M5 Oldbury Renewal Traffic Management Impact Assessment and Progress Report
Period: July–October 2017
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Executive Summary

Highways England have commissioned Kier Strategic Highways to undertake an operational review of the traffic management performance across the strategic and local authority road networks during the M5 Oldbury Viaduct Major Maintenance Scheme.

Oldbury and Park Street viaducts carry approximately 3km of the elevated sections of the M5 to the west of Birmingham between junctions 1 and 2. Constructed in 1970, it has deteriorated in recent years and has seen increased emergency interventions (55 in 2016). As a result, major structural repairs to the concrete deck, deck ends and re-waterproofing are required to prevent bigger challenges and further unplanned disruption in the future. The intervention to this key corridor will support economic growth locally and in the wider West Midlands, with customers benefitting from a safer, more resilient route and enhanced driver experience.

Major infrastructure upgrades which will affect the Strategic Road Network (SRN) in the West Midlands in the coming years include HS2, M6 J10 redesign, and on the local network, proposed Birchley island project (near M5 J2) and M5 J1 redesign. Therefore, a window of opportunity appeared between April 2017 and autumn 2018 to complete this work.

This section of the M5 is particularly busy, carrying around 60000 vehicles each way every day. It is important link for local trips in and around the West Midlands conurbation and more strategic trips between south west England and Wales and the north of England. Five traffic management options were progressed to the modelling stage to understand the impacts of each with the regard to the Highways England key objectives of safety for road users and workers, better customer experience and infrastructure delivery.

The option which has been implemented allows 2 narrow lanes of traffic to run in each direction on one side of the viaduct in contraflow system. Due to the geometry of the structure a 30mph speed limit is required and the slip roads at M5 J1 and J2 remain open to maintain access and limit congestion on the local road network. This option also requires additional traffic management at key decision points on the Strategic Network designed to balance traffic volumes around the works area, reducing traffic on the approach to junction 2 and through the work. The restriction is at M5 junction 4A as it is the last point at which traffic heading towards
the works can take the alternative strategic route via the M42. Without this restriction disruption would be worse, affecting the M5 corridor, as well as local roads, towns and villages.

There has been continual review of the Traffic Management since implementation, and concerns have been discussed with alterations made. To date additional signage, coning and lining amendments to improve safety and innovations such as rapid assistance motorcycles carrying emergency fuel throughout the roadworks have been implemented.

This interim review demonstrates that measures to manage traffic, including the restriction at M5 junction 4a, are working safely and successfully by encouraging drivers to avoid approaching Birmingham and beyond via the northbound M5. There has been an overall reduction in traffic on the M5 northbound approaching junction 4a, but the balance has changed, with more traffic using the M42 than the M5 northbound. It has delivered the expected reduction in flow on the M5 around junction 1 and junction 2. The average journey time on the M5 through junction 4A has been around 13 minutes, with an average delay of around 7 minutes during peak travel times. There have been some queues on the M6 to M5 link, however these have been within expectations and the restriction here has reduced southbound traffic flows through the works by almost a third. Flows around the strategic division route to the east of the ‘Birmingham Box’, have largely been within expectations. People are taking alternative routes, travelling north approaching Birmingham from the M40 via the M42 and M6, rather than using the M5, and by travelling south on the M5 from Birmingham via the M42 west. The number of incidents within the roadworks is below that seen on other roadworks around the network.

This report aims to summarise the modelling undertaken in advance of works starting, compared with the actual performance and measures instigated to balance the flow of traffic around the region. The holiday period up to the end of August sees flows generally fall by around 10% and therefore this report also includes information on flows from September to date when the traffic flows are known to increase.
Contents

1. Introduction ........................................................................................................................................................... 1
  1.1 Background .................................................................................................................................................. 1

2. Traffic Modelling ................................................................................................................................................... 2
  2.1 Traffic modelling completed in advance of the scheme................................................................. 2
  2.2 Traffic data ................................................................................................................................................... 2

3. Flow Analysis – Model v Actual Traffic Data ........................................................................................................ 4
  3.1 Birmingham Box traffic data comparison ......................................................................................... 4

4. M6 J8 to M5 J1 ..................................................................................................................................................... 6
  4.1 M6 J8 to M5 J1 Traffic Data ......................................................................................................................... 6
  4.2 M6 J8 to M5 J1 queues ................................................................................................................................ 6

5. M5 J4a .................................................................................................................................................................. 7
  5.1 M5 J5 to J4a Traffic data ............................................................................................................................. 7
  5.2 M5 J5 to J4a Journey time data ................................................................................................................... 8
  5.3 M5 J5 to J4a queues .................................................................................................................................... 8

6. Review of TM ........................................................................................................................................................ 9
  6.1 Western Arm ................................................................................................................................................ 9
  6.2 M5 Motorway J4A ....................................................................................................................................... 9
  6.3 M5 J4a - M42 link ......................................................................................................................................... 9
  6.4 2+2 Through the M5 J1-2 Roadworks ......................................................................................................... 9

7. Other measures .................................................................................................................................................. 10
  7.1 Incident plans ............................................................................................................................................. 10
  7.2 Local network signage ............................................................................................................................... 10
  7.3 Communications ........................................................................................................................................ 10
  7.4 Oldbury Board and Project Safety Risk Control Group .............................................................................. 10

8. Stakeholder Feedback ........................................................................................................................................ 11
  8.1 Local authority feedback / data .................................................................................................................. 11
  West Midlands Combined Authority .................................................................................................................... 11

9. Implications of changing TM ............................................................................................................................... 13
  9.1 Implications of removing TM ...................................................................................................................... 13

10. Alterations made to the TM .............................................................................................................................. 15
  10.1 Changes across the network ...................................................................................................................... 15

11. Conclusions .................................................................................................................................................... 17
  11.1 Conclusions................................................................................................................................................ 17
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Appendices

Appendix A – Birmingham Box Data
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1. Introduction

1.1 Background

M5 Oldbury Viaduct Renewal is a major concrete repair and re-waterproofing scheme on the 3.2km long elevated section of the M5 near Oldbury, in Sandwell, West Midlands. The structure was built in 1970 and the last large scale intervention was in the 1987. Since then there has been limited works, however the reinforced concrete deck showed signs of extensive deterioration and a number of potholes requiring emergency interventions have appeared which have revealed widespread damage to the deck below.

Five traffic management options were modelled and are assessed and these are fully detailed in the Traffic Management Options Report, Document Reference: 9-1120054-TOR-0001, dated July 2016.

The traffic management options covered in the report are summarised below,

- 3+3 (3 narrow lanes on each carriageway) – duration too long at between 5.5 and 7.5 years;
- 3+1 (closure of the M6 to M5 slips, three narrow lanes northbound on the M5 and one lane southbound from Junction 1 to Junction 2) – duration over 3 years, significant impact on the local network.
- 2+2 (2 narrow lanes in each direction, on the same carriageway in contraflow) with slips closed – Short duration (around 2 years) but with significant impact on the local area around Oldbury town centre;
- 2+2 (as above) with slips open – Short duration, lesser but still significant impact on Oldbury town centre;
- 2+2 with slips open (as above) and additional measures at M6 J8 and M5 J4a – Short duration, reduces traffic around the works area and Oldbury.

The chosen option was 2+2 narrow lanes with slip roads open in contraflow and the additional traffic management at M6 Junction 8 and M5 Junction 4a. This option has a shorter duration and reduces traffic on both the local and strategic road network through the road works. Therefore, giving the best balance of impact on the local area and across the West Midlands Combined Authority (WMCA) area, whilst still delivering a duration for the work that best fits the available programme window for the works.

This report summarises the proposals for the traffic management strategy and provides feedback on the impact of the measures experienced by the strategic and non-strategic road networks since its implementation in mid-July.
2. **Traffic Modelling**

2.1 **Traffic modelling completed in advance of the scheme**

Modelling of the traffic impact was undertaken in 2-parts to cover the impact on the local authority road network and the strategic road network (SRN) managed by Highways England. The West Midlands PRISM model has been used for wide scale modelling. Local modelling has been completed using Paramics micro-simulation modelling to assess queueing at the additional traffic management measures around M5 J4a.

The PRISM model was used initially to test the implications of a number of scenarios. Traffic flows in each case are significant. The traffic modelling concluded that the most suitable option was to provide additional traffic management on the SRN to influence drivers decisions before approaching the roadworks and rebalance traffic flows.

The final option developed is a contraflow system with 2 narrow lanes in each direction operating on the same side of the carriageway through the works area between M5 J1-J2. This maximises the effective working area to repair the deck in the shortest programme timescale and reduce the works programme. Additional traffic management (TM) measures have been put in place at M6 J8 – to M5, M5J4a (M42 interchange) and M6 J4a for the M42 to support this and encourage use of the M42/M6 around the “Birmingham Box.”

The modelling indicated that with the additional TM in place, there would be a reduction in traffic flows on the M5 through the works area. In addition there would be an increase in traffic using the M42 and M6 as well as greater numbers of vehicles on the local networks in the WMCA including Walsall, Dudley, Sandwell, Birmingham and Worcestershire.

The PRISM model is not appropriate to measure the length of queueing that might occur as a result of the proposals and so a simple local Paramics model was developed for the M5 J4a restriction. The Paramics model used July 2016 flow data to consider a worst case for the queueing in the initial period of the traffic management implementation. The modelling also showed that the road network within Sandwell was significantly over utilised with many of the road junctions at 90% capacity, and that the SRN in and around M5 J1-2 and M6 J8 was carrying more traffic as a result.

It was expected that following on from the “M5 Western Arm” roadworks in 2015, similar queues would be likely, but with the full length of the western arm available for queueing, the impact on the M6 and Walsall should be reduced. Therefore a model was not completed for this location.

2.2 **Traffic data**

The actual traffic data has been supplied by Highways England NTOC (National Traffic Operations Centre). It represents the peak hourly flow in the AM and PM peaks. It is for one direction on the link between junctions. The data has been fast tracked to us for this work, but is available around 2months later through the free to use Webtris HE traffic data website (http://webtris.highwaysengland.co.uk/).
3. Flow Analysis – Model v Actual Traffic Data

3.1 Birmingham Box traffic data comparison

A diagram of the Birmingham Box with traffic flows for each link (where possible) is illustrated in Appendix A of this report. The initial flow is from July 2016 when there was relatively normal traffic conditions and represents a one hour peak period flow. The PRISM model assumption is below this with the following rows providing a comparison of flows.

The following flow changes are shown:-

a) July 2017 pre-installation (The flow to compare against)
b) July 2017 post-installation
c) First half of August
d) Second half of August
e) First half of September
f) Second half of September

Further analysis will be continue for the remainder of the project.

The following paragraphs will summarise sections of the Box, M42 south side (M5 to M40), M42 east side (M40 to M6), M6 on the north side and M5 to the west. Further sections of the report will comment specifically on M6 J8 to M5 J1 and M5 J5 to J4a, as these are the key locations of the additional TM. The PRISM change is between the PRISM base model data and the TM scenario data.

PRISM model traffic flows expected M42 south (between M5 and M40) to carry around 2-3% more traffic. The actual fluctuation since July 2017 the fluctuation has been between -2% and +8%.

The traffic flow on the M42 has dropped between July 2016 and July 2017 by around 12-20% in each peak. Further analysis of the flows at M5 J4a reveal that for the same period from July 2016 to July 2017 there is a significant drop on the two movements from the M5 north and M42 and vice versa, ie M5 north of J4a to M42 eastbound and M42 westbound and to M5 north. The reduction in flows on these two movements equates to almost 400 vehicle per hour. This would suggest that the initial implementation of the works on the M5 J1-J2 in May/June (prior to July 2017) has led to alternative routes being used between north Worcestershire and Birmingham.

The M42 eastern side of the Birmingham box (M40 to M6) was expected to carry between 3 and 5% more traffic in each peak. The actual flow changes along this section show a large tidal increase in flow from M40 to junctions 4 and 5 (up 13% in the AM northbound and up 12% in the PM peak southbound). However north of Junction 5 through to the M6 flows are up around 4-8% northbound and relatively static southbound in the AM Peak. In the PM peak flows were relatively close to the PRISM expectation in September – with changes around 1-3%.

On the M6 to the north of Birmingham (M42 to M5) the model predicted flows would be broadly similar, with changes of 0% to -4% in each direction in either peak. The changes in flow seen between July and August 2017 have been between -2 and +4% which is very similar to the expected impact in the PRISM model.

Flows on the M6 both ways between J5 and J6 in September have increased significantly, up 15% in the AM peak and 7% in the PM peak. This major increase may be as a result of the completion of the works around the A38(M) Aston Expressway, and consequently more traffic accessing and egressing
the city centre on this route. Between junctions 8 and 7 on the M6 the PRISM model showed a very marginal (<1%) change. The latest flows show 3% reduction in the AM peak and a 3% increase in the PM peak.

On the west side of the box (the M5 from M6 to M42), there is no data available in the area around the works, due to the lack of vehicle detection. South of J3, the PRISM model predicted that southbound flows would be reduced by 5-8%. The reality has seen 20% reduction in flow from M5 J3 to J4 and similarly from M5 J4 and to M5 J4a. This maybe as a result of the driver altering travel patterns and associated with the drop noted above on the M42.

Northbound from M5 J4a to M5 J4 traffic flow was expected to fall by 8%. The model then predicted a significant increase of 13% from M5 J4 to J3. The flows show a 15% reduction in September between M5 J4a and J4. Between M5 J4 and J3 the reduction in flow is around 30%. This would suggest that the model expected traffic to avoid the traffic restriction at J4a and access the M5 at J4. This does not seem to have happened with less traffic accessing the strategic network, possibly due to the peak hour queues around M5 J3 and in to the works area around J2.
4. **M6 J8 to M5 J1**

4.1 **M6 J8 to M5 J1 Traffic Data**

The strategy for reducing through traffic between M5 J1 and J2 requires a lane reduction on the M5 Western Arm linking the M6 and M5 southbound traffic. Previously for the M5 Western Arm works the M6 J9 on slip was closed to traffic causing traffic delays throughout the daytime period (0600-1900) which affected the M6 as far north as J11 as well as the road networks around Walsall, Wolverhampton and Birmingham. It was part of the strategy for M5 Oldbury that the M5 Western Arm would be used to the fullest capacity to “store” traffic queues accessing the M5 southbound from the M6 J8.

The PRISM model predicted a reduction in flow on the link from M6 J9 to J8 of 6% in each peak hour. The flows for September show an 8-10% reduction in the AM and 16-17% reduction in the PM peak. It has also shown that the link capacity from J9 to J8 would exceed 75% through the peak hours and therefore queues could be expected to build.

Observations in the first few weeks shows queues back on to the M6 effecting the flow back towards J10, however this has settled down and reduced in length. Queues regularly fill the two lanes of the Western Arm on the approach to the lane restriction at the southern end, however this now rarely impedes the operation of the M6 for more than the peak hours.

The PRISM model predicted a 24% reduction in traffic on the southbound link to the M5 J1. In August the drop was around 30-34%. September has remained at around 32% in the PM, with the AM reduction being 28%. These figures represent just under a third of the traffic flow and this is what was required for the 2+2 contraflow to work.

4.2 **M6 J8 to M5 J1 queues**

Initially the queues associated with the introduction of the restriction on the Western Arm was severe, leading to prolonged periods of disruption to the mainline M6. However, following this initial period there has been significantly less impact. Generally the queues have been limited to the extent of the Western Arm and only impacted upon the mainline M6 at peak traffic periods.

Delays have not been measured, however regular radio reports have advised or delay around 20minutes in getting through the roadworks, from M6 to M5 J2. In general the queueing has been within expectations, both in terms of the PRISM model – which suggested that the M6 between J9 and J8 would operate at up to 90 % capacity compared to under 75% - and also from the experience of when works on the Western Arm were active.
5. M5 J4a

5.1 M5 J5 to J4a Traffic data

The second major part of the strategy is the lane restriction on the M5 northbound. This restricts the traffic flow northbound, whilst offering strategic traffic the option of remaining on the strategic network. Whereas, the PRISM data is comparing the reduction against the PRISM base model, the actual data is against July 2016 as a base year. The flow on the M5 J4a may have been adversely effected in July 2016 due to the presence of the ‘All Lane Running’ scheme on site between M5 J4A to J6. Indeed the July 2015 flows indicate a likely drop of around 800 vehicles per hour. When considering a higher base flow, then the September flows represent a reduction in flow of around 18%.

On the northbound M5 link from J5 to J4a, the PRISM model predicted that the flow here would drop by 6%, however the July figure shows a 7% increase in the AM peak and 15% increase in the PM Peak when compared against July 2016 flows. This would suggest that the M5 ALR scheme was effecting traffic flows in July 2016. The increases have fallen back to between 4-6% in each peak at the end of October.

The table below shows the M5 J4a flows

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<td>2006</td>
<td>1704 (↓15%)</td>
<td>2207</td>
<td>1748 (↓21%)</td>
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<tr>
<td>M5Nb to M42Eb</td>
<td>1715</td>
<td>1834 (↑7%)</td>
<td>1976</td>
<td>2118 (↑7%)</td>
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<tr>
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<td>1073</td>
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<td>1778</td>
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<td>1512</td>
<td>1368</td>
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<tr>
<td>M42Wb to M5Sb</td>
<td>1842</td>
<td>1762</td>
<td>1578</td>
<td>1872</td>
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Table 1 flows at the M5 J4a northbound diverge

The addition traffic management has led to a reduction in traffic on the approach to M5 J4a. The reduction in flow northbound on the M5 in these peaks has been 183 in the AM and 317 in the PM. The balance of flow continuing north on the M5 and using the M42 has also changed. In July, 54% of traffic continued north in the AM and 53% in the PM, with 46% and 47% using the M42. In September, this had changed to 48% AM (-6%) and 45% PM (-8%) continuing on the M5 northbound, and 52% AM and 55% PM using the M42.

It is also worth noting the reduction in traffic flows on the M5S and the link from M42W to M5N. These combine to give the marked reduction on the M42. There is also a PM peak increase on the M42W to M5 south movement which may reflect tidal flows out of Birmingham using this route to the M5 south.
5.2 M5 J5 to J4a Journey time data

Highways England NTOC have supplied journey time data for July and August 2016 and 2017. This data gives the journey time to complete the link between M5 J5 and M5 J4a, a distance of around 4.4 miles (or 7km). The data has been compared for August 2016 and 2017.

The data provides the average hourly journey time for three hours through the AM Peak and two hours in the PM peak. The AM peak data shows the maximum hourly average journey time in the AM peak in August 2016 was just under 5 minutes. The maximum hourly average for the PM peak was 12.73 minutes (so around 12mins 45 seconds). When compared to the August 2016 journey times, the AM peak shows a marginal decrease, and therefore would suggest the ALR roadworks did affect the M5 traffic flows. The PM peak shows an increase of 76 seconds. So it is taking just over a minute longer than the same time last year to complete the link.

5.3 M5 J5 to J4a queues

A Paramics model was developed in order to predict the likely queues that would develop on the M5 approaching Junction 4a and the additional TM. This model used 2016 flows from HE source data to develop the matrix. The model indicated that the queues in the morning peak would extend to around 5-6km. However with reductions in traffic flow or around 7-10% the queue would be limited to around 1km. The evening peak flows were found to be marginally less than the AM so the queues could be expected to be of a similar magnitude.

Anecdotally, queues in the morning have been largely at the lower end of expectations, with a proportion of the traffic diverting from the M5 onto the M42 and other routes. Whilst the evening peak queues are regularly starting just north of the Junction 5, but traffic queues rarely exceeding this location. As such we are largely getting queues around the expected distance even with an increased flow on the link.
6. Review of TM

6.1 Western Arm

M5 Western Arm lane restriction is located as far south as possible on the link, allowing two lanes to provide as much space as possible for any traffic stacking. Changes were made to the carriageway layout at the diverge on the M6 (J8) to allow vehicles in LBS2 to continue on the M6 southbound and as a result M6 J9 on slip has remained open (previously for the M5 Western Arm works the M5 J9 on slip was closed to traffic).

After the initial period, the queues that have occurred on the M5 Western arm have not impacted the M6 greatly, particularly outside of peak hours. In general this seems to be operating as the model predicted and we have not received adverse feedback from Walsall MBC which suggests impact on their network has been manageable.

6.2 M5 Motorway J4A

As per the traffic model, the traffic management at this location has led to queueing on the M5 Northbound carriageway. Queues have generally not exceeded the link, ie as far south as the northbound on slip at M5 J5. There has been a number of issues with late lane changes and the traffic management at this location has been refined to provide further advanced signing, road markings to support and improve lane discipline.

Delay information has been supplied by NTOC from August to September (inclusive) for the peak periods, 3 hours in the morning (0700-1000) and two hours in the afternoon (1600-1900). The data indicates that the maximum delay was 19 minutes. A “normal” journey time for the link would be around 6 minutes, therefore the maximum delay seen has been 13 minutes. The average journey time over this period has been around 13 minutes, with an average delay of around 7 minutes.

6.3 M5 J4a - M42 link

This link tends to operate relatively well albeit with some late lane changes to continue on M5 north. The slip to the M42 was expected to cope with the existing and increased demands and this has been born out. Flows have fluctuated over the period of the works however in as the tables above show flows on the link are around 1900-2200 per hour.

One minor issue raised by the HE Regional Control Centre around the sinusoidal nature of the exit slip and drivers not seeing the solid white line on the nearside in wet conditions is also being refined through the use of cylinders to emphasise the delineation between the carriageway and hard shoulder.

6.4 2+2 Through the M5 J1-2 Roadworks

Feedback from Sandwell MBC that the junction 2 on slip is operating at or above its capacity, which is affecting (on occasion) M5 J2 circulatory and Birchley Island. Unfortunately, there is nothing that can be done on the strategic road network to alleviate this situation. When the TM changes to facilitate the works on the northbound carriageway, the J2 on-slip may well be extended in length and therefore capacity for vehicles will increase. Conversely the J1 on slip may well be slightly shorter and so this will need to be monitored once implemented. Flows through the roadworks area are generally at or around 30mph and whilst there is some flow disturbance around the on-slips at J1 and J2 generally 500m downstream the two lanes tends to flow reasonably well.
7. **Other measures**

7.1 **Incident plans**

The HE Regional Control Centre is observing traffic flows around the strategic road network and is tracking the number and types of incidents across the network and the plans are being regularly reviewed and updated to improve flows and safety. Trends have shown that the majority of incidents within the M5 J1-2 network relate to running out of fuel and therefore motorcycle based mechanics carrying a containers of fuel have been deployed to assist drivers. This has brought response times and incident resolution times down.

There have been a total of 22 minor shunt type collisions from 1st July to 30th September, with only one having required an ambulance to attend. 15 of the collisions have happened in the main works area, 6 on the western arm and just 1 on the approach to M5 J4a.

The recovery team for the project have dealt with 346 breakdowns since the scheme first started in May. A significant number have been associated with drivers running out of fuel and so as part of the recovery plan new elements such as motorbike mechanics carrying a small amount of fuel have been used. The recovery time has been within 40 minutes for over 60% of incidents and under 2% have exceeded the target of 1 hour.

In addition to covering the strategic road network, Highways England traffic officers and M5 Oldbury scheme traffic officers have been patrolling the local road network in and around Oldbury town centre in order to provide assistance where need on the local network as well.

7.2 **Local network signage**

The contractor BMV JV has place a number of variable signs around the Oldbury and Sandwell MBC areas in advance of the motorway to provide travel information. These have generally been well received by Sandwell MBC. Following feedback from Worcester County Council and West Mercia additional measures including advanced signing and variable message signs have also been deployed around Worcestershire in advance of the M5 Motorway.

7.3 **Communications**

A dedicated communications team has been working to engage with key stakeholders about the scheme and the TM that is in place. Information is provided to the general public through the HE website, M5 Oldbury Facebook page and bulletins which should allow drivers to make informed decisions on travel. As a result the number of enquiries have fallen significantly since the installation of the additional TM measures.

7.4 **Oldbury Board and Project Safety Risk Control Group**

The Oldbury Board member’s regular review feedback network performance, resilience and recovery. As a result a Project Safety Risk Control Group (PSCRG) was established which including technical specialists and senior representatives of Highways England, BMV JV and Kier Highways Services Boards to review the effectiveness of the traffic management measures, the feedback from the local authorities and support any complex or difficult decisions necessary to ensure safety and local and strategic network function. This report aims to summarise and comment on the modelling undertaken in advance compared with the actual performance and measures instigated to optimise local and strategic network performance.
8. Stakeholder Feedback

8.1 Local authority feedback / data

Sandwell MBC

Sandwell MBC have provided anecdotal reports on the traffic impact on their network as the scheme progresses. Overall, the comments have generally been “it is as bad as expected” but perhaps no worse. They have also raised some issues regarding the M5 J2 on slip capacity (discussed earlier). SMBC have also provided some count data from March 2017, but at the current time there is nothing to compare this against. Surveys have been completed but the data is not available at the current time.

Walsall MBC

There has been minimal contact from Walsall MBC, which in itself suggests they are not overly concerned by the current TM Strategy.

West Midlands Combined Authority

Highways England and Kier have consulted with the West Midlands Combined Authority (WMCA) which includes Birmingham, Sandwell, Walsall, Wolverhampton and Dudley in advance of the M5 Oldbury Scheme. They have been instrumental in agreeing measures to safely deliver the M5 Oldbury scheme and sharing the impact across the local authority networks. Workshops have been held with these authorities to develop strategies for emergency situations and develop contingencies to recover the respective networks as quick and safe as possible. As a result the Highways Traffic Safety Officers have been deployed for the first time on the non-strategic route ensuring they remain open to traffic.

Worcestershire County Council

Worcestershire County Council have been in regular contact with HE over the last few months. The impact of the lane restriction at M5 J4a is likely to be most keenly felt in the north Worcestershire area. The feedback provided has been a combination of the anecdotal and numerical information.

There is no specific count site on the A38, however WCC have noted increased traffic on the A38 from M5 J5. Issues around the northbound exit from the M5 at Junction 5 have also been raised. This has come from observations and complaints by users in the area.

WCC have provided numerical data for a site on the A449 near Hawford, south of Ombersley. The data is for the northbound side of the dual carriageway only and shows a clear increase in traffic movements from January through to early October, 2017. The daily flow rises from just under 13000 in January to 14700 in June. It continues to rise through the period of the works and the figure for September is 15900. This represents an increase of 8%.

WCC have pointed out a significant increase through the AM peak period. The highest average hours are in the June for the period 0700-1000 and total 2760. The same period in September averaged 2912 a rise of 152 vehicles across the three hours – 5.6%. The figure for the weeks data in October is 3319, a rise of 20% from June.

Following a request for similar data from 2016, which WCC have kindly supplied, it is clear that this rise is not due to seasonal flow fluctuation. 2016 shows a largely flat profile when comparing June
to September. Therefore it can be considered that this increase in the morning peak is linked to the restrictions on the M5. As can be seen the actual number of extra vehicle is around 600 over the three hour period, around 200 per hour. This is compared to actual base flows of around 1000 per hours. Clearly this is significant, but it should be remembered that the A449 is a primary route and at this location is a dual carriageway, with a capacity well exceeding 1200 vehicles per hour.
9. Implications of changing TM

9.1 Implications of removing TM

The PRISM modelling which was undertaken at the optioneering stage showed that without the additional TM at M6 J8 and M5 J4a then the area around the works would become oversaturated with traffic and this increased volume would lead to flow breakdown in and around the M5 at Oldbury.

Removing any single part of the TM would be to weaken the overall strategy. All aspects of the TM have been designed to reduce the flow of traffic on the M5 approaching the works area between J1-2, and provide strategic route alternatives i.e. around the Birmingham box. The individual locations are discussed below

M6 J8 to M5

The removal of the lane restriction at M6 to M5 Western Arm could lead to an extra 20% of traffic on the M5 southbound approaching M5 J1. The vicinity of J1 (both local and strategic networks) is saturated under the current level of traffic for significant periods of the day.

With the removal of all the TM it is likely that flows will return to similar levels and the restrictions at M5 J1 and J2 will be particularly heavily hit. Consequently this will lead to more vehicles attempting to leave the M5 at these junctions putting significant pressure on the immediate road network around each junction. In addition the queues on the mainline M5 would have the potential to impact greatly on the M6 and the queueing south on the M5 would potentially impact junctions south of J2.

M5 J4a (M5 northbound)

The lane restriction on the M5 mainline south of M5 J4a has led to a reductions in flow of around 19-20% on the M5 northbound. This has spread the impact of the works to across a wider area but the queues on the M5 at J2, J3 and J4a have been as expected. Without this restriction at M5 J4a, then the first restrictions for traffic would have be at M5J3, which is too late to redirect traffic on the strategic network resulting in major movements off the strategic network onto the local road networks of Birmingham and Dudley local authorities within the WMCA.

M5 J4a (M42 to M5 north link)

The lane restriction on the M42 to M5 northbound link is important to the strategy. It has a small impact on traffic flows, around 100 vehicles in the AM peak and around 50 vehicles in the PM peak was the predicted reduction in the PRISM modelling. In reality the reduction in flow seen at this point has been over 150 vehicles per hour in each peak, in each direction. This reduction is far greater than expected and may be due to drivers wanting to avoid the M5 all together and choosing alternative route in the south Birmingham area, however the restriction on the M42 to M5 northbound link does help to ensure it remains unattractive for drivers to access the M42 at J2 and use the link to the M5 NB and “miss” the restriction at M5 J4A.

Without this restriction, greater numbers of vehicle may opt to join the M42 at J2 and head north on the M5 amplifying the queues at J3 and on in to the works.

The table below considers the main advantages and disadvantages of changes to the traffic management which has been implemented.
<table>
<thead>
<tr>
<th>Location</th>
<th>Change considered</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) M6 J8 to M5 Western Arm</td>
<td>Remove lane restriction on the western arm, returning layout of the merge of western and eastern arms to previous layout.</td>
<td>Removes any impact of the TM on the M6 Mainline</td>
<td>Likely to increase flows towards M5 J1 from the north, possibly by 20%. Increased flow may lead to uncontrolled queues at M5 J1, M5 mainline and potentially M6.</td>
</tr>
<tr>
<td>2) M5 J4a northbound approach</td>
<td>Remove lane restriction on approach to M5 J4a and returning the motorway to the ALR completed layout.</td>
<td>Less queueing at M5 J4a returns M5 to previous layout and capacity</td>
<td>Increased flow towards the works area. Traffic leaving M5 at other junctions, limited strategic management. Increased queueing possible at M5 J2, J3 and J4. Traffic diverting on to local road network. Significant impact on traffic flows in Oldbury area, potentially leading to queues from J2 south towards J3/J4/J4a.</td>
</tr>
<tr>
<td>3) M5 J4a northbound</td>
<td>Extension of lane restriction between diverge and merge of M5 J4a</td>
<td>Allows for greater control of traffic speeds. Allows for speed enforcement. Has little or no additional impact on queueing.</td>
<td>Extends the lane restriction which may frustrate drivers. May lead to abuse of hard shoulder (but that has to date not been an issue).</td>
</tr>
<tr>
<td>4) M5 J4a (M42 to M5 northbound link)</td>
<td>Remove the lane restriction</td>
<td>Would work well with 2) above. Reduces need for speed enforcement. Returns link to former layout.</td>
<td>Increased flow on to M5 northbound</td>
</tr>
</tbody>
</table>

Table 2: Summary of advantages and disadvantages for changing TM arrangements
10. Alterations made to the TM

10.1 Changes across the network

As part of the ongoing review of the Traffic Management many changes have occurred to refine how the TM is working. This includes signing, lining and coning. Each location is considered below.

M6 J8 to M5

Generally the lane restriction on the western arm has worked well. However, additional signing has been used to help address an issue with vehicles moving to lane 2 too early. As drivers became aware of the changes many vehicles were only using lane 2 or moving into lane 2 very early (ie around the 600 yards sign) and this led to a reduction in queueing space on the western arm and a greater impact on the M6 mainline. Signs stating “merge in turn” have been used to encourage greater use of lane 1 and this has had a good impact.

M5 J4a

There have been a number of changes on the M5 northbound approach to Junction 4a. Firstly the signing on the approaches have been extended to highlight the restriction ahead. The signing was then intensified with lane destination information.

Due to the number of late lane changes which were observed over a significant period, cylinders were used to encourage greater lane discipline. These were put along the centre line for a distance of 100m. These have been removed, after a considerable number of the cylinders were taken out by errant vehicles. The issue of late lane changing is still ongoing and so changes are being furthered considered which will implement a “tiger tail” 1.2m wide lined separation for a distance of around 100m. It is hoped that this will discourage the lane changing.

Following observation by the RCC, it appears there is some misuse of the hard shoulder at the M5 / M42 Diverge, especially in wet conditions. It has been proposed to implement cylinders at 18m intervals which will highlight the carriageway extent whilst still providing space for vehicles to access the hard shoulder.

The actual lane restriction at M5 J4a is approximately 300m in lengths before the carriageway opens out to two lanes. With the M42 to M5 northbound link joining under a 50MPH speed limit, it is important to control speed limits in this area. Removing the M42 to M5 restriction has been considered, but as seen above, this is having an impact on flows and is benefitting the overall strategy. Following further discussions between BMV and the Police an extension to the restriction would be possible, but should not be undertaken at the current time. Further monitoring of this will inform the longer term strategy.

Sandwell MBC

Within Sandwell metropolitan borough area a number of variable message signs have been implemented to highlight the works and additional delays / traffic. These have been moved around Oldbury in order to retain a degree of newness and therefore maintain public interest in them.
**Worcestershire County Council**

WCC have requested a review of the M5 J5 northbound off-slip, with a view to extending the two lane section at the end. The two lane section is approximately 45m in length on the immediate approach to the traffic signals. This review is currently being undertaken.

**Dudley MBC**

Dudley MBC have requested that lane 1 of the A456 Eastbound on the local network is dedicated to M5 north traffic. In the immediate approach to the junction this arrangement is both lined and signed, with A456 Birmingham and M5 south traffic in lane 2. It is proposed to supply temporary (black on yellow) signs highlighting this from around half a mile and quarter of a mile from the M5 J3.
11. Conclusions

11.1 Conclusions

The TM strategy has been implemented with two clear targets, a) reduce traffic flow at M5 J1 to J2 and b) rebalance traffic flows across a wider area to reduce the impact locally. This review demonstrates that the measures are working safely and successfully.

The additional measures have encouraged drivers to consider alternative routes and avoid the M5 through the works area. There is a reduction of traffic on the M5 and the M42 but the balance has also changed with more traffic using the M42 than the M5 northbound at M5 J4a.

The average journey time from M5 J5 to J4a has been 13 minutes, a delay of around 7 minutes during peak times. The technology installed through the smart motorways programme on the M5 from J4a to J6 have increased capacity on the M5 and also provided additional measures to control and manage traffic on the approach to the additional TM. The technology has also been used for queue detection and protection. In general delays on the approach to M5 J4a have been 1 minute greater than last year during the smart motorways works.

There have been delays on the M6 to M5 link but these have been well within expectations and reduced flows southbound through the works by approximately 30%. The impact on the M6 mainline has been limited to peak times and during periods where incidents have occurred. Flows around the strategic diversion route to the east of the “Birmingham Box” have been within 5% of expectations.

Overall the strategy has aligned well with what was expected from the results of the PRISM modelling.

There have been over 340 incidents dealt with by recovery, but collisions have totalled 22 across the TM, much lower than other roadworks schemes. Whilst there has been increased traffic on the local network, it has not lead to gridlock at the current time. Across the wider area there have been increases in traffic but generally this has been on principal roads.
Appendix A

Birmingham Box comparison
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