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1. Executive Summary

1.1 Introduction

On 24 September 2016 an articulated heavy goods vehicle (HGV) with a gross vehicle weight of 37.6 tonnes ignored advanced warning signs and breached the roadside restrictions and became stuck on the Marlow Suspension Bridge. The bridge has a 3 tonne weight limit and was subsequently checked, and whilst no immediate or direct damage could be attributed to the overweight vehicle, it is likely certain members of the bridge structure; the deck support hangers; were overstressed for a short period of time as a consequence of the HGV passing over the bridge.

Given the age, complexity and iconic status of this local landmark the provisions to deter errant drivers from crossing the bridge need to be reviewed for their sufficiency in order to avoid a similar reoccurrence.

1.2 Purpose

The purpose of this report is to explore the current measures and to analyse other options to reduce the risk of overweight vehicles from accessing the bridge. 18 options have been considered in addition to the “do nothing” scenario which has been treated as the control / baseline for this review. The options considered have been grouped into the following categories:

- Traffic regulation
- Physical roadside constraints
- Signage
- Communication
- Technology
- Traffic management

These options have been reviewed and scored against a number of pertinent criteria which are listed below:

- Likely effect on the structure of the bridge
- Effort to enforce
- Aesthetic impact on the surrounding area
- Operational impact on the highway network
- Ongoing maintenance requirements
- Road safety impact
- Cost
1.3 **Exclusions**

This review has not considered:

- Closing the bridge to vehicular traffic, due to the detrimental economic and social impact to Marlow and the surrounding area.

- Any alterations to the bridge that would strengthen the structure, as the likely cost of this approach will run into hundreds of thousands, if not millions of pounds and therefore prohibitively expensive for no additional benefit.

1.4 **Recommendations**

The 18 options have been assessed by reference to the criteria laid out in Section 1.2 and the results are detailed in Section 4.8.

It is recommended that a phased approach should be adopted to in the implementation of the following options:

- Improve the existing signage.
- Improve and broaden the existing communication strategy.
- Improve the width restriction features on each approach.
- Undertake new structural assessments on the Marlow bridge to consider increasing the weight limit to 3.5 tonnes maximum gross weight.

1.5 **Outline Delivery Programme**

The outline programme delivery for the above options is shown adjacent.

It is important to note, the imposition of a 3.5t weight limit is dependent on the Department for Transports agreement to an exemption (thereby de-criminalising local residents who are currently using the bridge). In the event an exemption is not be granted, and in order to apply the new weight restriction, the Marlow Bridge would need to become a toll bridge, and hence this process has been added to the programme as a contingency with the continued aim of de-criminalising the use of the bridge by some local residents.
2. Supporting Information

2.1 Structural Assessment

- A structural assessment of Marlow Suspension Bridge was undertaken in February 1990. This assessment provides both the context and reasoning for the current 3 tonne maximum gross weight limit as stipulated by the Traffic Regulation Order, 1999.

- The assessment in 1990 was undertaken as a national strategy to rationalise the weight limits on bridges across the UK and thereby comply with the Department of Transport standard BD21/84.

- A key assumption of the assessment was that both the structural design and as-built arrangements are identical, however inspections undertaken during component testing have shown that while the overall structural principles are correct some details slightly vary from the as-built records.

- Where weight restrictions are applied the Traffic Signs Regulations and General Directions stipulate that two standard weight limits are permitted, specifically 3 tonnes and 7.5 tonnes.

- The 1990 assessment used an in-house software package, CASSYS, which undertook a geometric non-linear finite element analysis of the structure. This determined that under a 7.5 tonne live load, some members would be stressed beyond 100% of its capacity resulting in component damage and/or failure. The results of the load to member capacity ratio are summarised below (figures greater than 1 indicate overstressing).

<table>
<thead>
<tr>
<th>Member</th>
<th>3 tonnes</th>
<th>7.5 tonnes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Chain</td>
<td>0.88</td>
<td>0.93</td>
</tr>
<tr>
<td>2 Hangers</td>
<td>0.67</td>
<td>1.17</td>
</tr>
<tr>
<td>3 Stiffening Girder</td>
<td>0.98</td>
<td>1.50</td>
</tr>
<tr>
<td>4 Cross-Girders</td>
<td>0.60</td>
<td>1.24</td>
</tr>
<tr>
<td>5 Deck Plate</td>
<td>0.97</td>
<td>1.95</td>
</tr>
<tr>
<td>6 Footway</td>
<td>0.54</td>
<td>0.54</td>
</tr>
<tr>
<td>7 Anchorages</td>
<td>0.92</td>
<td>0.97</td>
</tr>
<tr>
<td>8 Bearings</td>
<td>0.34</td>
<td>0.68</td>
</tr>
</tbody>
</table>
Given these results, the assessment recommended the live load on the Marlow Suspension Bridge should be restricted to vehicles of less than 3 tonnes.

A copy of the report can be found in Appendix A.

2.2 Traffic Regulation Order 1999

A Traffic Regulation Order (TRO) is the legal instrument by which the Road Traffic Regulation Act 1984 is applied to enforce the use of the bridge by vehicles.

A TRO dated June 1999 is in place which imposes two vehicle restrictions, specifically a weight limit of 3 tonnes and width restriction of 2.0m (6’6”).

There appears to be no documentation on file that relate specifically to and would justify the imposition of a 2.0m width restriction, however internet research of various vehicle specifications shows the given dimensions for vehicles weighing 3 tonnes and less are all less than 2.0m.

This 2m width restriction, in the form of traffic islands, raised kerbs, bell bollards, etc., therefore creates a self-enforcing engineering arrangement.

However it is worth noting the research also shows that some vehicles over 3 tonnes also have a width of less than 2m.

A copy of the TRO can be found in Appendix B.

2.3 Traffic Survey – November 2015

Transport for Buckinghamshire undertake bi-annual road traffic surveys on Marlow Road, north of the Marlow Suspension Bridge, in accordance with the Department for Transport procedure Road Traffic Estimates.

The most recent survey was undertaken in November 2015, and was undertaken over 12 hours. It found that a total of 9,074 vehicles of Class 3 to 12 used the Marlow Suspension Bridge. Of these:

- 8,136 were Class 3 vehicles (cars and taxis up to 3.5 tonnes)
- 988 were Class 5 vehicles (light goods vehicles up to 3.5 tonnes)
- 34 vehicles were Classes 4 and 6 to 12 and therefore above 3.5 tonnes.

A copy of the traffic survey from November 2015 can be found in Appendix C.

It is important to note there appears to be a slight inconsistency with regard to how the Department for Transport capture classified traffic data and the standard weight limits stipulated by the Road Traffic Regulation Act 1984, as one measures vehicles below 3.5 tonnes and the other establishes the lower weight limit as 3 tonnes.

By reference to these vehicle classifications, the number of vehicles that crossed the bridge and were between 3 tonnes and 3.5 tonnes cannot be determined.

The next scheduled traffic survey is planned for November 2017.
• The bridge structure does not appear to have been significantly compromised despite the inconsistency between the manner in which the survey results are collated and how the weight restrictions are applied, and more importantly the actual number of vehicles crossing the Marlow Bridge which exceed the current weight restriction.

2.4 Police Enforcement & Education Operation – March / April 2017

• The Thames Valley Police (TVP) undertook a 6 week operation which started 1 March 2017. Each session, which covered both sides of the Marlow Bridge, was 90 minutes long and carried out between 0700 - 1800hrs. The information provided by TVP is contemporary and suggests the number of overweight vehicles attempting to cross the bridge during a 90 minute long daytime period varies from 15 to 58 (depending on the time of day).

• During the operations in March 2017 two vehicles over 12.5 tonnes were prevented from crossing the bridge. The most common vehicles turned around were the Mercedes Sprinter Van (3.5 tonnes) and the Land Rover Discovery Series 4 (3.2 to 3.5 tonnes). The Thames Valley Police continued the operation until the 21 April 2017 during which over 40 fixed penalty notices were issued.

• On 21 April 2017 TVP undertook a further survey using plain clothes police officers during which the number of overweight vehicles was 22 in a 60 minute period.

• A copy of the results from the Police Enforcement & Education Operation can be found in Appendix D.
3. Site Information

3.1 Marlow Suspension Bridge

- The Marlow Suspension Bridge is a significant piece of highway infrastructure which enables local traffic to move from one side of the River Thames to the other. The bridge itself, in combination with its surroundings, is also a tourist attraction and has played a major role in the evolution of Marlow, influencing the local economy and the town’s social and cultural environment of the town.

- The bridge is a major landmark on the River Thames and given its age, complexity and iconic status there is an abundance of information about this structure that is available both on file within Buckinghamshire County Council’s archives and with the Marlow Society.

- Since the opening of the Marlow Bypass in 1972 the Marlow Bridge appears to have continued to be the established route for local traffic.

3.2 A Brief History

- The Marlow Bridge is located on the boundary of Buckinghamshire and Berkshire and was originally constructed between 1829 and 1831 to a design by William Tierney Clark. The bridge replaced a wooden bridge which had previously collapsed. The bridge is a Grade I Listed Structure (Historic England Ref 111758).

- The structure comprises of a twin chain supporting a suspended deck over the River Thames which was substantially reconstructed during 1965 and reopened to traffic in 1966. During the refurbishment the original wrought iron chain links were replaced with mild steel alternatives.

- In 1999 the bridge was reviewed by reference to the latest traffic regulations, and a traffic regulation order (TRO) made which imposed a weight restriction of 3 tonnes (maximum gross weight) and a width restriction of 6'6" (2.0m), with the only exemptions being to blue light emergency services.

- The bridge underwent a further minor refurbishment in 2002 during which a number of the bridge deck hangers were upgraded, replacing some ductile iron components with marine grade steel.

3.3 Existing Width Restriction Enforcement Measures

- The existing width restriction of 6'6" (2.0m) is the minimum legal width permitted for a public highway in accordance with Clause 5.3.4 of the Traffic Signs Manual Chapter 3 – Regulatory Signs 2008. It is subject to a traffic regulation order (TRO) making it legally enforceable as a traffic movement offence. These signs comply with the above referenced regulations and are located sufficiently far in advance and approaching the Marlow bridge on all key routes to advise drivers of the approaching restriction. The restriction is signed on both the Buckinghamshire and Berkshire approaches.

- The width restriction is further supported by physical infrastructure which includes kerb build-outs, traffic islands, bell bollards and road markings. These are located on both sides of the bridge.
3.4 Existing Weight Restriction Enforcement Measures

- The existing weight restriction is 3 tonnes maximum gross weight and is compliant with the requirements of Department for Transport standard BD21/01.

- The restriction is subject to a traffic regulation order (TRO) and is also signed on all approaches to the bridge. These signs comply with the Traffic Signs Manual Chapter 3 – Regulatory Signs 2008 and are located sufficiently far in advance and approaching the Marlow bridge, on all key routes to the bridge, to advise drivers of the approaching restriction. These signs are located on both sides of the bridge within Buckinghamshire and Berkshire.

- The weight restriction is not directly supported by any measures apart from occasional, though infrequent, enforcement by Thames Valley Police and/or Trading Standards. It is indirectly supported by the width restriction measures, however at 2.0m wide many vehicles that exceed 3 tonnes maximum gross weight; which include transit vans, light goods vehicles and larger domestic vehicles; are able to freely negotiate the localised narrowing.
4. Improvement Options Considered

4.1 Bridge Use

- The Marlow Bridge is a key element of highway infrastructure across the River Thames. It is therefore important to fully utilise it to the economic and social benefit of the local community as they are intrinsically linked. However a balance needs to be reached between how the bridge is used, in particular by vehicular traffic, and ensure it operates well within its structural capacity, and continues to serve its key purpose into the foreseeable future, that being to enable public access across the River Thames.

- It needs to be recognised the bridge is being regularly traversed by local traffic which exceeds the current 3 tonne weight limit. It also needs to be recognised that small commercial vehicles (i.e. transit vans etc.) are also occasionally travelling across the bridge.

4.2 Comparisons and Options

- There are a number of historic bridges across the United Kingdom that continue to allow modern vehicles to use them. These have been used as reference points to consider some of the options against. These bridges include:

  o the Clifton Suspension Bridge, Bristol
  o Mill Lane bridge Bathampton, Bath
  o Swinford Bridge, Witney Oxfordshire

4.3 Traffic Regulation Orders

4.3.1 Increase in the Permitted Weight Limit

- The 3 tonne maximum gross weight limit emanated from the structural assessment on the Marlow Suspension Bridge undertaken in 1990, thereby complying with DMRB Standard BD21/01. In so doing this has precluded some local traffic which includes cars, taxi’s, sport utility vehicles and light goods vehicles from using the bridge, as some of these vehicle models have maximum gross weights up to 3.5 tonnes.

- The process of increasing the weight limit on the bridge is both complex and lengthy, and will require a number of government approvals to implement.

- In the first instance a new detailed structural assessment to DMRB Standard BD101 is required, using more up to date finite element analysis software. A further assessment to DMRB Standard BD21/01 will then be undertaken and assuming the outcome is favourable, and with the approval of the Technical Approval Authority, representation will then need to be made to the seek the Department for Transport (DfT) agreement to change the weight limit. This process only addresses the capacity of the Marlow Bridge.
• It is important to note that any change to the weight limit is not intended to promote the use of Marlow Suspension Bridge to commercial traffic.

• The next step is to modify the existing traffic signs. The Traffic Signs Regulations and General Directions 2016 stipulate the permitted weight limits are either 3 tonnes or 7.5 tonnes. Buckinghamshire County Council will need to write to the Secretary of State for Transport to seek relaxation of the regulations and grant “authorisation of traffic signs and special direction” under the Road Traffic Regulation Act 1984. Given the iconic nature of the Marlow Suspension Bridge the Department for Transport will need to be satisfied that the structure is being protected and therefore the approval process to change the weight limit is likely to be lengthy (more than 6-12 months).

• Following approval from the DfT the regular County Council approval process will be followed which includes consultation with local stakeholders and consideration whether or not a Key Decision is required.

• The relevant traffic signs will then be updated, which will make the weight limit change enforceable.

4.3.2 Enforcement by Police / Trading Standards Officers

• The Thames Valley Police (TVP) currently has the responsibility for enforcing the restrictions under the Highway Code (TS50 failure to comply with a statutory sign).

• Officers from Trading Standards are also able to enforce the restrictions but there is no evidence that they are currently undertaking these enforcement activities.

• The constraining infrastructure has been installed to create an environment which is as self-enforcing as possible. However, traffic surveys indicate that a proportion of drivers continue to cross the bridge illegally.

• The traffic survey results show there is a clear need for continuing enforcement operations. The number of fines given out in the latest enforcement activity suggest it is unlikely to present a financial burden on the police service. However, it is recognised that TVP need to prioritise the enforcement activities in the region and therefore their objective is likely to be an automated system thereby avoiding the need for police manpower. Automated systems are discussed further in the Technology section of this report.

• Assuming no other technical solution is implemented, and irrespective of the physical infrastructure, the occasional police activity is still be required to remind drivers of the need to comply with the statutory weight limit signs.

4.4 Physical Constraints

4.4.1 Improve the Existing Width Restriction Features

• There is evidence that oversized vehicles are crossing the Marlow Suspension Bridge, breaching the containment measures which are already in place.
• The existing traffic islands and bell bollards restrict the road width to 6’6” (2.0m) which is the minimum legal width permitted for a public highway. These permitted engineering features are an inhibiting feature for oversized vehicles and have been installed to support the Traffic Regulation Order. These features are an effective self-enforcing measure and implemented as sensitively as possible in this conservation area.

• The standard height of the kerbs and the curved shape of the base of the bollards are reasonably forgiving to permit vehicles which unintentionally strike these features. However, drivers of some oversized vehicles who intentionally travel over the bridge can also exploit this weakness. Refer to Appendix F.

• Any change to the width restrictions would need to be consistently applied on both sides of the bridge thereby necessitating agreement from both Buckinghamshire County Council and the Royal Borough of Windsor and Maidenhead.

• The current arrangement could be improved with the installation of high containment kerbs, as they appear are more imposing. This type of kerbing has been used on the Clifton Suspension Bridge in Bristol.

![Control measures at the Clifton Suspension Bridge, Bristol.](image)

• It is noted however that while drivers are likely to approach these features with more care, the kerbs can still be breached by vehicles whose wheel base is marginally wider than 2.0m.

• If more robust / preventative kerbs are installed, there is also the increased risk that more permitted vehicles would strike the measures causing damage to their vehicles.
4.4.2 Install Height Restriction

- The current highway constraint does not impose a height restriction on the approach to or on the Marlow Bridge. The existing TRO would there need to be amended to cater for this new constraint.

- A height restriction barrier would be an effective measure to prevent severely overweight vehicles from crossing the bridge, if the height was set appropriately, however there are a number of inherent significant risks to this approach. Refer to Appendix F.

- The introduction of a height restriction would inadvertently prevent some permitted fire, ambulance and/or police service vehicles from travelling over the bridge. Other passenger vehicles would also be inadvertently affected, in particular those domestic vehicles with roof or bicycles racks.

- Department for Transport standard BD65/14 stipulates that the design requirements of collision protection beams (CPB) to the superstructures of existing bridges over highways must not inhibit or constrain vehicular traffic.

- A CPB can only be installed if the beam and its supports are constructed to form an integral part of the bridge. A CPB mounted on free-standing supports in advance of a bridge is deemed to be an obstruction to the highway and is not permitted as it contravenes Section 178 of the Highways Act 1980. As such, the CPB would need to be attached to the Marlow Suspension Bridge. To be effective the CPB would need to be installed at both ends of the structure.

- As the CPB’s would need to be fixed to the bridge the cost would be significant. Likewise, in the event of a collision, the cost of inspections, investigations and repairs would also be significant. If any impact took place the road would need to be closed as a precautionary measure, whilst the checks took place. In addition, as the structure is a Grade I listed structure permission will need to be sought from Historic England.

- The height restriction barrier would need to be visible and conspicuous at all times of day / night and in all weather conditions. As such, it would be difficult to blend into the surrounding environment within this conservation area at this iconic structure.
4.5 Signage

4.5.1 Improve Existing Signs

- The existing signs have been assessed and were found to be compliant with the Traffic Signs Regulations and General Directions, 2016.

- While all the signs are visible, and comply with the required standard, their conspicuity could be improved.

- Some of the signs could be moved to locations which offer better forward visibility.

- The signs could also be modified to include yellow backing boards to make them more conspicuous and/or by stating the distance to Marlow Suspension Bridge to offer more information to drivers.
4.5.2 Install Additional Signs

- There are no signs along Temple Lane advising drivers of the weight or width limits on Marlow Suspension Bridge. Vehicles turning towards the bridge will therefore only become aware of these limits upon reaching the bridge itself.

- Additional advanced warning signs could be installed on the arterial routes, notably at locations where drivers could take alternative routes.

- Enhanced regulatory signs could also be installed at the bridge.

- There is a risk this option would increase street clutter, and so would require careful consideration in this conservation area which will need to be consulted on by stakeholders.

4.5.3 Install Vehicle Activated Signs (VAS)

- The advanced warning to drivers could be improved by the installation of vehicle activated signs (VAS) linked to height detectors. These could be used on the arterial routes to warn drivers of large vehicles of the restriction ahead.

- These signs would need to be positioned at locations where drivers could take alternative routes and on both approaches to the Marlow Suspension Bridge.

- There is a risk this option would increase street clutter, and so would require careful consideration in this conservation area which will need to be consulted on by stakeholders.
Height detectors along the A41 Bicester Road, Blackthorn. The vehicle activated sign can be seen in the distance.

A typical vehicle activated sign which will show drivers an electronic message when a set of conditions occur.

### 4.6 Communications

#### 4.6.1 External Communications

- Information about the existing restrictions at Marlow Suspension Bridge could be improved by communicating relevant messages on Buckinghamshire County Council’s website as well as social media. Traditional methods such as local media releases to newspapers and radio, leaflets and letter drops, community committees and external groups / organisations meetings could also be used.

- The general public should be encouraged to be familiar with their plated and operating weights as well as the width of their vehicle. Drivers can use public weighbridges to assess their vehicle’s weight.
4.6.2 Satellite Navigation and Web Mapping Services

- Satellite navigation providers should be contacted to request they update their mapping data with details of the weight and width restrictions (also height as appropriate). This will help ensure the message is provided to as many drivers as possible.

- Similarly, a ‘legal request’ can be submitted to amend Google Maps to highlight the restrictions at Marlow Suspension Bridge. This can be carried out by ‘submitting feedback’ using the website.

4.6.3 Freight Gateway

- Freight Gateway is a freight management mapping product which allows local authorities to publish key information about their network on their own website such as weight / height / width restrictions. Drivers can then select the most appropriate routes for their journeys.

4.6.4 Creation of Substandard Bridges List

- As part of a freight management strategy a list of the structures which have weight / height / width restrictions could be published on Buckinghamshire County Council’s website.

4.7 Technology

4.7.1 CCTV Monitoring

- CCTV cameras could be erected in advance of the bridge and used as evidence to enforce against overweight vehicles.

- The use of CCTV cameras to prosecute drivers is closely regulated by the home office and Department for Transport. The extent to which Thames Valley Police would be able to prosecute using CCTV images as evidence would require further detailed investigation before any investment was made.

- If legally feasible, the CCTV will require administrative co-operation between the system operator (BCC) and Thames Valley Police (TVP). There are existing District Council and County Council CCTV systems operating within Marlow; however these would need to be upgraded.

4.7.2 ANPR Monitoring

- Automated Number Plate Recognition (ANPR) cameras and software could be installed, combined with data obtained from the DVLA, to provide an enforcement option similar to CCTV monitoring.

- The Highway Authority would need to obtain approval from the DfT to the ANPR cameras and install advisory signage and apply for the appropriate Traffic Regulation Order (TRO). This would include delegated powers to ensure the legality of any enforcement.

- Consideration could also be given to linking Weigh-in-Motion (WIM) technology with ANPR, to provide more accurate detection and enforcement. WIM technology using systems such as ViPERWIM could be investigated further.
4.8 Traffic Management Layouts

4.8.1 Create Visual Corridor

- Site observations suggest the approach roads to the existing road narrowing are wide enough for large vehicles to travel along at speed with limited consideration by drivers on legal weight and width restrictions.

- The existing road narrowing could be enhanced by extending the build-outs / traffic islands to create a longer narrower approach corridor / street scene. This option would highlight to drivers of large vehicles the restrictions on the bridge.

- It is likely that any amendment to the length of the existing islands will result in further damage claims being made by drivers of legitimate vehicle. The existing islands already have extensive evidence of vehicle strikes and the location has a history of damage only claims being made against the Council, reputed in the main.

4.8.2 Installation of 2-Way Traffic Signals

- The introduction of 2-way alternate lane traffic signals would limit the number of vehicles to a single file along the centre of the deck. This could reduce the severity of potentially overloading structural components from grossly overweight vehicles, as the overall live load from vehicles will be reduced as the risk of a traffic queue will be avoided.

- Whilst the overall load on the bridge would be reduced, this option would not prevent the single point load from traversing the bridge.

- Traffic speeds along the bridge could increase as a result.

- Signals would have a significant impact on traffic flows using the route and would need careful consideration before implementation.
4.8.3 Installation of a One-Way System / Tidal Flow System

- The introduction of a one-way system or tidal flow system would limit the number of vehicles to a single file along the centre of the deck. This could reduce the severity of any potential overloading effect from grossly overweight vehicles sharing the bridge with a queue of oncoming or following traffic.

- Traffic speeds along the bridge could increase as a result.

- An area would need to be made available for vehicles to turn around should they need to. This will be very difficult to accommodate as there is limited highway space available at either of the bridge.

- This system would be expected to reduce traffic flows using the route and would need careful consideration before implementation.

- Pedal cyclists / motorcyclists / scooter drivers could be tempted to travel illegally against the flow of traffic.

- A TRO would need to be put in place to support this option.

4.8.4 Conversion into a Toll Bridge

- The bridge could be converted into a toll road for vehicular traffic. Tolls would contribute to the ongoing operation and maintenance costs of the bridge.

- This option will require the Secretary for Transport to put in place specific legislation to enable the toll to exist and is likely to require the creation of a designated company to operate it.

- The toll system would need to be manned 24-hours a day (either on site or remotely) and would likely require planning permission as it is likely that toll booths and a barrier arrangement will be required.

- Toll collectors could help enforce the restrictions on the bridge in person, however this could put these people into situations where conflicts could arise.

- The payment systems would need to be easy to understand and use.

- A toll system would have a significant impact on traffic flows using the route and would need careful consideration before implementation.

- An area would need to be made available for vehicles to turn around should they need to. This will be very difficult to accommodate as there is limited highway space available at either of the bridge.

- A TRO would need to be put in place to support this option.

- Examples of this option are currently in place at Bathampton, Bath and Swinford, Oxfordshire.
4.8.5 Installation of Automatic Barrier

- An automatic barrier to control oncoming vehicle movement could be installed. An example is currently in operation on the Clifton Suspension Bridge in Bristol (refer to the image in Section 4.3.1) – where a weighbridge is positioned on both approaches to the bridge and if a vehicle is above the weight limit, the barriers will lock preventing overweight vehicles accessing the bridge.

- Such an option will require substantial technical design input and investment.

- The location of any automatic barriers and associated weighbridges or Weigh-in-Motion (WIM) sensors embedded in the road would need to be carefully considered to avoid existing physical constraints and maintain the existing access arrangements for adjacent properties.

- The implementation of this option will require a new TRO and require both new and revised signage.

- Once in place traffic disruption may result, particularly when non-permitted vehicles try to gain access to the bridge resulting in a blockage to traffic flow from time to time.

- The barriers would need to be able to identify smaller vehicles such as motorcycles, scooters, bicycles etc. and raise the barrier accordingly.

- The layout would need to prevent drivers from driving around the barrier by using the oncoming lane of traffic.

- There will always be the risk of the occasional technology failure and potential damage to vehicles and barriers in the event of a collision.
## 5.0 Analysis of the Improvement Options Considered

- The various options have been considered by reference to a number of criteria. These are listed below with further consideration given to the likely effect from which a score is produced.

<table>
<thead>
<tr>
<th>In consideration of the option under review ....</th>
<th>Very High</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
<th>Very Low</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Likely effect on the structure of the bridge</strong></td>
<td>Significant and immediate damage to the bridge structure resulting in its full closure</td>
<td>Moderate increase in stress on the bridge structure within permissible limits, and an increase in the inspection regime</td>
<td>Minor increase in stress on the bridge structure well within permissible limits, and no change to the regular inspection regime</td>
<td>Negligible increase in stress on the bridge structure well within permissible limits, and no change to the regular inspection regime</td>
<td>No effect on the bridge structure and no change to the regular inspection regime</td>
</tr>
<tr>
<td><strong>Effort to enforce the option</strong></td>
<td>Increased police / trading standards enforcement operations</td>
<td>Use of Trading Standards officers to occasionally carry out enforcement</td>
<td>Occasional police enforcement using resources when available</td>
<td>Semi automated system with back office support to audit automated enforcement tickets</td>
<td>Fully automated with no additional human resources required</td>
</tr>
<tr>
<td><strong>The level of human resources needed to enforce</strong></td>
<td><strong>Impact on the aesthetics of the bridge / area</strong></td>
<td>Significant engineering infrastructure that significantly changes the aesthetic throughout the area</td>
<td>Localised major engineering infrastructure that significantly changes the aesthetic of the area</td>
<td>Localised engineering infrastructure that changes the aesthetic of the area</td>
<td>No change to the current aesthetic arrangement</td>
</tr>
<tr>
<td><strong>Impact on the operation of the network</strong></td>
<td>Significantly worse and extended periods of traffic congestion across the local highway network</td>
<td>Worsening but short duration traffic congestion across the local highway network</td>
<td>No change to the current traffic congestion across the local highway network</td>
<td>Slight improvement to traffic congestion across the local highway network</td>
<td>Improved traffic congestion across the local highway network</td>
</tr>
<tr>
<td><strong>Will the options increase traffic congestion</strong></td>
<td>Complex, time consuming, specialist, frequent maintenance required</td>
<td>Simple, time consuming, specialist, frequent maintenance required</td>
<td>No change to the current maintenance requirements</td>
<td>Simple, quick, specialist, and infrequent maintenance required</td>
<td>Simple, quick, general, and infrequent maintenance required</td>
</tr>
<tr>
<td><strong>Ongoing maintenance</strong></td>
<td>The traffic arrangement has changed, is very complex and requires drivers to make quick complex decisions</td>
<td>The traffic arrangement has not changed and therefore no additional risk to drivers</td>
<td>The traffic arrangements have not changed and drivers are aware of approaching highway constraints</td>
<td>The traffic arrangement has been simplified making driver decisions easier</td>
<td></td>
</tr>
<tr>
<td><strong>Impact on Road Safety</strong></td>
<td><strong>Ability for drivers to make decisions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Cost</strong></td>
<td>The capital expenditure to undertake work</td>
<td>£500k</td>
<td>£100k - £500k</td>
<td>£10k - £100k</td>
<td>&lt; £10k</td>
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<td>Option</td>
<td>Likely Effect on Structure</td>
<td>Effort to Enforce Option</td>
<td>Impact on Aesthetics</td>
<td>Impact on Network Operation</td>
<td>Ongoing Maintenance</td>
</tr>
<tr>
<td>--------</td>
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<td>--------------------------</td>
<td>---------------------</td>
<td>-----------------------------</td>
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<tr>
<td></td>
<td>Weighting</td>
<td>x 5</td>
<td>x 3</td>
<td>x 2</td>
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<td>4.1.1 - Increase permitted weight</td>
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<td>3</td>
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<td>4.1.2 - Increased enforcement by Police</td>
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<td>5</td>
<td>1</td>
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<td>3</td>
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<td>4.2.1 - Improve width restriction measures</td>
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<td>4.2.2 - Install height restriction</td>
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<td>4</td>
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<td>4.3.1 - Improve signage</td>
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<td>2</td>
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<td>4.3.2 - Install additional signage</td>
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<td>4.3.3 - Install VAS signage</td>
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<td>4.4.1 - External communications</td>
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<td>4.4.2 – SAT NAV / Google mapping</td>
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<td>4.4.3 - Freight gateway</td>
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<td>4.4.4 - Publish substandard bridge list</td>
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<td>3</td>
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<td>4.5.1 - Enforcement by CCTV</td>
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<td>2</td>
<td>3</td>
<td>3</td>
<td>5</td>
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<td>4.5.2 - Enforcement by ANPR</td>
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<td>4.6.1 - Construct visual corridor</td>
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<td>4</td>
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<td>4</td>
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<td>4.6.2 - Install automatic</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Option</td>
<td>Likely Effect on Structure</td>
<td>Effort to Enforce Option</td>
<td>Impact on Aesthetics</td>
<td>Impact on Network Operation</td>
<td>Ongoing Maintenance</td>
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<tr>
<td>-------------------------------</td>
<td>-----------------------------</td>
<td>---------------------------</td>
<td>----------------------</td>
<td>-----------------------------</td>
<td>---------------------</td>
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<tr>
<td>barriers</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td>4.6.3 - Toll bridge</td>
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<td>5</td>
<td>5</td>
<td>4</td>
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<td>4.6.4 - Two-way traffic signals</td>
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<td>3</td>
<td>5</td>
<td>4</td>
<td>4</td>
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<tr>
<td>4.6.5 - One-way system / tidal flow system</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>
6.0 Conclusions and Recommendations

6.1 Conclusions

- There is clear evidence that traffic in excess of the 3 tonne gross weight limit regularly use the bridge.
- The current measures and enforcement do not prevent these overweight vehicles from using the bridge and appear to be ignored / abused by some drivers and misunderstood by others.
- Continued use by severely overweight vehicles will affect the function of the structure and will increase the frequency and cost of maintenance operations.

6.2 Recommendations

Noting the foregoing and the associated risks, both in terms of physical risk (in terms of added infrastructure) and soft risks (in terms of likelihood of approvals being granted), the options that are available to the County Council are limited. The following are actions that can be taken in the short term to address the immediate problem.

- Improve the existing signage. This is a low cost measure which will help improve the communication and enforcement strategies.
- Improve and broaden the existing communication strategy. This is a low cost measure which will proactively help deter overweight vehicles from using this route.
- Improve the width restriction features on each approach to provide a more robust deterrent for heavy good vehicles.
- Undertake new assessments to DMRB Standard BD101 and DMRB Standard BD21/01 using modern modelling techniques to understand the current load carrying capacity of the bridge.

In the medium term the County Council will

- Investigate the costs and feasibility of installing an active management scheme for deterring the use of the bridge by over sized vehicles. This to include the possible introduction of Weigh In Motion sensors and associated Variable Message Signs to alert drivers.

In the medium to long term the County Council will continue to petition DfT to allow:

- Enforcement of moving traffic offences to enable the authority to issue Fixed Penalty Notices to registered keepers of vehicles traversing the structure in contravention of the TRO
- To apply a non-standard weight limit on the structure to allow access to vehicles that, whilst plated above the MGW rarely achieve that weight. The intent is to raise the limit to 3.5T
Appendix A. Structural Assessment 1990

BUCKINGHAMSHIRE COUNTY COUNCIL

Structural Assessment of Marlow Suspension Bridge

February 1990

Rendel Palmer & Tritton
61 Southwark Street
London SE1 1SA
CLIENT:
BUCKINGHAM COUNTY COUNCIL

HARLOW SUSPENSION BRIDGE

Structural Assessment

ENGINEER:
Rendel Palmer & Tritton
61 Southwark Street
London
SE1 1SA

February 1990
1.0 INTRODUCTION
   1.1 Terms of Reference
   1.2 General Description of Structure
   1.3 Scope of Assessment
   1.4 Principal Inspection

2.0 ASSESSMENT ANALYSIS
   2.1 Source Documents
   2.2 Global Analysis
   2.3 Local Analysis

3.0 RESULTS OF ASSESSMENT
   3.1 Chains
   3.2 Hangers
   3.3 Stiffening Girders
   3.4 Cross-Girders
   3.5 Deck Plate
   3.6 Footway
   3.7 Towers
   3.8 Anchorages
   3.9 Bearings
   3.10 Expansion Joints
   3.11 Wind Loading

4.0 DISCUSSION OF RESULTS
1.0 INTRODUCTION

1.1 Terms of Reference

The County Engineer's Department of Buckinghamshire County Council engaged Mendeel Palmer & Tritton to perform a structural assessment of Marlow Suspension Bridge, in accordance with RPT's letter ref. SNH/WW/1316 dated 21st December 1989.

1.2 General Description of Structure

Marlow Suspension bridge is a twin chain supported suspension bridge originally constructed between 1829 and 1831. Severe corrosion of the anchorages and failure of a number of the hangers prompted an almost complete reconstruction of the bridge in 1968.

In order to maintain the structural form and appearance of the bridge it was designed to accommodate traffic consistent with a 5 ton weight restriction over the bridge.

1.2.1 Chains

Twin eye-bar link mild steel chains are connected each to alternate cross-girders. The chains are supported directly by roller bearing assemblies at the tower tops. The anchorages comprise high tensile steel tie rods pretensioned against the masonry and brickwork abutment.

1.2.2 Hangers

The hangers are solid 35mm diameter mild steel rods welded into a hanger tube at the bottom and held by a pin between the link connector plates at the top.

1.2.3 Stiffening Girder

The stiffening girder is a truss comprising structural 'tees' as chords and flats as the diagonals. All the connections are
HSFG bolted. The stiffening girder is supported at the piers and at the abutments by a rotating link bearing to give vertical and lateral restraint.

1.2.4 Cross-Girders

The cross-girders comprise universal beams which are supported directly by the hangers and are also connected into the longitudinal truss of the stiffening girder. A cantilever truss of structural 'tee' chords and flats support the footway.

1.2.5 Deck Plate

The deck plate consists of an orthotropic steel plate with open stiffeners and spans between the cross-girders. The deck plate panels are connected by a single sided butt weld and stiffener continuity is provided with an HSFG bolted connection. The deck is surfaced with 12mm thick gritted epoxy dressing.

1.2.6 The footway is supported off the cantilever truss and comprises 75mm thick timber planking spanning at least three cross-girders.

1.2.7 Towers

The towers are in the form of a masonry faced arch with brickwork infilling. There is a steel portal arch tie within the tower and the tower bearings are mounted upon a reinforced concrete slab.

1.2.8 Abutments

The abutments have masonry footings supporting a brickwork abutment that originally was tunnelled out to house the anchorage chains. In the reconstruction the chains were replaced with tie rods and the tunnel completely infilled with mass concrete. The tie rods were debonded from the concrete to prevent cracking at
the front of the abutment. The abutment is faced with masonry and the wing walls have brick parapets rendered with cement to a masonry pattern.

1.3 Scope of Assessment

The bridge currently has a 5 tonne weight restriction. This is a category of restriction that does not comply with the Department of Transport, Departmental Standard BD 21/84, 'The Assessment of Highway Bridges and Structures'. Two categories of weight restriction complying with BD 21/84 were considered for the bridge: 7.5 tonne Assessment Live Loading which corresponds to the loading applied by two axle light goods vehicles and 3 tonne Assessment Live Loading which corresponds to the loading applied by cars and vans.

In accordance with Clause 5.2 of BD 21/84 the ultimate limit state alone was considered and a rigorous fatigue analysis of the structure was not performed. This could be examined but requires further data to make realistic estimates of historical loading.

1.4 Principal Inspection

A Principal Inspection was performed concurrently to determine the condition of the structure. Access was only available to the underside of the bridge over land and not over water. The inspection was confined therefore to the areas where access was available and the conclusions reached in these areas were considered as indicative of the areas not inspected. A further inspection of the remaining areas will be carried out when the bridge is repainted.

The Principal Inspection showed the bridge to be in good structural condition generally with almost no loss of section through corrosion. The area noted as most critically affected was the cross-girder to stiffening girder connection and a condition factor of 0.9 was applied to the cross-girder in this region.
2.0 **ASSESSMENT ANALYSIS**

2.1 Source Documents

All dimensions and section properties were derived from Drawing Series 31393/C - "Strengthening of Marlow Bridge for 5 Ton Vehicles".

The construction practices used and hence the loading sequence was interpreted from ICE Proceedings Paper No. 7017 1967 (June) - "Modern Techniques and Problems in the Restoration of Marlow Suspension Bridge".

Steel properties were deduced with reference to "Historical Structural Steelwork Handbook" and its reference to BS 15 and BS 968.

The assessment was carried out in accordance with the following Departmental Standards and Codes of Practice all to their latest amendments:

- BD 21/04 The Assessment of Highway Bridges and Structures
- BD 37/08 Loads of Highway Bridges
- BS5400, Parts 2, 3 & 4 - Steel, Concrete and Composite Bridges

2.2 Global Analysis

The global analysis of the bridge was performed using Rendel Palmer & Tritton's in-house geometric non-linear finite element programme CABSYS. The results from CABSYS gave design member actions for the stiffening girder, chains, anchorages and bearings.

Due to the non-linearity of the structure and the interplay of stiffnesses between the chain and the stiffening girder, the critical live loading on the deck to produce maximum stiffening girder moment had to be iterated. The first estimate of the

Wind loading was applied to the bridge but no dynamic analysis was conducted as the results would be independent of traffic loading. The wind loading did not critically affect the stresses developed in the structure but produced significant deflections in the chain.

The live loading applied to the bridge was in accordance with BD 21/84. This standard is limited to loaded lengths of less than 50m. Values for loaded lengths in excess of 50m were extrapolated with reference to the document that forms the basis of long span loading: "Interim Design Standard - Long Span Bridges - Report on Study of Vehicle Loadings".

2.3 Local Analysis

The local analysis to determine the actions within the orthotropic deck plate and the cross-girders was based upon the Pelikan and Esslinger Approach.

Continuity of the stringers over the cross-girders was assumed. This is dependent on the shear capacity of the HSFG connection and the longitudinal shear developed. A back check to confirm this assumption was performed.

The deck plate was checked for single wheel loads as the most critical loading and the cross-girders were checked for both single axle loading in each lane and KHL + UHL loading over two deck plate panels. The latter proved critical.
3.0 RESULTS OF ASSESSMENT

3.1 Chains

Under 7.5t Assessment Live Loading distributed to give maximum chain tension the upper chain is stressed to 90% of its capacity and the lower chain is stressed to 93% of its capacity. A check for 3t Assessment Live Loading was therefore not performed.

3.2 Hangers

The connection of the hanger to the chain is the weakest part of the hanger and is stressed to 117% and 67% of its capacity under 7t and 3t Assessment Live Loading respectively. The weld between the hanger bar and the hanger rod is also overstressed to 70% of its capacity under 7.5t loading.

In order to strengthen the hanger to accommodate this loading, the hangers would have to be first removed.

3.3 Stiffener Girder

The 7.5t Assessment Load was applied to give the worst bending moment in the stiffening girder. The results from the first set of computer analyses yielded an over stress of 50%. As such an over stress would require complete replacement of the stiffening girder, this investigation was curtailed and a rigorous analysis of the 3t assessment load was started.

A variety of loaded lengths and locations were chosen so as to find the greatest bending moment in the stiffening girder under the action of the 3t assessment load. After considerable computer analysis the greatest moment was found to be 98% of permissible.

To complete the check the shear capacity of the stiffening girder was calculated and the largest shear was found to be 53% of capacity.
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To complete the check the shear capacity of the stiffening girder was calculated and the largest shear was found to be 53% of capacity.
3.6 Footway

The timber planking is 75mm thick and under footway loading assuming simple support and a very conservative grading of the timber is stressed to 54% of its capacity. This is indicative of a possible 20% loss of section before the plank is overstressed. This corresponds to 20mm of lost thickness to rot or wear.

3.7 Towers

The axial compression in the tower is increased by 0.5 N/mm² due to the support of the chain. 50% of this load is due to the self-weight of the deck. The live loading does not therefore affect the stability of the tower.

In addition to this the maximum movement of the roller bearings due to live load is 20.1 mm and will not adversely affect the stability of the tower. The actual movement capacity of the bearing is 150mm.

3.8 Anchorages

The 3t and 7.5t Assessment Live Loads were applied to the whole bridge to give the worst load on the anchorages. All aspects of the steel and concrete anchorage details were found to be structurally adequate with the greatest load at 97% of the tie rod capacity.

3.9 Bearings

The bearings for the stiffening girder support at the piers and abutments are not overstressed by either 7.5 tonne or 3 tonne Assessment Live Loading. The member being stressed to 68% and 34% of its capacity respectively.
3.10 Expansion Joints

The compression seals of the expansion joints are intended to form the longitudinal restraint of the deck. In actuality these seals have to a large extent perished and the restraint is provided by the debris collected in the chase for the expansion joint.

3.11 Wind Loading

Wind Loading in accordance with BS 5490 Part 2 was applied to the bridge. The loading produced very little stress in the bridge but the chains deflected markedly (nearly 200mm). Thus visible chain deflections would occur on windy days.
TABLE 3.1

Load to Member Capacity Ratio for
3.2 tonne and 7.5 tonne Assessment Live
Load to BD 21/84

<table>
<thead>
<tr>
<th>MEMBER</th>
<th>LOAD : Member Capacity Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3 tonne</td>
</tr>
<tr>
<td>Chain</td>
<td>0.66</td>
</tr>
<tr>
<td>Hangers</td>
<td>0.67</td>
</tr>
<tr>
<td>Stiffening Girder</td>
<td>0.98</td>
</tr>
<tr>
<td>Cross-Girders</td>
<td>0.60</td>
</tr>
<tr>
<td>Deck Plate</td>
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</tr>
<tr>
<td>Footway</td>
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</tr>
<tr>
<td>Anchorages</td>
<td>0.92</td>
</tr>
<tr>
<td>Bearings</td>
<td>0.34</td>
</tr>
</tbody>
</table>
4.0 DISCUSSION OF RESULTS

The results of the assessment show that the bridge as it stands has the capacity to take 3 tonne Assessment Live Loading in accordance with BD 21/84. The maximum load level to member capacity ratio being 0.50. The results also show that considerable strengthening work would be required in order to allow the bridge to accommodate 7.5t Assessment Live Loading.

It is noted that there is no vehicle parapet protection to the hangers. The bridge is thus vulnerable to hanger damage and this is evident from the existing damage to the hangers. The possibility of progressive collapse following the severance of a number of hangers must be considered. It is estimated that at least 4 consecutive hangers would need to be severed to initiate progressive collapse. For the most critically loaded hanger only 15% of the maximum load is due to dead load. It is considered therefore that the risk of collapse is acceptable as the structure is likely to be lightly loaded.

For some bridges it is possible to allow the occasional over-weight vehicle to traffic the bridge by employing suitable traffic control measures to ensure that only one vehicle is on the bridge at any one time. This is not an option that can be employed for Marlow Suspension Bridge since there is local failure of the deck plate under a single wheel for 7.5t Assessment Live Loading.

In order to accommodate single over-weight vehicles the deck plate would have to be strengthened in its entirety and this is not considered a viable option.

The most appropriate action given the presence of a full capacity high level crossing of the River Thames by the A404, is to restrict the loading of Marlow Suspension Bridge to vehicles of less than 3 tonnes.
THE BUCKINGHAMSHIRE COUNTY COUNCIL
AND THE ROYAL BOROUGH OF WINDSOR AND MAIDENHEAD COUNCIL
(MARLOW BRIDGE) (TRAFFIC REGULATION) ORDER, 1999

BUCKINGHAMSHIRE COUNTY COUNCIL AND THE ROYAL BOROUGH OF
WINDSOR AND MAIDENHEAD COUNCIL (hereinafter referred to as "the Councils") in
exercise of their powers under Sections 1(1), 2(2), 3(2) and 92 and Part IV of Schedule 9 of the
Road Traffic Regulation Act 1984 ("the Act"), and of all other enabling powers, and having
regard to Section 122 of the Act and after consultation with the Chief Officer of Police in
accordance with Part III of Schedule 9 to the Act, hereby make the following Order:-

1. In this Order

"maximum gross weight" –

(a) in relation to a vehicle not drawing a trailer, means the maximum gross
weight as defined in regulation 3(2) of the Road Vehicles (Construction
and Use) (Regulations) 1986; and

(b) in relation to a vehicle drawing one or more trailers, the total weight
obtained by taking the maximum gross weight (as so defined) of each
vehicle in the combination and adding them together.

2. No person shall cause or permit any vehicle with a maximum gross weight
exceeding 3 tonnes to proceed on or along the length of road specified in Schedule 1 to
this Order.

3. No person shall cause or permit any vehicle exceeding six feet six inches in width
or any vehicle which with its load exceeds six feet six inches in width to proceed on or
along the length of road specified in Schedule 2 to this Order.
4. Nothing in Article 3 shall render it unlawful for vehicles being used for fire brigade, ambulance or police purposes to proceed on or along the lengths of road specified therein.

5. Pursuant to the provisions of Section 3(2) of the Act the Councils are satisfied that for preventing damage to the road or buildings on or near it, it is requisite that Section 3(1) shall not apply to this Order.

6. The Buckinghamshire County Council and Berkshire County Council (Marlow Bridge) (Weight Restriction) Order, 1996 is hereby revoked.

7. This Order may be cited as "The Buckinghamshire County Council and The Royal Borough of Windsor and Maidenhead Council (Marlow Bridge) (Traffic Regulation) Order, 1999" and shall come into operation on 25th June 1999.

SCHEDULE 1

3 tonnes weight restriction

Length of road at Marlow in the County of Buckinghamshire and in the Royal Borough of Windsor and Maidenhead

That length of C80 leading from Marlow to Bisham as is carried by Marlow Bridge over the River Thames in the County of Buckinghamshire and in the Royal Borough of Windsor and Maidenhead – measured from a point at the southernmost pier of the said bridge a distance of 70 metres northwestwards.

SCHEDULE 2

6 feet 6 inches width restriction

Lengths of road at Marlow in the County of Buckinghamshire and in the Royal Borough of Windsor and Maidenhead

That length of C80 leading from Marlow to Bisham as is carried by Marlow Bridge over the River Thames in the County of Buckinghamshire and in the Royal Borough of Windsor and Maidenhead from a point 58 metres north of the northern pier of the said bridge and continuing to the northern pier and from a point 27 metres south of the southern pier of the said bridge and continuing to the southern pier.
THE COMMON SEAL of BUCKINGHAMSHIRE COUNTY COUNCIL was hereunto affixed this 22nd day of June 1979 in the presence of:

[Signature]

Member of the Council

[Signature]

Head of Legal Services

THE COMMON SEAL of THE ROYAL BOROUGH OF WINDSOR AND MAIDENHEAD COUNCIL was hereunto affixed this 22nd day of June 1979 in the presence of:

[Signature]

Borough Secretary

[Signature]

SENIOR SOLICITOR
### Appendix C. Traffic Survey 2015

#### Section 1

8900 Marlow Road, Ref: 1052
Gazette Ref: 45/02
Grid Ref: 495100 186171
Tuesday, 17/11/2015

<table>
<thead>
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<th>Vehicle</th>
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<th>Road 2, C20 Birtham side</th>
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<td>6</td>
<td>356</td>
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<tr>
<td>09:00-10:00</td>
<td>3</td>
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<td>348</td>
</tr>
<tr>
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<td>271</td>
</tr>
<tr>
<td>11:00-12:00</td>
<td>1</td>
<td>1</td>
<td>224</td>
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<tr>
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<td>21:00-22:00</td>
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<tr>
<td>22:00-23:00</td>
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<table>
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<tr>
<th>Traffic Zones</th>
<th>Veh</th>
<th>Hha</th>
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<tbody>
<tr>
<td>V Class 1 - HCT</td>
<td>67</td>
<td>1</td>
</tr>
<tr>
<td>V Class 2 - HCT</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>V Class 3 - HCT</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>V Class 4 - HCT</td>
<td>18</td>
<td>8</td>
</tr>
<tr>
<td>V Class 5 - HCT</td>
<td>26</td>
<td>13</td>
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<tr>
<td>V Class 6 - HCT</td>
<td>36</td>
<td>16</td>
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<tr>
<td>V Class 7 - HCT</td>
<td>48</td>
<td>17</td>
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<tr>
<td>V Class 8 - HCT</td>
<td>63</td>
<td>17</td>
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<tr>
<td>V Class 9 - HCT</td>
<td>80</td>
<td>17</td>
</tr>
<tr>
<td>V Class 10 - HCT</td>
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<td>17</td>
</tr>
</tbody>
</table>

#### LIST OF VEHICLE CLASSIFICATIONS WHEN UNDERTAKING A TRAFFIC SURVEY

1. **PEDAL CYCLES** - should include cycles on footways and carriageway.
2. **EXCEPT CYCLES** - includes all vehicles other than pedal cycles.
3. **CARS & TAXIS** - includes vehicles carrying persons on footways and carriageway.
4. **BUSES & COACHES** - includes public service vehicles and buses on footways and carriageways.
5. **LIGHT GOODS VEHICLES** - includes vehicles carrying persons on footways and carriageway.
6. **HEAVY LIGHT GOODS** - includes vehicles carrying goods over 3.5 tonnes.
7. **HEAVY GOODS VEHICLES** - includes vehicles carrying goods over 3.5 tonnes.
8. **WEIGHTS WITH TWO AXLES** - includes vehicles carrying goods over 3.5 tonnes.
9. **WEIGHTS WITH FOUR AXLES** - includes vehicles carrying goods over 3.5 tonnes.
10. **ARTICULATED WITH THREE & FOUR AXLES** - includes all articulated vehicles with 3 axes or more.
11. **ARTICULATED WITH FIVE AXLES** - includes all articulated vehicles with 5 axes or more.
12. **ARTICULATED WITH SIX OR MORE AXLES** - includes all articulated vehicles with 6 or more axes.

**NOTES RELATED TO VEHICLE CLASSIFICATIONS:**

- *Goods Vehicle Exemptions*: Some goods vehicles, such as Skip Lorries, Tippers, Tractors, Cranes and Army Vehicles are exempt from having rear and side bars fitted. These should be recorded in categories 7 - 12 as appropriate.
- *Articulated Goods Vehicles*: Please note that where a vehicle has 5 or more axes (including an articulated trailer), it should be recorded as 12 and not the number of axes on the vehicle itself.
- *Goods Vehicles towing small trailers*: Some goods vehicles will be towing a small piece of equipment such as a compressor. Small trailers such as this should be ignored, and the towing vehicle recorded in the relevant category.
- *Road Goods Vehicles towing large trailers*: You will see from time to time a HGV right towing a 1, 2 or 3 axle heavy trailer. These vehicles must be recorded as articulated (categories 10 - 12).
- *Unusual Vehicle Types*: Note any unusual vehicles or ask for clarification from your site supervisor.

**CONTACT TELEPHONE NUMBERS:**

Simon Vale: (Work) 01293 387447 (Mobile) 07977 162112
Timothy Sharples: (Work) 01293 362392 (Mobile) 07720 656878

**PLEASE REMEMBER THE FOLLOWING IT IS VERY IMPORTANT:**

*WHEN YOU ARE OUTSIDE OF YOUR VEHICLE ON SITE YOU ARE REQUIRED TO WEAR YOUR HIGH VISUALISED WAISTCOAT AT ALL TIMES. THERE ARE NO EXCEPTIONS!*

Original version: April 2009
Appendix D. Police Enforcement & Education Operation

Thames Valley Police ran an education and enforcement operation on Marlow Bridge for six weeks from March 1st 2017. Each bridge session was 90 minutes long, between 0700-1800hrs and covered both sides of the bridge. Below are the reported results:

<table>
<thead>
<tr>
<th>Date</th>
<th>Vehicles turned back</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/03/2017</td>
<td>54</td>
</tr>
<tr>
<td>02/03/2017</td>
<td>58</td>
</tr>
<tr>
<td>03/03/2017</td>
<td>40</td>
</tr>
<tr>
<td>07/03/2017</td>
<td>54</td>
</tr>
<tr>
<td>08/03/2017</td>
<td>31</td>
</tr>
<tr>
<td>09/03/2017</td>
<td>35</td>
</tr>
<tr>
<td>10/03/2017</td>
<td>41</td>
</tr>
<tr>
<td>13/03/2017</td>
<td>24</td>
</tr>
<tr>
<td>14/03/2017</td>
<td>47</td>
</tr>
<tr>
<td>15/03/2017</td>
<td>36</td>
</tr>
<tr>
<td>16/03/2017</td>
<td>35</td>
</tr>
<tr>
<td>21/03/2017</td>
<td>20</td>
</tr>
<tr>
<td>22/03/2017</td>
<td>20</td>
</tr>
<tr>
<td>24/03/2017</td>
<td>25</td>
</tr>
<tr>
<td>25/03/2017</td>
<td>28</td>
</tr>
<tr>
<td>26/03/2017</td>
<td>31</td>
</tr>
<tr>
<td>30/03/2017</td>
<td>19</td>
</tr>
<tr>
<td>31/03/2017</td>
<td>15</td>
</tr>
</tbody>
</table>

Observations / Notes:

- Two vehicle turned around were over 12.5 metric tonnes.
- The most common vehicles turned around were the Mercedes Sprinter Van (3.5 metric tonnes) and the Discovery Series 4 (3.2 to 3.5 tonnes).

Enforcement period between 03/04/17 and 21/04/2017

During the enforcement period from 3/4/17 to date over 40 fixed penalty notices (£50) were issued.

On 21/4/17 during one hour at the bridge in plain clothes the police observed that the numbers of overweight vehicles are beginning to creep up again (22 in 60 minutes).
# Appendix E. Simplified Guide To Lorry Types And Weights

<table>
<thead>
<tr>
<th>Recommended Description</th>
<th>Identifier</th>
<th>UK Maximum Gross Weight (tonnes)</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LIGHT GOODS VEHICLES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 axles</td>
<td>3.5</td>
<td>no rear side windows</td>
</tr>
<tr>
<td><strong>SMALLER 2-AXLE LORRIES</strong></td>
<td>2 axles</td>
<td>Over 3.5 7.5</td>
<td></td>
</tr>
<tr>
<td><strong>BIGGER 2-AXLE LORRIES</strong></td>
<td>2 axles</td>
<td>Over 7.5 18</td>
<td></td>
</tr>
<tr>
<td><strong>HEAVY GOODS VEHICLES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 axles rigid</td>
<td>25 26*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 axles artic.</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 axles rigid</td>
<td>30 32*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 axles artic.</td>
<td>36 38*</td>
<td></td>
</tr>
<tr>
<td><strong>MULTI-AXLE LORRIES</strong></td>
<td>Vehicle and draw-bar trailer 4 axles</td>
<td>30 36**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 axles artic.</td>
<td>41*</td>
<td></td>
</tr>
<tr>
<td><strong>AXLE LORRIES</strong></td>
<td>Vehicle and draw-bar trailer 5 axles</td>
<td>41**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 axles draw-bar</td>
<td>41* and **</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 or 6 axles artic.</td>
<td>44* and ***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 axles draw-bar</td>
<td>44**,*** and ***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 axles artic.</td>
<td>44*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 axles draw-bar</td>
<td>44* and **</td>
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</tr>
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</table>
## Appendix F. Simplified Guide To Vehicle Widths and Heights

<table>
<thead>
<tr>
<th>Types of vehicles</th>
<th>Typical vehicles illustration</th>
<th>Typical Dimensions (m)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>O/A Width</td>
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<tr>
<td>Small car</td>
<td>![Small Car Illustration]</td>
<td>1.688</td>
</tr>
<tr>
<td>Luxury 4x4</td>
<td>![Luxury 4x4 Illustration]</td>
<td>2.034</td>
</tr>
<tr>
<td>Car Derived Van</td>
<td>![Car Derived Van Illustration]</td>
<td>1.832</td>
</tr>
<tr>
<td>Transit Vans</td>
<td>![Transit Van Illustration]</td>
<td>1.986</td>
</tr>
<tr>
<td>Box Van</td>
<td>![Box Van Illustration]</td>
<td>2.100</td>
</tr>
<tr>
<td>FTA Design Articulated Vehicle</td>
<td>![FTA Design Articulated Vehicle Illustration]</td>
<td>2.550</td>
</tr>
</tbody>
</table>