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ZOUCH BRIDGE REPLACEMENT BRIDGE SCHEME

Project Engineering and Traffic Assessment

Proof of Evidence of

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For Leicestershire County Council

Project reference: Zouch Bridge
Project number: 6053459

Quality information

Prepared by	Checked by	Verified by	Approved by
KN	JF, DG, MH, DB		
Karen Notman Associate Director			

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1. Witness Details

NAME: Karen Notman

OCCUPATION: Chartered Civil Engineer

JOB TITLE: Associate Director Traffic and Local Roads, AECOM

QUALIFICATIONS: BEng(Hons), CEng, MICE,

Chair of the Institution of Civil Engineers, East Midlands Region 2017/18

1.1 Although I now work for AECOM, I previously worked for Leicestershire County Council (LCC) and held a number of roles that mean that I am familiar with both the bridge and the location.

August 2015-to date	Associate Director Traffic and Local Roads, AECOM
January 2011 - August 2015	Engineering Design Manager, LCC
2007-2011	Group Manager, Highways South, LCC
2003-2007	Area Highway Manager, Southern Division, LCC
2000-2003	Northern Divisional Engineer (Melton and Charnwood), LCC
1997-2000	Assistant Divisional Engineer, Melton, LCC
1991-1997	Assistant/Senior Engineer Transportation Planning, LCC
1987-1991	Graduate Trainee Engineer, LCC

1.2 During the time that I was the Engineering Design Manager for the County Council I was made aware of the poor condition of Zouch Bridge following a condition survey report prepared in 2013, and of the need to replace it In the longer term, namely beyond the two year period. The scheme was a renewal scheme outside of our programme of routine maintenance work and we secured corporate funding for design and construction work to replace the bridge in financial year 2014/15.

1.3 I was the Engineering Design Manager in the early stages of feasibility and design for the scheme to replace the bridge at Zouch when the decision was made to pursue an 'off-line' option. This appeared to be a logical approach given the very lengthy diversion route involved for an 'A' road that is an important east-west route and the amount of public utility services running through the bridge.

1.4 AECOM (then known as URS) was engaged in November 2014 to undertake the design work under the Midlands Highway Alliance Professional Services Partnership framework (MHA PSP) and a Contractor (Galliford Try) was engaged for Early Contractor Involvement (ECI) under the MHA Medium Schemes Framework (MHA MSF) to provide advice on the construction.

1.5 I joined AECOM as an Associate Director in August 2015 and I had the opportunity to take over the AECOM project management role for the Scheme at the end of 2016, working with Barry Watson-Evans as the LCC Project Manager for the Scheme. At this point, the design was being amended to reflect the requirements of the Environment Agency (EA) following the flood modelling work that had been required.

2. Instructions given by Client

2.1 AECOM was engaged in November 2014 to undertake the design work under the Midlands Highway Alliance Professional Services Partnership framework (MHA PSP). The scope for the work included designing, detailing and specification for replacing the life-expired road bridge over the River Soar on a parallel alignment, including a new embankment over the footprint of the original bridge.

2.2 The design work included detailed design of highways, structures and embankments such as geometry, drainage, pavement, fencing and safety fencing, utilities, kerbs, footways, traffic signs and road markings, earthworks and site clearance; as well as an early design check on the need to provide ground improvement to the embankment. The development of construction status documents included specifications, pre-construction health and safety information and construction status drawings. Other client support included liaison with the utilities. The majority of the design work was initially expected to be completed by the beginning of 2016.

2.3 Flood risk modelling was not initially required, but was subsequently requested. Following the flood risk modelling work, it was found that the design did not provide sufficient assurance that the flood risk would not increase. A meeting was held on the 8th December 2016 to discuss changes to the cross section of the proposed bridge structure and the vertical alignment to enable the carriageway levels on the new bridge to be changed in order to assist with the problems identified through the flood modelling.

2.4 Design changes were required to adjust the design to tie back into the existing carriageway at the existing 'low spot' to facilitate the production of a satisfactory flood risk assessment. This was because the proposed vertical alignment was higher than the existing carriageway and removed the existing low spot in the vicinity of the Marina entrance where the flood modelling showed flood water over-topping the carriageway before flooding other local areas.

2.5 I was asked to take over the AECOM project management for the re-design of the highway and bridge structure at Zouch at the end of 2016. LCC requested AECOM to carry out additional feasibility studies to identify proposed changes to the vertical alignment at the west end of the proposed alignment to facilitate the production of a satisfactory flood risk assessment (FRA) model to meet the Environment Agency's requirements for the Scheme and provide assurance that flood risks would not increase.

2.6 A number of design options were considered:

2.6.1 (a) amend the vertical alignment to allow a tie-in on the Leicestershire side which does not change the 'low spot', thus allowing flood water to continue to overtop the highway.

2.6.2 (b) increase the number of longitudinal bridge beams to facilitate a reduction of the overall construction depth (i.e. no change to the soffit level) commensurate with the findings of (a) above. Consider 3 No. pairs or 2 No. triples;

2.6.3 (c) amend the span arrangements, subject to the findings of (b) above, increase the central span and, as a last resort, incorporate a central pier.

2.7 The vertical alignment was amended to allow a tie-in on the Leicestershire side which does not change the 'low spot'. In order to produce a 'same-upstream same-downstream' flow around the new bridge during periods of high flooding, the vertical alignment at the west end was re-arranged and the crest point moved so that the road connects into the same point as the existing alignment in order to reduce the level above the western abutment.

2.8 The structures team considered options to modify the existing longitudinal beams or otherwise raise the soffit level to a 300mm freeboard height above the 100 year flood level, allowing for climate change, as advised by the Flood Study Team.

2.9 The structural feasibility design was prioritised to minimise the amount of design changes and focus on two separate options:

2.9.1 a) Change the steel beam design to a reduced tapered depth at the west end of the west span so that required soffit level can be achieved;

2.9.2 b) If this is insufficient, consider options to increase the number of longitudinal beams to allow the bridge deck section depth to be reduced;

2.9.3 c) If neither option is viable, a further review with other disciplines would be required before consideration of other options such as changing the span arrangement.

2.10 AECOM Structures Team identified that option b) was feasible and it was possible to increase the number of longitudinal main beams from four to six and this has enabled the depths of the

beams to be reduced from 1000mm to 700mm i.e. a reduction in construction depth of 300mm. AECOM were instructed to proceed with this amendment and prepare a drawing for circulation and approval by Leicestershire County Council (LCC). The new bridge general arrangement for planning purposes was approved by LCC.

2.11 AECOM was subsequently requested on 25th January 2017 to provide amended scheme drawings and documents to support the checking and approval processes for the bridge design. This included addressing comments from the Technical Approval Authority (TAA) and the Statutory Utility Providers in advance of Approval in Principle (AIP) by LCC and subsequent Planning Approval; and following AIP approval, to progress the scheme ready for construction.

3. Information provided to the Client

3.1 The LCC Project manager has been provided with highway and bridge design drawings and information as the design work has progressed showing the proposed geometry, drainage, pavement, fencing and safety fencing, utilities, kerbs, footways, traffic signs and road markings, earthworks and site clearance. He has also been provided with information for the supporting work undertaken, such as flood risk modelling.

3.2 Preliminary Design May 2014 – April 2015

3.2.1 Initial design sketches provided by LCC were reviewed by Aecom. The horizontal alignments did not incorporate transitions for both options provided and therefore would not comply with TD 9/93 design standards in the DMRB. A compliant preliminary design was then developed by Aecom in conjunction with the bridges design team and ECI contractor.

3.2.2 The Aecom bridges team requested the following key items to be incorporated into the design relating to buildability and demolition of the existing bridge:

- A minimum 6 m distance from the westbound line of channel of the existing bridge to the outside face of parapet edge beam of the new bridge construction;
- Allowing for a laydown area and a 'bridge jacking and foundation zone' to the east of the east pier, we require a clear distance of 4500 mm from the westbound edge of kerb to say a 2000mm walkway area to the north of the 'bridge jacking and foundation zone'
- The jacking zone will be required to safely install the bridge into place avoiding the overhead electricity line that crosses the site, avoiding the use of cranes that would encroach into the safe working distance from the overhead cable.

3.2.3 Information to be provided in April 2015 included:

- ZOBR-URS-XX-XX-DR-SE-00200 P1 – Existing Bridge to be demolished
- ZOBR-URS-XX-XX-DR-SE-00600 P1 – Borehole Location Plan
- ZOBR-URS-XX-XX-DR-SE-00601 P1 – Borehole Long Section
- ZOBR-URS-XX-XX-DR-SE-00615 P1 – West Abutment Embankment Wall details
- ZOBR-URS-XX-XX-DR-SE-00616 P1 – East Abutment Embankment Wall details
- ZOBR-URS-XX-XX-DR-SE-00620 P1 – Revetment Details
- ZOBR-URS-XX-XX-DR-SE-01700 P1 – Standard Notes
- ZOBR-URS-XX-XX-DR-SE-01701 P1 – Zouch Bridge General Arrangement
- ZOBR-URS-XX-XX-DR-SE-01702 P1 – Piling Layout & Reinforcement
- ZOBR-URS-XX-XX-DR-SE-01703 P1 - Piers Layout & Reinforcement
- ZOBR-URS-XX-XX-DR-SE-01704 P1 – East Abutment Outline
- ZOBR-URS-XX-XX-DR-SE-01705 P1 – West Abutment Outline
- ZOBR-URS-XX-XX-DR-SE-01706 P1 – East & West Abutment Reinforcement Details
- ZOBR-URS-XX-XX-DR-SE-01708 P1 – Deck Outline
- ZOBR-URS-XX-XX-DR-SE-01709 P1 – Deck reinforcement
- ZOBR-URS-XX-XX-DR-SE-01720 P1 – Construction Sequence
- ZOBR-URS-XX-XX-DR-SE-01801 P1 – Steelwork details Sheet 1 of 3
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- ZOBR-URS-XX-XX-DR-SE-01803 P1 – Steelwork details Sheet 3 of 3
- ZOBR-URS-XX-XX-DR-SE-02000 P1 – Deck Waterproofing
- ZOBR-URS-XX-XX-DR-SE-02300 P1 – Bridge Joint details
- ZOBR-URS-XX-XX-AP-SE-00001 A2 – General Arrangement
- SE-1702 A4 – Bar Schedule – East & West Abutment and Piers Piles Reinforcement
- SE-1703 A4 - Bar Schedule –Pier Reinforcement
- SE-1706 A4 - Bar Schedule – East & West Abutment Reinforcement
- SE-1709 A4 - Bar Schedule –Deck Reinforcement
- 47073000/SPC02/Rev0 A4 – Bridge Specification
- ZOBR-URS-00-XX-DR-HY-00100 - Site Plan & Index of Drawings
- ZOBR-URS-00-XX-DR-HY-00101 - Highway Geometric Design Long Section
- ZOBR-URS-00-XX-DR-HY-00102 - Geometric Cross Sections Proposed & Existing Sheet 1 of 4
- ZOBR-URS-00-XX-DR-HY-00103 - Geometric Cross Sections Proposed & Existing Sheet 2 of 4

- ZOBR-URS-00-XX-DR-HY-00104 - Geometric Cross Sections Proposed & Existing Sheet 3 of 4
- ZOBR-URS-00-XX-DR-HY-00105 - Geometric Cross Sections Proposed & Existing Sheet 4 of 4
- ZOBR-URS-00-XX-DR-HY-00201 - General Site Clearance
- ZOBR-URS-00-XX-DR-HY-00301 - Fencing & Accommodation Works
- ZOBR-URS-00-XX-DR-HY-00401 - Vehicle Restraint System
- ZOBR-URS-00-XX-DR-HY-00501 - Existing Drainage System
- ZOBR-URS-00-XX-DR-HY-00502 - Proposed Drainage System
- ZOBR-URS-00-XX-DR-HY-00601 - Earthworks
- ZOBR-URS-00-XX-DR-HY-00701 - Pavement Design
- ZOBR-URS-00-XX-DR-HY-01101 - Kerbs, Footway, Traffic Signs & Road Markings
- ZOBR-URS-00-XX-DR-HY-01201-12011 - Sign Schedules
- ZOBR-URS-00-XX-DR-HY-01601 - Existing Services
- ZOBR-URS-00-XX-DR-HY-01602 - C4- Severn Trent Water
- ZOBR-URS-00-XX-DR-HY-01603 - C4- BT Openreach
- ZOBR-URS-00-XX-DR-HY-01604 - C4- National Grid – Gas
- ZOBR-URS-00-XX-DR-HY-01605 - C4- Electricity
- 47073000/SPC01 - Highway Specification

3.3 Detailed Design May 2015 – December 2016

3.3.1 Development of the Scheme preliminary design into detailed design, including the following noted items:

- Highway Geometry & Cross Section
    - Footway added to north side as requested by Nottinghamshire County Council
    - Finalise access geometry, tie-ins and access tracks
    - Isopachyte analysis requested by the Contractor
    - Setting Out Information
- Drainage Design
    - Confirm outfall for south east quadrant
    - Develop outline drainage design into detailed design and model network
    - Seek drainage approval from authority
- Fencing
    - Finalise proposed fencing arrangements following negotiations between LCC and landowners

- Earthworks
    - Liaise with bridges & geotechnics team to detail embankment tie-ins
- Pavement
    - Tie-in details
    - Review Specification
- Statutory Undertakers
    - Review C4 diversions against change in highway cross section
- Traffic Management
    - Discuss phasing of works with Client and ECI contractor
- Specification Document
    - Review and update in accordance with detailed design changes.

3.3.2 Information to be provided included:

- ZOBR-ACM-XX-XX-DR-CE-00100 - Site Plan
- ZOBR-ACM-XX-XX-DR-CE-00101 - Setting Out Information
- ZOBR-ACM-XX-XX-DR-CE-00102 - Mainline Long Section
- ZOBR-ACM-XX-XX-DR-CE-00103 - Access Road Long Sections
- ZOBR-ACM-XX-XX-DR-CE-00104 - Mainline Cross Sections CH0 to CH140 Sheet 1 of 4
- ZOBR-ACM-XX-XX-DR-CE-00105 - Mainline Cross Sections CH160 to CH260 Sheet 2 of 4
- ZOBR-ACM-XX-XX-DR-CE-00106 - Mainline Cross Sections CH280 to CH380 Sheet 3 of 4
- ZOBR-ACM-XX-XX-DR-CE-00107 - Mainline Cross Sections CH400 to CH497 Sheet 4 of 4
- ZOBR-ACM-XX-XX-DR-CE-00108 - Access Road Cross Sections
- ZOBR-ACM-XX-XX-DR-CE-00109 - Typical Cross Sections Sheet 1 of 2
- ZOBR-ACM-XX-XX-DR-CE-00110 - Typical Cross Sections Sheet 2 of 2
- ZOBR-ACM-XX-XX-DR-CE-00201 - Site Clearance
- ZOBR-ACM-XX-XX-DR-CE-00301 - Fencing
- ZOBR-ACM-XX-XX-DR-CE-00401 - Vehicle Restraint Systems
- ZOBR-ACM-XX-XX-DR-CE-00501 - Drainage Layout
- ZOBR-ACM-XX-XX-DR-CE-00502 - Drainage Details
- ZOBR-ACM-XX-XX-DR-CE-00601 - Proposed Earthworks
- ZOBR-ACM-XX-XX-DR-CE-00701 - Pavement Design
- ZOBR-ACM-XX-XX-DR-CE-00702 - Isopachyte Contours
- ZOBR-ACM-XX-XX-DR-CE-01101 - Kerbs and Footways
- ZOBR-ACM-XX-XX-DR-CE-01201 - Traffic Signs and Road Markings

- ZOBR-ACM-XX-XX-DR-CE-02701 - Public Utilities
- ZOBR-ACM-XX-XX-DR-CE-02702 - C4 Drawing Severn Trent Water
- ZOBR-ACM-XX-XX-DR-CE-02703 - C4 Drawing BT Openreach
- ZOBR-ACM-XX-XX-DR-CE-02704 - C4 Drawing National Grid – Gas
- ZOBR-ACM-XX-XX-DR-CE-02705 - C4 Drawing Western Power Distribution Diversion
- ZOBR-ACM-XX-XX-DR-CE-02706 - National Grid 400kV Overhead Clearance
- Highway Specification

3.4 Detailed Design December 2016 Onwards

3.4.1 Detailed design for the Scheme was amended to meet the requirements of the Flood Risk Assessment (FRA). This involved revisions to all deliverables on both the highways and bridges side. All the deliverables listed above were revised and re-issued including resubmitted NRSWA C3/C4 enquires to the affected Statutory Undertakers. Since the end of 2016 I have provided the LCC Project Manager with updated highway and bridge design drawings and information as the design work has progressed to amend the design to reflect the requirements of the Environment Agency.

3.4.2 Key Design Parameters:

3.4.2.1 Design Speed

70kph design speed as agreed with LCC. The existing speed limit is to be reduced to 40mph from the national speed limit, which corresponds to a design speed of 70kph.

3.4.2.2 Horizontal Geometry

A 360m radius (desirable minimum Radius with 5% superelevation) with 35m long transitions links the existing A6006 to the west and the realigned straight section running over the new bridge. Following the straight section, a 720m radius (desirable minimum Radius with 2.5% superelevation) with 35m long transitions is used to tie into the east end of the scheme. Horizontal radii values are taken from Table 3 and transition length calculations from paragraph 3.16 of TD 9/93 of the DMRB.

3.4.2.3 Vertical Geometry

A minimum crest K value of 30 and a minimum sag value of 20 are used as per Table 3, TD 9/93 of the DMRB. The main vertical curve over the bridge alignment is a K value of 40, which was increased to achieve the required Stopping Sight Distance (SSD) from the Marina and Environment Agency (EA) access tracks. A maximum longitudinal grade of 2.5% has been used to connect the vertical curves.

3.4.2.4 Superelevation

Superelevation has been applied to both curved sections in accordance with Table 3, TD 9/93 of the DMRB. 5% has been applied to the 360m radius and 2.5% applied to the 720m radius.

3.4.2.5 Forward Visibility

The required Stopping Sight Distance (SSD) for a design speed of 70kph is 120m (Table 3, TD 9/93 of the DMRB), which is achieved along the realigned road and bridge.

3.4.2.6 Junction visibility

Junction visibility checks have been undertaken successfully using a set back from the A6006 (x distance) of 2.4m and visibility distance (y distance) of 120m as indicated at Figure 3.0 below and in accordance with Section 7 of TD 42/95, DMRB for the following access tracks:

- Southwest Field Access
- Marina/Boat Club Access
- Environment Agency (EA) Access
- Main Street Access

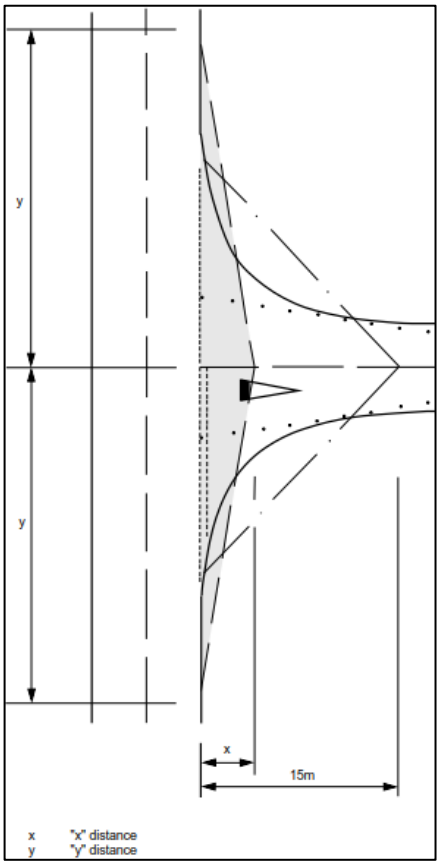

Figure 3.0: Visibility Standards

3.4.2.7 Highway Cross Section On Proposed Bridge

The highway cross section has the following profile:

Verge 1.0m - Footway 2.05m - Carriageway 6.6m - Footway 3m - Verge 1.0m

|_____|_____|_____|_____|_____|

3.4.3 Information to be provided in July 2017 included:

- ZOBR-ACM-XX-XX-AP-SE-00001 A1 – General Arrangement (AIP)
- ZOBR-ACM-XX-XX-DR-SE-00200 T2 - Existing Bridge to be demolished
- ZOBR-ACM-XX-XX-DR-SE-00600 T2 - Borehole Location Plan
- ZOBR-ACM-XX-XX-DR-SE-00601 T2 - Borehole Long Section
- ZOBR-ACM-XX-XX-DR-SE-00603 T2 - Schematic of Earthworks during construction
- ZOBR-ACM-XX-XX-DR-SE-00615 T2 - West Abutment Embankment Wall details
- ZOBR-ACM-XX-XX-DR-SE-00616 T2 - East Abutment Embankment Wall details
- ZOBR-ACM-XX-XX-DR-SE-00620 T2 - Revetment details
- ZOBR-ACM-XX-XX-DR-SE-01700 T2 - Standard details – General Notes
- ZOBR-ACM-XX-XX-DR-SE-01701 T2 – General Arrangement
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- ZOBR-ACM-XX-XX-DR-SE-01703 T2 – Pier Outline and reinforcement details
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- ZOBR-ACM-XX-XX-DR-SE-02000 T2 – Deck Waterproofing details
- ZOBR-ACM-XX-XX-DR-SE-02300 T2 – Bridge Joint details
- ZOBR-ACM-XX-XX-SK-SE-00001 A1 – General Arrangement Idealised Structure
- SE-01703 A4 – Bar Bending Schedule
- SE-01706 A4 – Bar Bending Schedule
- SE-01709 A4 – Bar Bending Schedule

3.4.4 Bridge design drawings provided in support of the Approval in Principle in January 2018:

- ZOBR-ACM-XX-XX-AP-SE-00001 P4 – General Arrangement
- ZOBR-ACM-XX-XX-DR-SE-01720 T4 - Construction Sequence
- ZOBR-ACM-XX-XX-SK-SE-00001 A3 – General Arrangement Idealised Structure

3.5 Construction Considerations

3.5.1 The Scheme has been designed so that the new bridge and road alignment are constructed alongside the existing arrangement. The utilities and traffic are then diverted over to the new arrangement before demolishing the existing bridge. This means that traffic and utilities will only be disrupted for a short time (a few days).

3.5.2 The bridge will be slid into place ('launched') from the west to avoid the Health and Safety risks of lifting bridge beams directly below the overhead HV electricity supply crossing the site. The bridge is straight and must be launched in line with its final position. The horizontal bend in the road alignment means that some additional land is required for the 'launch area' outside of the limits of the highway. The launch area needed affects the landowner to the south west of the bridge and some temporary accommodation works will be needed; however, changes to the farm/Environment Agency (EA) access at this point are also needed to improve the angle at which the access meets the A6006 and the visibility available for emerging traffic.

3.5.3 The new embankments will be constructed on site, together with the east and west supporting abutments and piers on each side of the River. The minimum ambient temperature for casting of the concrete is +5^{o}C. Before starting the launching sequence, the concrete in the abutments and piers has to achieve a class 32/40 strength.

3.5.4 A contractor's working platform will be designed by the contractor and constructed at the top of the bank on the west side and temporary steelwork supports designed and put in place. There needs to be space for offloading the beams and fabrication of the sections and temporary works area.

3.5.5 The bridge is fabricated off site and transported to the site to be 'launched' into position. The construction sequence for the bridge 'launch' is in 8 stages (sequences) as indicated on the Construction Sequence Drawing ZOBR-URS-XX-XX-DR-SE-01720.

3.5.6 Sequence 1: The vertical alignment of the east and centre span girders are fixed by the contractor on the west bank to suit the final vertical alignment and then site welded. Before

launching the bridge, the contractor designs and installs temporary plan bracing and a temporary roller is designed and fitted to the east pier. The bridge, complete with temporary nosing, is launched using strand jacks on the west pier.

3.5.7 Sequence 2: If required, counter weights are fitted on the western end of the bridge and the launch continues until the temporary nosing reaches the east pier.

3.5.8 Sequence 3: West span girders are site welded to the centre span girders. Again, before this can take place, the vertical alignment of the girders must be fixed by the contractor to suit the final vertical alignment. The deck formwork is installed to the centre and west spans.

3.5.9 Sequence 4: The deck formwork, falsework and edge protection are installed, the reinforcement is fixed, and the concrete is placed for the west and centre span deck slab and centre span parapet edge beam. This avoids the use of any tall plant in close proximity to the overhead High Voltage (HV) cables.

3.5.10 Sequence 5: The concrete placed in Sequence 4 needs to achieve class C40/50 strength before continuing with the bridge launch to the final location. All temporary diagonal plan bracing on the west and east spans only are removed. Temporary bracing must be in place between the beginning of the construction sequence and all of the deck slab concrete achieving a compressive strength of class C 40/50. The centre span diagonal bracing remains, but should not protrude below the bottom flanges.

3.5.11 Sequence 6: The temporary nosing and temporary roller bearings are removed. Bearings are installed, reinforcement fixed and the concrete placed to the east span deck and east abutment integral connections. The maximum ambient temperature for casting the abutment integral connections is 18^{o}C.

3.5.12 Sequence 7: The concrete is placed to the parapet edge beams of the east and west spans, together with the west span deck and west abutment integral connections.

3.5.13 Sequence 8: Concrete is placed to the remaining sections of parapet edge beam, the formwork for the parapet edge beam is removed and the parapets installed.

3.5.14 Only when the deck structure is completed and all structural concrete has achieved the class compressive strength can the backfill be placed.

3.5.15 The Scheme affects the embankment and landowners to the south of the existing bridge. It also brings the construction work further south which will make temporary access arrangements for the Marina easier to achieve.

3.5.16 The levels on the two side private accesses have been adjusted to match the new vertical alignment. A maximum gradient of 5% was assumed for the private accesses.

3.6 Impact on land required

3.6.1 The Scheme requires land to the south of the existing bridge for construction of the new road alignment and bridge parallel to the existing bridge. The land is required for the width of the new embankment, with an allowance for drainage and fencing at the bottom ('toe') of the embankment.

3.6.2 Additional land is not required to the north of the existing road alignment. The new bridge will be further away from the Marina frontage.

3.6.3 The bridge would be 'launched' from the west side.

3.7 Utility apparatus

3.7.1 There are a number of utility apparatus within the existing bridge to cross the River, namely a medium pressure gas main, British Telecom cables and Severn Trent Water (STW) mains supply. There are also plans for a STW vacuum-pumped sewer (foul water supply) to be installed utilising the bridge. It is expected that the supply will need to be maintained.

3.7.2 With the Scheme, the bridge can be constructed, together with accommodation channels for the utility apparatus whilst the existing bridge and utility apparatus continue in use. Disruption is only for a short period as the utility supplies are switched over to the new bridge and the old supply dis-continued.

3.7.3 The delay in implementation of the Scheme means that once the new STW vacuum pumped sewer planned for 2019 is installed in the bridge utilising a redundant 160mm diameter cast iron STW pipe, the cost and difficulty of diverting the utility supplies will be significantly increased.

3.8 Traffic impact

3.8.1 Importance of the route

3.8.1.1 The road bridge at Zouch takes the A6006 over the River Soar approximately 500m east of its junction with the A6 at Hathern. Figure 3.1 shows the location of the bridge.

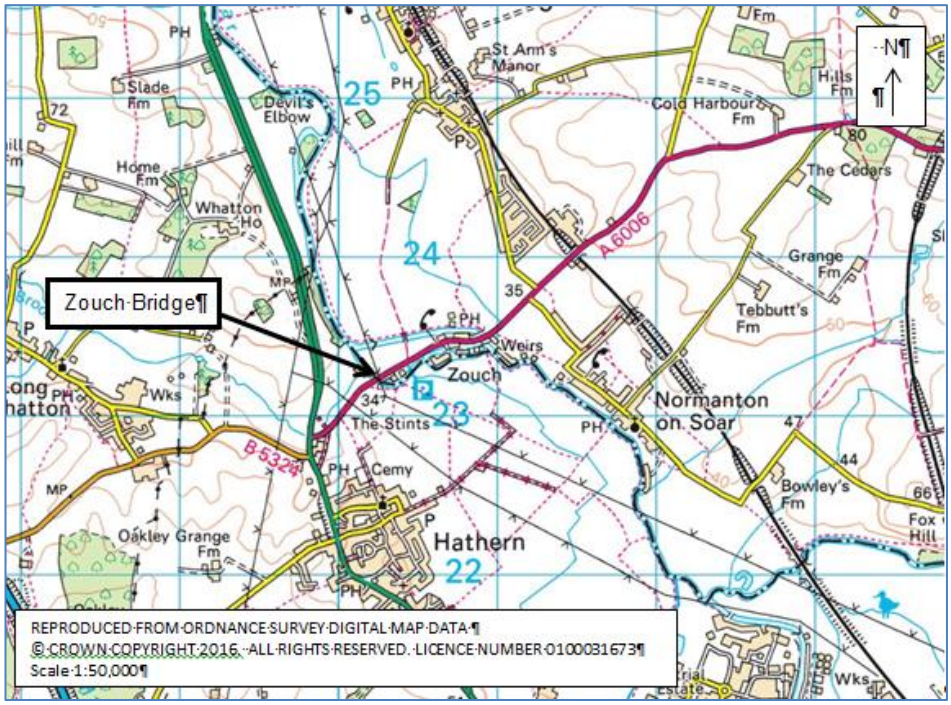

Figure 3.1: Site Location

3.8.1.2 The A6006 is classified as an 'A' road, the highest class of classified road and top tier of the roads classification system, and it is therefore a major road 'intended to provide large-scale transport links within or between areas' (Source: Guidance on Road Classification and the primary Route network, DfT). It is a strategically important route linking Leicestershire with Nottinghamshire and an important east-west route between Charnwood and Melton Borough. It and is identified within the Leicestershire Local transport Plan (LTP3 2011) as being an important route linking the market towns of Loughborough and Melton Mowbray.

3.8.1.3 The current traffic flows recorded west of the bridge demonstrate that the road is well used, carrying in the region of 12,000 vehicles per day Average Annual Daily Traffic (AADT), which is the level of flow to be expected for a road of this nature when assessed against flows for a new road within the Design manual for Roads and Bridges (DMRB).

3.8.1.4 Traffic survey data has been provided by LCC who operate a permanent traffic count site to the immediate west of the bridge location. This data is summarised in Table 3.1 below for both Annual Average Daily Traffic (AADT) (i.e. Monday to Sunday average) and Annual Average Weekday Traffic (AAWT) (i.e. Monday to Friday average).

Year	AAWT	AADT
2006	11444	10577
2007	11751	10869
2008	10672	9926
2009	11200	10402
2010	11143	10255
2011	11738	10751
2012	11615	10628
2013	11741	10750
2014	12546	11455
2015	12452	11376
2016	12264	11271
2017	12287	11282

Table 3.1: Traffic Flows (Source LCC)

3.8.1.5 For comparison to table 3.1, the design Manual for Roads and Bridges (DMRB) indicates that for a road of similar characteristics to the A6006, then a flow range of up to 13,000 AADT in the opening year should be considered for a new road (Source: Table 2.1, DMRB, TA46/97).

3.8.1.6 Figure 3.2 below shows the variation in usage of the A6006 during the year. This shows that the road carries least traffic in December and January and most in June July.

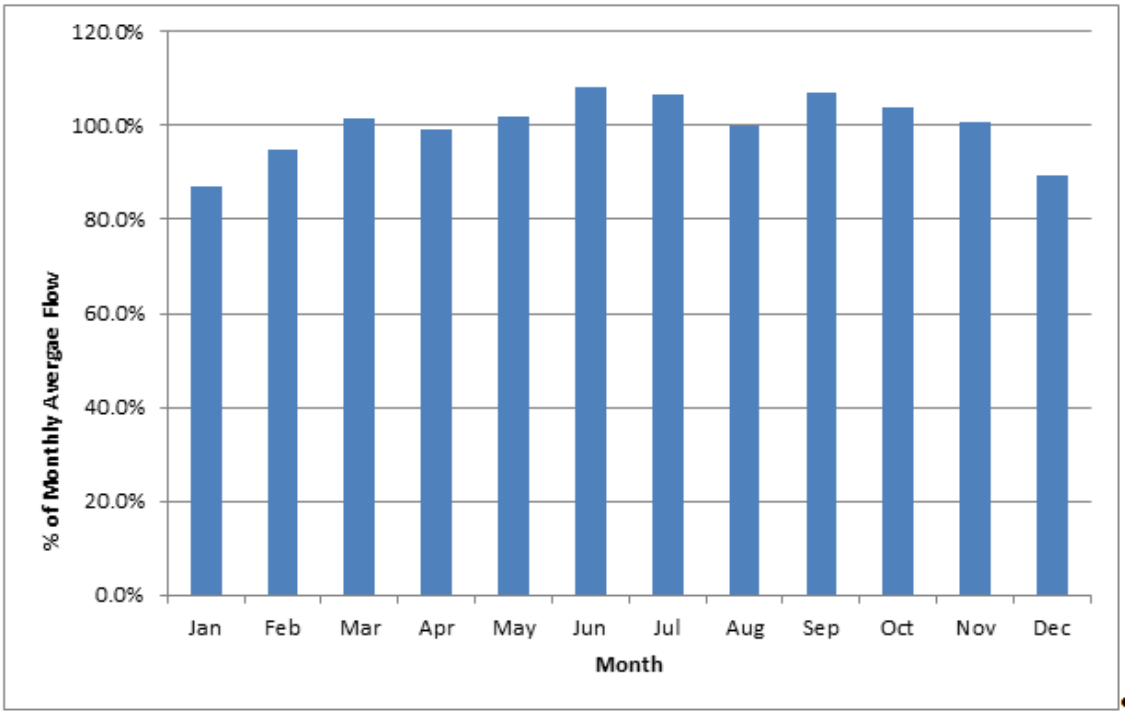

Figure 3.2: Variation in traffic flows during the year

3.8.1.7 An estimate of how traffic would likely grow (due to demographic and other economic factors) has been extracted from the National Trip End Model (NTEM) Tempro database.

These factors have been used to calculate 18hr AAWT (0600-2400hrs) and 24hr AADT for 2018 and 2033 for the noise and air quality assessments associated with this study. Table 3.2 below provides these future years forecasted traffic flows.

2018		2033	
18-Hr-AAWT	24-Hr-AADT	18-Hr-AAWT	24-Hr-AADT
13,051	11,689	15,471	13,856

Table 3.2: Future Year Traffic Flow Forecasts

3.8.1.8 Taking into account the above traffic flows for traffic growth between now and the design year of 2033 additional traffic would be seeking to use this route, irrespective of whether the scheme is provided or not.

3.8.2 Scenario without the scheme

3.8.2.1 There are two options that could be taken by the highway authority if the Scheme did not go ahead.

3.8.2.2 Firstly, if no scheme were to be brought forward, then the bridge would continue to deteriorate and would require the application of a weight limit (via a Traffic Regulation Order (TRO)) prior to being closed or, under extreme circumstances, an emergency closure.

3.8.2.3 Secondly, a scheme could be submitted to replace the bridge along its existing alignment. This would require a full road closure for the duration of the works, requiring a long diversion for traffic using the A6006 or the construction of a temporary vehicular bridge alongside the existing.

3.8.2.3.1 Neither of the above options would be as satisfactory as the Scheme, in transport terms.

3.8.3 Traffic Management Arrangements during Construction

3.8.3.1 The construction of the replacement bridge and approaches to the south of the existing carriageway will enable the new bridge and approaches to be built largely without the need for lengthy road closures and associated extensive traffic diversions as, while the new bridge is being constructed, all motorised and non-motorised traffic will continue to use the existing bridge and the existing pedestrian facilities.

3.8.3.2 It is currently anticipated that Traffic Management, in the form of isolated road closures and / or traffic light control for short durations only, will be needed for the following construction activities for which advance notice to road-users and nearby residents:

- delivery of bridge beams;

- completion / connection of service diversions; and
- completion of carriageway tie-ins at west and east extremities of the scheme.
- Advance notice to road-users and nearby residents will be made ahead of each of the required closures.

3.8.4 Speed Limits

3.8.4.1.1 The speed limit over the bridge is currently governed by the national speed limit. Under the revised arrangement, it is proposed to extend the 40 mph limit which is in place north of the bridge, to a point south-west of the entrance to Loughborough Boat Club and adjacent caravan park (whereupon the national speed limit will be resumed). These changes in speed limit would be confirmed via a Traffic Regulation Order and are reflected in Figures 3.3 and 3.4 below.

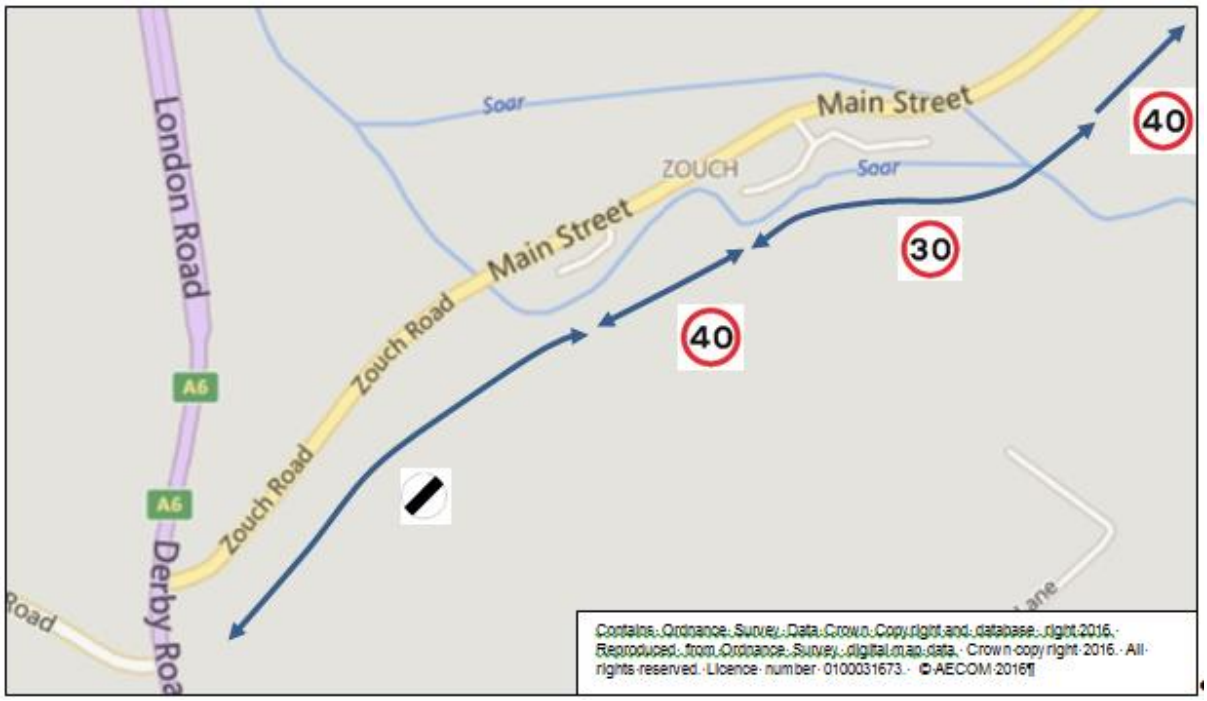

Figure 3.3: Speed Limits - Current

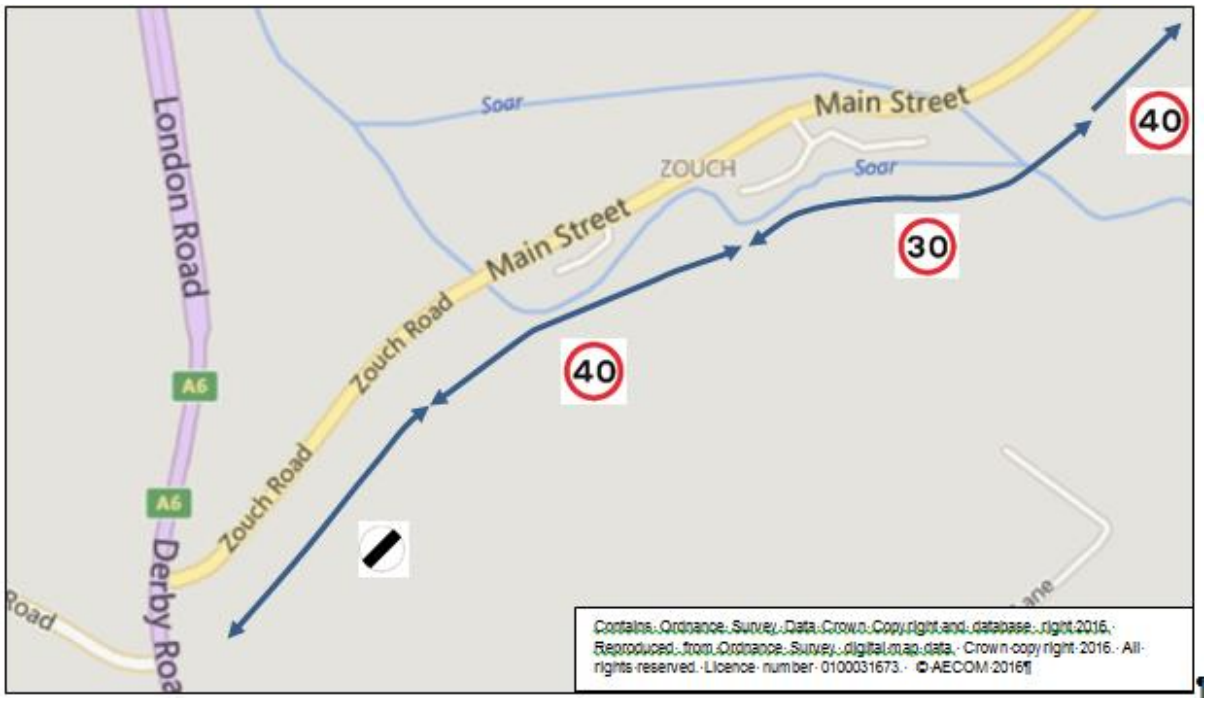

Figure 3.4: Speed Limits - Proposed

3.8.5 Diversionary Routeing

3.8.5.1 The make up of Annual Average Daily Traffic (AADT) traffic using the A6006 is indicated in Table 3.3 below:

Cycles	M/cycles	Cars/vans	Buses	Car/van+trailer	HGVs	Total AADT
42	51	9038	1925	558	524 (4.3%)	12,137

Table 3.3: Breakdown of AADT by traffic vehicle types

3.8.5.2 The diversion route is approximately 30 miles (48km) in length and takes about 43 minutes without traffic but typically between 45 mins and 65 minutes (source: Google maps).

3.8.5.2

3.8.5.3 Using the Department for Transport's WebTAG Data Book (table A1.3.5 Market Price Values per Vehicle based on distance travelled), the average cost of time per car is 17.99p per minute. It is 23.38p per minute for a light goods vehicle, 23.92p per minute for a HGV and 27.42p per minute for a bus.

3.8.5.2

3.8.5.2

3.8.5.2

3.8.5.2

3.8.5.4 If the traffic is diverted for a day then applying the lowest value for a car to the total traffic, even at 43 minutes, suggests that the monetary impact on traffic at market values, is £93,888 per day. Accounting for buses and HGVs, however, increases this to £103,030 per day. The length of the diversionary route is particularly unsuitable for non-motorised road

3.8.5.2

3.8.5.2

3.8.5.2

3.8.5.2

users such as pedestrians, cyclists and equestrians. There are in the region of 42 cyclists per day using the route.

3.8.5.5 The Scheme proposes to construct the new bridge carrying the A6006 and open it to traffic prior to stopping up the existing route across Zouch Bridge to allow for replacement of the bridge without subjecting road users to a lengthy diversionary route during the period of the construction works.

3.8.6 Access and Public Right of Way

3.8.6.1 The Scheme would require minor amendments to the junction with an existing side road, a field access to the south-west of the proposed bridge and the access to the Mobile Park Home, Loughborough Boat Club and the Marina. A similar amendment to access the public right of way is also required.

4. Recommendations

4.1 The Scheme is based on the location of the existing bridge and the considers the constraints upon the scheme:

- It is an important 'A' road carrying 12,000 vehicles per day,
- Lengthy diversions for traffic of approximately 30 miles if the road is closed,
- The presence of significant utility apparatus within and above the bridge, and
- The relatively close proximity of Zouch Marina.

4.2 Constructing the new bridge alongside the existing one allows the existing road alignment and bridge to be used until the new one is completed and available to traffic.

4.3 Prefabricating the bridge and bringing it to site to launch into position is quicker and requires less construction traffic than full construction in situ. Only a few days of road closures are needed which can be planned to targeted weekends as far as possible, avoiding lengthy delays to traffic for prolonged periods.

4.4 Diverting the alignment to the south avoids the Marina frontage. Although the Scheme affects land to the south of the existing bridge, it does not directly affect buildings. It also brings the construction work further south away from the frontage of the Marina which will make temporary access arrangements for Zouch Marina easier and therefore minimise the impact of the works on the Marina.

4.5 Incorporating channels for utility apparatus within the new bridge allows the utility apparatus to cross the River and diversion works to be undertaken whilst maintaining the existing services so that disruption to services is minimised.

4.6 The existing highway alignment does not meet current highway design standards. Easing the horizontal bend in the alignment by moving the bridge south and re-aligning the road brings the highway design closer to meeting highway design standards at a reduced design speed, whereas a movement to the north would potentially exacerbate the situation..

4.7 The current Scheme is the appropriate way to provide the Scheme so as to manage the disruption to both traffic and utility services, and to ensure that the design meets the required design standards for forward visibility and super elevation.

5. Scheme description

5.1 The existing highway bridge over the River Soar at Zouch was constructed in 1930 and is located approximately 500m east of its junction with the A6 north of Loughborough at Hathern. It carries the A6006 Zouch Road / Main Street over the River Soar. Despite several repair schemes over recent years, it continues to deteriorate and it is now considered to be nearing the end of its useful life.

5.2 The bridge. Is aligned northeast-southwest and currently consists of an east abutment, west abutment and nine intermediary piers, three of which are found on the river bed. The existing bridge has a total length of just over 77m. The overall width of the bridge is just less than 13m.

5.3 The Scheme is for the replacement of the existing Zouch Bridge offline, immediately to the south of the existing bridge, with a steel-concrete composite three span deck structure installed by incremental launching. It commences from a point west of the River Soar 18.1metres south of the middle of the existing highway and passes in three spans over 18.0m of floodplain to the west of the River Soar, the 31.5m wide River Soar and 24.0m of flood plain to the east of the River Soar, terminating on the east side of the River Soar at a point 15.4m to the south of the middle of the existing highway. The overall length of the structure is 81.7m.

5.4 The structure provides a Headway of not less than 2.7m above the normal water level of 32.77m Above Ordnance Datum. This Headway is maintained for 100% of the River Soar width at normal water level. It therefore provides what is set out by the Bridge Scheme details as set out in the Scheme document itself.

5.5 The overall width of the bridge will be 12.65m, maintaining the existing single carriageway width of 6.6m and facilities for non-motorised users with hard surfacing either side of 3.0m width on

the south side of the bridge and 2.05m width on the north side. The 3.0m width on the south side will 'future-proof' the bridge for the possible future provision of a combined footway/cycleway along the length of the bridge.

5.6 The bridge will be bounded by a 1.0m high parapet on the north side of the bridge and a 1.4m high parapet on the south side.

5.7 It is proposed to extend the current 40mph speed limit from Zouch village across the bridge to the west. The remainder of the road will remain de-restricted with the national speed limit of 60mph for a single carriageway road.

5.8 Existing Statutory Undertaker (SU) provisions are to be diverted into the new structure, with the exception of the National Grid overhead electricity lines where minimum clearances will be maintained.

5.9 Over the length of the realigned carriageway it is proposed that the existing accesses and Public Rights of Way will remain but will be improved and realigned to meet current Design Standards, for example, the private farm access from the A6006 to the south west of the bridge, opposite the Marina, Boat Club and Mobile Home Park will be realigned, improving visibility for traffic emerging onto the A6006.

5.10 The existing carriageway will remain open until completion of the Scheme and the traffic is switched to the new bridge. Generally, there is no closure of the river waterway.

5.11 The existing road bridge and embankment is to be demolished upon opening of the new bridge and the length of existing highway alignment that is made redundant by the Scheme will be stopped up. No change to the level of traffic flow is expected as a result of the Scheme.

6. Mitigation features

6.1 The primary reason for the Scheme is to replace an existing bridge nearing the end of its useful life with a new structure and approaches. The Scheme does not intend to offer any particular environmental benefits. Any slight negative impacts in the vicinity of the realigned carriageway will be offset, as far as possible, by the incorporation of mitigating measures into the Scheme.

6.2 Traffic Noise: It is anticipated that any impact of traffic noise will be mitigated by the reduction of the speed limit over the entire length of the scheme and suitable planting where the new road alignment passes closer to the residential properties on Main Street. The new bridge structure and its approaches will not need the on-going repairs and associated road works that have been required.

6.3 Visual Impact: The impact of the Scheme is proposed to be minimised by mitigating planting and the proposed bridge solution has been re-designed to a slimmer profile which will have less impact visually than the original design. There is scope for additional planting on the redundant areas of highway and embankment areas. No street lighting is proposed.

6.4 Pedestrians and Cyclists: The environment and safety for pedestrians and cyclists will be improved following the construction of the scheme. Pedestrian and cycling facilities are also proposed across the bridge which will not preclude the future provision of a combined footway/cycleway facility.

6.5 Flood Risk: The Scheme has been re-designed to ensure that the risk of flooding is no worse than the existing bridge and road profile.

6.6 Land required: The material for the new embankments will be imported, which allows the gradients of the embankment side slopes to be increased by more than the natural fill material would normally permit. This reduces the width needed for the embankments and therefore helps to minimise the land take required. The highway surface water drainage has also been re-designed so that it is piped part way along the toe (bottom) of the embankment along Main Street to help minimise the land take requirement.

6.7 Accesses and Public Rights of Way: The existing accesses and Public Rights of Way will be realigned to meet current Design Standards, for example, the private farm access from the A6006 to the south west of the bridge, opposite the Marina, Boat Club and Mobile Home Park will be realigned, improving visibility over the bridge for traffic emerging onto the A6006.

7. Alternative proposal

7.1 The Alternative Assessment, with my input, is being prepared as a stand alone document to ensure it can be read as a complete assessment. In my view that alternative offers no real advantage when examined against the Scheme which has been promoted and to which the Orders before this inquiry relate and in fact there are serious disadvantages relating to disruption, cost and build-ability which all count against it.

7.2 On 30th May 2018, following the promotion of an 'on-line' proposal as an alternative solution, I was asked to produce a suitable plan to reflect an 'on-line' replacement of the bridge sufficient to produce a clear representation to demonstrate the effect of an 'online' bridge solution, comprising a General Arrangement Drawing showing the full extent of the scheme including approach embankments, a long section and sufficient cross-sections to demonstrate the land take required. I was subsequently asked to add the long section to the general arrangement to

allow ease of cross-referencing. Should this option be pursued, then additional design work would be required for the bridge.

7.3 I was also asked to undertake an evaluation of the impact of the traffic management for the alternative 'on-line' option to assist in the consideration of the option. This included an estimate of the cost of maintaining the diversion route traffic signing and the impact on traffic diverted.

7.4 I provided the LCC Project Manager with:

- ZOBR-ACM-XX-XX-DR-CE-00101 Online Option

  General arrangement drawing with long section to reflect an 'on-line' replacement of the bridge sufficient to produce a clear representation to demonstrate the effect of an 'online' bridge solution indicating the effect on the land take required. The land take required is indicated as a red line and the land to be returned to landowners is indicated by a dotted line.

- ZOBR-ACM-XX-XX-DR-CE - Online Option Cross Sections.

- ZOBR-ACM-XX-XX-AP-SE-00001 On-line Bridge Option

  The drawing shows minor adjustments to the bridge abutments, etc. to reflect the revised orientation of the bridge for an on-line solution; however, the bridge itself will need to be re-designed for the new orientation because of the increased width needed to accommodate the tighter highway bend.

- An indicative cost of set up and maintenance of the traffic management for the diversion route of approximately 18 months i.e. traffic signing.

- A high level evaluation of the impact on traffic of putting in place an 'online' bridge solution.

7.5 Design considerations

7.5.1 Difficulties arose in producing an initial design model sufficient to demonstrate the 'on-line' option and a number of dis-benefits were highlighted by both the highway and bridge designers.

7.5.2 The horizontal bend is tightened to 510m. When the 'on-line' option was modelled with a crest curve of 3000m radius, which is the design minimum for a 70kph (40mph) road, the super elevation of 3.5% could be achieved but forward visibility was restricted to below the standard forward visibility requirements of DMRB TD9/93 for a design speed of 70kph of Stopping Sight Distance (SSD) of 120m. Heading eastwards the crown of the road interrupts the visibility line and westwards the upstand on the southern kerbline. The forward visibility

analysis for this 'on-line' option shows that a forward visibility of 90m SSD can be achieved in both directions, which is one step below desirable minimum, (i.e. a relaxation).

7.5.3 Designers should normally aim to achieve Desirable Minimum values for stopping sight distance. Relaxations should also be avoided adjacent to the interface on the length of road with the lower Design Speed. Care should also be taken where an alignment changes from a higher to a lower Design Speed. As the 40mph speed limit has been introduced on a higher speed road, we endeavoured to achieve the 120m SSD standard requirement.

7.5.4 An alternative vertical design that complies with the standard 120m SSD starts to approach a 4000m curve which pushes the tie-ins each side of the bridge further out, and also the earthworks outwards. The larger crest curve has the same high point location as the 'off-line' solution, hence the tie- in points are now further away from the bridge in each direction and the earthworks slightly wider. This makes it more difficult to tie in with the 'low spot' in order to achieve the Environment Agency's requirements.

7.5.5 The levels on the two side private accesses were adjusted to match this new vertical alignment, with the point opposite the Zouch Marina boat yard access being approximately 50mm higher than with the smaller crest curve and the access to the south east approximately 200mm higher. A maximum gradient of 5% was assumed for the private accesses. The level difference will be slightly higher at the access to the south west and the access mouth may need realigning to allow vehicles to turn in and out.

7.5.6 The new carriageway alignment requires super-elevation on the curves south west of the bridge of 3.5% which corresponds to a design speed of 70kph and a horizontal curve of 510m; however, although the centre line of the road will tie –in at the 'low spot', the channel line is higher and the tie-in is not achieved.

7.5.7 Tying into the 'low spot' at the western end of the bridge meant that either:

- the forward visibility over the bridge was compromised, or
- adequate super-elevation could not be achieved.

7.5.8 Both forward visibility and super-elevation affect road safety. If there is inadequate forward visibility then a vehicle may not be able to stop safely if there is an obstruction in the road. Super-elevation is the angle of the carriageway on the bend to help vehicles to stay in contact with the carriageway. The option shown on the drawings does not have adequate super-elevation built in to meet current design standards for the horizontal bend and speed of the road; however, adequate super-elevation is not apparent on the existing road alignment, which does not meet current design standards. The carriageway crossfalls 2.5%

from the central crown out to each channel introducing an 'adverse camber', similar to the existing situation.

7.5.9 The bridge structure itself has been designed for the Scheme ('off-line') alignment. The bridge deck is straight but the road alignment has a horizontal bend. This is a tighter bend with the 'on-line' option. The 'on-line' option therefore involves re-orientation of the bridge deck and the bridge will therefore need to be re-designed so that it is suitable for the 'on-line' arrangement. It is expected that it will need to be wider to cater for the tighter bend in the horizontal alignment of the road.

7.6 Construction considerations

7.6.1 The angle of the 'on-line' bridge means that the bridge deck would need to be 'launched' from the east because of the effect on the frontage of the Marina. The 'launch area' needed affects the landowner to the north east of the bridge on a temporary basis and temporary accommodation works will be needed.

7.6.2 The 'on-line' option affects the embankment to the north and therefore the landowners to the north. It also brings the construction work further north. This will make temporary access arrangements for the Marina difficult to achieve as they will be within the area directly affected by the construction works. Temporary access arrangements may need to be agreed.

7.7 Impact on land required

7.7.1 The 'online' solution reduces the land required to the south east of the existing bridge along Main Street. A temporary structure to cater for diverted traffic or utility apparatus would require the original extent of land south of the bridge to facilitate this.

7.7.2 The bottom of the embankment to the north moves a few metres north on the north side of the bridge and at least another 2-3m allowance is needed for drainage and fencing. This affects the land owner to the north east of the bridge and may have an impact on the Marina frontage.

7.7.3 The angle of the 'on-line' bridge means that the bridge deck would need to be 'launched' from the east because of the effect on the frontage of the Marina. The 'launch area' needed would affect the landowner to the north east of the bridge on a temporary basis and temporary accommodation works will be needed.

7.7.4 Moving the launch area to the east of the bridge means that the land required to the south west of the existing bridge is reduced.

7.8 Utility apparatus

7.8.1 There are a number of utility apparatus within the existing bridge to cross the River, namely a medium pressure gas main, British Telecom cables and Severn Trent Water (STW) mains supply. There are also plans for a STW vacuum-pumped sewer (foul water supply) to be installed utilising the bridge.

7.8.2 With the Scheme ('off-line' solution), the bridge can be constructed, together with accommodation for the utility apparatus whilst the existing bridge and utility apparatus continue in use. Disruption is only for a short period as the utility supplies are switched over to the new bridge and the old supply dis-continued.

7.8.3 An 'on-line' solution requires the road and utility apparatus to be temporarily cut off or expensive diversion arrangements put in place whilst the old bridge is demolished and the new bridge is constructed. It is unlikely that STW will accept lengthy interruption to the water mains supply which comes from Melton Mowbray, similarly the medium pressure gas main will need to be maintained.

7.8.4 Maintaining the supply may mean the construction of a temporary structure, which will need to be worked around during demolition of the old bridge and construction of the new one, or drilling beneath the River. Even if there was an alternative to redirect water and gas supply over the wider area using other parts of the distribution network, local residents, businesses and landowners will need temporary arrangements to provide water and heating and communications.

7.8.5 The diversion of the public utilities will be much more expensive for an 'on-line' solution and there is a greater risk of disruption to services. Once the new STW vacuum pumped sewer planned for 2019 is installed in the bridge utilising a redundant cast iron STW pipe, the cost and difficulty of diverting the utility supplies will be significantly increased.

7.9 Traffic impact

7.9.1 The road bridge at Zouch takes the A6006 over the River Soar approximately 500m east of its junction with the A6 at Hathern. The route is an important east-west route between North West Leicestershire/Charnwood and Melton Mowbray. The current traffic flows demonstrate that the road is well used, carrying in the region of 12,000 vehicles per day which would need to be diverted for the whole construction period. It is estimated that the construction of the replacement bridge, including diverting the existing highway traffic onto the new bridge and realigned approaches will take about 15 months to complete and the demolition of the existing bridge will take a further 3 months. The overall construction period is therefore in the region of 18 months.

7.9.2 The diversion route is approximately 30 miles (48km) in length. The cost of setting up and maintaining the traffic management for 18 months is estimated to be about £249,000 based on the typical figures quoted by traffic management providers, as indicated in figure 7.1 below.

Figure 7.1: Typical traffic management rates

Item	Description	Quantity	Unit	Rate	Amount
01	Installation of diversion route over 120 signs.	1.00	Sum	£ 2,400.00	£ 2,400.00
02	Provision of special signs for diversion subject to final TM drawing.	1.00	Item	£ 825.00	£ 825.00
03	Hire of Diversion routes	78.00	Week	£ 840.00	£ 65,520.00
04	Provision of TM maintenance crew if requested (minimum visit once per week).	TBA	Visit	£ 325.00	Rate Only
05	Removal of diversion upon completion of works.	1.00	Sum	£ 2,400.00	£ 2,400.00

7.9.3 The Annual Average Daily Traffic (AADT) for the route and its make-up are shown in Table 3.3 above.

7.9.4 It takes about 43 minutes without traffic and typically in the region of 45 minutes to 65 minutes (source: Google maps) to travel around the diversionary route.

7.9.5 Using the Department for Transport's WebTAG Data Book (table A1.3.5 Market Price Values per Vehicle based on distance travelled), the average cost of time per car is 17.99p per minute. It is 23.38p per minute for a light goods vehicle, 23.92p per minute for a HGV and 27.42p per minute for a bus.

7.9.6 Applying the lowest value for a car to the total traffic, even at 43 minutes, suggests that the value of delays on traffic diverted for 18 months at market values, is £51.40m. Accounting for buses and HGVs, however, increases this to £56.41m.

	Cars/vans	HGVs	Buses	Total vehicles
	9688	524	1925	12137
Market value (£/min)	0.1799	0.2392	0.2742	
No. days (1.5x365)	547.5	547.5	547.5	
Journey time (mins)	43	43	43	43 minutes
Delay cost (£m)	41.03	2.95	12.43	£56.41m
Journey time (mins)	45	45	45	45 minutes
Delay cost (£m)	42.94	3.09	13.00	£59.03m
Journey time (mins)	65	65	65	65 minutes
Delay cost (£m)	62.02	4.46	18.78	£85.27m

Table 7.1: Valuation of delays

7.9.7 Table 7.1 above suggests that the value of delays of imposing the traffic diversion for the period of the construction works would be in the region of £56-85 million. In reality, the diversion will take much longer and the length of the diversion means that journey times will be more unreliable for the majority of traffic, particularly at peak times. A significant amount of traffic will therefore try to find shorter more reliable routes which will impact on local unsuitable roads and villages.

7.9.8 The diversionary route would not be appropriate for non-motorised users such as pedestrians, cyclists and equestrians. Temporary accommodation or an appropriate alternative diversionary route is required.

8. Summary and Conclusion

8.1 The existing bridge is in poor condition and in need of replacement and is strategically important in terms of transport infrastructure and the regional economy, linking Leicestershire with Nottinghamshire.

8.2 The objective of the scheme is to replace the bridge with minimal disruption to the travelling public and without the need to implement lengthy traffic diversions.

8.3 Design considerations

8.3.1 The Scheme proposes to construct the replacement bridge immediately south parallel to the existing alignment to minimise the need for traffic diversions during construction, and has been designed to meet current highway and bridge design standards for forward visibility and superelevation as set out in the Design Manual for Roads and Bridges (DMRB TD9/93), and the requirements of the Environment Agency in terms of ensuring that the flooding risk is not made any worse by the implementation of the Scheme.

8.3.2 There were a number of issues arising when the drawings were being produced to represent the alternative 'on-line' proposal. The vertical design did not meet both the requirements of both the Environment Agency and of current design standards for both forward visibility and superelevation which meant that a compromise solution was needed.

8.4 Construction considerations

8.4.1 The Scheme proposes to launch the bridge from the west of the bridge. The launch area for the alternative 'on-line' proposal would need to move to the north east of the bridge because of the impact on the Marina.

8.4.2 There are concerns that temporary access arrangements for the Marina would be difficult to achieve for the alternative 'on-line' proposal as they will be within the area directly affected by the construction works. Temporary access arrangements may need to be agreed.

8.5 Impact on land required

8.5.1 The Scheme moves the road alignment and bridge to the south of the existing bridge and this requires land to the south and the realignment of private accesses.

8.5.2 The alternative 'on-line proposal' requires less land to the south of the existing alignment, but requires land to the north of the existing alignment and it will be difficult to maintain access to the Marina during the construction works.

8.6 Utility apparatus

8.7 There are a number of utility apparatus within the existing bridge to cross the River, namely a medium pressure gas main, British Telecom cables and Severn Trent Water (STW) mains supply. There are also plans for a STW vacuum-pumped sewer (foul water supply) to be installed utilising the bridge.

8.8 The Scheme incorporates a channel facility on each side of the bridge deck to accommodate the utility apparatus so that once the new bridge is built, the utility service apparatus can be diverted more quickly, easily and cost effectively whilst the existing bridge and utility apparatus continue in use. Disruption is only for a short period as the utility supplies are switched over to the new bridge and the old supply dis-continued.

8.9 The proposed alternative 'on-line' solution requires the road and utility apparatus to be temporarily cut off or expensive diversion arrangements put in place for in the region of 18 months whilst the old bridge is demolished and the new bridge is constructed. It is unlikely that STW will accept lengthy interruption to the water mains supply which comes from Melton Mowbray, similarly the medium pressure gas main will need to be maintained.

8.10 It is expected that the supply will need to be maintained, which may mean the construction of a temporary structure, which will need to be worked around during demolition of the old bridge and construction of the new one, or drilling beneath the River. Even if there was an alternative to redirect water and gas supply over the wider area, the local residents, businesses and landowners will need services maintained.

8.11 The diversion of the public utilities will therefore be much more expensive for an 'on-line' solution and there is a greater risk of disruption to services. Once the new STW vacuum pumped sewer planned for 2019 is installed in the bridge utilising a redundant cast iron STW pipe, the cost and difficulty of diverting the utility supplies will be significantly increased.

8.12 The Scheme allows for service diversions to be undertaken with much less disruption and cost involved.

8.13 Traffic impact

8.14 The route is an important east-west route between North West Leicestershire/Charnwood and Melton Mowbray. The current traffic flows are in the region of 12,000 vehicles per day. The scheme intends to avoid lengthy road closures and maintain access during the period of the construction works.

8.15 The alternative 'on-line' proposal requires a road closure for the whole construction period of in the region of 18 months. This would entail an additional 30miles (48km) and a minimum of 43 minutes additional time per vehicle per day. The cost of setting up and maintaining the diversion route is estimated to be in the region of £249,000. The value of the delay is estimated to be in the region of £56 million - 85 million.

8.16 The Scheme is much less disruptive to traffic, avoiding lengthy and costly diversionary works.

8.17 Overall Assessment

8.18 The present Zouch Bridge is nearing the end of its useful life and is in need of replacement. The Scheme to construct a replacement bridge to the south of its current location will maintain an important element of the transport infrastructure by carrying the A6006 over the River Soar. The A6006 is an important east-west route across the north of Leicestershire and provides a

strategic connection linking Leicestershire with Nottinghamshire, with traffic flows of in the region of 12,000 vehicles per day.

8.19 The Scheme proposes to construct the new bridge and open it to traffic before the present bridge structure deteriorates further and becomes unsafe for traffic to use, which would avoid the introduction of lengthy diversionary routes of approximately 30 miles. The Scheme intends to maintain access during the period of the construction works, avoiding the need for lengthy diversion works during the 18 month construction period.

8.20 The primary reason for the Scheme is to replace an existing bridge nearing the end of its useful life with a new structure and approaches. The Scheme does not intend to offer any particular environmental benefits. Any slight negative impacts in the vicinity of the realigned carriageway will be offset, as far as possible, by the incorporation of mitigating measures into the Scheme.

9. Glossary

AADT	Annual Average Daily Traffic	The total volume of vehicle traffic of a highway or road for a year divided by 365 days (i.e. Monday to Sunday average). AADT is a useful and simple measurement of how busy the road is.
AAWT	Annual Average Weekday Traffic	Annual Average Weekday Traffic (i.e. Monday to Friday average).
AIP	Approval in Principle	The document which records the agreed design approach in accordance with BD2/12 Technical Approval of Highway Structures, Volume 1, Section 1 of the DMRB.
BEng(Hons)	Bachelor of Engineering degree (with Honours)	
CDM	Construction Design and Management Regulations 2015	The Construction (Design and Management) Regulations 2015 (CDM 2015) cover the management of health, safety and welfare when carrying out construction projects
CEng	Chartered Engineer	An Engineer registered with the Engineering Council. The formation process of a Chartered Engineer consists of obtaining an accredited Engineering degree and a minimum of four years of professional post graduate peer reviewed experience. The title Chartered Engineer is protected by civil law and is a terminal qualification in engineering.
°C	Degrees Centigrade/Celsius	
DfT	Department for Transport	The ministerial Government department planning and investing in the United Kingdom's transport infrastructure.
DMRB	Design Manual for Roads and Bridges	A series of 15 volumes forming part of a suite of technical documents produced by Highways England that provide standards, advice notes and other documents relating to the design, assessment and operation of trunk roads in the United Kingdom. Design standards for county roads are drawn from these.
EA	Environment Agency	A non-departmental public body, established in 1995 and

		sponsored by the United Kingdom government's Department for Environment, Food and Rural Affairs (DEFRA), with responsibilities relating to the protection and enhancement of the environment in England (and until 2013 also Wales).
ECI	Early Contractor Involvement	Involvement of a contractor at the design stage to provide advice on buildability
FRA	Flood Risk Assessment	
HGV	Heavy Goods Vehicle	Goods vehicle over 7.5t in weight.
HV	High Voltage	The high voltage (HV) Network is typically 6.6 kilovolts and above, and can be distributed through overhead lines and underground cables.
Isoprachyte	Isoprachyte contours	Isoprachyte contours illustrate thickness variations from the existing i.e. variations in the extent of excavation or fill.
Kph	Kilometres per hour	Roads are designed to kph design speeds
K value	Factor in the choice of vertical curves	See Table 3, TD9/93 for the appropriate K value for a crest curve (hill) based on visibility criteria and for a sag curve (dip) based on comfort criteria. K is the length of curve required to change the gradient by 1%. Radius = 100*K.
LCC	Leicestershire County Council	Leicestershire County Council is the county council for the English non-metropolitan county of Leicestershire.
LTP	Leicestershire Transport Plan	The local Transport Plan (LTP3) explains how LCC will work to make sure that transport continues to play an important part in Leicestershire's future. The LTP3 includes the long term strategy (2011 – 2026) and short term (3 year) Implementation Plans.
m/km/mm	Metres/kilometres/millimetres	
MHA	Midlands Highway Alliance	The Midlands Highway Alliance is a unique self-funding partnership of 21 English local highway authorities promoting excellence in the delivery of highway services.
MICE	Member of the Institution of Civil Engineers	The Institution of Civil Engineers (ICE) is an independent professional association for civil engineers and a charitable body in the United Kingdom based in London. The ICE aims to support the civil engineering profession by offering professional qualification, promoting education, maintaining professional ethics, and liaising with industry, academia and government.
Mph	Miles per hour	
MSF	Medium Schemes Framework	The Midlands Highway Alliance's construction framework
NRSWA	New Roads and Street Works Act 1991	This is the Code of Practice for the Co-ordination of Street Works and Works for Road Purposes and Related Matters. It provides a legislative framework and Thsets out the objectives of the co-ordination function.
NTEM	National Trip End Model TEMpro Database	TEMPro, the Trip End Model Presentation Program, is designed to allow detailed analysis of pre-processed trip-end, journey mileage, car ownership and population/workforce planning data from the National Trip End Model (NTEM). It forecasts the growth in trip origin-destinations (or productions-attractions) up to 2051 for use in transport modelling.
PSP	Professional Services Partnership	The Midlands Highway Alliance's design consultancy framework
SU	Statutory Undertaker	Various companies and agencies with legal rights to carry

		out certain development and highways works. Generally speaking they are utilities and telecoms companies or nationalised companies such as Network Rail.
STW	Severn Trent Water	Severn Trent plc is a water company based in the United Kingdom.
TAA	Technical Approval Authority	The organisation responsible for agreeing the Approval in Principle and subsequently accepting the relevant certificates for compliance with technical requirements.
TA46/97	Technical Advice Note 46 1997 Traffic flow ranges for use in the assessment of new rural roads	DMRB Volume 5 Section 1 Part 3 (TA 46/97) Assessment and preparation of road schemes. Assessment of road schemes. Traffic flow ranges for use in the assessment of new rural roads. Sets out carriageway standard options related to opening year flow ranges for use as starting points in the design and economic assessment of new rural trunk road links.
TD9/93	Technical Document 9 1993 (amended 2002) Highway Link Design	Volume 6, Section 1 of the DMRB concerned with highway link design.
TD42/95	Technical Document 42 1995 Geometric Design of Major/Minor Priority Junctions	Volume 6, Section 2 of the DMRB concerned with the Road Geometry of Junctions
TRO	Traffic Regulation Order	Traffic Regulation Orders (TROs) are legal agreements which allow highway authorities or the police to enforce regulations including weight restrictions, speed limits, on-street parking and one-way streets
WebTAG	Web based Transport Analysis Guidance issued by the Department for Transport.	Projects or studies that require government approval are expected to make use of this guidance. For projects or studies that do not require government approval, TAG serves as a best practice guide.