

Highways Agency
Temple Quay House
2 The Square
Temple Quay
Bristol
BS1 6HA

M42 ATM Monitoring and Evaluation Project Summary Report

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Mott MacDonald
Stoneham Place
Stoneham Lane
Southampton
Hampshire
SO50 9NW
UK

Tel: 44 (0) 23 8062 8800
Fax: 44 (0) 23 8062 8801


Mott MacDonald

M42 ATM Monitoring and Evaluation Project Summary Report

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1 Introduction

The purpose of this report is to act as a reference document for the work that has been carried out on the M42 Active Traffic Management (ATM) Monitoring and Evaluation Project. The report also summarises the main benefits of the project and identifies the lessons learnt. This report is also available as an interactive document, which forms an archive of the main documents produced on the project in an interactive format to enable easy access to all the salient parts.

1.1 Structure of Report

This report includes several chapters; each addresses a specific aspect of the ATM Monitoring and Evaluation project:

- 1- **Introduction:** This describes the purpose of the document and report structure.
- 2- **M42 ATM Pilot Overview:** Contains the background to ATM, the Operational Regimes, infrastructure and Area of Study.
- 3- **Approach:** This section describes the data sources and methodology.
- 4- **Results:** This presents the results from the 12 month 4-Lane Variable Mandatory Speed Limits (4L-VMSL) ATM report and further analysis.
- 5- **Benefits of the Project:** This section describes the benefits that were gained from undertaking the project.
- 6- **Lessons Learnt:** Explains the lessons that have been learnt from the project. These are useful for any other Monitoring and Evaluation project that may be undertaken in the future.
- 7- **How has the concept of ATM progressed:** This summarises how ATM has influenced government strategy on transport regarding rolling out the Managed Motorways programme.
- 8- **The Future:** Future development of the M42 ATM section is explained in this chapter.
- 9- **References:** A list of references used to produce this report can be found here. Where the 12 month 4L-VMSL report is referenced (Reference 2); it includes a section reference. This refers to the relevant section in that report.
- 10- **Contacts:** This chapter gives contact details of the Project Manager and Project Director for ATM Monitoring and Evaluation within Mott MacDonald. It also includes contact details of the current HA Project Sponsor.

2 M42 ATM Pilot Overview

2.1 What is Active Traffic Management?

The Government's "Ten Year Plan", published in 2000, pledged £180 billion to modernise Britain's transport system. This is being spent on public transport, railways and roads infrastructure.

The Highways Agency has been tasked to develop its role as a network operator by implementing traffic management, network control and other measures aimed at:

- Making best use of existing infrastructure.
- Responding faster to incidents and reducing clear up times.
- Reducing congestion, increasing reliability of journey times and providing safer roads.

Active Traffic Management has been introduced as a key deliverable against the above requirements. It aims to tackle congestion by introducing new technology along with innovative solutions to make best use of the existing road space. To do this ATM uses variable mandatory speed limits and variable message signs to maximise traffic throughput through busy sections. By utilising these technologies, it enables the dynamic operation of hard shoulder running during congested and incident periods.

In order to measure the effectiveness of ATM, a monitoring and evaluation contract was let by the Highways Agency to Mott MacDonald Ltd. The core of this was to assess the impact of ATM through a number of traffic performance indicators, which were developed and agreed with the project stakeholders *[Ref. 1]*.

2.2 M42 Area of Study

ATM has been constructed on the M42 between Junctions 3A and 7, which is shown in **Figure 2.1**. A combination of long distance and local traffic makes the M42 section between J3A and J7 one of the busiest motorways in the UK, forming part of a major strategic route, which allows traffic to connect between the South and the North of England.



Figure 2.1: 17km¹ of ATM are now installed on the M42 Motorway in the West Midlands south-east of Birmingham.

Three junctions located within the M42-ATM section allow for local traffic to use part of the section to reach their destinations. This is particularly true at Junction 6, which provides the main link between Birmingham International Airport and the motorway network, as well as being the main junction allowing access to the National Exhibition Centre (NEC).

Since the beginning of the ATM monitoring and evaluation project in 2002, there have been a number of infrastructure changes within the study area. These changes in the study area include:

- A period of construction for a large amount of infrastructure associated with ATM.
- Developments at Birmingham International Airport and at the Business Parks near to the M42.

¹ The section lengths defined in the figure are link lengths and are not inclusive of the distance between slip roads.

- The M6 Toll opening in 2004. The M42-ATM section is the main arterial motorway to accommodate the traffic travelling from the M40, and the southern part of the 'Birmingham motorway box', toward the M6-Toll motorway.

All of these, to varying degrees, have had an effect on the operation of the M42-ATM section.

2.3 ATM Operational Regimes

ATM uses the following Operational Regimes (ORs) to manage motorway traffic:

- **3-Lane Variable Mandatory Speed Limits (3L-VMSL):** This OR uses variable mandatory speed limits to maintain flow through heavily congested sections of the motorway. 3L-VMSL operates automatically, although network operators are able to intervene with the operation if necessary.
- **4-Lane Variable Mandatory Speed Limits (4L-VMSL):** This OR uses variable mandatory speed limits, **as well as the hard shoulder**, to manage the traffic on the motorway. The hard shoulder can only operate as a running lane for traffic when the operators in the West Midlands Regional Control Centre (WMRCC) are confident that the lane is safe to open. Once the check is complete, the hard shoulder is opened up and a mandatory speed limit of 60 mph or less is activated.

When 4L-VMSL originally began operation in 2006, the maximum allowed speed limit during Hard Shoulder Running (HSR) was 50 mph. In March 2008 the limit was increased to 60 mph during HSR.

- **Ramp Metering:** Implemented on the M42-ATM section to address the problem of flow breakdown at merging sections, caused by congestion during busy periods when the motorway is near its capacity. Ramp metering (RM) aims to maximise throughput on the main carriageway, without disrupting the local road network. It does this by using traffic signals to control the discharge of traffic from the slip road to reduce the flow breakdown caused by merging traffic with the main carriageway. RM is currently implemented on Junctions 4, 5 and 6 in both directions on the M42-ATM section.

2.4 ATM Infrastructure



Figure 2.2: Existing and additional technologies required for ATM on the M42.

ATM uses many existing and established motorway technologies including CCTV, emergency phones and road sensors. However, additional technologies are needed for the operation of ATM including:

Lightweight Gantries – with the ability to hold signs showing internationally recognised pictograms.

Highways Agency Digital Enforcement Camera System (HADECS) – purpose built enforcement cameras to enforce the mandatory speed limits.

Emergency Refuge Areas (ERAs) – safe areas away from the traffic for use in the event of a breakdown or emergency. They are wider than the hard shoulder to provide additional safety and are connected to the Highways Agency (HA) regional control centre in nearby Quinton by both CCTV cameras and emergency roadside telephones so that vehicles can be detected when they enter the ERA.

Emergency Roadside Telephones – situated in every emergency refuge area and offering a direct link to the HA regional control centre.

Sensors – are buried in the road surface to measure the general speed and flow of traffic. The sensors are used, via a computer system called MIDAS (Motorway Incident Detection and Automatic Signalling), to automatically set the most appropriate speed limit for current traffic conditions.

2.5 Timeline of Activities

Table 2.1 shows the ORs implemented over the lifetime of the project.

Operational Regime	Dates
NO-VSL	March 2002 – February 2003 (12 months)
3L-MVSL	December 2005 – August 2006 (9 months)
4L-MVSL (HSR50)	September 2006 – March 2008 (19 months)
4L-MVSL (HSR60)	March 2008 - ongoing
Ramp Metering	October 2008 - ongoing

Table 2.1: Duration of ORs on the M42-ATM section

3 Approach

3.1 Data Sources

The data sources used by the evaluation of ATM include:

- MIDAS Loop Data;
- Individual Vehicle Data (IVD);
- National Traffic Statistics;
- STATS 19 Accident Data;
- Weather Information;
- NEC Table of Events;
- NTCC Data;
- HALOGEN;
- Local Traffic Counts;
- CCTV Footage;
- Automatic Number Plate Recognition (ANPR) Data;
- Instrumented Vehicle Data (for vehicle emissions testing);
- Pollution Measurement Sensors;
- Noise Data;
- User Consultation.

Data was collected for specified time periods throughout the project as was necessary to complete the analysis with the exception of specialist data which was more selective (i.e. pollution, noise, consultation, CCTV and IVD). [See **Section 2.2.1 in Ref. 2**]

3.2 Methodology

To assess the impact of ATM, a comparison between 'Before' and 'After' data was carried out.

Figure 3.1 shows the general structure for the methodology used by the project.

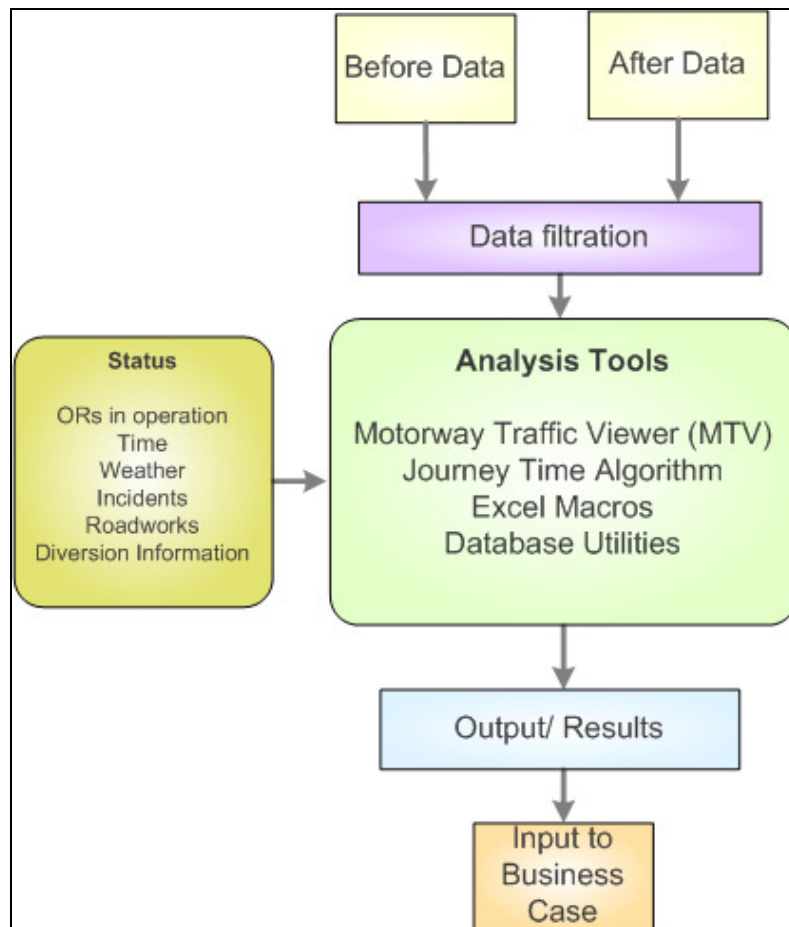


Figure 3.1: High level overview of the Analysis Methodology developed by Mott MacDonald

Raw traffic related data was subjected to a filtration process to exclude days with incidents, unusual traffic conditions and inappropriate operation of 4L-VMSL due to technical faults.

Primary Indicators (**Table 3.1**) were used to quantify the impact of ATM based on the project objectives agreed with the Highways Agency. Results and interpretations from Primary Indicators were supported by evidence from Secondary Indicators (See **Table 3.2**).

Primary indicators	Secondary indicators
Throughput and peak throughput	Speed differential between lanes
Average journey times	Duration of speed less than x mph
Variability in journey times	Frequency of speed less than x mph
Speed limit compliance	Flow/speed plots
Number & severity of accidents	HGV percentage
Noise	Lane utilisation
Emissions and air quality	Headway distribution
User consultation	Vehicle speed distribution
	Vehicle hour delay

Table 3.1: Indicators used for traffic analysis of ATM.

Secondary Indicators	Primary Indicators					
	Journey Time	Throughput	Compliance	Safety	Emissions	Noise
Speed Differential Between Lanes				X		
Time periods of Speed less than X	X					
Frequency of Speed less than X	X				X	
Flow/Speed Relationship	X	X				
Percentage of HGVs	X	X			X	X
Lane Utilisation percentage		X		X		
Headway Distribution		X				
Speed Distribution			X	X		X
Vehicle Hour Delay	X	X				

Table 3.2: The relationship between Primary and Secondary Indicators²

For a valid evaluation, the assessed periods had to be comparable (with regard to seasonality and sample size) so that the conclusions reached were both accurate and representative.

Expert panel meetings were held at key milestones during the project. The aims of these meetings were to provide advice and recommendations on the way forward following the delivery of a key milestone. In total six expert panel meetings were held over the lifetime of the project.

² Cells highlighted in blue represent a link between the primary indicators in the identified column and the secondary indicators in the specified row.

Participants in these meetings were representatives of the main stakeholders (i.e. Highways Agency, Managing Consultant, Evaluation Consultants and the DfT) as well as academic and technical experts. The participating experts differed between meetings according to the main subject discussed. The minutes from these meetings were distributed to all participants and agreed actions were taken on board by updating the project plan.

These meetings helped in the interpretation of results and ensured the correct adaptation of the methodology where necessary. Although these meetings were infrequent, they proved to add real value to the quality of the work produced.

4 Results

Over the lifetime of the project several deliverables were produced. Each deliverable provided key conclusions and recommendations which were relevant to the progress of the project. In this section, the focus is on the impact of hard shoulder running which is the main benefit of ATM.

4.1 HSR50 – 12 Month Report Results

Table 4.1 identifies the key results from the 12 month report for ATM. *[Ref. 2]*.

Traffic Indicators	Results
Capacity	<p>Observed capacity increased under 4L-VMSL operation by an average of 7-9%.</p> <p>Traffic growth between the NO-VSL and 4L-VMSL cases is in line with national motorway traffic growth.</p> <p>4L-VMSL delivers consistent, measurable benefits, supported by user consultation that has shown that an extra 7% of users encountered no congestion on the M42-ATM section in 2007 compared to 2003.</p> <p><i>[See Section 3.7 in Ref. 2]</i></p>
Average and Variability of Journey Times	<p>4L-VMSL reduces average journey times by up to 24% in the northbound direction and 9% in the southbound direction.</p> <p>Drivers are now able to better predict their journey times with a 22% reduction in the variability of journey times.</p> <p>Under 4L-VMSL journey times have remained consistent between seasons.</p> <p><i>[See Section 4.4 in Ref. 2]</i></p>
Compliance	<p>Speed Compliance on the main carriageway has, on average, been 94% or better at 70 mph, 60 mph and 50mph speed limits.</p> <p>The compliance on the hard shoulder was on average 97% or better at 50 mph and 93% or better at the 40 mph speed limit between September 2006 and September 2007.</p> <p><i>[See Section 5 in Ref. 2]</i></p>

Traffic Indicators	Results
Safety	<p>4L-VMSL has smoothed traffic operation and potentially reduced driver's workload.</p> <p>Although the monitoring period is too short to give conclusive evidence in terms of road safety, initial observed results are encouraging with the average number of Personal Injury Accidents (PIA) having reduced from 5.08 per month to 1.83 per month.</p> <p><i>[See Section 6.5 in Ref. 2]</i></p>
Noise	<p>Minor reduction in noise levels have been observed with an estimate of between 1.8 to 2.4 dB (A).</p> <p><i>[See Section 7.3 in Ref. 2]</i></p>
Vehicle Emissions and Air Quality	<p>The overall isolated effects of ATM on emissions from all vehicles were:</p> <ul style="list-style-type: none"> Carbon-monoxide (CO) reduced by 4% Particulate Matter (PM) reduced by 10% Hydrocarbons (HC) increased by 3% Carbon-dioxide (CO₂) reduced by 4% Oxides of Nitrogen (NO_x) reduced by 5% Fuel consumption reduced by 4% <p>The reductions in emissions are similar to those obtained from two studies of the impact of variable speed limits on the M25. These results are based on normalised data to give equivalent traffic flows between the 'Before' and 'After' cases.</p> <p><i>[See Section 8.4 in Ref. 2]</i></p>
User Consultation Surveys	<p>The results from user consultation surveys demonstrate ATM has proved to be a success for users.</p> <p>In 2007, 30% of long distance users thought the M42 was better or much better than other UK motorways, compared to 16% in 2003. This shows a marked improvement in perceptions of the M42 for long distance users.</p> <p><i>[See Section 9.9 in Ref. 2]</i></p>

Table 4.1: Key Results from the 12 month ATM report.

For a comprehensive list of reports produced, please see **Appendix A**.

A list of Presentations and Papers produced are shown in **Appendix B**.

4.2 Hard Shoulder Running at 60 mph

Since the evening peak period on 15th October 2008, Hard Shoulder Running with variable mandatory speed limits up to 60 mph (HSR60) has been in operation on all links of the M42-ATM section. By comparing HSR50 with HSR60, the data has shown that:

- HSR60 reduces average journey time on the M42-ATM section by 4% when compared to HSR50.
- An increase in the variability of journey times has been observed on some days as expected, as HSR60 is able to utilise more speed limits.
- HSR60 gives a better level of service compared to HSR50.
- HSR60 has increased average traffic speed by 5 mph.
- Speed limit compliance remained consistent for both HSR50 and HSR60 cases.
- The overall impression from RCC Operators was that they were content that HSR60 performed as well as was expected, and did not lead to an increase in incidents, or poor driver behaviour. **[Ref. 3]**.

4.3 Ramp Metering

Since October 2008, Ramp Metering has been operational on six sites of the M42-ATM (J4, J5 and J6 in both directions).

Available data has been filtered using criteria similar, but not identical, to those of the Highways Agency 'standard' approach.

In general, there are indications of benefits between 'Before' and 'After' cases including:

- reduced average journey time;
- reduced ramp flow;
- increased upstream flow;
- saving in VHD.

These benefits should, however, be considered in view of the effect of HSR60 operation, together with the availability of a very small number of days when ramp metering was operational. The technical evaluation has shown that the high ramp demand has limited the ramp metering system into a queue management controller, rather than an effective metering system. **[Ref. 4]**.

5 Benefits of the Project

The Monitoring and Evaluation project on the M42 has provided a number of benefits in analysing the way ATM operates:

- The project established a sound approach for monitoring and evaluating ATM/Managed Motorway schemes and similar ITS applications.
- The project gathered a large amount of data which can be used to support the academic community on research relating to motorway operation.
- The project has helped to understand the safety impact of ATM/Managed Motorways.
- The project has helped raise the profile of the HA through publication of several technical papers at a number of well known international conferences.
- The project has demonstrated the feasibility of developing tools to support evaluation of future schemes.
- The project responded rapidly to a wide variety of ad hoc requests from a range of sources to support the broader objectives of the HA.
- The Monitoring and Evaluation project provided the evidence required to support the business case for ATM/Managed Motorways.
- The results have shown that ATM/Managed Motorways, at some locations, offers a real alternative to motorway widening schemes at a lower cost.
- Mott MacDonald's 12 month 4L-VMSL report was used by both the HA and DfT to inform government ministers of the benefits of ATM. Following this a decision was made to proceed with the Managed Motorways programme.

6 Lessons Learnt

The M42-ATM Monitoring and Evaluation project has been running successfully since 2002. The experiences gained over the lifetime of the project have enriched the understanding of motorway operation and how best to utilise ATM/Managed Motorways. Several lessons have been learnt through the project's life. These are explained below:

- Before the monitoring and evaluation project, MIDAS had mainly been used as a safety and signalling system. It soon became apparent that MIDAS loops could be used to support monitoring and evaluation activities, and has since become the main backbone for data analysis. Maintenance of MIDAS loops is therefore crucial for any monitoring and evaluation type project.
- Weather data for this project was not available close to the site. Where possible, weather data should be collected from a nearby HA weather monitoring station.
- Monitoring of noise and emissions is affected by global changes in environment. Although these factors are small, they need to be considered as they may impact the results.
- The capacity gained from HSR is affected by many contributing factors including location, situation, traffic composition and signage. These factors need to be considered within any assessment of capacity.
- When considering Ramp Metering, the use of the Log Data produced by the system is vital for the evaluation of this system.
- The standard approach to ramp metering needs to be reviewed to accommodate the effect of HSR.
- Compliance with the higher speed limits has remained good on the M42-ATM section. However, compliance with the 40 mph speed limit has fluctuated. This is due to a number of factors, mainly road works. Compliance with VMSL should be monitored over a long period.
- It was found that presenting analysis results in a monthly report format can provide a misleading picture, as the results are based on small data sets. It is recommended that in future assessments of similar ITS applications, results are presented in 5 reports: The first being a Day 1 observational report to review the first's day operation of a new scheme. The second, a 1 month report to assess the initial results and impact of the system. The third, a 3 month report to review the monitoring plan. The fourth, a 6 month report to provide a full evaluation. The fifth, a 12 month report to show the effects of seasonality on the system and the understanding factors associated with ATM to inform the evaluation.

- Modelling was found to be useful in understanding the factors associated with the ITS applications. However, it must be stressed that modelling is an estimation tool only and it is not a replacement for site data surveys and traffic analysis.
- For robust and comprehensive analysis it is important that the monitoring and evaluation team receive information on all aspects of the project, especially on construction and traffic management schedules.
- Operational reports from the RCC and Managing Consultant were very useful for the data filtration process.
- Forming an expert panel as a steering group to help direct the Monitoring and Evaluation project proved invaluable.
- Safety assessments require at least 3 years worth of data before a sound conclusion can be reached.
- HALOGEN data was found to be critical for the evaluation of ATM.
- MTV was found to be a very useful tool, both the online Web Application and Version 2 of the stand alone software.
- Although the Journey Time Algorithm (JTA) was found to be a viable alternative to ANPR for estimation of journey times, it is essential for future schemes to have a generic JTA tool.

In conclusion, Monitoring and Evaluation is an essential part of all future pilot schemes, as the cost of monitoring and evaluation is relatively small, but of great potential benefit to large and costly schemes.

7 How has the concept of ATM progressed?

The results obtained from the M42 ATM Monitoring and Evaluation project completed by Mott MacDonald have proved that the initial concept of using the hard shoulder as a running lane has worked. Following the delivery of the 12 month report, the HA and DfT reviewed the business case for motorway widening schemes. Following this review, the Secretary of State for Transport, the Rt Hon Geoff Hoon MP, made the following speech to the House of Commons on 15th January 2009 regarding Britain's Transport Infrastructure.

"Motorways are essential for enabling people and goods to move around the country.

Successful trials on the M42 have enabled us safely to open up motorway hard shoulders in peak periods, delivering more reliable journey times and adding a third more capacity at peak times. All delivered at a lower cost than a more conventional road widening scheme.

After further detailed work, I can announce today a programme of up to £6 billion which includes applying these techniques to some of the most congested parts of the M1, M25, M6, M62, the M3 and M4 approaching London, and the motorways around Manchester, Birmingham and Bristol.

This is the first step in our strategy to provide for managed motorways across the core of the motorway network linking our major cities over the next 10-15 years, reducing congestion with fewer environmental impacts than with conventional motorway widening." [Ref. 5].

8 The Future

8.1 Further Work on the ATM Pilot Scheme

As part of a range of measures that are being applied to the M42-ATM section, the HA is constructing a Through Junction Running (TJR) scheme at J5 of the M42 Southbound and at J10 of the M6 both Northbound and Southbound. TJR is scheduled to become operational on the M42 at J5 late in 2009, and on the M6 at J10 late in 2010 or early in 2011.

Currently on the M42-ATM section, HSR is set up to act as a dedicated off-slip i.e. traffic using the hard shoulder is fed onto the slip road at the downstream junction. The operation of TJR will enable traffic on the hard shoulder to travel through the junction onto the downstream link without the need to change lane. Therefore, the overarching aim of TJR is to increase the utilisation of the hard shoulder and potentially increase throughput on the motorway. *[Ref. 6].*

8.2 Managed Motorways

Following on from the delivery of the 12 month report the HA and DfT reviewed the business case for widening schemes versus ATM schemes and the following reports were published by the HA and DfT.

- Advanced Motorway Signalling and Traffic Management Feasibility Study (ATM feasibility study) published in March 2008.
- Interim Advice Note 111/08, Managed Motorway Implementation Guidance, Dynamic Use of the Hard Shoulder Running, Version 1, May 2008.
- Interim Advice Note 112/08, Managed Motorway Implementation Guidance, Through Junction Hard Shoulder Running, Version 1, May 2008.
- Delivering Choice and Reliability, our Command Paper published in July 2008.
- Delivering a Sustainable Transport System in November 2008.
- Britain's Transport Infrastructure, Motorways and Major Trunk Roads in January 2009.

The above reports are published on the Highways Agency and DfT websites (www.highways.gov.uk and www.dft.gov.uk).

The 'Managed Motorways' concept will be applied across key parts of the network throughout England as follows:

- Future schemes will be implemented with a maximum speed limit of 60 mph during HSR, as is currently the practice on the M42-ATM scheme. *[Ref. 3].*
- The design for future schemes may be developed to allow the hard shoulder to be opened up for TJR.
- The spacing of gantries for the roll out of the managed motorways programme is under review, with a view to increasing the nominal spacing from 500m.

- The spacing of ERAs for the roll out of the managed motorways programme is being increased from a spacing of 500m on the M42 to approximately 800m.

9 References

- 1 Van Vuren, T., Poole, A., Meekums, R., 2004. *M42 Active Traffic Management Monitoring Project: Assessment Methodology Report V3*. [PDF] Mott MacDonald.
- 2 Sultan, B., Poole, A., Meekums, R. and Potter, R. 2008. *ATM Monitoring and Evaluation: 4-Lane Variable Mandatory Speed Limits, 12 Month Report (Primary and Secondary Indicators)*. [PDF] Mott MacDonald (Published by the Department of Transport, July 2008).
- 3 Ogawa, MJ. 2009. *M42 ATM Monitoring and Evaluation: 4-Lane Variable Mandatory Speed Limits, HSR60 6 Month Operation Report*. [PDF] Mott MacDonald.
- 4 Elliott, G., Sultan, B., 2009. *M42 ATM Monitoring and Evaluation: Ramp Metering Evaluation*. [PDF] Mott MacDonald.
- 5 Quotation from Former Secretary of State for Transport the Rt Hon Geoff Hoon MP 15th January 2009. This speech can be found on the DfT website:
http://www.dft.gov.uk/press/speechesstatements/speechesstatesformerministers/geoffhoo n?view=Alt_1
- 6 Sultan, B., 2009. *TN091 Through Junction Running, Analysis Methodology*. [PDF] Mott MacDonald.

10 Contacts

For further information regarding the M42 Active Traffic Management Scheme then please contact the following:

Steve Self
Senior Traffic Technology Officer
HA Project Sponsor
Tel: 0117 372 8328
Email: steve.self@highways.gsi.gov.uk

Highways Agency
Temple Quay House
2 The Square
Temple Quay
Bristol
BS1 6HA
www.highways.gov.uk

Andrew Arlow
Project Manager
Tel: 0238 062 8584
Email: andrew.arlow@mottmac.com

Mott MacDonald
Stoneham Place
Stoneham Lane
Southampton
Hampshire
SO50 9NW
www.transporttech.mottmac.com
www.mottmac.com

Bob Meekums
Project Director
Tel: 0238 062 8730
Email: bob.meekums@mottmac.com

Appendix A Key Project Deliverables

Title	Description	Reference
Data Collection Methodology Report - February 2003	This document presents the data collection methodology for the M42 ATM "Before" and "After" Monitoring Project.	203754_MM_002
Assessment Methodology Report V3 – September 2004	This report forms the third version of the analysis methodology report for the assessment of the M42 ATM project.	203754_MM_003_V3 42691/DOC/1803
Before Noise Report – October 2004	This report presents the noise data collected during the summer and winter 'before' surveys and aims to determine whether there is a difference in the datasets.	MM_004_V1 Issue 2 42691/DOC/1804/V1
Traffic Conditions on the M42 J3a-J7 Nov 2002 to Oct 2003 – December 2004	The objective of the report was to examine the traffic conditions on the M42 Junction 3a to Junction 7 for the period November 2002 to October 2003.	203754_MM_007_V1 DOC/1807/V1
Environmental Assessment – March 2005	This report provides an initial appraisal of the vehicle emissions and air pollution assessments undertaken as part of baseline assessment of the M42 ATM project.	203754_MM_005_V1 DOC/1805/V1
Road Safety 'Before' Report – May 2005	This report describes the 'Before' situation of the M42 Junctions 3a to 7 in terms of road safety prior to the start of construction of the ATM.	203754_MM_006_V1 B 42691/DOC/1806_V1
Consultation with M42 users and people living near the M42 – July 2004	This report sets out the results of consultation for the M42 ATM monitoring project.	203754_MM_008a_V1
3-Lane Mandatory Variable Speed Limits 6 month Report – November 2006	This report investigates the impact of 3L-MVSL-OR on motorway operation by undertaking a detailed assessment of the changes in traffic characteristics between the 'Before' and 'After' cases.	203754_MM_007_V2 DOC/1807/V2

Title	Description	Reference
Examination of Noise Impacts: Final Report – August 2007	This report presents the results from the ‘After’ noise survey, carried out at the same locations where noise levels were monitored during the ‘Before’ surveys.	203754_MM_004_V2 DOC/1804/V2
4-Lane Variable Mandatory Speed Limits 6 month Report (Primary & Secondary Indicators) – October 2007	In this report, the performance of 4L-VMSL over the period between October 2006 and April 2007 is assessed against NO-VSL, whilst its performance over the period between January and April 2007 is assessed against 3L-VMSL.	203754_MM_007_V2b DOC/1807/V2b
Vehicle Emissions and Air Pollution Impacts – November 2007	This report assesses the vehicle emissions and pollution impact after running 4L-VMSL.	203754_MM_005_V2 DOC/1805/V2
Consultation with Local Users, Local Non-Users and Long Distance Users – November 2007	The main objective of this document is to report on the current perceptions from drivers about ATM, now that it is in place.	203754_MM_008_V2 DOC/1808/V2
4-Lane Variable Mandatory Speed Limits 12 month Report (Primary & Secondary Indicators) – June 2008	In this report, the performance of 4L-VMSL is assessed between October 2006 and September 2007. The period between October 2006 and September 2007 is assessed against NO-VSL, whilst its performance over the period between January and August 2007 is assessed against 3L-VMSL.	203754_MM_007_V3 DOC/1807/V3
12 Month Safety Review – September 2008	This report reviews the first 12 months of Personal Injury Accident (PIA) data during 4L-VMSL operation and compares the results against the period of 3L-VMSL operation and the M42 prior to the implementation of ATM.	203754_MM_006_V3
4-Lane Variable Mandatory Speed Limits HSR60 6 Month Operation Report – August 2009	This report provides an assessment of traffic conditions during HSR60 operation between 16th October 2008 and 30th April 2009 (this represents 6 months of typical operation)	251507/010/A

Title	Description	Reference
Ramp Metering Evaluation Report – August 2009	This report presents the findings and conclusions of an impact assessment for ramp metering on the M42-ATM section.	251507/011/A

Appendix B Presentations and Papers

Numerous papers and presentations have been given throughout the ATM project. Below is a selection of the main ones:

Evaluating the Impact of Active Traffic Management on Motorway Operation - A paper written for *The Institution of Engineering and Technology (IET)*

B. Sultan³, R. Meekums³, M. Brown⁴ and D. Grant⁴

Influence of Active Traffic Management on traffic noise from high speed roads – Inter-Noise 2007, Istanbul

P. Abbott⁵, P. Morgan⁵, C. Bird⁴ and R. Potter³

Active Traffic Management – Progress of the Before and After Monitoring Project – ITS UK, April 2005

R. Meekums³, R. Stewart⁴ and J. White⁴

Active Traffic Management – Progress of the Before and After Monitoring Project – ITS World Congress 2005, San Francisco

R. Meekums³, R. Stewart⁴ and J. White⁴

Active Traffic Management Interim Results of the Before and After Monitoring Project – ITS World Congress 2006, London

R. Meekums³ and J. White⁴

M42 Active Traffic Management Pilot Project – Interim Results – ITS World Congress 2007, Beijing

R. Meekums³, M. Freeman⁶, C. Bird⁴ and J. White⁴

M42 Active Traffic Management Pilot Project –12 Month Results - ITS World Congress 2008, New York

R. Meekums³, B. Sultan³, R. Potter³, M. Brown⁴ and D. Grant⁴

³ Mott MacDonald

⁴ Highways Agency (HA)

⁵ Transport Research Laboratory (TRL)

⁶ Transport and Travel Research (TTR)