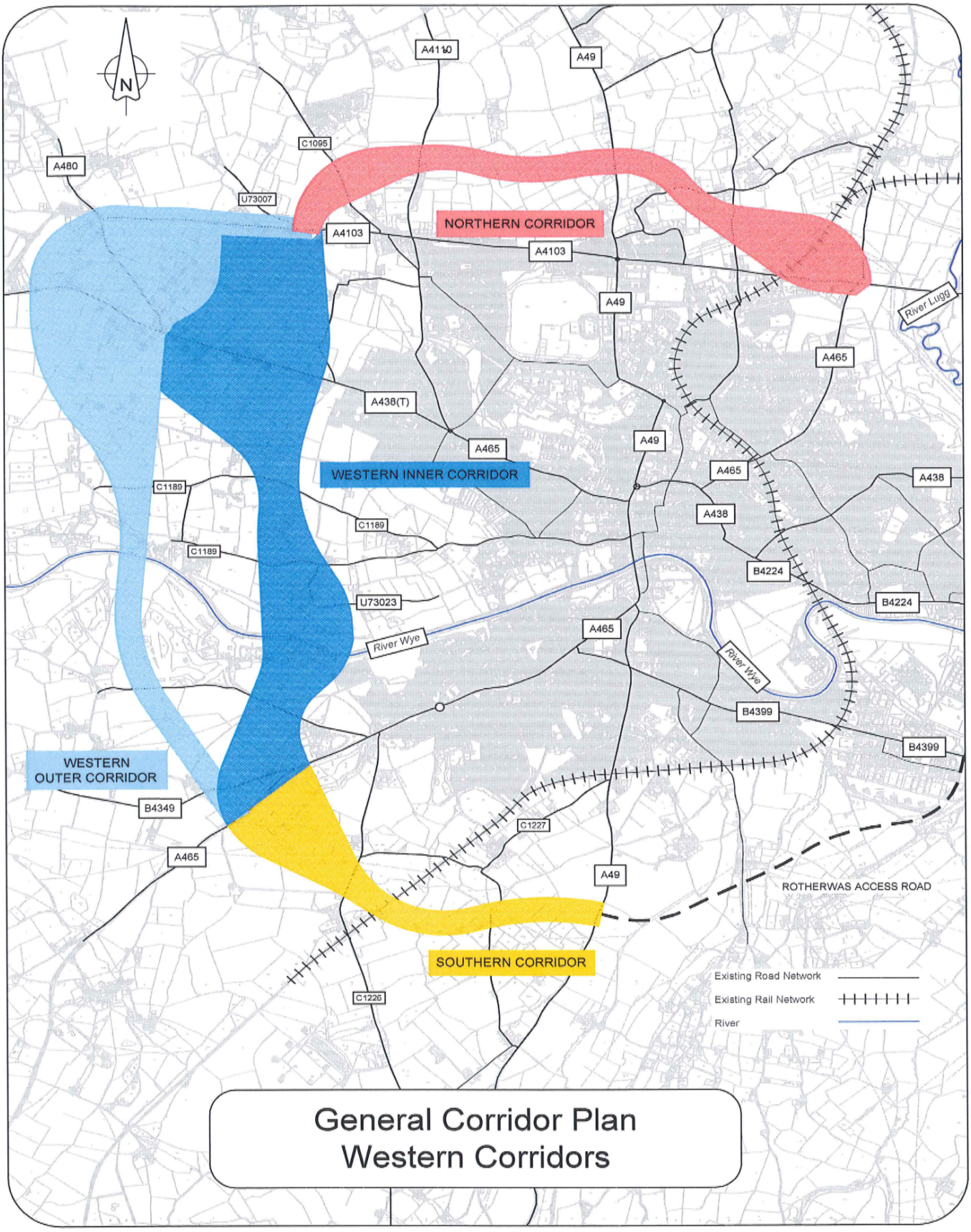

Fig A1.5 Western Corridors

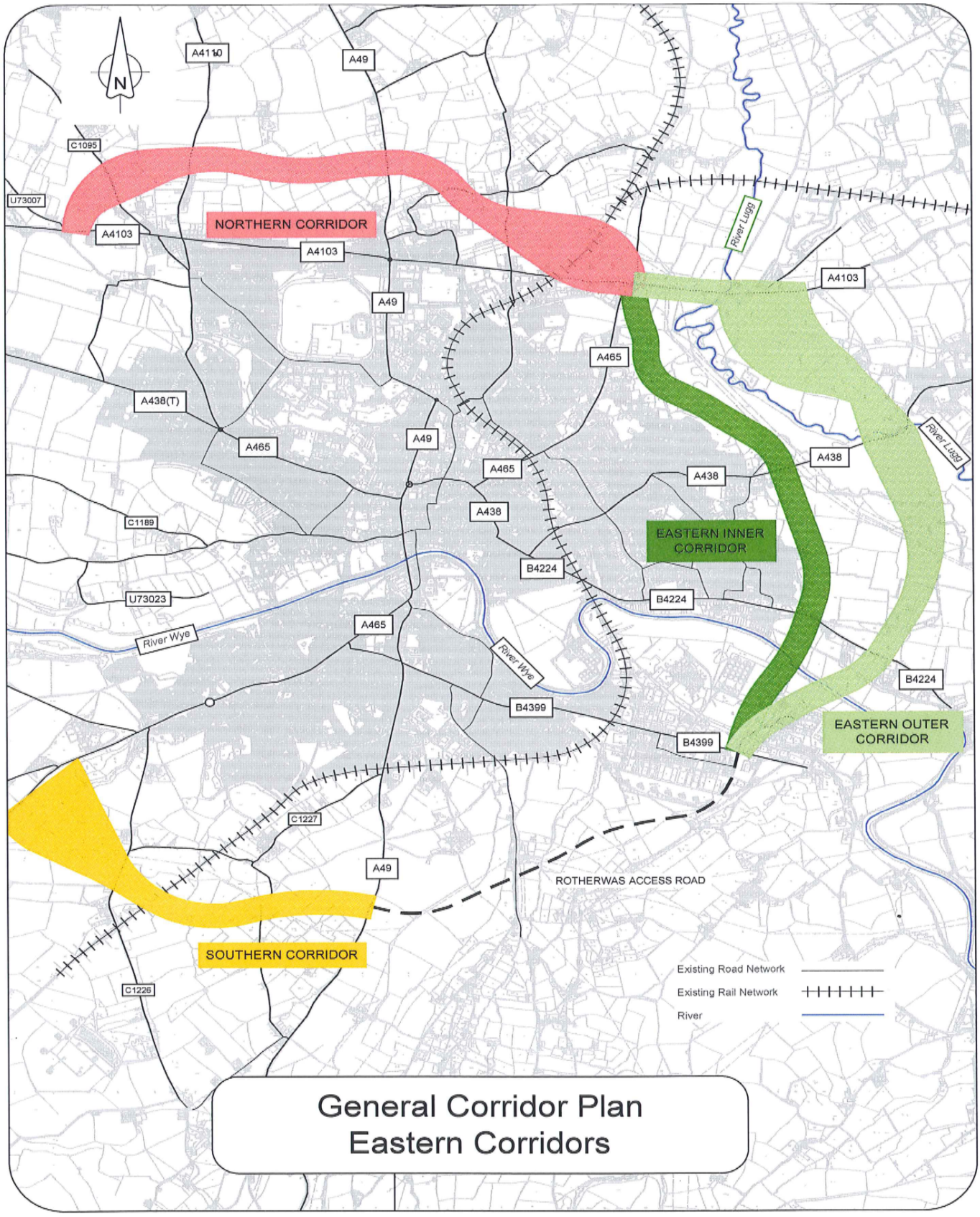

Fig A1.6 Eastern Corridors

A1.1.11. Figures A1.5 and A1.6 above have been developed through a clear identification of constraints set out in the Stage 1 Scheme Assessment Report. The conclusions taken forward from the Stage 1 Engineering Assessment process are outlined in section A1.3 and are further analysed in the subsequent respective chapters. These findings have led to the identification of a broader study area which aims to produce a number of corridor links, as described in Chapter 2, which are to be individually assessed to inform the final decision to eventually support the Major Scheme Business Case to the Department of Transport for the final relief road corridor.

A1.2. Existing Conditions and Problems

Transport Infrastructure

A1.2.1. Hereford serves as the main centre for an extensive rural area providing access to employment, retailing, health and leisure facilities. It also plays an important role in the context of the wider West Midlands region as it has been identified as one of five sub-regional areas for longer-term development meaning that it will accommodate the majority of the future housing and employment development within the County.

A1.2.2. Hereford's transport problems are principally congestion, poor air quality and severance caused by traffic resulting in poor access and safety issues for vulnerable road users. These are, to some extent, compounded by the high levels of car dependence in the surrounding rural areas due to the high spatial concentration and self-containment of employment; 70% of residents travel less than 5km to work. The problems identified through the Hereford Transport Review can be summarised as follows:

- Congestion particularly affecting roads around the city centre
- Poor access to industrial areas which constrain economic development
- Intrusion of traffic into residential areas
- Need for improved road safety for vulnerable road users
- Poor pedestrian facilities in parts of the city centre
- Lack of facilities for cyclists
- Too many journeys to school by car

A1.2.3. The Hereford Transport Strategy identifies significant traffic overloading in the city centre, specifically on the A49 (Trunk) at Greyfriars Bridge and the adjoining road junctions. This overload would become increasingly difficult to accommodate and reduces public acceptability of sustainable measures which would further reduce capacity such as bus priority, pedestrianisation and on-road cycle provision.

A1.3. Stage 1 Appraisal Conclusions

Route Corridors

A1.3.1. The Stage 1 assessment strategy was to conduct a broad summary of constraints encountered using the routes set out in Fig A1.3 and A1.4 as well as identifying regions of constraints under various aspects such a topography, land use, geology, hydrology and existing utilities. The developing assessment approach led to the conception of route corridors which were identified as 'Western Route Corridors' and 'Eastern Route Corridors'. These reflected the target routes set out however, the Stage 1 assessment also ensured that a broader corridor assessment was undertaken to inform this assessment process.

Western Route Corridor Conclusions

A1.3.2. Options W1 and W2, represent the western inner corridors, and follow more of a 'bypass style' route at its commencement and termination, tying into the A49 in the north and south furthermost from the city. These do not provide an attractive link to the employment area of the Rotherwas Industrial Estate or contribute to the potential for a link from the A49 to the north to the A465 at Aylestone Hill.

A1.3.3. All west corridors require a number of highway bridges; however the main structures would be a single road over a rail bridge at Merry Hill and a single crossing over the River Wye. The western corridors cross the Wye in the vicinity of the Belmont Lodge buildings with its adjacent river gorge on each side of the River Wye. At this location the topography to the east of the Belmont Golf Course links is favourable as the river gorge is at its lowest and bank vegetation least, reducing structure height, cost and environmental impact. This however would approach existing properties on the outskirts of Hereford and an inner western route also crosses the Yazor Brook which is a major contributory to flooding in the areas of Whitecross and Huntington.

A1.3.4. Avoiding impacting upon the Belmont Lodge area, a western corridor orientates towards an outer route corridor and establishes itself through connection with the A438 Kings Acre Roads at feasible locations seen as potential junctions or 'through' routes. This existing road holds a row of residential properties at each side for the majority of its length within the study area and all western corridors were seen to have a severe impact upon local residents and commercial properties and local businesses. An assessment leading to a preferred location to adjoin this road will have a consequential impact on the potential final preferred corridor on the western side of Hereford.

A1.3.5. Several options exist for the link from the A4103 Roman Road to the A49 north of the City. Few major topographical or environmental constraints exist, however, the use of the high quality section of the A4103 to minimise the length of new road required would have both environmental and economic advantages.

A1.3.6. The link from the A49 North of the City to the A465 at Aylestone Hill presents some engineering challenges. Frequent road bridge crossings, large level differences but particularly the railway crossing in close vicinity to 66KV overhead cables will restrict the alignment options or cause high construction costs. Severance to existing and proposed residential and employment areas in Holmer is also to be considered.

Western Corridor Stage 1 Recommendations

- The choice of crossing location over for a western corridor will be a critical decision and it is recommended that both inner and outer corridors included in the Stage 1 assessment are refined and both considered in greater detail in this Engineering Assessment.
- The outer corridor should be moved further west south of the A465 to avoid the woodland area and the inner corridor continue to cut through the narrowest section of this woodland.
- All western corridors considered in this report will tie into the B4399 Rotherwas Access Road to provide best access to the employment zone of Rotherwas as W3 and W4 of this Stage 1 Assessment.
- Additional corridors should be explored at the next stage, further west to minimise the severance on the Kings Acre Road and of the proposed development land between A438 and A4103.
- The corridors should utilise the high quality elements of the A4103 to reduce the length of new road required. Consultation with the Highways Agency over the quality (number of direct accesses) at this location will be required.
- The link from the A49 north of the City to the A465 at Aylestone Hill needs to be considered in detail. The use of the Stage 1 corridor at the railway line should be avoided due to the conflict with the overhead cables. The optimum location for junctions on the A465 and A49 should be sought and the alignment between detailed to minimise severance of existing and proposed development land.

Eastern Corridors

A1.3.7. The eastern corridors all have impacts upon the ecology of the Wye and Lugg river floodplains. The inner eastern corridor utilises the land between the existing city limits and the SSSI and SAC of the Lugg meadows and significant mitigation will be necessary to ensure the impact on the floodplain and it ability to perform as a functional floodplain does not impede on surrounding land and properties. However, benefits exist with the inner eastern routes with the opportunity to provide greater amenity access to these areas by the provision of sustainable links with road. The corridor is also the shortest as it links the A49 to the south with the A49 to the north, utilising the existing Rotherwas Access Road for much of its length.

A1.3.8. Whilst the unmitigated ecological effects may be greater for the eastern corridors, the landscape effects are much lower than those to the west. The inner corridor especially does not extend into the undeveloped countryside very far, hugging the existing development boundary and making use of the favourable topography.

A1.3.9. The outer eastern corridor crosses the River Wye once and then the River Lugg twice. Of the Lugg crossings, one is via an existing structure, although this is likely to require upgrading and strengthening and is of some historic importance itself while the other bridge at Lugwardine can benefit from a relocation leading to an improved realignment of the approaching existing carriageways

A1.3.10. The impact upon the river floodplains is most evident with the outer eastern corridor, however both eastern corridors will impact upon floodplain storage and river conveyance without significant mitigation works. Significant bridge and culvert structures, if not a long stilted structure will be required to cross the Wye and Lugg floodplains increasing the cost of these options.

Eastern Corridor Recommendations

- Investigate both inner and outer eastern corridors in more detail in the next assessment phase.
- Align the eastern corridor to avoid the Heritage Sites of Rotherwas Chapel. This will divide the corridors at Chapel Lane to two different river crossing points either side of the Rotherwas Chapel.
- The inner corridor alignment should be designed in some detail to fully establish the impact of earthworks upon the Lugg floodplain and the encroachment onto the SSSI/SAC and nature reserves.
- The outer corridor should be aligned to avoid the heritage site within the Lugg meadows.

A1.3.11. This Engineering Assessment aims to identify a number of outline corridor design options to relieve the city of its urban transport problems and the current impact of 'through' traffic, strictly on the basis of a relief road, by taking forward the findings from Stage 1. This report will be proposing a selection of corridor links for a relief road around the city which will aim to provide links to strategic road networks while seeking to provide a continuous strategic corridor that brings travel benefits to commercial and public users of both the new and existing road networks.

A2. Engineering Assessment Methodology

A2.1. Current Information and Data

A2.1.1. The information and data used in this appraisal have been obtained from a variety of published sources and includes such information as historical ground investigation information, flood risk assessments and historical traffic data while reference has also been made to a number of previous studies that have been undertaken within the study area.

Documents

- Herefordshire Council Local Transport Plan
- Design Manual for Roads and Bridges (DMRB)
- Hereford Multi Modal Study (JMP Consultants 2009)
- Herefordshire Strategic Flood Risk Assessment

Organisations

- Herefordshire Council
- Herefordshire Council Planning Service
- Highways Agency

Maps and Drawings

- Ordnance Survey Maps
- Utility Maps

Websites

- Transport Analysis Guidance (WebTAG)
- Herfordshire Council Website

A2.2. Development of Scheme Corridors

Overview

A2.2.1. The Stage 1 Scheme Assessment identified a number of wide and broadly defined corridors with four routes being considered on the east and four on the west of Hereford. Each corridor was assessed in terms of the impact that the proposals would have on the environment, existing land use, topography, areas of flood plain as well as assessing the overall economic benefits to be gained from each route. As part of this assessment, the constraints associated with each corridor are highlighted and this information has been used in developing the corridors which are to be assessed during this process.

A2.2.2. The options being considered include corridors located on both the eastern and western side of Hereford. On each side of Hereford, east or west, an inner option and an outer option are being considered. The inner options are routes as close as is reasonable to the existing developed city limits. The outer options are routes further away from the existing city but limited by what is considered to be potentially economically viable. A corridor too far outside of the city may prove unattractive to local traffic moving in and around Hereford City Centre and strategic traffic wishing to bypass the City Centre and areas where local congestion already occurs.

Western Corridors

A2.2.3. Map A0.01 in Appendix A shows the corridors being considered on the western side of Hereford.

A2.2.4. Map A0.03 in Appendix A illustrates the corridors associated with the Inner Corridor and the Outer Corridor for the western proposal. The Northern and Southern Corridors are common to both Inner and Outer Corridors; therefore, moving south to north, the Western Inner Corridor will provide a link from the A49 / Rotherwas Access Road Roundabout junction to the A438 King Acres Road, which passes through the eastern side of Belmont Golf Course. The Western Inner Corridor will provide a link to the A4103 Roman Road before traversing the A49 and ending at the A4103 Roman Road / A465 Aylestone Hill roundabout junction.

A2.2.5. Similarly the Western Outer Corridor, moving south to north, will also link the A49 / Rotherwas Access Road Roundabout junction to the A438 King Acres Road which will avoid Belmont Golf Club by bordering the boundary on the western side of the golf club. The Western Outer Corridor will then provide links to the A4103 Roman Road before traversing the A49 and ending at the A4103 Roman Road / A465 Aylestone Hill roundabout junction.

A2.2.6. It is also proposed that the Rotherwas Access Road will also form part of the Hereford Relief Road and will provide links to the B4399 at Rotherwas Industrial Estate.

Eastern Corridors

A2.2.7. Map A0.02 in Appendix A shows the corridors proposed for the eastern side of Hereford.

A2.2.8. Similar to that of the Western Corridors, the Southern Corridor, Rotherwas Access Road and the Northern Corridor are common to both the Eastern Inner and Outer Corridors.

A2.2.9. Moving south to north, the Eastern Inner Corridor route will begin at the A465 Belmont Road and will provide a link to the A49 / Rotherwas Access Road which in turn links the B4399. From the B4399 / Rotherwas Access Road roundabout junction the Eastern Inner Corridor will provide links to the A438 Ledbury Road and to the A4103 Roman Road / A465 Aylestone Hill roundabout junction. The Eastern Inner Road will also provide a link to the A49 before ending on the Roman Road, at a point north-west of Herford City.

A2.2.10. The Eastern Outer Corridor is similar to its inner counterpart as this corridor begins and terminates at the same locations (connecting the Northern and Southern Corridors). The main difference between the inner and outer routes is that the outer corridor route passes through part of the Rotherwas Industrial Estate and provides a link to the A465 Aylestone Hill by traversing the Lugg floodplain aligning in close proximity to the village of Lugwardine. The Eastern Outer Corridor will also provide a link by widening of the existing road network and underlying structures at A465 Aylestone Hill road to connect back to the A4103 Roman Road / A465 Aylestone Hill roundabout junction.

A2.3. Corridor Links Description

Overview

A2.3.1. Within each corridor, there are a number of potential highway alignment options for the Hereford Relief Road. Again using the information obtained as part of the Stage 1 Scheme Assessment, a number of potential corridors have been established with a view to minimising the impacts on the surrounding environment, as far as reasonably possible. In order to simplify the reporting of the assessment process, each corridor has been broken up into a series of links.

Southern Corridor

A2.3.2. As detailed in Section A2.2 of this report, the northern and southern routes are common to both the western and eastern alignments. The links associated with the Southern Corridor are shown in Map A0.03 in Appendix A.

A2.3.3. The Southern Corridor consists of 2 links as detailed in Table A2.1. For each link being considered, Table A2.1 also provides information in relation to the length and design speed associated with each link.

Table A2.1: Southern Corridor Links			
Link Name	**Proposed Speed Limit (mph)**	**Design Speed (kph)**	**Corridor Link Lengths (km)**
SC1	60	100	3.12
SC2	60	100	3.09

A2.3.4. SC1 is situated on the northern boundary of the Southern Corridor and provides a link between the A49 Ross Road and the A465. It is proposed that SC1 will tie into the A49 Ross Road at the A49 Ross Road / Rotherwas Access Road roundabout junction. The tie in on the A465 is at a point 75m north-east of the priority junction with the B4349. The full extent of Link SC1 is illustrated in Map A3.01 in Appendix A. The main constraints associated with Link SC1 are as follows:

- A structure will be required to clear the existing railway track; and
- A structure will be required to cross the Newton Brook / Haywood Forest Park

A2.3.5. SC2 is situated on the southern boundary of the Southern Corridor and also provides a link between the A49 Ross Road and the A465. SC2 follows the same path as SC1 to a point where SC1 intersects with the existing railway line. At this point SC2 heads in a north-westerly direction and ties in to the A465 at a point approximately 550m south-west of the priority junction with the B4349. This is illustrated in Map A3.02 in Appendix A. The main constraints associated with Link SL2 are listed below:

- A structure will be required to clear the existing railway track;
- There is a special wildlife site and ancient woodland close to the A465; and
- The existing topography

Western Corridors

A2.3.6. Map A0.03 in Appendix A shows the links associated with the Western Inner and Outer Corridors.

Western Inner Corridor

A2.3.7. Table A2.2 below lists the links associated with the Western Inner Corridor. For each link being considered, Table A2.2 provides information in relation to the length and design speed associated with each link.

Table A2.2: Western Inner Corridor Links

Link Name	Proposed Speed Limit (mph)	Design Speed (kph)	Corridor Link Lengths (km)
WL1	60	100	3.57
WL2	60	100	4.35
WL3	60	100	3.35
WL4	60	100	3.89
WL5	60	100	4.06
WL6	60	100	4.60
WL7	40	70	1.23

A2.3.8. WL1 is situated on the eastern boundary of the Western Inner Corridor and extends from the B4349 / B4352 priority junction at Clehonger to the A438 Roman Road. The tie in point for WL1 on the King Acres Road is located between House Nos. 161-167. The full extent of Link WL1 is illustrated in Map No A3.03.

A2.3.9. WL2 is similar to that of WL1 to a point approximately 0.75km north-east of Lower Breinton. While WL1 link continues north before tying into the King Acres Road, Link WL2 continues in a north westerly direction tying in to the Kings Acres Road at a point approximately 80m west of the A438 King Acres Road / A480 priority junction.

A2.3.10. WL3 is also similar to that of WL1 only that WL3 cuts through Belmont Golf Course whereas WL1 is situated on the eastern boundary of Belmont Golf Course without causing any severance. WL3 is approximately 3.4km in length and extends from the B4349 / B4352 priority junction at Clehonger to the A438 Roman Road between House Nos. 161-167, as shown in Map No A3.05.

A2.3.11. WL4 is situated on the western boundary of the Western Inner Corridor. This link begins south-west of the B4349 / B4352 priority junction at Clehonger. Moving north, this link passes through the Belmont Golf Club on the eastern side before tying in to the King Acres Road at point situated between House Nos. 161-167. The full extent of Link WL4 is illustrated in Map No A3.06.

A2.3.12. WL5 is similar to that of WL1 and WL2 in so much as this link begins at a point in close proximity of the B4349 / B4352 priority junction at Clehonger. However while WL1 and WL2 passes on the eastern boundary of Belmont Golf Club, WL5 passes through the Golf Course. At a point approximately 0.75km north of Lower Breinton, WL5 follows the same path as WL2 and ties in on the A438 King Acres Road at a point approximately 80m west of the A438 King Acres Road / A480 priority junction. This is illustrated in Map No A3.07.

A2.3.13. WL6 is similar to that of WL4 and is situated on the western boundary of the Western Inner Corridor. This link follows a similar path as WL4 up to a point approximately 0.75km north-east of Lower Breinton where WL6 then follows the same path as WL2 and will tie in on the A438 King Acres Road at a point approximately 80m west of the A438 King Acres Road / A480 priority junction. This is illustrated in Map No A3.08.

A2.3.14. The main constraints that are common to each of the above links (WL1-WL6) are considered to be as follows:

- A structure will be required to cross the River Wye;
- This link intersects Belmont Golf Course;
- Formation of a new junction with King Acres Road;
- The impact on residential properties on King Acres Road; and
- The height of existing topography on approach to the River Wye

A2.3.15. WL7 begins at the point where links WL1, WL3 and WL4 ends between House Nos. 161-167 on the A438 King Acres Road. Moving north, this link moves to the west of the Huntington before tying in to the Roman Road at a point approximately 100m east of the Roman Road / Towtree Lane junction and approximately 800m west of the Roman Road / Canon Pyon Road / Three Elms Road signalised junction. The full extent of Link WL7 is illustrated in Map No A3.09. The main constraints associated with link WL7 are as follows:

- The formation of a new junction onto A4103 Roman Road;
- The formation of a new junction onto A438 King Acres Road; and
- The impact on properties located in Huntington

Western Outer Corridor

A2.3.16. There are seven links associated with the Western Outer Corridor Route as detailed in Table A2.3. For each link being considered, Table A2.3 provides information in relation to the length and design speed associated with each link.

Table A2.3: Western Outer Corridor Links

Link Name	Proposed Speed Limit (mph)	Design Speed (kph)	Corridor Link Lengths (km)
WL8	40	70	1.09
WL9	60	100	4.36
WL10	60	100	4.90
WL11	40	70	1.04
WL12	40	70	0.76
WL13	40	70	0.87
WL14	40	70	0.76

A2.3.17. WL8 is situated on the north eastern boundary of the Western Outer Corridor and provides a link between the A438 King Acres Road and the A4103 Roman Road. The tie in point on the King Acres Road is located at a point approximately 80m west of the A438 King Acres Road / A480 priority junction whereas the tie in point on the Roman Road is situated in close proximity of Lower Veldifer, approximately 850m west of the Roman Road / A480 roundabout junction. This is illustrated in Map A3.10 in Appendix A. The main constraints associated with link WL8 is the impact that this link will have on commercial properties located of A438 King Acres Road.

A2.3.18. WL9 provides a link from the A465 to the A438 Kings Acres Road. This link avoids traversing through the Belmont Golf Course and is situated on lands on the western boundary of the golf course. WL9 ties into the A438 King Acres Road at a point approximately 80m west of the A438 King Acres Road / A480 priority junction. The full extent of Link WL9 is illustrated in Map No A3.11.

A2.3.19. WL10 is located on the western boundary of the Western outer Corridor. WL10 is similar to that of WL9 and follows the same path from the A465 to a point approximately 185m north of the River Wye and approximately 400m west of Lower Breinton. At this point WL10 heads in a north westerly direction and ties into the A428 King Acres Road at a point approximately 220m east of the A438 Kings Acres Road / A4103 priority junction. This is illustrated in Map No A3.12.

A2.3.20. The main constraints associated with links WL9 and WL10 are considered to be as follows:

- Area of wooded area located to the south of the link;
- A structure will be required to cross the River Wye;
- The availability of land to form a new junction onto King Acres Road; and
- Both links will impact on listed buildings

A2.3.21. Moving south to north, WL11 begins at the same point WL9 finishes, approximately 80m west of the A438 King Acres Road / A480 priority junction. WL11 provides a link between the A438 King Acres Road and the A4103 Roman Road. The tie in point for WL11 on the Roman Road is at the A4103 Roman Road / A480 roundabout junction. The full extent of Link WL11 is illustrated in Map No A3.13. The main constraints associated with link WL11 are as follows:

- Area of land located to the south of the link which is currently owned by Herefordshire Council;
- The impact on residential properties located of A438 King Acres Road; and
- The realignment of the A480

A2.3.22. WL12 also provides a link between the A438 King Acres Road and the A4103 Roman Road. Moving south to north, WL12 begins at the same point where WL10 finishes, approximately 220m east of the A438 Kings Acres Road / A4103 priority junction. The tie in point on the A4103 Roman Road is the same as WL11, at the A4103 Roman Road / A480 roundabout junction. This is illustrated in Map No A3.14. The main constraints associated with link WL12 is the impact that WL12 will have on the existing geometry of the Roman Road / A480 roundabout junction and the impact on the residential properties in close proximity of this junction.

A2.3.23. WL13 is a link that involves utilising the existing highway infrastructure and will involve upgrading this infrastructure as necessary. WL13 provides a link between the A4103 Roman Road / A480 roundabout junction and the point where link WL8 ties in to the Roman Road, in close proximity of Lower Veldifer, approximately 850m west of the Roman Road / A480 roundabout junction. This is illustrated in Map No A3.15.

A2.3.24. WL14 is similar to WL13 in so much as this link involves utilising the existing infrastructure. Moving west to east, WL14 provides a link from where WL13 ends to the same point as where WL8 ties in to the Roman Road, a point approximately 100m east of the Roman Road / Towtree Lane junction and approximately 800m west of the Roman Road / Canon Pyon Road / Three Elms Road signalised junction. This is illustrated in Map No A3.16.

A2.3.25. The main constraints associated with links WL13 and WL14 are considered to be as follows:

- The realignment and upgrade of the A4103 Roman Road; and
- The impact on residential properties located of A4103 Roman Road

Northern Corridor

A2.3.26. As detailed in Section A2.2 of this report, the northern and southern routes are common to both the western and eastern alignments. The links associated with Northern Corridor is shown in Map A0.03 in Appendix A.

A2.3.27. The Northern Corridor consists of 4 links and Table A2.6 overleaf lists the links associated with the corridor. For each link being considered, Table A2.4 provides information in relation to the length and design speed associated with each link.

Table A2.4: Northern Corridor Links			
Link Name	**Proposed Speed Limit (mph)**	**Design Speed (kph)**	**Corridor Link Lengths (km)**
NC1	40	70	2.64
NC2	60	100	2.75
NC3	60	100	2.23
NC4	40	70	2.33

A2.3.28. NC1 is situated on the southern boundary of the Northern Corridor and provides a link between the A4103 Roman Road and the A49. Moving west to east, Link NC1 begins at the point where WL7 ties in to the A4103 Roman Road which is located at a point approximately 800m west of the Roman Road / Canon Pyon Road / Three Elms Road signalised junction. The tie in on the A49 is at a point approximately 825m north of the Roman Road / Holmer Road roundabout junction. The full extent of Link NC1 is illustrated in Map No A3.17.

A2.3.29. NC2 is similar to that of NC1 and provides a link between the A4103 Roman Road and the A49. This link ties into the A4103 Roman Road and the A49 at the same points as NC1 but follows a different path between Chainage 0-1100m. This is illustrated in Map No A3.18.

A2.3.30. The main constraints associated with links NC1 and NC2 are considered to be as follows:

- Residential properties to the east of Canon Pyon Road;
- National Parks & Garden located to the North of the Link NC2;
- Chainage 0-200m lies within a Source Protection Zone 3;
- A structure will be required to cross Tillington Road; and
- A structure will be required to cross Canon Pyon Road

A2.3.31. NC3 provides a link between the A49 and the Roman Road / A465 Aylestone Hill roundabout junction. Moving west to east, Link NC3 begins where Links NC1 and NC2 ends, at a point approximately 825m north of the Roman Road / Holmer Road roundabout junction. Link NC3 ties into the Roman Road at a point approximately 200m west of the Roman Road / A465 Aylestone Hill roundabout junction and therefore the proposals will include upgrading this 200m section of existing highway. The full extent of Link NC3 is illustrated in Map No A3.19. The main constraints associated with link NC3 are considered to be as follows:

- Area of residential properties located of Roman Road and Holmer Terrace;
- Existing farm buildings situated to the east of the railway line in close proximity to Aylestone Hill Road;
- Chainage 2180-2330m lies within Flood Zone 3;
- Chainage 1800-1900m lies within a mineral deposit area; and
- Chainage 2070-2330m encroaches on the boundary to a Special Area of Conservation

A2.3.32. NC4 is similar to that of NC3 and provides a link between the A49 and the Roman Road / A465 Aylestone Hill roundabout junction. This link, similar to NC3, ties into the A49 at a point approximately 825m north of the Roman Road / Holmer Road roundabout and ties into the Roman Road at the roundabout junction with the A465 Aylestone Hill. Moving west to east, NC4 follows the same path as NC3 up until approximate Chainage 850m, where NC4 continues in a more northern direction than that of NC3. The full extent of Link NC4 is illustrated in Map No A3.20. The main constraints associated with link NC4 are considered to be as follows:

- Area of residential properties located of Roman Road and Holmer Terrace;
- Existing farm buildings situated to the east of the railway line in close proximity to Aylestone Hill Road;
- Chainage 2080-2330m lies within Flood Zone 3;
- Chainage 2000-2330m lies within a mineral deposit area; and
- Chainage 2330m encroaches on the boundary to a Special Area of Conservation

Eastern Corridors

A2.3.33. Map A0.04 in Appendix A shows the links associated with the Eastern Inner and Outer Corridors.

Eastern Inner Corridor

A2.3.34. The Eastern Inner Corridor consists of 3 links and Table A2.5 below lists the links associated with the corridor. For each link being considered, Table A2.5 provides information in relation to the length and design speed associated with each link.

Table A2.5: Eastern Inner Corridor Links

Link Name	Proposed Speed Limit (mph)	Design Speed (kph)	Corridor Link Lengths (km)
EL1	40	70	2.11
EL2	40	70	1.30
EL3	40	70	1.29

A2.3.35. Moving north to south, EL1 provides a link between the A465 Aylestone Hill and the A438 Ledbury Road. The tie in point for EL1 on the A465 is at the A4103 Roman Road / A465 Aylestone Hill roundabout junction while the tie in point on the A438 Ledbury Road is at a point approximately 250m east of the Ledbury Road / Hampton Dene Road priority junction. The full extent of Link EL1 is illustrated in Map No A3.21. The main constraints associated with link EL1 are as follows:

- The location of the floodplain;
- An area of mineral deposits situated to the north of the link;
- The impact that this link will have on Areas of Special Scientific Interest; and
- The existing topography situated to the south of the link

A2.3.36. EL2 provides a link between the A438 Ledbury Road and the B4224 Hampton Park Road. Moving north to south, EL2 begins where EL1 ended, a point approximately 250m east of the Ledbury Road / Hampton Dene Road priority junction. The tie in point on the B4224 Hampton Park Road is located at the priority junction with Holywell Gutter Lane. This is illustrated in Map No A3.22.

A2.3.37. EL3 provides a link between the B4224 Hampton Park Road and the B4399 The Straight Mile. Moving north to south, EL3 begins where EL2 ended, at the Hampton Park Road / Holywell Gutter Lane priority junction. The tie in point on the Straight Mile is at The Straight Mile / Rotherwas Access Road roundabout junction. The full extent of Link EL3 is illustrated in Map No A3.23.

A2.3.38. The main constraints associated with links EL2 and EL3 are considered to be as follows:

- The location of the floodplain;
- An area of mineral deposits situated to the north of the link; and
- The impact that this link will have on Areas of Special Scientific Interest

Eastern Outer Corridor

A2.3.39. The Eastern Outer Corridor consists of 9 links as detailed in Table A2.6 below. For each link being considered, Table A2.6 provides information in relation to the length and design speed associated with each link.

Table A2.6: Eastern Outer Corridor Links

Link Name	Proposed Speed Limit (mph)	Design Speed (kph)	Corridor Link Lengths (km)
EL4	60	100	0.73
EL5	60	100	1.24
EL6	60	100	1.94
EL7	60	100	1.45
EL8	60	100	1.58
EL9	60	100	1.98
EL10	60	100	1.89
EL11	60	100	2.01
EL12	60	100	1.38

A2.3.40. EL4 is located on the northern boundary of the Eastern Outer Corridor. The link EL4 involves utilising the existing highway infrastructure, upgrading as necessary. EL4 will provide a link between the Roman Road / A465 Aylestone Hill roundabout junction and the Lugg Bridge. This is illustrated in Map No A3.24.

A2.3.41. EL5 is similar to that of EL4 and follows the same path up to the point of the Lugg Bridge. While WL4 ends at this point, EL5 provides a link to a point along the A465 approximately 240m east of the priority junction with the A4103 east of Lugg Bridge. At this point, Link EL5 ties back into the A465 at a point 650m north east of the A4103. The full extent of Link EL5 is illustrated in Map No A3.25.

A2.3.42. The main constraints associated with links EL4 and EL5 are considered to be as follows:

- The location of the floodplain;
- An area of mineral deposits situated to the north of the link; and
- The impact that both links will have on Conservation Areas and Cultural Heritage Areas

A2.3.43. EL6 is situated on the western boundary of the Eastern Outer Corridor. EL6 provides a link between the A465 Aylestone Hill Road and the A438 Ledbury Road. The tie in point on the A465 Aylestone Hill Road is the Lugg Bridge while the tie in point on the A438 Ledbury Road is at the Lugwardine Bridge in Lugwardine. This is illustrated in Map No A3.26.

A2.3.44. EL7 is situated on the eastern boundary of the Eastern Outer Corridor. EL7 also provides a link between the A465 Aylestone Hill Road and the A438 Ledbury Road. EL7 ties in to the A465 at a point approximately 240m east of the priority junction with the A4103, located east of Lugg Bridge. The tie in point on the A438 Ledbury Road is at a point approximately 240m west of the Lugwardine Bridge. This is illustrated in Map No A3.27.

A2.3.45. EL8 is also situated on the eastern boundary of the Eastern Outer Corridor. EL8 provides a link between the A465 Aylestone Hill Road and the A438 Ledbury Road but includes realigning the existing A438 Ledbury Road via a new junction to be located on lands approximately 180m south-west of the Lugwardine Bridge. The full extent of Link EL8 is illustrated in Map No A3.28.

A2.3.46. The main constraints associated with links EL6, EL7 and EL8 are considered to be as follows:

- The location of the floodplain;
- The impact that these links will have on areas of mineral deposits; and
- The impact that these links have on National Parks and Gardens

A2.3.47. EL9 is situated on the western boundary of the Eastern Outer Corridor. EL9 provides a link between the A438 Ledbury Road and the B4224 Hampton Park Road. Moving north to south EL9 begins at the point where EL7 ends, approximately 240m west of the Lugwardine Bridge. The tie in on the B4224 Hampton Park Road is at a point 700m south-east of the priority junction with Holywell Gutter Lane. This is illustrated in Map No A3.29.

A2.3.48. EL10 is similar to that of EL9 in so much as it provides a link between the A438 Ledbury Road and the B4224 Hampton Park Road. Moving north to south, EL10 begins where EL8 ends, at a point approximately 180m south-west of the Lugwardine Bridge. The tie in point on the B4224 Hampton Park Road is the same location as WL9 and is at a point 700m south-east of the priority junction with Holywell Gutter Lane. This is illustrated in Map No A3.30.

A2.3.49. EL11 also provides a link between the A438 Ledbury Road and the B4224 Hampton Park Road. EL11 is situated on the eastern boundary of the Eastern Outer Corridor. Moving north to south, EL11 begins where EL6 ends, at Lugwardine Bridge. The tie in on the B4224 Hampton Park Road is the same as EL9 and EL10, at a point 700m south-east of the priority junction with Holywell Gutter Lane. This is illustrated in Map No A3.31.

A2.3.50. The main constraints associated with links EL9, EL10 and EL11 are considered to be as follows:

- The location of the floodplain; and
- The impact that these links will have on areas of mineral deposits

A2.3.51. EL12 provides a link between the B4224 Hampton Park Road and The Straight Mile. Moving north to south, EL12 begins where link WL9, WL10 and WL11 ends. The tie in point on The Straight Mile is at the roundabout junction with the Rotherwas Access Road. The full extent of Link EL12 is illustrated in Map No A3.32. The main constraints associated with link EL12 are considered to be as follows:

- The location of the floodplain; and
- A structure will be required to cross the River Wye

A2.4. Junction Strategy

Background

A2.4.1. A junction strategy assessment normally forms part of a detailed Scheme Assessment and utilises traffic flow information which has assessed the volume of traffic which is anticipated to use new / existing links throughout the highway network being considered. This information is then used to assess the most appropriate junction layout at each intersection and also highlights the impact that the scheme proposals will have on existing traffic distribution and travel patterns throughout the study area. This will highlight existing junctions that are anticipated to experience an increase in the volume of traffic and those that will experience a decrease. Those which are anticipated to experience a significant increase can then be assessed as part of the junction strategy assessment to identify what improvements, if any, are required to ensure the junction operates within capacity with an efficient operational performance.

A2.4.2. At this stage in the assessment, no traffic flow information is available and therefore a detailed junction strategy assessment cannot be undertaken. It is recommended that when suitable traffic flow information is available, that a detailed assessment is undertaken to determine the suitability of the junction type to be implemented at each intersection.

Initial Assessment

A2.4.3. From historical traffic flow information obtained from the Hereford Traffic Model used in the Hereford Multi Modal Study, it is proposed that the Hereford Relief Road will take the form of an all purpose dual carriageway (D2AP).

A2.4.4. Using the above Modal Study, it is calculated that the highest 24 hour Annual Average Daily Traffic (AADT) forecast traffic flow for a 2019 opening year on the Hereford Relief Road equates to be between 26,000 and 28,000 vehicles. This was calculated by pro rata of the existing modelled flows back from 2026 to 2019 for the peak hours and then factoring back up to obtain AADT flows by using 2009 existing AADT data to derive AADT factors.

A2.4.5. In relation to the junction strategy, it is proposed that the number of new junctions will be restricted to locations where the Relief Road intersects key transport routes to and from Hereford and the location of new junctions associated with each route is described in more detail below. It is also proposed that all new junctions will be at grade when tying into the existing highway infrastructure. It should be noted however that the type of junction to be implemented at each intersection can only be confirmed following a detailed junction strategy assessment.

A2.4.6. It is proposed that all minor roads will be picked up by collector roads which will then provide a link onto the Hereford Relief Road at suitable junction locations.

A2.4.7. In accordance with the Design Manual for Roads and Bridges, it is important to provide an element of consistency along the route and therefore any new junction along the route should be of a similar type and nature. Implementing a variety of different junction types should be avoided as this may cause driver confusion and uncertainty and may result in an accident.

Southern Corridor

A2.4.8. Both SC1 and SC2 provide a link between the A49 Ross Road and the A465 Belmont Road. Both SC1 and SC2 links will tie-in with two major routes which are located at either end of both links – the A49 Ross Road and the A465 Belmont Road.

A2.4.9. It is proposed that the A49 Ross Road / Rotherwas Access Road will be upgraded from a three arm roundabout to a four arm roundabout with the Relief Road forming the fourth arm. It is also proposed to provide a new 4 arm roundabout junction where the relief road intersects the A465 Belmont Road.

Western Corridors

A2.4.10. The links associated with both the Western Inner Corridor and Western Outer Corridor tie in / intersect three major routes, which are:-

- A465 Belmont Road;
- A438 King Acres Road; and
- A4103 Roman Road

A2.4.11. As the western links tie into the southern links, the new junction to be formed on the A465 Belmont Road will take the form of a 4 arm roundabout, as detailed above, where the western links will form the northern arm of the new junction.

A2.4.12. It is proposed that the new junction to be formed with the A438 King Acres Road will take the form of a four arm signalised crossroad junction. A signalised crossroad junction is proposed to minimise the impact that the junction will have on the residential properties along the boundary of King Acres Road.

A2.4.13. The new junctions to be formed where the western links tie into the A4103 Roman Road are also anticipated to take the form of a roundabout junction. Link WL7 ties in to the Roman Road approximately 800m west of the Roman Road / Canon Pyon Road / Three Elms Road junction. The proposed new junction will take the form of 4 arm roundabout where WL7 will form the southern arm of the junction.

A2.4.14. Link WL8 ties into the Roman Road approximately 850m west of the Roman Road / A480 roundabout junction. It is proposed that this junction will take the form of 3 arm roundabout where WL8 will form the southern arm of the junction.

A2.4.15. Links WL11 and WL12 both tie in at the A4103 Roman Road / A480 roundabout junction. It is proposed that Link WL11 will form the realigned southern arm of this existing junction, while WL12 would form a realigned western arm of this junction.

Northern Corridor

A2.4.16. The links associated with both the Northern Corridor tie in / intersect three major routes, which are:-

- A49;
- A4103 Roman Road; and
- A465 Aylestone Hill

A2.4.17. Links NC1 and NC2 provide a link between the A4103 Roman Road and the A49 and tie into both roads at the same locations. It is proposed to provide a new four arm roundabout junction at both locations.

A2.4.18. Similarly, NC3 and NC4 provide links from the A49 and the A465 Aylestone Hill. Both NC3 and NC4 tie into the A49 at the same point as NC1 and NC2 and will form the eastern arms of this junction. It is proposed that the tie in point on the A465 Aylestone Hill will be at the existing roundabout junction with Roman Road, where NC3 and NC4 will form the northern arm of this junction.

Eastern Corridors

A2.4.19. The links associated with both the Eastern Inner Corridor and Eastern Outer Corridor tie in / intersect four major routes, which are:-

- B4399 The Straight Mile;
- B4224 Hampton Park Road;
- A438 Ledbury Road; and
- A465 Aylestone Hill

A2.4.20. It is proposed that the eastern links will tie into the existing three arm The Straight Mile / Rotherwas Access Road roundabout, where the eastern links will form the fourth arm (northern arm) of this roundabout junction.

A2.4.21. Where the eastern links intersect both the B4224 Hampton Park Road and the A438 Ledbury Road, it is proposed to construct four arm roundabout junctions where the Relief Road will form the northern and southern arms of both junctions.

A2.4.22. The eastern links tie into the A465 Aylestone Hill. EL1 is proposed to tie into the A438 Roman Road / A465 Aylestone Hill where this link will form the southern arm of the junction.

A2.4.23. Link EL6 is proposed to tie into the A465 Aylestone Hill at the Lugg Bridge where the new junction will take the form of a three arm roundabout with EL6 forming the southern arm of the junction.

A2.4.24. Links EL7 and EL8 tie into the A465 Aylestone Hill at the same location, which is approximately 240m east of the A465 Aylestone Hill / A4103 priority junction located to the east of Lugg Bridge and it is anticipated that a new junction will also take the form of a three arm roundabout, where links EL7 and EL8 form the southern arm of the new junction.

A2.5. Engineering Assessment Criteria

A2.5.1. The primary focus of this Engineering Assessment is to identify and assess the engineering constraints in accordance with the Design Manual for Roads and Bridges Volume 5 – Section 1: TD 37/93 Scheme Assessment Reporting.

A2.5.2. In accordance with DMRB Volume 5 – Section 1: TD 37/93 Scheme Assessment Reporting, under the engineering assessment, the impact of each route option will be assessed against the following criteria:

- Engineering Standards;
- Climate, Topography and Land Use;
- Geology, Geomorphology, and Existing Ground Conditions;
- Hydrology, Hydrogeology and Drainage;
- Utilities;
- Engineering Standards of Proposed Structures; and
- Any Departures form Standard

A2.6. Engineering Report Structure

A2.6.1. As detailed in Section A2.2, this scheme assessment considers corridors located on both the eastern and western side of Hereford City. On each side of Hereford, east or west, an inner option and an outer option are being considered. In order to simplify the reporting of the assessment process, each route has been broken up into a series of links with the links associated with each route within each corridor being described below.

A2.6.2. For the purposes of this report, the impact that each link, within the relevant corridors, is anticipated to have on the key assessment criteria will be reported in the following structure as set out in Table A2.7.

Table A2.7: Reporting Structure

Reporting Sequence	Corridor Name	Links
1st	Southern Corridor	SC1-SC2
2nd	Western Inner Corridor	WL1-WL7
3rd	Western Outer Corridor	WL8-WL14
4th	Northern Corridor	NC1-NC4
5th	Eastern Inner Corridor	EL1-EL3
6th	Eastern Outer Corridor	EL4-EL12

A2.6.3. Following the Introduction and the Assessment Methodology are the following chapters:

- Chapter 3 provides details a summary of the Engineer Standards;
- Chapter 4 provides details Climate, Topography and Land Use;
- Chapter 5 provides details Geology and Ground Conditions;
- Chapter 6 provides details Hydrology, Hydrogeology and Drainage;
- Chapter 7 provides details of Utilities;
- Chapter 8 provides a Preliminary Assessment of Structures; and

A3. Engineering Standards

A3.1. Geometric Design Parameters

A3.1.1. The engineering assessment of each link has been undertaken in accordance with TD37/93 'Scheme Assessment Reporting' (DMRB Volume 5.1.2).

A3.1.2. The Design Manual for Roads and Bridges (DMRB) Volume 6: Section 1 – Highway Link Design (TD 9/93) outlines the basic principles to be used when determining the design speed and geometric alignment of single and dual carriageway roads in both urban and rural areas.

A3.1.3. The speed limit for each link is either 60mph or 40mph (as per Map No. A1.01). These speed limits equate to design speeds of 100A and 70A respectively, in accordance with TD 9/93.

A3.1.4. For the purposes of this design it was assumed that the standard carriageway cross-section would be a Dual Two Lane (D2AP) layout as per TD27/05 'Cross-sections and Headrooms' (DMRB 6.1.2). For further details see Figure A3.1.

A3.1.5. Due to physical constraints such as existing buildings and topography the achievable geometric alignment may require relaxations and departures from standard in accordance with TD 9/93. Departures from Standard and Relaxations have been identified, and their severity determined in terms of steps below desirable minimum. This chapter also includes an assessment of any Engineering Design Constraints and their impacts.

A3.1.6. Horizontal and vertical design of proposed links has been based on Digital Terrain Model (DTM) from Ordinance Survey Land-Form PANORAMA data. This model is based on contours at 10m vertical intervals. Features within this model such as existing roads, embankments and river beds have been largely ignored with vertical levels being extrapolated from the contours without a high degree of accuracy. A detailed 3D survey containing accurate levels of key features, particularly existing roads and tie-in points would be required for any future detailed design proposals.

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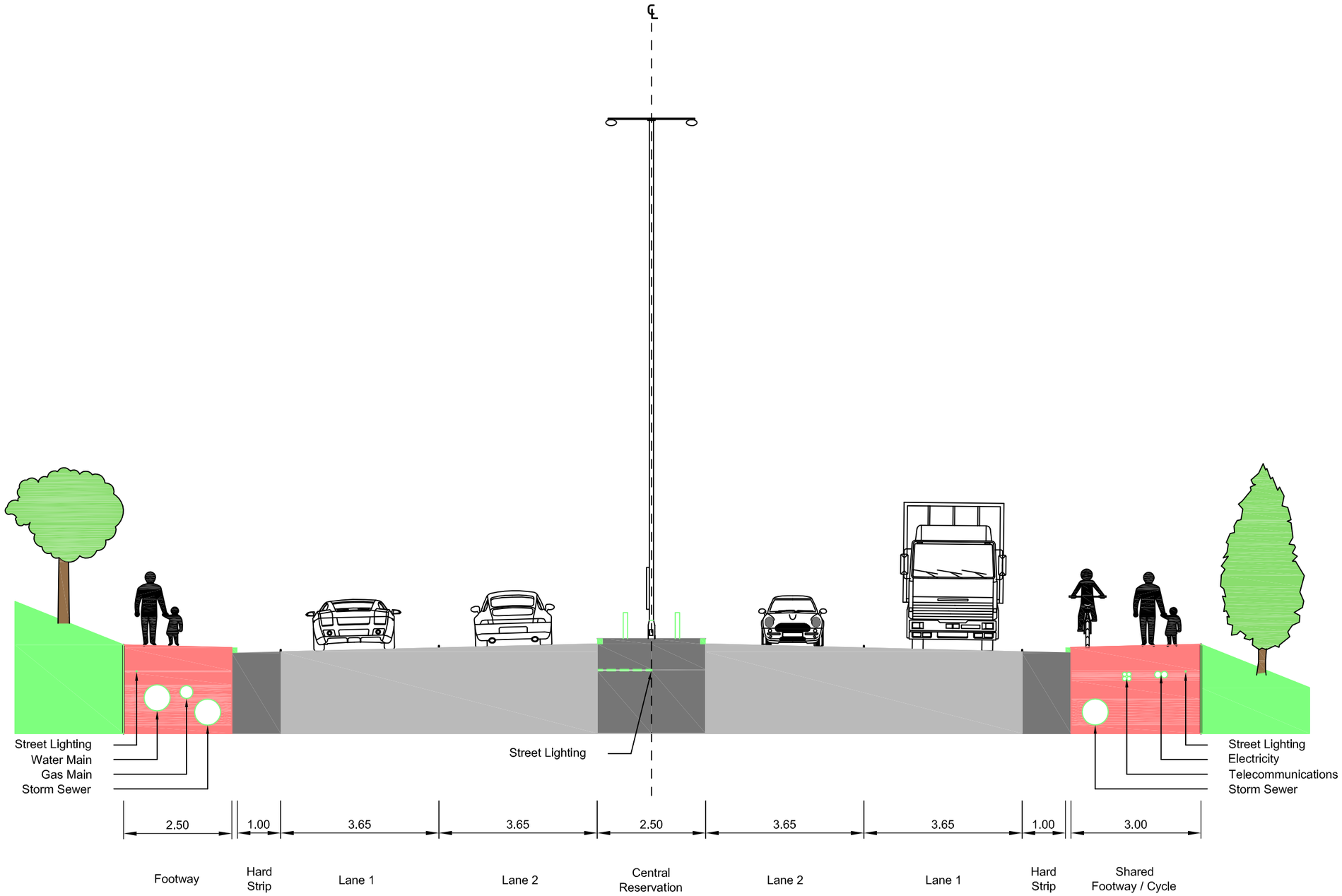

Rev	Revision details	Chkd	Appd	Date

Drawn: MS		Preliminary	✓
Design: JRP		For comment	
Chkd: SD		For tender	
Appd: RM		For construction	
Date: May 2010		As constructed	
		Other	

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Project Name

Hereford Relief Road

Drawing Title

Typical Design Cross Section

Original Drawing Size :	A3
Scale : 1:100	Dimensions : -

Drawing No	Figure No	Rev
551497-H-P-A3.1	A3.1	-

A3.2. Corridor Links Assessment

SOUTHERN CORRIDOR

Southern Corridor Link 1 (SC1)

A3.2.1. Southern Corridor Link 1 commences at the existing roundabout junction at the western end of the Rotherwas Access Road, on the A49 Ross Road. The link proceeds in a westerly direction predominantly at grade, crossing Grafton Lane, which may need to be stopped up and an open watercourse, which would require culverting. The link then begins to turn to a more northerly direction in order to avoid two localised high points in the topography. At this point it begins to rise at a maximum gradient of 4% on embankments up to 8.3m high in order to pass over the Hereford to Newport Railway Line (HNL) (CH 1725m) which will require an appropriate structure. Once across the railway line, the link proceeds in cutting up to 6.25m deep, and passes under an existing minor road. SC 1 then crosses over a Special Wildlife Site, ancient woodland and Newton Brook on a structure. SC 1 terminates on the A465 Belmont Road close to the junction with the B4349 and an area of housing.

Southern Corridor Link 2 (SC2)

A3.2.2. Southern Corridor 2 follows the same horizontal and vertical alignment as Southern Corridor 1 as far as the crossing of the railway line. After this point the two diverge. Once across the railway line, the link proceeds in cutting up to 6.2m deep, and passes under an existing minor road. SC 2 then skirts the southern edge of a Special Wildlife Site and ancient woodland, before terminating at a proposed roundabout on the A465 Belmont Road.

Table A3.1: Engineering Design Constraints & Impacts

Link Name	Chainage		Major Features	Impacted	Avoided
	Start	End			
Southern Corridor Links					
SC 1	0	---	Major Road (A49) Existing Roundabout	✓	
	865	---	Minor Road (Grafton Lane)	✓	
	1725	---	Railway Line – Overpass		✓
	2075	---	Minor Road (C1226) – Underpass		✓
	2770	2890	Special Wildlife Site	✓	
	2770	2890	Ancient Woodland	✓	

Table A3.1: Engineering Design Constraints & Impacts					
Link Name	Chainage		Major Features	Impacted	Avoided
	Start	End			
	2850	---	Newton Brook	✓	
	3123	---	Major Road (A465 Belmont Road) Proposed Roundabout	✓	
SC2	0	---	Major Road (A49) Existing Roundabout	✓	
	865	---	Minor Road (Grafton Lane)	✓	
	1725	---	Railway Line		✓
	2084	---	Minor Road (C1226) – Underpass		✓
	2400	3000	Special Wildlife Site		✓
	2400	3000	Ancient Woodland		✓
	2850	---	Newton Brook		✓
	3093	---	Major Road (A465 Belmont Road) Proposed Roundabout	✓	

WESTERN INNER CORRIDOR

Western Link 1 (WL1)

A3.2.3. Western Link 1 commences at a proposed roundabout on the A465 Belmont Road. From here it heads north, avoiding nearby listed buildings and structures. An embankment up to 6.5m maximum height will be required before crossing over the C1199 Ruckhall Lane on an overpass structure. The link turns right to avoid crossing the existing Belmont Lodge Golf Club. Two horizontal relaxations are required to avoid the golf club without affecting nearby properties. The link then traverses a substantial ridge (9m cutting required) on the approach to the River Wye before crossing on a substantial structure perpendicular to the floodplain and river. Once across the River Wye the proposed link rises through cutting up to 4.5m deep before severing the existing minor road U73023 Warham Lane at CH 1500m. The road then rises changing to embankment (6m maximum height) before crossing over the C1189 Lower Breinton Road via a new overpass structure. The link continues in a northerly direction, in cut (10m maximum depth) before passing beneath U73022 Hill Road via an underpass. The link crosses a Groundwater Source Protection Zone 3 at CH 3180m before traversing a Groundwater Source Protection Zone 1 at CH 3240m. The link connects to a proposed signalised

junction on the A438 Kings Acre Road. Several existing residential buildings along the King's Acre Road may have to be demolished to provide space for the new junction.

Western Link 2 (WL2)

A3.2.4. Western Link 2 commences at the A465 Belmont Road and follows the same initial horizontal and vertical alignment as western link 1 until CH 2500 where it turns left connecting the western inner corridor to the western outer corridor. The link continues in a northerly direction, in a proposed cutting (10m maximum depth) before passing beneath U73022 Hill Road via an underpass. Two relaxations in horizontal radii (510m) are required to reach the proposed signalised junction at A438 Kings Acre Road whilst avoiding existing properties in the area. The link crosses Source Protection Zone 3 at CH 4040m before terminating at the proposed junction. Several existing residential buildings along the King's Acre Road may have to be demolished to allow for the new junction.

Western Link 3 (WL3)

A3.2.5. Western Link 3 commences at a proposed roundabout on the A465 Belmont Road. From here it heads north, avoiding nearby listed buildings and structures. An embankment up to 7.5m maximum height will be required before crossing over the C1199 Ruckhall Lane on an overpass structure. The link takes the most direct south to north route crossing the existing Belmont Lodge Golf Club. The link then traverses a substantial ridge (15m deep cutting required) on the approach to the River Wye before crossing on a substantial structure perpendicular to the floodplain and river. Once across the River Wye the proposed link continues through cutting up to 6m deep before crossing beneath the C1189 Lower Breinton Road via a new underpass structure. The link continues in a northerly direction, in cutting to a maximum depth of 7.5m to pass beneath U73022 Hill Road via a second underpass structure. The link crosses Source Protection Zone 3 at CH 2950m before traversing Source Protection Zone 1 at CH 3010m. The link terminates with a proposed signalised junction on the A438 Kings Acre Road. Several existing residential buildings along the A438 King's Acre Road may have to be demolished to allow for the new junction.

Western Link 4 (WL4)

A3.2.6. Western Link 4 commences at a proposed roundabout on the A465 Belmont Road. From here it turns east which requires a relaxation from standard to achieve a radius of 510m whilst avoiding the existing listed and residential buildings to the east before traversing the existing Belmont Lodge Golf Club.

The same horizontal and vertical alignment as Western Link 3 is followed from CH 1500m to the end of the link.

Western Link 5 (WL5)

A3.2.7. Western Link 5 commences at a proposed roundabout on the A465 Belmont Road. From CH 0 to CH 2500 the link follows the same horizontal and vertical alignment as Western Link 3. From CH 2500m to the proposed signalised junction on the King's Acre Road the link follows the same horizontal and vertical alignment as Western Link 2.

Western Link 6 (WL6)

A3.2.8. Western Link 6 commences at a proposed roundabout on the A465 Belmont Road. From CH 0m to CH 1500m the link follows the same horizontal and vertical alignment as Western Link 4. From CH 1500m to the proposed signalised junction on the A438 King's Acre Road the link follows the same horizontal and vertical alignment as Western Link 3.

Western Link 7 (WL7)

A3.2.9. Western Link 7 commences at a proposed signalised junction at the A438 King's Acre Road. Several existing residential buildings along the King's Acre Road may have to be demolished to allow for the new junction. From here, it heads north, remaining largely at grade until CH 600m where the road level rises to embankment (maximum height of 2m) to cross the floodplain between CH 600m and CH 1234m. The horizontal geometry of the link avoids listed buildings and structures to the east and connects to a proposed roundabout at the A4103 Roman Road.

Table A3.2: Engineering Design Constraints & Impacts

Link Name	Chainage		Major Features	Impacted	Avoided
	Start	End			
Western Inner Links					
WL 1	0	---	A465 Belmont Road Proposed Roundabout	✓	
	200	450	Listed Buildings		✓
	450	1020	National Parks and Gardens	✓	
	490	---	C1199 Ruckhall Lane Proposed Overpass		✓
	600	1100	Land Use Golf Course		✓

Table A3.2: Engineering Design Constraints & Impacts					
Link Name	Chainage		Major Features	Impacted	Avoided
	Start	End			
	605	---	Existing Watercourse: Proposed Culvert	✓	
	960	1020	Special Wildlife Site	✓	
	1020	1240	Flood Zone 3	✓	
	1020	1240	Proposed Viaduct River Wye	✓	
	1500	---	U73023 Warham Lane Proposed Severance	✓	
	1960	---	C1189 Lower Breinton Road Proposed Overpass		✓
	2625	---	U73022 Hill Road Proposed Underpass		✓
	3180	3240	Source Protection Zone 3	✓	
	3240	3573	Source Protection Zone 2	✓	
	3573	---	A438 King's Acre Road Proposed Signalised Junction	✓	
WL2	0	---	A465 Belmont Road Proposed Roundabout	✓	
	200	450	Listed Buildings		✓
	450	1020	National Parks and Gardens	✓	
	480	---	C1199 Ruckhall Lane Proposed Overpass		✓
	600	1100	Land Use Golf Course		✓
	605	---	Existing Watercourse: Proposed Culvert	✓	
	960	1020	Special Wildlife Site	✓	
	1020	1240	Flood Zone 3	✓	
	1020	1240	Proposed Viaduct River Wye	✓	
	1500	---	U73023 Warham Lane Proposed Severance	✓	
	1930	---	C1189 Lower Breinton Road Proposed Overpass		✓
	2700	---	U73022 Hill Road		✓

Table A3.2: Engineering Design Constraints & Impacts					
Link Name	Chainage		Major Features	Impacted	Avoided
	Start	End			
			Proposed Underpass		
	4040	4346	Source Protection Zone 3	✓	
	4346	---	A438 King's Acre Road Proposed Signalised Junction	✓	
WL3	0	---	A465 Belmont Road Proposed Roundabout	✓	
	100	400	Listed Buildings		✓
	500	950	National Parks and Gardens	✓	
	500	1100	Land Use: Golf Course	✓	
	500	---	C1199 Ruckhall Lane Proposed Overpass		✓
	560	---	Existing Watercourse: Proposed Culvert	✓	
	950	1030	Special Wildlife Site	✓	
	950	1270	Flood Zone 3	✓	
	950	1270	River Wye: Proposed Viaduct	✓	
	1700	---	C1189 Lower Breinton Road Proposed Underpass		✓
	2420	---	U73022 Hill Road Proposed Underpass		✓
	2950	3010	Source Protection Zone 3	✓	
	3010	3353	Source Protection Zone 2	✓	
	3353	---	A438 King's Acre Road Proposed Signalised Junction	✓	
WL4	0	---	A465 Belmont Road Proposed Roundabout	✓	
	0	---	Listed Building		✓
	350	---	Listed Building		✓
	500	---	B4349 Proposed Severance	✓	
	950	---	Existing Watercourse: Proposed Culvert	✓	
	1080	---	C1199 Ruckhall Lane		✓

Table A3.2: Engineering Design Constraints & Impacts					
Link Name	Chainage		Major Features	Impacted	Avoided
	Start	End			
			Proposed Underpass		
	1100	1500	National Parks and Gardens	✓	
	1100	1650	Land Use: Golf Course	✓	
	1400	1500	Special Wildlife Site	✓	
	1500	1800	Flood Zone 3	✓	
	1500	1800	River Wye: Proposed Viaduct	✓	
	1900	3000	Land Use: Orchard		✓
	2230	---	C1189 Lower Breinton Road Proposed Underpass		✓
	2950	---	U73022 Hill Road Proposed Underpass		✓
	3500	3550	Source Protection Zone 3	✓	
	3550	3887	Source Protection Zone 2	✓	
	3887	---	A438 King's Acre Road Proposed Signalised Junction	✓	
WL5	0	---	A465 Belmont Road Proposed Roundabout	✓	
	100	350	Listed Buildings		✓
	500	930	National Parks and Gardens	✓	
	500	---	C1199 Ruckhall Lane Proposed Overpass		✓
	500	1100	Land Use: Golf Course	✓	
	560	---	Existing Watercourse: Proposed Culvert	✓	
	860	930	Special Wildlife Site	✓	

Table A3.2: Engineering Design Constraints & Impacts					
Link Name	Chainage		Major Features	Impacted	Avoided
	Start	End			
	860	1160	Flood Zone 3	✓	
	1000	1200	River Wye: Proposed Viaduct	✓	
	1400	2500	Land Use: Orchard		✓
	1700	---	C1189 Lower Breinton Road Proposed Underpass		✓
	2420	---	U73022 Hill Road Proposed Underpass		✓
	3770	4058	Source Protection Zone 3	✓	
	4058	---	A438 King's Acre Road Proposed Signalised Junction	✓	
WL6	0	---	A465 Belmont Road Proposed Roundabout	✓	
	0	---	Listed Building		✓
	500	---	B4349 Proposed Severance	✓	
	950	---	Existing Watercourse: Proposed Culvert	✓	
	1080	1500	National Parks and Gardens	✓	
	1100	1700	Land Use: Golf Course	✓	
	1175	---	C1199 Ruckhall Lane Proposed Underpass		✓
	1400	---	Listed Building		✓
	1500	1800	Flood Zone 3	✓	
	1500	1800	River Wye: Proposed Viaduct	✓	
	1800	1850	Special Wildlife Site	✓	
	1900	3000	Land Use: Orchard		✓
	2230	---	C1189 Lower Breinton Road Proposed Underpass		✓
	2950	---	U73022 Hill Road Proposed Underpass		✓
	4220	4596	Source Protection Zone 3	✓	
	---	3573	A438 King's Acre Road	✓	

Table A3.2: Engineering Design Constraints & Impacts					
Link Name	Chainage		Major Features	Impacted	Avoided
	Start	End			
			Proposed Signalised Junction		
WL7	0	---	A438 King's Acre Road Proposed Signalised Junction	✓	
	0	1190	Source Protection Zone 2	✓	
	0	1234	Source Protection Zone 3	✓	
	650	900	Listed Buildings		✓
	1175	---	Existing Watercourse: Proposed Culvert	✓	
	1234	---	A4103 Roman Road Proposed Roundabout	✓	

WESTERN OUTER CORRIDOR

Western Link 8 (WL8)

A3.2.10. Western Link 8 commences at a proposed signalised junction on the A438 Kings Acre Road. There are several buildings in close proximity to this location and it is anticipated that approximately 3 structures will have to be demolished to provide space for the proposed link. From here the link heads in a north-easterly direction before crossing and severing the existing A480, which may require additional works to provide a new access onto the Kings Acre Road to the east of the existing junction. Moving north, the proposed link enters an area of land currently used as nurseries and skirts around several structures. The topography is reasonably flat and so earthworks are anticipated to be minimal. The link changes to a more northerly direction and terminates at a proposed roundabout on the A4103 Roman Road. The entire link is within Source Protection Zone 3.

Western Link 9 (WL9)

A3.2.11. Western Link 9 commences at a proposed roundabout on the A465 Belmont Road. From here it heads in a north-westerly direction in cuttings up to a maximum of 1.57m deep before crossing and severing the B4349 at grade. The link continues across farmland initially at grade and then on embankments up to 11.4m high before crossing and severing the C1199 Ruckhall Lane and skirting the western boundary of the Belmont Lodge and Golf Resort in cutting up to 13.4m deep. On the approach to the River Wye the alignment turns to cross the floodplain and river, on a substantial structure, at

a perpendicular angle. Once across the River Wye the proposed alignment begins to rise through cuttings up to 4.7m deep and crosses under the C1189 Upper Breinton Road, which may require some reprofiling of the existing vertical alignment of Upper Breinton Road. The link continues in a northerly direction, remaining close to existing levels and avoiding any major constraints until the approach to the A438 Kings Acre Road. The link encroaches on Source Protection Zone 3 (CH 4035m) and there are several buildings in close proximity to the proposed alignment which may need to be demolished to provide space. The link terminates with a proposed signalised junction on the A438 Kings Acre Road.

Western Link 10 (WL10)

A3.2.12. Western Link 10 follows the same horizontal and vertical alignment as WL 9 from the start up until after the crossing of the River Wye (CH 2650m). Once across the River Wye, WL 10 turns in a north-westerly direction and underpasses the C1189 Upper Breinton Road, with a suitable structure required. The link continues, predominantly at grade, crossing and severing 3 laneways and Breinton Lane before turning to a more northerly direction to meet the A438 Kings Acre Road. The link encroaches on Source Protection Zone 3 (CH 4735m) and the topography also necessitates cuttings up to 4.1m deep on the western side of the alignment (CH 4325m-CH 4650m). The link terminates with a proposed signalised junction on the A438 Kings Acre Road.

Western Link 11 (WL11)

A3.2.13. Western Link 11 commences at a proposed signalised junction on the A438 Kings Acre Road. There are several buildings in close proximity to this location and it is anticipated that approximately 3 structures will have to be demolished to provide space for the proposed link. From here the link heads in a north-westerly direction and ties into the A480, which will require to be widened. It is proposed to severe the southern end of the A480, with local access being provided via the existing junction on the A438 Kings Acre Road. The link follows the horizontal and vertical alignment of the A480 until it meets the existing roundabout on the western end of the A4103 Roman Road at which point it terminates.

Western Link 12 (WL12)

A3.2.14. Western Link 12 commences at a proposed signalised junction on the A438 Kings Acre Road, approximately 1km west of WL 11. This is a short link over reasonably flat ground. Starting in a northerly direction and turning in a north-easterly direction, it connects into the roundabout at the western end of the A4103 Roman Road where it terminates. The entire link is within Source Protection Zone 3.

Western Link 13 (WL13)

A3.2.15. Western Link 13 commences at the existing roundabout on the western end on the A4103 Roman Road and follows the existing horizontal and vertical alignment travelling east along the Roman Road for approximately 870m. This will require considerable widening of the existing carriageway. The link terminates at the location where WL 14 commences and would connect directly with WL 14. The entire link is within Source Protection Zone 3, and may encroach slightly upon land currently used as nurseries and within Floodzone 2 and 3.

Western Link 14 (WL14)

A3.2.16. Western Link 14 commences at the end of WL 8 and WL 13 on the A4103 Roman Road, and follows the existing horizontal and vertical alignment travelling east along the Roman Road for approximately 760m. As with WL 13, considerable widening will be required with asymmetric widening in some locations in order to avoid existing buildings. The entire link is within Source Protection Zone 3 and crosses Floodzones 2 and 3 (CH 0m – 700m). In addition to this there are also several culverts crossing under the Roman Road which should require to be extended and a section of Yazor Brook runs close to the existing southern carriageway edge (CH 400m – 700m). At this location, it is proposed to widen the road to the south to avoid neighbouring properties on the northern side of the road. This should require works to culvert the brook along its current alignment, or realign the brook to beyond the proposed earthworks extents. The link terminates with a proposed roundabout on the A4103 Roman Road at the start of Northern Corridor Links 1 and 2 as detailed in the next section.

Table A3.3: Engineering Design Constraints & Impacts					
Link Name	Chainage		Major Features	Impacted	Avoided
	Start	End			
Western Outer Links					
WL8	0	---	A438 Kings Acre Road Proposed Traffic Signalised Junction	✓	
	0		Existing Structures	✓	
	0	1093	Source Protection Zone 3	✓	
	185	590	Land Use - Nurseries	✓	
	1093	---	A4103 Roman Road Proposed Roundabout	✓	

Table A3.3: Engineering Design Constraints & Impacts					
Link Name	Chainage		Major Features	Impacted	Avoided
	Start	End			
WL9	0	---	A465 Belmont Road Proposed Roundabout	✓	
	291	---	B4349 Proposed Severance	✓	
	1010	---	Open Watercourse	✓	
	1300	---	C1199 Ruckhall Lane Proposed Severance	✓	
	1300	2440	Land Use – Golf Course		✓
	2245	2495	Flood Zone 3	✓	
	2440	2479	River Wye	✓	
	2479	2617	National Park and Garden	✓	
	2600	2664	Flood Zone 3	✓	
	2600	2610	River	✓	
	3018	---	Upper Breinton Lane Proposed Underpass		✓
	3578	---	Green Lane Proposed Severance	✓	
	3578	3600	Special Wildlife Site		✓
	4035	4360	Source Protection Zone 3	✓	
	4180	4360	Existing Structures	✓	
	4360	---	A438 Kings Acre Road Proposed Traffic Signalised Junction	✓	
WL10	0	---	A465 Belmont Road Proposed Roundabout	✓	
	291	---	B4349 Proposed Severance	✓	
	1010	---	Open Watercourse	✓	
	1300	---	C1199 Ruckhall Lane Proposed Severance	✓	
	1300	2440	Land Use – Golf Course		✓

Table A3.3: Engineering Design Constraints & Impacts					
Link Name	Chainage		Major Features	Impacted	Avoided
	Start	End			
	2245	2495	Flood Zone 3	✓	
	2440	2479	River Wye	✓	
	2479	2617	National Park and Garden	✓	
	2600	2664	Flood Zone 3	✓	
	2600	2610	River	✓	
	3022	---	Upper Breinton Lane Proposed Underpass		✓
	3347	---	Lane Proposed Severance	✓	
	3495	---	Lane Proposed Severance	✓	
	3557	---	Lane Proposed Severance	✓	
	3768	---	Breinton Lane Proposed Severance	✓	
	4735	4900	Source Protection Zone 3	✓	
	4900	---	A438 Kings Acre Road Proposed Traffic Signalised Junction	✓	
WL11	0	---	A438 Kings Acre Road Proposed Traffic Signalised Junction	✓	
	0	1037	Source Protection Zone 3	✓	
	320	---	A480 Proposed Severance	✓	
	245	555	Nurseries		✓
	490	735	Nurseries		✓
	882	---	Proposed Severance	✓	
	1037	---	A4103 Roman Road Existing Roundabout	✓	
WL 12	0	---	A438 Kings Acre Road Proposed Traffic Signalised Junction	✓	

Table A3.3: Engineering Design Constraints & Impacts					
Link Name	Chainage		Major Features	Impacted	Avoided
	Start	End			
	0	755	Source Protection Zone 3	✓	
	680	---	Minor Road Proposed Junction	✓	
	755	---	A4103 Roman Road Existing Roundabout	✓	
WL13	0	---	A4103 Roman Road Existing Roundabout	✓	
	0	867	Source Protection Zone 3		
	500	700	Land Use – Nurseries	✓	
	867	---	A4103 Roman Road	✓	
WL14	0	---	A4103 Roman Road Proposed Roundabout	✓	
	0	758	Source Protection Zone 3	✓	
	0	725	Flood Zone 2	✓	
	0	725	Flood Zone 3	✓	
	758	---	A4103 Roman Road Proposed Roundabout	✓	

NORTHERN CORRIDOR

Northern Corridor Link 1 (NC1)

A3.2.17. Northern Corridor Link 1 commences at a proposed roundabout on the A4103 Roman Road. From here the link heads north at grade away from the roundabout before turning right (horizontal radius of 360m) and heading east, largely avoiding the national park and gardens to the north before rising to embankment (7m maximum height) and crossing C1095 Tillington Road on an overpass structure. The road level then reduces and changes to cut at CH 850m before passing under the A4110 Canon Pyon Road via a proposed underpass. The existing residential properties in the vicinity of the A4110 Canon Pyon Road are avoided. The road level then rises to the existing grade and continues east before approaching the proposed roundabout at the A49 Holmer Road. The proposed roundabout location avoids both the existing properties on the Holmer Road as well as the existing flood zone to the south.

Northern Corridor Link 2 (NC2)

A3.2.18. Northern Corridor Link 2 commences at a proposed roundabout on the A4103 Roman Road. From here the link heads north at grade away from the roundabout before turning right (horizontal radius of 600m) and heading east. A large radius is used to improve the angle of entry to the proposed roundabout at the A4103 Roman Road. However as the link turns east the larger radius requires the link to traverse the national parks and gardens located to the north on approach to the C1095 Tillington Road. The link then rises to embankment and crosses the Tillington Road on a proposed overpass structure before the road level reduces and underpasses the A4110 Canon Pyon Road via a proposed underpass. From CH 1500m to the proposed roundabout at the A49 Holmer Road the link follows the same horizontal and vertical alignment as NC1.

Northern Corridor Link 3 (NC3)

A3.2.19. Northern Corridor Link 3 commences at a proposed roundabout on the A49 Holmer Road. The link heads south east at grade avoiding existing properties to the south as well as high topography to the north. The link then approaches and crosses the Coldwell Road via an overpass structure. Embankments are required (9m maximum height) both on approach to and after the proposed bridge structure. The road level then descends to the existing grade and continues east avoiding the area zoned as a proposed UDP housing site to the south. The road level then rises again to overpass the existing railway lines at CH 1680m. Embankments are required (8m maximum height) on approach to and after the required structure. The road level then descends and meets the existing A4103 Roman Road at CH 2000m. From here the link follows the existing alignment of the A4103 Roman Road. This existing road will require widening to accommodate the wider carriageway cross section between CH 2000m and CH 2227m. The existing bridge crossing the disused canal at CH 2060m will also have to be widened or replaced to accommodate the larger carriageway section. The link then approaches and terminates at a proposed roundabout on the A465 Aylestone Hill Road.

Northern Corridor Link 4 (NC4)

A3.2.20. From CH 0m to CH 800m the Northern Corridor Link 4 follows the same horizontal and vertical alignment as NC3. At CH 800m the link turns east avoiding the area zoned as a proposed housing site to the south, with the road level rising to embankment (8m maximum height) and over-passing the existing railway lines via a new structure. The road remains on embankment and turns right, heading south to meet the A4103 Roman Road and A465

Aylestone Hill Road at a proposed roundabout. A new bridge structure will be required to cross the existing disused canal at CH 1680m.

Table A3.4: Engineering Design Constraints & Impacts					
Link Name	Chainage		Major Features	Impacted	Avoided
	Start	End			
Northern Corridor Links					
NC1	0	---	A4103 Roman Road Proposed Roundabout	✓	
	0	200	Source Protection Zone 3	✓	
	470	---	C1095 Tillington Road Proposed Overpass		✓
	600	690	National Park and Gardens	✓	
	1100	---	A4110 Canon Pyon Road Proposed Underpass		✓
	2450	---	Existing Ditch: Proposed Culvert	✓	
	2500	2600	Flood Zone 3		✓
	2641	---	A49 Holmer Road Proposed Roundabout	✓	
NC2	0	---	A4103 Roman Road Proposed Roundabout	✓	
	0	200	Source Protection Zone 3	✓	
	570	---	C1095 Tillington Road Proposed Overpass		✓
	575	820	National Park and Gardens	✓	
	1220	---	A4110 Canon Pyon Road Proposed Underpass		✓
	2500	2600	Flood Zone 3		✓
	2540	---	Existing Ditch: Proposed Culvert	✓	
	2752	---	A49 Holmer Road Proposed Roundabout	✓	
NC 3	0	---	A49 Holmer Road Proposed Roundabout	✓	

Table A3.4: Engineering Design Constraints & Impacts					
Link Name	Chainage		Major Features	Impacted	Avoided
	Start	End			
	120	---	Existing Stream: Proposed Culvert	✓	
	580	---	Coldwells Road Proposed Overpass		✓
	700	1600	UDP Proposed Housing Site		✓
	900	---	Existing Stream: Proposed Culvert	✓	
	1680	---	Existing Railway Lines: Proposed Bridge		✓
	2060	---	Existing Disused Canal: Proposed Bridge		✓
	2070	2330	Special Area of Conservation		✓
	2180	2330	Source Protection Zone 3	✓	
	2330	---	A465 Aylestone Hill Road Proposed Roundabout	✓	
NC4	0	---	A49 Holmer Road Proposed Roundabout	✓	
	120	---	Existing Stream: Proposed Culvert	✓	
	580	---	Coldwells Road Proposed Overpass		✓
	700	1600	UDP Proposed Housing Site		✓
	1800	---	Existing Railway Lines: Proposed Bridge		✓
	2060	---	Existing Disused Canal: Proposed Bridge		✓
	2070	2330	Special Area of Conservation		✓
	2080	2331	Source Protection Zone 3	✓	
	2330	---	A465 Aylestone Hill Road Proposed Roundabout	✓	

EASTERN INNER CORRIDOR

Eastern Link 1

A3.2.21. Eastern Link 1 commences at the proposed roundabout at the A465 Aylestone Hill Road. From here the link heads south following a horizontal alignment dictated by the topography (along existing ridge). The link largely avoids the existing floodplain to the east but the carriageway will be built up on embankment across the entire of the link (maximum height 6.5m) to achieve

the required level above the floodplain. The link also avoids the Special Wildlife Site to the west as well as the existing listed buildings and residential buildings also located to the west. The alignment however impacts on the Broadlands Local Nature Reserve. The link connects to a proposed roundabout at the A438 Ledbury Road avoiding existing buildings in the vicinity.

Eastern Link 2

A3.2.22. Eastern Link 2 commences at a proposed roundabout on the A438 Ledbury Road. The link heads south across farmland remaining largely at grade for its entire length. At CH 900m the link bears right to reduce the impact on an existing orchard as well as to avoid existing buildings along the B4224 Hampton Park Road. The link connects to the B4224 Hampton Park Road via a proposed roundabout.

Eastern Link 3

A3.2.23. Eastern Link 3 commences at a proposed roundabout at the B4224 Hampton Park Road. From here the link heads south at grade. At CH 100m the road level rises forming an embankment (maximum height 7m) on approach to the River Wye. The carriageway is carried across the river and floodplain by a new 200m span viaduct structure. Upon crossing the river the road level reduces but remains on embankment to achieve the required height across the rest of the floodplain. The link avoids an existing listed structure and associated conservation area to the east of the link before reducing to grade and connecting to a proposed roundabout at the B4399 Straight Mile Road.

Table A3.5: Engineering Design Constraints & Impacts					
Link Name	Chainage		Major Features	Impacted	Avoided
	Start	End			
Eastern Inner Links					
EL1	0	---	A465 Aylestone Hill Road Proposed Roundabout	✓	
	240	---	Existing Stream: Proposed Culvert	✓	
	380	1700	Source Protection Zone 3	✓	
	380	1700	National Park and Gardens	✓	
	920	1220	Special Wildlife Site		✓
	900	1500	Lugg Meadows: Site of Special Scientific Interest		✓

Table A3.5: Engineering Design Constraints & Impacts					
Link Name	Chainage		Major Features	Impacted	Avoided
	Start	End			
	2000	2000	50m North of Listed Building		✓
	2114	---	A438 Ledbury Road Proposed Roundabout	✓	
EL 2	0	---	A438 Ledbury Road Proposed Roundabout	✓	
	775	---	Existing Stream: Proposed Culvert	✓	
	1100	1296	Orchard	✓	
	1296	1296	Conservation Area	✓	
	1296	---	B4224 Hampton Park Road Proposed Roundabout	✓	
EL3	0	---	B4224 Hampton Park Road Proposed Roundabout	✓	
	100	1293	Flood Zone 3	✓	
	400	400	River Lugg: Special Area of Conservation		✓
	700	800	Ancient Monument		✓
	1293	---	B4399 The Straight Mile Road Proposed Roundabout	✓	

EASTERN OUTER CORRIDOR

Eastern Link 4 (EL4)

A3.2.24. Eastern Link 4 commences at the proposed roundabout at the A465 Aylestone Hill Road. The link heads east following the existing alignment of the A465 Aylestone Hill Road. This existing stretch of road will have to be widened to accommodate the wider carriageway cross section. Eleven flood relief culverts located between CH 220m and CH 630m will have to also be extended to accommodate the wider carriageway. The existing listed bridge (Lugg Bridge) may require strengthening/widening to accommodate the increase in traffic as well as the wider carriageway. The link connects to a proposed roundabout located on the A465 Aylestone Road.

Eastern Link 5 (EL5)

A3.2.25. Eastern Link 5 commences at the proposed roundabout at the A465 Aylestone Hill Road. The link follows the same horizontal and vertical alignment as Eastern Link 4 until CH 700m. After crossing the existing Lugg Bridge the link heads further east to a proposed roundabout also located on the A465 Aylestone Hill Road. This link will require the existing A465 Aylestone Hill Road to be realigned to connect to the proposed roundabout at the new location.

Eastern Link 6 (EL6)

A3.2.26. Eastern Link 6 commences at the proposed roundabout at the A4103 Roman Road. From here the link heads south on embankment (maximum height 4m) keeping to the east of the existing floodplain to the west. At CH 740m to CH 1940m the link crosses an area zoned as national park/garden. In addition at Ch 1640m the link traverses floodzone 3 remaining on embankment to achieve the desired level above the floodplain. The link then crosses the River Lugg (new bridge structure required) at a new location close to the existing Luggwardine Bridge (Listed Structure) before connecting to a proposed roundabout at the A438 Ledbury Road.

Eastern Link 7 (EL7)

A3.2.27. Eastern Link 7 commences at a proposed roundabout on the A465 Aylestone Hill Road. From here the link heads south on embankment (maximum height 4m). At CH 640m to CH 1452m the link crosses an area zoned as national park/garden. In addition at Ch 1670m the link traverses floodzone 3 remaining on embankment to achieve the desired level above the floodplain. The link then crosses the River Lugg (new bridge structure required) at a new location 250m west of the existing Luggwardine Bridge (Listed Structure) before connecting to a proposed roundabout at the A438 Ledbury Road.

Eastern Link 8 (EL8)

A3.2.28. From CH 0m to CH 800m Eastern Link 8 follows the same horizontal and vertical alignment as Eastern Link 7. From here the alignment heads south. At Ch 1250m the link traverses floodzone 3 remaining on embankment to achieve the desired level above the floodplain. The link then crosses the River Lugg (new bridge structure required) at a new location 100m west of the existing Luggwardine Bridge (Listed Structure) before connecting to a proposed roundabout at the A438 Ledbury Road.

Eastern Link 9 (EL9)

A3.2.29. Eastern Link 9 commences at a proposed roundabout on the A438 Ledbury Road. From here the link heads south on embankment (maximum height 3.5m) crossing an existing floodplain. A bridge structure will be required to cross the existing stream at CH 600m. The link then bears right (radius 1020m) avoiding an area of archaeological significance. At CH 1300m the link enters and crosses land currently being used as orchards. The link then connects to a proposed roundabout at the B4224 Hampton Park Road the location of which was chosen to avoid existing buildings and properties in close proximity.

Eastern Link 10 (EL10)

A3.2.30. Eastern Link 10 commences at a proposed roundabout on the A438 Ledbury Road. From here the link heads south on embankment (maximum height 3.75m) crossing an existing floodplain. A bridge structure will be required to cross the existing stream at CH 500m. The link then bears right (radius 1440m) avoiding an area of archaeological significance. From CH 1100m to the proposed roundabout at B4224 Hampton Park Road the link follows the same horizontal and vertical alignment as Eastern Link 9.

Eastern Link 11 (EL11)

A3.2.31. Eastern Link 11 commences at a proposed roundabout on the A438 Ledbury Road located close to the Luggwardine Bridge (Listed Structure). From here the link heads south on embankment (maximum height 3.75m) crossing an existing floodplain. A bridge structure will be required to cross the existing stream at CH 630m. The link then bears right (radius 1440m) avoiding an area of archaeological significance. From CH 1300m to the proposed roundabout at B4224 Hampton Park Road the link follows the same horizontal and vertical alignment as Eastern Link 9.

Eastern Link 12 (EL12)

A3.2.32. Eastern Link 12 commences at a proposed roundabout on the B4224 Hampton Park Road. The link heads south west on embankment (maximum height 7.5m) across the existing flood plain. The road level then rises on approach to the River Wye and crosses via a proposed bridge structure. The road level then reduces but remains on embankment across the remainder of the floodplain. The link avoids existing listed structures to the north but several smaller properties between CH 800m and 1000m would need to be demolished to allow for the carriageway. The link then turns left avoiding additional properties in the vicinity of Chapel Road. The link connects to the existing roundabout at B4399 Straight Mile Road and the Rotherwas Access

Road. It is likely that the existing roundabout would need to be upgraded to accommodate the new link road.

Table A3.6: Engineering Design Constraints & Impacts					
Link Name	Chainage		Major Features	Impacted	Avoided
	Start	End			
Eastern Outer Links					
EL 4	0	---	A465 Aylestone Hill Road Proposed Roundabout	✓	
	0	729	Flood Zone 3	✓	
	200	700	Special Wildlife Site		✓
	220	---	Existing Flood Relief Culvert	✓	
	260	---	Existing Flood Relief Culvert	✓	
	315	---	Existing Flood Relief Culvert	✓	
	360	---	Existing Flood Relief Culvert	✓	
	400	---	Existing Flood Relief Culvert	✓	
	440	---	Existing Flood Relief Culvert	✓	
	460	---	Existing Flood Relief Culvert	✓	
	510	---	Existing Flood Relief Culvert	✓	
	570	---	Existing Flood Relief Culvert	✓	
	605	---	Existing Flood Relief Culvert	✓	
	630	---	Existing Flood Relief Culvert	✓	
	690	690	Special Area of Conservation	✓	
	690	---	River Lugg: Existing Listed Bridge	✓	
	729	---	A465 Aylestone Hill Proposed Roundabout	✓	
EL5	0	---	A465 Aylestone Hill Road Proposed Roundabout	✓	
	0	700	Flood Zone 3	✓	
	200	700	Special Wildlife Site		✓
	220	---	Existing Flood Relief Culvert	✓	
	260	---	Existing Flood Relief Culvert	✓	

Table A3.6: Engineering Design Constraints & Impacts					
Link Name	Chainage		Major Features	Impacted	Avoided
	Start	End			
	315	---	Existing Flood Relief Culvert	✓	
	360	---	Existing Flood Relief Culvert	✓	
	400	---	Existing Flood Relief Culvert	✓	
	440	---	Existing Flood Relief Culvert	✓	
	460	---	Existing Flood Relief Culvert	✓	
	510	---	Existing Flood Relief Culvert	✓	
	570	---	Existing Flood Relief Culvert	✓	
	605	---	Existing Flood Relief Culvert	✓	
	630	---	Existing Flood Relief Culvert	✓	
	690	---	River Lugg: Existing Listed Bridge	✓	
	690	690	Special Area of Conservation	✓	
	1242	---	A465 Aylestone Hill Road Proposed Roundabout	✓	
EL6	0	---	A4103 Roman Road Proposed Roundabout	✓	
	0	---	Listed Buildings		✓
	0	1940	Special Scientific Interest	✓	
	740	1940	National Park and Gardens	✓	
	980	1100	Flood Zone 3	✓	
	1640	1940	Flood Zone 3	✓	
	1800	---	Existing Drain: Proposed Culvert	✓	
	1800	---	Existing Drain: Proposed Culvert	✓	
	1895	---	River Lugg: Proposed Bridge	✓	
	1895	1895	Special Area of Conservation	✓	
	1900	---	Listed Bridge		✓
	1940	---	A438 Ledbury Road Proposed Roundabout	✓	
EL7	0	---	A465 Aylestone Hill Road Proposed Roundabout	✓	

Table A3.6: Engineering Design Constraints & Impacts					
Link Name	Chainage		Major Features	Impacted	Avoided
	Start	End			
	0	---	Listed Buildings		✓
	630	700	Flood Zone 3	✓	
	640	1452	National Park and Gardens	✓	
	650	---	Existing Stream: Proposed Culvert	✓	
	800	---	Listed Building		✓
	1150	1452	Flood Zone 3	✓	
	1250	---	Existing Stream: Proposed Culvert	✓	
	1380	1452	Special Wildlife Site	✓	
	1380	---	River Lugg: Proposed Bridge	✓	
	1380	1380	Special Area of Conservation	✓	
	1452	---	Listed Bridge		✓
	1452	---	A438 Ledbury Road Proposed Roundabout	✓	
EL8	0	---	A465 Aylestone Hill Road Proposed Roundabout	✓	
	630	700	Flood Zone 3	✓	
	640	1500	National Park and Gardens	✓	
	650	---	Existing Stream: Proposed Culvert	✓	
	1250	1578	Flood Zone 3	✓	
	1350	---	Existing Drain: Proposed Culvert	✓	
	1475	---	River Lugg: Proposed Bridge	✓	
	1475	1475	Special Area of Conservation	✓	
	1578	---	A438 Ledbury Road Proposed Roundabout	✓	
EL9	0	---	A438 Ledbury Road Proposed Roundabout	✓	
	0	1350	Flood Zone 3	✓	
	600	---	Existing Stream: Proposed Culvert	✓	
	800	1000	Scheduled Ancient Monument Area		✓

Table A3.6: Engineering Design Constraints & Impacts					
Link Name	Chainage		Major Features	Impacted	Avoided
	Start	End			
	1300	1982	Orchard	✓	
	1770	1982	Flood Zone 3	✓	
	1982	---	B4224 Hampton Park Road Proposed Roundabout	✓	
EL10	0	---	A438 Ledbury Road Proposed Roundabout	✓	
	0	1250	Flood Zone 3	✓	
	500	---	Existing Stream: Proposed Culvert	✓	
	700	1000	Scheduled Ancient Monument Area		✓
	1670	1887	Flood Zone 3	✓	
	1200	1887	Orchard	✓	
	1887	---	Listed Building		✓
	1887	---	B4224 Hampton Park Road Proposed Roundabout	✓	
EL11	0	---	A438 Ledbury Road Proposed Roundabout	✓	
	0	---	Existing Listed Bridge		✓
	0	1400	Flood Zone 3	✓	
	630	---	Existing Stream: Proposed Culvert	✓	
	800	1100	Scheduled Ancient Monument Area		✓
	1320	2012	Orchard	✓	
	2012	---	Listed Building		✓
	2012	---	B4224 Hampton Park Road Proposed Roundabout	✓	
EL12	0	---	B4224 Hampton Park Road Proposed Roundabout	✓	
	0	---	Listed Building		✓
	0	1381	Flood Zone 3	✓	
	300	500	River Wye: Special Area of Conservation	✓	

Table A3.6: Engineering Design Constraints & Impacts					
Link Name	Chainage		Major Features	Impacted	Avoided
	Start	End			
	300	600	River Wye: Proposed Viaduct	✓	
	800	1000	Listed Building		✓
	800	1000	Scheduled Ancient Monument Area		✓
	1381	---	B4339 the Straight Mile Road Proposed Roundabout	✓	

A3.3. Departures from Standards

A3.3.1. All links considered within this report have been designed using the geometrical standards contained in TD9/93 'Highway Link Design'.

SOUTHERN CORRIDOR

Southern Corridor Link 1

A3.3.2. At this stage of design development, no Relaxations or Departures from standard have been identified for this route.

Southern Corridor Link 2

A3.3.3. None Identified.

WESTERN INNER CORRIDOR

Western Link 1

A3.3.4. At this stage of design development, two Relaxations have been identified. Due to the constraints on the horizontal layout, bends of radius 510m and 610m are required within the design. Both radii are a one-step Relaxation for the design speed of 100kph.

Western Link 2

A3.3.5. At this stage of design development, four Relaxations have been identified. Due to the constraints on the horizontal layout, bends of radius 510m and 610m are required within the design. Both radii are a one-step Relaxation for the design speed of 100kph.

Western Link 3

A3.3.6. None Identified.

Western Link 4

A3.3.7. At this stage of design development, one Relaxation has been identified. Due to the constraints on the horizontal layout, a bend of radius 510m is required within the design. A 510m radius is a one-step Relaxation for the design speed of 100kph.

Western Link 5

A3.3.8. At this stage of design development, one Relaxation has been identified. Due to the constraints on the horizontal layout, a bend of radius 510m is required within the design. A 510m radius is a one-step Relaxation for the design speed of 100kph.

Western Link 6

A3.3.9. At this stage of design development, three Relaxations have been identified. Due to the constraints on the horizontal layout, bends of radius 510m are required within the design. A 510m radius is a one-step Relaxation for the design speed of 100kph.

Western Link 7

A3.3.10. None Identified.

WESTERN OUTER CORRIDOR

Western Link 8

A3.3.11. At this stage of design development, one Departure from Standard has been identified. Due to the constraints on the horizontal layout, the Stopping Sight Distance is limited to 90m over the first 150m of the link. SSD of 90m is a one-step relaxation for the design speed of 70kph, however as this type of relaxation is not permitted on the immediate approaches to junctions and so a Departure from Standard is generated.

A3.3.12. One Relaxation has also been identified. Due to the constraints on the horizontal layout, a bend of radius 255m is required within the design. A 255m radius is a one-step Relaxation for the design speed of 70kph.

Western Link 9

A3.3.13. None Identified.

Western Link 10

A3.3.14. None Identified.

Western Link 11

A3.3.15. None Identified.

Western Link 12

A3.3.16. None Identified.

Western Link 13

A3.3.17. At this stage of design development, one Relaxation has been identified. Due to the constraints on the horizontal layout, a bend of radius 300m is required within the design. A 300m radius is a one-step Relaxation for the design speed of 70kph.

Western Link 14

A3.3.18. None Identified.

NORTHERN CORRIDOR

Northern Corridor Link 1

A3.3.19. At this stage of design development, one Departure from Standard has been identified. Due to the constraints on the vertical layout, a crest curve with a k value of 17 is required within the design. A crest curve of this value is a one-step Relaxation for the design speed of 70kph, however this is coincident with a reduction in the Stopping Sight Distance to 90m. SSD of 90m is a one-step relaxation. This combination of Relaxations is not permitted by DMRB standards and so a Departure from Standard is generated.

A3.3.20. This departure could be removed from the design, however this would have a significant effect of the required earthworks, as there are substantial areas of both cut and fill required in order to avoid severance by providing an overpass to C1095 Tillington Road and underpass A4110 Canon Pyon Road.

Northern Corridor Link 2

A3.3.21. At this stage of design development, two Departures from Standard have been identified. Due to the constraints on the vertical layout, a crest curve with a k value of 17 is required within the design. A crest curve of this value is a Departure from Standard for the design speed of 100kph.

A3.3.22. This crest curve also has the effect of reducing forward visibility and as a result the Stopping Sight Distance is limited to 90m. SSD of 90m is a Departure from Standard for a design speed of 100kph.

A3.3.23. These departures could be removed from the design, however this would have a significant effect of the required earthworks, as there are substantial areas of both cut and fill required in order to avoid severance by providing an overpass to C1095 Tillington Road and underpass A4110 Canon Pyon Road.

A3.3.24. One Relaxation is also present within the design. Due to the constraints on the horizontal layout, a bend of radius 600m is required within the design. A 600m radius is a one-step Relaxation for the design speed of 100kph.

Northern Corridor Link 3

A3.3.25. At this stage of design development, four Departures from Standard have been identified. Due to the constraints on the vertical layout, two crest curves with a k value of 17 are required within the design. A crest curve of this value is a Departure from Standard for the design speed of 100kph.

A3.3.26. These crest curves also have the effect of reducing forward visibility and as a result the Stopping Sight Distance is limited to 90m. SSD of 90m is a Departure from Standard for a design speed of 100kph.

A3.3.27. These departures could be removed from the design; however this would have a significant effect of the required earthworks. The first Departure enables the existing ground profile to be followed closely before the crossing of Codwells Road and therefore the need for earthwork cuttings minimised. The second Departure is surrounding the railway crossing and minimises the requirement for earthwork embankments either side of this crossing.

A3.3.28. One Relaxation is also present within the design. Due to the constraints on the horizontal layout, a bend of radius 580m is required within the design. A 580m radius is a one-step Relaxation for the design speed of 100kph.

North Corridor Link 4

A3.3.29. At this stage of design development, four Departures from Standard have been identified. Due to the constraints on the vertical layout, two crest curves with a k value of 17 are required within the design. A crest curve of this value is a one-step Relaxation for the design speed of 70kph, however this is coincident with a reduction in the Stopping Sight Distance to 90m. SSD of 90m is a one-step relaxation. This combination of Relaxations is not permitted by DMRB standards and so a Departure from Standard is generated.

A3.3.30. These departures could be removed from the design; however this would have a significant effect of the required earthworks. The first Departure enables the existing ground profile to be followed closely before the crossing of Codwells Road and therefore the need for earthwork cuttings minimised. The second Departure is surrounding the railway crossing and minimises the requirement for earthwork embankments either side of this crossing.

A3.3.31. The two additional Departures relate to sag curves with a k value of 17. A sag curve of this value is a Departure from Standard for the design speed of 100kph.

A3.3.32. Again, these departures could be removed from the design; but would have a significant effect of the required earthworks in the same locations as described above.

EASTERN INNER CORRIDOR

Eastern Link 1

A3.3.33. At this stage of design development, one Departure from Standard has been identified. Due to the constraints on the vertical layout, a crest curve with a k value of 17 is required within the design. A crest curve of this value is a one-step Relaxation for the design speed of 70kph, however this is coincident with a reduction in the Stopping Sight Distance to 90m. SSD of 90m is a one-step relaxation. This combination of Relaxations is not permitted by DMRB standards and so a Departure from Standard is generated.

Eastern Link 2

A3.3.34. None Identified.

Eastern Link 3

A3.3.35. None Identified.

EASTERN OUTER CORRIDOR

Eastern Link 4

A3.3.36. None Identified.

Eastern Link 5

A3.3.37. None Identified.

Eastern Link 6

A3.3.38. None Identified.

Eastern Link 7

A3.3.39. None Identified.

Eastern Link 8

A3.3.40. None Identified.

Eastern Link 9

A3.3.41. None Identified.

Eastern Link 10

A3.3.42. None Identified.

Eastern Link 11

A3.3.43. None Identified.

Eastern Link 12

A3.3.44. At this stage of design development, one Departure from Standard has been identified. Due to the constraints on the vertical layout, a crest curve with a k value of 55 is required within the design. A crest curve of this value is a one-step Relaxation for the design speed of 100kph, however this is coincident with a reduction in the Stopping Sight Distance to 160m. SSD of 160m is a one-step relaxation. This combination of Relaxations is not permitted by DMRB standards and so a Departure from Standard is generated.

Table A3.7: Standards Achieved

Link Name	Chainage (m)	SSD (m)	Horizontal (m)	Vertical 'k' Value
Southern Corridor				
SC 1	---	---	---	---
SC 2	---	---	---	---
Western Inner Corridor				
WL 1	200-700	---	510 (1 STEP)	---
	900-1650	---	610 (1 STEP)	---
WL 2	200-700	---	510 (1 STEP)	---
	900-1650	---	610 (1 STEP)	---
	2850-3050	---	510 (1 STEP)	---
	3850-4300	---	510 (1 STEP)	---
WL 3	850-1000	---	---	---
WL 4	125-525	---	510 (1 STEP)	---
WL 5	3550-3950	---	510 (1 STEP)	---
WL 6	125-525	---	510 (1 STEP)	---
	3000-3325	---	510 (1 STEP)	---
	4100-4500	---	510 (1 STEP)	---
WL 7	---	---	---	---
Western Outer Corridor				
WL 8	25-150	90m (1 STEP)	255 (1 STEP)	---
WL 9	---	---	---	---
WL 10	---	---	---	---
WL 11	---	---	---	---
WL 12	---	---	---	---
WL 13	60-110	---	300 (1 STEP)	---
WL 14	---	---	---	---
Northern Corridor				
NC 1	400-550	90m (1 STEP)	---	CREST K=17 (1 STEP)
NC 2	500-650	90m (DEPARTURE)	---	CREST K=17 (DEPARTURE)
	430-670	---	600 (1 STEP)	---

NC 3	---	---	580 (1 STEP)	---
	250-400	90m (DEPARTURE)	---	CREST K=17 (DEPARTURE)
	1625-1750	90m (DEPARTURE)	---	CREST K=17 (DEPARTURE)
NC 4	100-150	---	---	SAG K=17 (DEPARTURE)
	250-350	90m (1 STEP)	---	CREST K=17 (1 STEP)
	1550-1600	---	---	SAG K=17 (DEPARTURE)
	1700-1850	90m (1 STEP)	---	CREST K=17 (1 STEP)
Eastern Inner Corridor				
EL 1	1275-1375	90m (1 STEP)	---	CREST K=17 (1 STEP)
EL 2	---	---	---	---
EL 3	---	---	---	---
Eastern Outer Corridor				
EL 4	---	---	---	---
EL 5	---	---	---	---
EL 6	---	---	---	---
EL 7	---	---	---	---
EL 8	---	---	---	---
EL 9	---	---	---	---
EL 10	---	---	---	---
EL 11	---	---	---	---
EL 12	220-630	160m (1 STEP)	---	CREST K=55 (1 STEP)

A4. Climate, Topography and Land Use

A4.1. Assessment Chapter Structure

A4.1.1. This section will consider the relationship of the route alignments to climate change projections, the topography encountered along the route and how the alignments may impact on existing and future land use.

A4.2. Climate Change Scenarios

A4.2.1. The Climate Change Act 2008 creates a new approach to managing and responding to climate change in the UK. At the heart of the Act is a legally binding target to reduce the UK's greenhouse gas emissions to at least 80 per cent below 1990 levels by 2050, to be achieved through action at home and abroad. To achieve this the Act introduces five year 'carbon budgets' which define the emissions pathway to the 2050 target by limiting the total greenhouse gas emissions allowed in each five year period, beginning in 2008.

A4.2.2. For the period covering 2008-12 the carbon budget requires emission reductions of 22% below 1990 levels, 28% for 2013-17 and 34% for 2018-22. These are in line with the recommendations of the Committee on Climate Change.

A4.2.3. Climate change is likely to lead to changes in land use and increased pressure on resources. Within the UK climate change is likely to lead to more extreme weather patterns, with increased flood risk, flash flooding and drier, warmer summers. This will lead to changes in agriculture and land use as farming may have to adapt to growing different crops or more drought resistant varieties. With an increased flood risk, it will become more important that development within floodplains and flood storage areas is curtailed.

A4.2.4. Modelled climate change predictions indicate that there will be significant impacts on businesses, infrastructure and the natural environment in the UK. A strategy of adaptation is required to maximise the opportunities and minimise the impacts of climate change. The UK Climate Change Projections programme has recently published a series of climate change projections based on the latest research and using three emission scenarios over the next century. These scenarios are based on low emissions, medium emissions and high emissions and predict changes for 2020, 2050 and 2080.

A4.2.5. Example projections for 2080 using the medium emissions scenario indicates that summers will be generally warmer with mean daily maximum temperatures increasing. Winters are also likely to become warmer. Changes in precipitation are predicted to be generally small overall, although there are likely to be increased precipitation in winter and decreases in summer. It is predicted that southern England will be experience the greatest degree of change with changes being least in northern Scotland.

A4.2.6. The table below shows the key findings for the West Midlands using the three scenarios and the changes are central estimates only.

Table A4.1: Climate change prediction scenarios for the West Midlands

Factor	Emission scenario								
	2020			2050			2080		
	Low	Med	High	Low	Med	High	Low	Med	High
Winter mean temperature increase (^{o}C)	1.2	1.3	1.2	1.8	2.1	2.3	2.5	2.9	3.4
Summer Mean temperature increase (^{o}C)	1.5	1.5	1.4	2.3	2.6	2.9	2.8	3.7	4.7
Annual mean precipitation (percentage change)	1.0	0	0	0	0	0	2	1	1
Winter mean precipitation (percentage change)	5.0	5.0	6	10	13	14	14	17	23
Summer mean precipitation (percentage change)	-6	-7	-4	-12	-17	-17	-13	-20	-26

A4.2.7. Herefordshire Council, a partner in the Herefordshire Partnership, signed Herefordshire's Climate Change Strategy '2020 Vision' in June 2006. This aims:

> *'To place Herefordshire at the forefront of climate change understanding and initiatives within the United Kingdom and to ensure we make our contribution towards tackling this global problem in a coherent, appropriate and beneficial way for Herefordshire'.*

A4.2.8. Actions within the climate change strategy include reducing carbon dioxide emissions, tackling fuel poverty, adaptation to climate change, flood risk management and improving air quality. Due to the large agricultural sector in Herefordshire methane emissions in the county are high compared to the rest of the UK with over a third of Herefordshire's greenhouse gas emissions due to agriculture. More intense rainfall events will lead to increased flooding and over the past 60 years there has been an upward trend in the peak flows of the River Wye, with flooding occurring on a more frequent basis.

A4.2.9. Hereford Council has published a 'Take Action on Climate Change' booklet which sets out ways for individuals to contribute to reductions in greenhouse gases. As well as highlighting ways of saving energy and reducing water usage, it sets out ways for people to reduce their transport impacts. Measures include car sharing, walking and cycling for short trips instead of using the car and increased use of public transport.

A4.2.10. Transport is a major source of greenhouse gases contributing to climate change. The amount of emissions is dependent on vehicle kilometres travelled, therefore a longer route will contribute to higher emissions of gases. However, a less congested route will lead to more steady state driving which slightly reduces the amount of emissions.

Corridor Links Impacts

A4.2.11. Southern Corridor Link 1 is 3.123km long and SC2 is 3.0km long. Both have a design speed of 60mph. The difference in length is not considered significant in terms of greenhouse gas emissions from traffic.

A4.2.12. Western Inner Corridors present the shortest routes which are WL1 and WL3 with the longest route being WL5. The shortest routes are preferable in terms of greenhouse gas emissions.

A4.2.13. Western Outer Corridors are all similar in length and are likely to lead to no significant difference in terms of emissions.

A4.2.14. Northern Corridor Links – routes NC1 and NC3 are slighter shorter than NC2 and NC4 but the difference is only 0.2km and not likely to be significant in terms of traffic emissions.

A4.2.15. Eastern Inner Corridor is 4.7km in length which is shorter than the Western Inner Corridor and with the same number of junctions as the western corridors presents the preferable option in terms of traffic emissions.

A4.2.16. Eastern Outer Corridor is approximately 5.8km long and the junction lengths are not significantly different in length to make one route permutation significantly better than another in terms on emissions. Of the two eastern routes, the Inner Corridor being shorter is the preferable route in terms of greenhouse gas emissions.

A4.3. Topography

Introduction

A4.3.1. In general the topography to the west of Hereford is undulating with ground levels ranging from 60m AOD to 100m AOD. The banks of the River Wye are steep and heavily wooded. The terrain becomes more level north of the River Wye. East of the town the terrain is flatter with the flood plain of the River Lugg and Lugg Meadows the predominant feature in the landscape. The area is less urban in nature than the western side of Hereford.

A4.3.2. Levels and chainages in the following sections refer to design drawings A3.01 to A3.32. It should be noted at this stage that the accuracy of the underlying 3D Ordnance Survey on which the design has been proposed is limited at areas of localised variations. Localised levels and terrain deviations such as culvert streams and rivers and existing road embankments have not been sufficiently detailed due to the lack of detail from the 3D Ordnace Survey data particularly in locations of surrounding flat terrain. A detailed 3D topographical survey may be required at a later stage when a proposed corridor is selected.

Southern Corridor

Southern Corridor Link 1

A4.3.3. SC1 starts at the intersection with the A49 Ross Road and the Rotherwas Access Road at a level of 70m AOD. The route continues at grade until approximately Ch 1000 where an embankment begins to carry the road over the existing rail line to Ch 1900. At Ch 1900 the existing ground level is approximately 95m AOD and the ground level rises slightly at C1227 Grafton Lane to around 100m AOD. A cutting is proposed from Ch 1900 to Ch 2650 reducing the ground level to around 80m AOD and will be up to 6.25m below existing ground level. This is to accommodate an underpass under C1227 Grafton Lane at Ch 2075. From Ch 2650 to Ch 3123 an embankment is proposed and a structure is required to carry the road over Hayleasow Wood and Newton Brook. The embankment will up to 8m above ground level. The route terminates with a proposed roundabout at the A465 at Ch 3123.

Southern Corridor Link 2

A4.3.4. SC2 follows the same route as SC1 from the A49 to the proposed bridge over the rail line. Here the route diverges from SC1 and follows a more southerly alignment. Ground levels at the rail line are around 82m AOD and the route is carried on an embankment over the line. Ground levels rise to around 100m AOD at C1227 Grafton Lane and the route passes under C1227 Grafton Lane in a cutting from Ch 1880 to Ch 2740. Ground levels then fall to around 90m AOD at the A465.

A4.3.5. In terms of the topography, SC2 is the preferred route as there are fewer earthworks and fewer structures required.

Western Inner Corridor

Western Link 1

A4.3.6. WL1 begins at the proposed roundabout on the A465 and is a continuation of SC1. Ground levels here are 85m AOD and as the route travels northwards ground levels fall to around 80m AOD at Ruckhall Lane. It is proposed to provide an overpass for the route at Ruckhall Lane at Ch 490. Ground levels fall sharply to around 55m AOD at the southern bank of the River Wye and a deep cutting is required from Ch 450 to Ch 1000 to tie the road into a new viaduct over the river. The cutting will have a maximum depth of 10m below existing ground level.

A4.3.7. North of the Wye ground levels rise from around 55m AOD at the northern bank to around 80m AOD at C1189 Upper Breinton Road. The road in this section will be supported on an embankment and it is proposed to sever the minor road at Broomy Hill and provide an overpass for Upper Breinton Road. An underpass will carry the route under Lower Breinton Road at around Ch 1960. Ground levels at Upper Breinton Road rise slightly to 85m AOD before falling to around 70m AOD at the A438 King's Acre Road and a cutting is proposed at Ch 2600 to 3100 to tie the road into existing levels at the A438.

Western Link 2

A4.3.8. WL2 initially follows the same alignment as WL1 as far as the intersection with C1189. At this point WL2 diverges and proceeds in a north westerly direction and intersects with A438 King's Acre Road at King's Acre Halt. An overpass will carry C1189 Upper Breinton Road over the new route at Ch 2700. Ground levels here are around 82m AOD and rise slightly to around 85m AOD at Ch 3100 before falling to around 70m AOD at the proposed junction with A438 King's Acre Road. Minor cuttings are proposed from Ch 2500 to Ch 3500 to tie in with existing road levels.

Western Link 3

A4.3.9. WL3 begins at the A465 proposed roundabout and is a continuation of SC1. It travels due north for most of its length and intersects with A438 at a new signalised junction. Ground levels at the A465 are around 85m AOD and fall gradually along the alignment to the banks of the River Wye. An embankment is proposed from Ch 0 to Ch 500 and it is proposed to provide an overpass for the route at Ruckhall Lane. A major cut is required at the River Wye for a new viaduct, with the cutting up to 20m in depth. A cut is also required on the northern bank from Ch 1300 to 1600; this will be less severe with a maximum depth of 5.64m.

A4.3.10. Ground levels rise moving northwards from the Wye from around 55m AOD to 80m AOD at C1189 Upper Breinton Road. It is proposed to provide an underpass for the route at Lower Breinton Road at Ch 1700 and provide an overpass for Upper Breinton Road at Ch 2420. Ground levels fall from Upper Breinton Road towards A438 King's Acre Road from 80m AOD to 70m AOD. A cutting is proposed from Ch 2350 to 2850 before coming at grade to the junction with A438 King's Acre Road.

Western Link 4

A4.3.11. WL4 begins on the A465 and is a continuation of SC2. Ground levels at the proposed roundabout with A465 are around 90m AOD and fall to around 80m AOD at Ruckhall Lane. A cutting is proposed from Ch 0 to Ch 750 with a maximum depth of 3.5m. It is proposed to sever the B4349 where the route crosses it at Ch 500. A major cutting is required on the south bank of the Wye from Ch 950 to Ch 1480 and the route will pass under the existing Ruckhall Lane at Ch 1080. From Ruckhall Lane to the south bank of the Wye, ground levels fall steeply from 80m AOD to 55m AOD.

A4.3.12. North of the Wye ground levels rise again to around 70m AOD at C1189 Lower Breinton Road and it is proposed to provide an underpass at Lower Breinton Road at Ch 2230. This section of the alignment will be in a cutting from Ch 1880 to Ch 2120. Ground levels rise again to around 80m AOD at C1189 Upper Breinton Road and it is proposed to provide an overpass for Upper Breinton Road at Ch 2950. Ground levels then fall to around 70m AOD at A438 King's Acre Road and the route will be carried in a cutting from Ch 2500 to Ch 3400 with a maximum depth of 4.65m.

Western Link 5

A4.3.13. WL5 begins at a proposed roundabout on the A465 and proceeds northwards to a proposed signalised junction at A438 King's Acre Road. Ground levels at the A465 are around 85m AOD and fall slightly to Ruckhall Lane at around 80m AOD. From Ch 70 to Ch 530 the road will be supported on an embankment with a maximum height of 4.8m. Ground levels then fall sharply towards the Wye where levels are around 55m AOD. It is proposed to provide an overpass for the new route at Ruckhall Lane at Ch 500. Due to the differences in ground levels a major cutting will be required at the Wye from Ch 530 to 950. A viaduct will be constructed over the Wye at 9m above ground level.

A4.3.14. North of the river ground levels rise from 55m AOD to 70m AOD at C1189 Lower Breinton Road. A cut is required from Ch 1330 to Ch 1640 on the north bank of the Wye. It is proposed to carry the new route in an underpass under Lower Breinton Road at Ch 1700. Ground levels continue to rise to around 83m AOD at C1189 Upper Breinton Road and then fall again to the A438 King's Acre Road at around 70m AOD. The route will be carried on an overpass over Upper Breinton Road at Ch 2420. To tie in with ground levels at the A438 King's Acre Road, a cutting is required from Ch 3500 to Ch 4058.

Western Link 6

A4.3.15. WL6 starts on the A465 at a level of around 90m AOD. As the route proceeds northwards ground levels gradually fall to around 80m at Ruckhall Lane. A cutting is proposed from Ch 0 to Ch 750 with a maximum depth of 3.5m. The alignment crosses the B4349 and it is proposed to sever this road at Ch 500. From Ruckhall Lane to the banks of the Wye ground levels fall sharply to 55m AOD at the river. A major cut is required from Ch 950 to Ch 1480. A proposed overpass will carry Ruckhall Lane over the route.

A4.3.16. North of the river ground levels rise gradually to around 85m AOD in the vicinity of Upper Hill Farm. A cut is required from Ch 1880 to 2150 to take the road over the north bank of the Wye. The route crosses over C1189 Lower Breinton Road and Upper Breinton Road and it is proposed to carry the new route in an underpass under Lower Breinton Road at Ch 2230 and carry the route over Upper Breinton Road using an overpass at Ch 2950. Minor cuts are required to tie the route into the A438 King's Acre Road junction.

Western Link 7

A4.3.17. WL7 is a short section connecting A438 King's Acre Road with A4103 Roman Road. The ground level is fairly even at around 65m AOD and there are no major earthworks associated with this alignment. A culvert is proposed at Ch 1650 for Yazor Brook.

Preferred Route

A4.3.18. WL2 is the preferred route in the western inner corridor as the route follows more closely the existing topography and the earthworks requirement is less.

Western Outer Corridor

Western Link 8

A4.3.19. WL8 is a short section connecting WL9 and WL6 with the A4103 Roman Road. Ground levels at A438 King's Acre Road junction are around 70m AOD and remain fairly constant to Roman Road. There are minimal earthworks associated with this route.

Western Link 9

A4.3.20. WL9 starts at a proposed roundabout on the A465. Ground levels here are around 90m AOD. Minimal earthworks are required in the first section of this alignment and it is proposed to sever the B4349 at Ch 291. As the route proceeds northwards ground levels fall to around 80m AOD at Ch 1000. The road will be carried on an embankment between Ch 460 and Ch 1300 with a maximum height of 10m. Ground levels rise again beyond Ch 1000 to around