<table>
<thead>
<tr>
<th>Scheme Name</th>
<th>A38(M) Tame Valley Viaduct Maintenance Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Authority</td>
<td>Birmingham City Council</td>
</tr>
</tbody>
</table>

**SENIOR RESPONSIBLE OWNER DECLARATION**

I confirm that Birmingham City Council wishes A38(M) Tame Valley Viaduct Maintenance Scheme to be taken forward for consideration for funding in the Spending Review period. I understand that any cost incurred in submitting the scheme through the prioritisation process is at the authority’s own risk.

As Senior Responsible Owner for A38(M) Tame Valley Viaduct Maintenance Scheme, I confirm that I have the necessary authority to make the above declaration.

Signed:  

Name: John Blakemore  

Position: Chief Highway Engineer
SECTION 1: THE SCHEME AS PREVIOUSLY CONFIGURED

For schemes with a bid for Programme Entry (or PE combined with other approval stages) with the Department this section should describe the scheme as submitted in the business case. Please state separately if there had been any changes since business case submission prior to June 2010.

For schemes with a previous approval (Provisional Approval or Programme Entry) please describe the scheme as previously approved, stating separately any subsequent changes previously notified to or discussed with DfT prior to June 2010 or identified in the scheme as prioritised within the former Regional Funding Allocations.

1.1 Description of the scheme
This should clearly state the scope of the scheme and describe all of its key components.

General Description of the Viaduct

Tame Valley Viaduct forms the northern end of the A38(M) Aston Expressway between Birmingham city centre and Junction 6 of the M6 motorway. The viaduct, which was opened to traffic in 1972, is 620m long and comprises 21 spans. The structure spans over a number of businesses, roads, an electrified railway and the River Tame.

The deck comprises a composite concrete slab with four longitudinal steel box girders. These are connected to cross box girders which in turn are supported on reinforced concrete columns. The structural deck accommodates the carriageway with seven lanes of traffic operating under a tidal flow system. There are no hard shoulders, footways or a central reservation.

The A38(M) forms an integral part of the West Midlands motorway network and carries a weekday two-way 12 hour (07:00 to 19:00) traffic flow in excess of 80,000 vehicles.

A typical cross section of the viaduct is provided on the attached drawing.

Structural Assessment and Load Carrying Capacity

Detailed structural assessments have revealed significant deficiencies in the carrying capacity of the viaduct including non-compliance of some of the critical structural elements with the current design standards. The theoretical carrying capacity of the bridge is zero tonne based on a number of sub-standard structural components within the longitudinal and cross boxes.

Further rigorous analytical work complemented by ongoing monitoring inspections is currently being implemented. This is aimed at ensuring operational safety, establishing the rate of structural deterioration and enhancing the theoretical load carrying capacity of the viaduct.
Scheme Proposals

The design and strengthening works estimated at an overall cost of £31m would involve the following main activities:

- Completion of the detailed design and checking work including complex finite element analysis
- Provision of additional access points and appropriate strengthening of the affected areas to comply with the current health and safety requirements
- Installation of internal flange and web stiffeners, and diaphragms in both longitudinal and cross boxes
- Concrete repairs to the deck slab where appropriate
- Localised retrofitting of shear studs if necessary at the deck level
- Complete repainting of the boxes requiring provision of an extensive access system to protect businesses, roadways and footpath from falling debris. Consideration also needs to be given to the access at railway locations.
- Bearing replacement
- Parapet strengthening if necessary

It is envisaged that majority of the work is carried out from inside the boxes with little impact on the running surfaces of the carriageway during the day time.

All stiffening will be fitted by either site welding, bolted connections or structural adhesives depending on location and suitability. Where welding is used, there may be times when traffic management at the carriageway level has to be employed to prevent imposition of live traffic loading during the application and cooling off periods. The design and construction management process however, will ensure that this is kept to an absolute minimum, hence reducing inconvenience to both local and motorway traffic.

Proposed Procurement Process

Given the nature, technical complexity, specialist nature and high level of commercial risk involved in the scheme, it is proposed to deliver the scheme through a partnership contract with Early Contractor Involvement.
Following completion of the design and the independent Category III checking procedures, it is proposed to strengthen a trial span of the bridge including longitudinal and transverse boxes. This forms Phase 1 of the works.

The trial works will provide considerable information and knowledge in respect of latent defects enabling accurate final outturn costs to be arrived at. Practical design amendments will also be incorporated to improve efficiency and costs when strengthening the remaining spans during Phase 2 of the works.

**Funding Requirements**

The overall cost of the scheme is estimated at £31m. The proposed procurement strategy is based on a step-by-step process aimed at exploiting opportunities to use the state of the art assessment and design techniques to take full advantage of the inherent strength of the existing structural components and rationalising the strengthening works.

It is envisaged that DfT would set aside funding for the project, but instead of allocating a single block to Birmingham, would release funding for each stage of the scheme, once the technical and financial implications have been satisfactorily established.

Given the complex nature of the project and its sensitive location, this would offer DfT the opportunity to play an integral role in the decision making process whilst overseeing and influencing the delivery and risk management of the strengthening works.
1.2 What are the primary objectives of the scheme?
Please limit this to the primary objectives (ideally no more than 3) such as reducing congestion; the problems to which this scheme is the solution. Do not include secondary objectives i.e. things that the scheme will contribute to (for example it may be an objective of a new road scheme to include improved facilities for cyclists, but that is not a primary objective)

The primary objectives of the scheme are to:

- Ensure safety, reliability and continued unrestricted availability of this vital infrastructure asset linking one of the busiest sections of the M6 motorway to the Birmingham road network.
- Avoid the need for imposition of stringent interim measures, such as lane closures and/or further formalised weight restrictions which will be necessary if the strengthening works are not undertaken. Such measures will cause delays and inconvenience to the M6 traffic with adverse impact on the economy of the entire West Midlands conurbation.
- Proactively manage, monitor and ultimately remove the risk of structural failures, consequent disruptions and health and safety implications.

1.3 What are the key milestones for delivery, including estimated start and completion date of the scheme as proposed?
Please list all relevant milestones with dates including start and completion of statutory processes, public inquiries procurement etc. For the purposes of this question assume that no Full Approval decision will be given before December 2011 and no DfT funding will be available before 2012/13. Please describe any implications arising from the non-availability of DfT funding until 2012/13 if that represents a delay to your previously assumed timetable.

- **Feb 2011 - Oct 2011:** Undertake further assessment; clarify scope of strengthening needs; improve scheme estimate and refine business case
- **Autum 2011:** – Submit Best and Final Funding Bid for Phase 1 of the works to DfT
- **Jan 2012 - Mar 2013:** Complete detailed design and contract development
- **Apr 2013 – Sep 2013:** Issue tenders and appoint contractor
- **November 2013 – April 2014:** Strengthening works for the trial span
• April 2014 – July 2014: Further development of the Business Case / Best and Final Funding Bid for Phase 2 for submission to DfT

• Feb. 2015 – September 2016: Complete the strengthening of remaining 20 spans

1.4 What are the key risks to the delivery to this timetable, aside from the availability or otherwise of DfT funding?

*Please list the biggest risks (ideally no more than three) that have a potentially significant impact on the timing of the scheme. For each risk please describe its likelihood, and quantify the potential time delay.*

Box girder structures are complex to analyse and difficult to strengthen. The main learning points from similar structures such as Avonmouth Viaduct M5, Tinsley Viaduct M1 and Bidston Moss Viaduct M53 indicate that the risk associated with latent defects i.e existing steel and weld quality, dimensional tolerances and construction details can significantly influence the overall cost of the works.

The key risk for Tame Valley Viaduct strengthening works is the uncertainty over the nature and extent of the required works and the impact of the existing latent defects. This uncertainty means that it will be difficult to arrive at an accurate cost estimate at the design stage.

The proposed delivery approach involves strengthening of a trial span and using the information obtained to determine a final outturn price with a high degree of confidence.

The approach also envisages close cooperative working between the City Council and the DfT, enabling the Department a requisite level of control appropriate for a project with such a regional significance.

1.5 What is the total estimated outturn cost of the scheme?

*Please provide the latest estimated cost of the scheme (and for schemes with a live Programme Entry bid with DfT an explanation of any key changes from the costs in the MSBC) broken down by main category (construction, land, utility diversions etc.) and including any eligible preparatory costs as defined in previous guidance. For the purposes of this question please assume no DfT funding available until 2012/13. Include the impact of any delay, if applicable. Please also include the revised funding profile for the scheme and breakdown by funder based on the funding split assumed in the MSBC. Please also state what inflation assumptions you are using.*

A provisional estimate of £31 million at 2008 prices for the full construction cost including design and supervision has been used to inform the cost/benefit assessment, as set out in Section 1.6. This figure excludes optimism bias.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LA contribution</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Third Party contribution</td>
<td>£0.6m</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DfT funding requested</td>
<td></td>
<td>£1.2m</td>
<td>£2.2m</td>
<td>£2m</td>
<td>£17m</td>
<td>£8m</td>
</tr>
<tr>
<td>TOTAL</td>
<td>£0.6m</td>
<td>£1.2m</td>
<td>£2.2m</td>
<td>£2m</td>
<td>£17m</td>
<td>£8m</td>
</tr>
</tbody>
</table>

1.6 What is your best estimate of the scheme’s BCR? If there is any variance between this and the BCR in your most recently submitted business case, please explain the reason and attach AMCB/TEE tables and supporting information. For schemes that do not have a live business case with the Department please indicate when this BCR was calculated and provide AMCB/TEE tables and any other supporting evidence.

No previous business case has been submitted for the scheme.

A provisional BCR, based on the TUBA assessment, has been produced utilising the West Midlands PRISM model to estimate the benefits of avoiding the consequences of restricting the vehicle flow capacity of the section of road carried by the viaduct.

The key assumptions are:

- No accident benefits have been calculated for this scheme at present;
- Carbon benefits are those calculated within TUBA and hence exclude any associated with other, non modelled, time periods;
- All costs and benefits are presented in 2002 values and prices and discounted to 2002;
- The appraisal period is for 60 years post opening

Overall the benefits for the scheme are as follows:

- Present Value of Benefits (PVB) = £224,270,000
- Present Value of Costs (PVC) = £35,758,000 (included 66% optimism bias)
- Net Present Value (NPV) = £221,123,000
- Benefit to Cost Ratio (BCR) = 6.27
- BKR (Placing Indirect Cost in PVB not PVC) = 6.78

Copies of the following are attached;

- Initial Economic Assessment Report by Atkins
- PRISM Model Validation Report

1.7 Are there significant benefits or costs that have not been captured in the above BCR?
**Please explain whether there likely to be material benefits or costs that have not been captured in the above BCR. Please differentiate between monetised NATA benefits that have not been captured in the above BCR, non monetised NATA benefits and impacts that you do not think are included within the NATA framework. Please provide evidence to support any further impacts claimed. We will ask for more detailed evidence in due course during 2011 for schemes in the Development Pool.**

Delays during construction and benefits during future maintenance have not been included.

It is envisaged however, that majority of the work is carried out from inside the boxes with little impact on the running surfaces of the carriageway during the day time.

**1.8 Please describe the latest position regarding any developments associated with the case for the scheme?**

If the business case for the scheme is associated with housing and commercial developments please describe the latest position regarding each of these developments, particularly where there have been changes since the most recently submitted business case. This should include any changes to numbers of housing, jobs etc. and information on planning consents applied for or granted. If possible please provide a letters or statement of intent from individual developers that state their present intentions regarding the scale, nature and timing of their developments.

As part of the Highways Agency’s Active Traffic Management Scheme, works between Junctions 5 and 8 of the M6 are programmed to commence in December 2011. As the scheme valued at £91m is expected to generate additional traffic onto the A38(M), it is imperative that Tame Valley Viaduct remains fully operational offering full unrestricted access.

---

**SECTION 2: SCOPE FOR REVISED PROPOSALS**

In this section we are asking for an early indication of your intent, without prejudice to what you might choose to include in your Best and Final Bid in autumn 2011, if selected for the Development Pool. Nothing you include here will be binding upon you or DfT.

**2.1 What changes in scope do you plan to consider as compared against the scheme as described above?**

Please attach plans and/or maps if necessary to illustrate the nature of the possible changes. You may include more than one option here but please be clear on any ‘red line’ issues – e.g. reductions in scope below which you would not be prepared to take the scheme forward.

There is no scope to change the fundamental nature of the scheme, i.e. strengthening the viaduct to ensure that it meets minimum standards of safety and durability for the continuing vehicular movement on a key part of the highway network.
The inclusion of the scheme in the Regional Funding Allocation for the West Midlands was based on a single phase design and construct project valued at £31m.

The City Council’s preference is a step-by-step process based on exploratory and pilot stages described in Section 1.1 rather than a single phase design and construct scheme.

A single phase design and construct scheme will need to be delivered within a partnership environment enabling the strengthening design to benefit from an early and collaborative involvement of designer, checker and steel work contractor. The risks associated with the latent defects however, would not be comprehensively addressed and that significant deviations from the estimated project cost would be possible.

### 2.2 Can you describe the likely impact of the scope changes described above on value for money and achievement of your stated objectives

Your answer to this question does not need to include a precise value for money calculation (unless one is already available) but it should provide a commentary on where there would be expected to be a material change to costs and benefits (both monetised and non-monetised), and in which direction. Please provide evidence if available.

A design and construct approach as described in Section 2.1 would increase the uncertainties and risks over the existing latent defects, hence is expected to result in increased outturn costs.

### 2.3 Can you describe the impact of the scope changes on your timescales for delivery at 1.3 above

For example if they would require restarting statutory processes, procurement etc.

Given the nature of the scheme, the overall delivery timescales whilst dependant upon the successful outcome of each stage of the project, are not expected to be significantly different from those provided in Section 1.3.

### 2.4 In addition to any significant changes in scope, can you quantify the potential for savings in the overall cost of the scheme, for example through value engineering?

We do not necessarily expect firm costings at this stage but please give some indication of scale.

Strengthening of steel box girders has generally involved the addition of supplementary plates and stiffeners to the existing sections. These are heavy, cumbersome to lift and manoeuvre, and difficult to connect to the existing steelwork. However, strengthening of other bridge types by means of carbon-fibre reinforced polymers (CFRP) has now become more commonplace.
These materials are lightweight and are fixed to the bridge by means of structural adhesives. This makes installation quicker, simpler and generally more economic. Their use for Tame Valley Viaduct will definitely be considered.

The new Eurocodes for structural design are less prescriptive in their approach than previous codes of practice and allow the designer greater freedom to achieve economy in design. It is expected that their use will reduce the cost of strengthening.

2.5 What is your latest assessment of the cost, feasibility or value for money of any alternatives to the proposed scheme.

This could include any lower cost alternatives to the scheme as appraised by you in previous business cases or those proposed by third parties. Please make reference to any material differences with the preferred scheme in costs or benefits such as carbon impact.

There are no realistic alternatives to strengthening the viaduct. Constructing a replacement, for instance, would be far more expensive and vastly more disruptive. There is no possibility of providing an effective and enforceable alternative route. Ongoing monitoring cannot be considered as a medium or long-term alternative to strengthening, since the risk of failure remains with consequences that include emergency closures, unplanned disruption to traffic, and then the necessity of repairs and strengthening without the benefit of a considered approach.

SECTION 3: FUNDING

Please quote all amounts in £m to three decimal points (i.e. to the nearest £1000)

3.1 Taking into account the range of possible scope changes and cost savings described in Section 2, what is the extent of the potential reduction in the overall cost of the scheme from the figure provided in Section 1.5?

By its nature, it is not possible to accurately estimate any potential reductions through the alternative delivery model. The proposed delivery approach offers the most cost effective solution, ensuring the overall expenditure is kept to a minimum.

3.2 Third Party contributions

Please specify the third party contributions proposed so far and the extent of the further contributions that you think would be possible? Please state each potential third party organisations and their role or interest in the scheme. Please support this by attaching any funding commitments or letters of intent from individual funders wherever possible.

No third party contributions are anticipated at this stage. It is however, intended to pursue funding through the Local Enterprise Partnership (LEP) following completion of the design and possible implementation of the trial span i.e Phase 2 of the woks.
3.3 Local Authority funding

Please specify the scale of the funding contribution you would be prepared to consider providing from your own resources.

All development works undertaken to date will be met from City Council resources. In agreeing the Council’s Final Business Case for the Birmingham Highway Maintenance and Management PFI (BHMMMPFI) with DfT and HMT, it was accepted and agreed, on a value for money basis, that the full cost of the strengthening works for Tame Valley Viaduct and Aston Road North Flyover would be excluded from the specification.

It was agreed that the Council could submit a Major Scheme bid, which would have to be subject to any regional prioritisation, for the whole cost of these works. No provision was made within the BHMMMPFI Final Business Case for any part of these costs.

The Council is no longer in receipt of block funding for Maintenance and Integrated Transport from 2011. It has been understood that, unlike major improvement projects where there is a discernable benefit to the project sponsor, major maintenance works aimed at maintaining the status quo should receive full funding.

3.4 DfT funding to be requested

Taking into account the extent of the potential for reductions in overall cost and additional third party funding what is the scale of reductions in the previously requested DfT contribution.

It is suggested that an amount be set aside as part of the determination of the major projects programme, but be retained by DfT for release in stages as determined by successful progress. The first allocation to enable a pilot on one of the spans is estimated to be £4 million from the current four year allocation of 2011 to 2015.

SECTION 4: ADDITIONAL INFORMATION FOR STRUCTURAL MAINTENANCE SCHEMES

4.1 Why does scheme need to be started in the Spending Review period (i.e. up to 2015) and how great is the risk of the structure requiring closure or significant weight restrictions in that period?
A series of ever more refined assessments has established beyond doubt that there are deficiencies within the structure. Thin-walled box girder bridges are known to be a vulnerable form of construction, and this has necessitated the strengthening of many similar major structures (e.g. M5 Avonmouth Viaduct, M1 Tinsley Viaduct, M53 Bidston Moss Viaduct) to avoid the risk of closure.

It is difficult to be precise in quantifying the likelihood within the review period of the deficiencies leading closure of all or part of the structure, or the need for weight restrictions; however the consequences of any of these measures would be extremely high. When these two factors are combined, the risks are very high and unsustainable for a structure of such local and regional importance.

4.2 Please provide a detailed explanation of what would happen if the scheme was not funded?

With continuing use and cycles of loading from a 24 hour traffic volume of 90,000 vehicles, the condition of the viaduct will continue to deteriorate. Factors of safety that are already substandard will reduce to the point where they become critical, and the imposition of interim measures such as lane or weight restrictions will become inevitable.

Monitoring of the viaduct does not reduce these risks; it only serves to detect failures and enable the restrictions to be implemented before there is a danger to the public. The cost of monitoring is around £200,000 per annum and given the scale and complexity of the structure, with around 3 km of box girders to inspect, monitoring can never be considered a comprehensive or completely failsafe measure. The risks will only increase the longer the strengthening is delayed.

SECTION 5: ADDITIONAL INFORMATION

Please add any additional information that is relevant to your expression of interest that is not covered elsewhere in the form

Specifically please provide relevant technical information (latest inspection reports etc) to back up response to the questions in section 4 above.

There have been over twenty reports about written about the viaduct in the past ten years relating to its condition and the assessment of its capacity. These have been summarised in an “overarching report”.

These reports will be made available upon request.
SECTION 6: FURTHER WORK

We will be providing you separate technical guidance on the information that we will require for schemes in the Development Pool in the first part of 2011, particularly on modelling and appraisal, prior to the submission of Best and Final Funding Bids. Based on the requirements of this guidance, please provide an indication of what further modelling and appraisal work you would need to undertake if selected for the Development Pool and an indication of the earliest that you would be able to submit a Best and Final Funding Bid.

To date, assessment work has been focussed upon confirming that the structure is substandard and is in need of strengthening. This has now been proven. The nature of the deficiencies has been identified, but their exact extent has not been detailed. Further assessment work is proposed to quantify the extent of substandard features so that the precise scope of strengthening requirements can be identified. Following this, preliminary design work is required to determine the optimum methods of strengthening, thereby allowing a more accurate estimate of costs to be determined. In parallel, the programme for strengthening and any requirement for traffic management during the works would be developed, enabling a more accurate BCR to be calculated.

The City Council will be consulting with and seeking DfT’s guidance and approval for the following;

- Traffic modelling,
- Production of an Appraisal Summary Table (AST) for the entire scheme
- Details required for the Best and Final Funding Bid for Phase 1 of the works

The above will be submitted by the Autumn of 2011 in line with the proposals described in this submission.

Following completion of the trial span strengthening, Phase 1 works, it is proposed to submit a further Funding Bid detailing the main strengthening works in July 2014.

**CONTACT DETAILS FOR FURTHER ENQUIRIES**

<table>
<thead>
<tr>
<th>Lead Contact:</th>
<th>Kamyar Tavassoli</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position:</td>
<td>Infrastructure Manager</td>
</tr>
<tr>
<td>Tel:</td>
<td>0121 303 7346</td>
</tr>
<tr>
<td>E-mail:</td>
<td><a href="mailto:kamyar.tavassoli@birmingham.gov.uk">kamyar.tavassoli@birmingham.gov.uk</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alternative Contact:</th>
<th>Paul O'Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position:</td>
<td>Street Services Manager</td>
</tr>
<tr>
<td>Tel:</td>
<td>0121 303 7412</td>
</tr>
<tr>
<td>E-mail:</td>
<td>paul.o'<a href="mailto:day@birmingham.gov.uk">day@birmingham.gov.uk</a></td>
</tr>
</tbody>
</table>