
Project: **M11 Junctions 6 to 8 Improvements
(Managed Motorways – Dynamic Use of Hard Shoulder)**

Subject: **Revised DfT Airport Passenger Forecasts – Additional Sensitivity Tests**

Date of Issue: **Revision 1 - 20th March 2009**

1 Introduction

- 1.1 The 2001 London and South Midlands Multi Modal Study and the 2003 Air Transport White Paper identified forecast future capacity issues with the M11 between Junctions 6 and 8. The Highways Agency subsequently examined proposals for capacity improvements between 2004 and 2008.
- 1.2 On 3rd March 2008 the Secretary of State announced that the form of capacity improvements to the M11 between Junctions 6 and 8 in the period before 2030 required further assessment. To this end, the M11 Junctions 6 to 8 Improvements (Managed Motorways – Dynamic Use of Hard Shoulder) Options Identification Report (OIR) was prepared and issued in January 2009.
- 1.3 The airport growth forecasts used for the OIR were based on BAA forecasts of growth in numbers of passengers and employees at Stansted Airport. These reflected the Stansted Generation (G2) Airport Development proposal as described in BAA's March 2008 SG2 planning application.
- 1.4 In January 2009, the Department for Transport (DfT) published UK Air Passenger Demand forecasts¹. Table 1 shows both the BAA and DfT airport growth forecasts for passengers. A number of sensitivity tests were undertaken in the OIR to provide a comparison of the DfT and BAA airport passenger forecasts in relation to the M11 Junction 6 to 8 Improvements; however, these were limited to the DfT central demand forecasts for 2030.

Table 1 BAA & DfT Airport Growth Forecasts

Forecasts	Demand (mppa)	2003	2015	2021	2030	2036
BAA	G2 Passengers	21.0	38.5	51.0	68.0	68.0
DfT (Central Demand)	G2 Passengers	N/A	36	N/A	70	N/A
	G2 Passengers with Heathrow R3	N/A	36	N/A	56	N/A

- 1.5 This Sensitivity Test document must be read in conjunction with the aforementioned OIR. This document describes the results of a series of additional sensitivity tests undertaken to examine the effects of changes to the transport models and their input assumptions since they were used to inform the OIR.

¹ Department for Transport – UK Air Passenger Demand and CO₂ Forecasts, January 2009

Sensitivity Tests

- 1.6 Given that the DfT G2 forecasts without a third runway at Heathrow Airport (Heathrow R3), are very similar to BAA's forecasts, these are not considered further. However, the DfT G2 forecasts, with Heathrow R3, are significantly different compared to the BAA forecasts, particularly in 2030. These form the focus of this additional set of sensitivity tests.

2 Description of Sensitivity Tests

- 2.1 The following tests, all using DfT's G2 forecasts with Heathrow R3 in 2030, have been carried out as listed in Table 2 and reported in Sections 3 to 7 of this document.

Table 2 Description of Sensitivity Tests

Test	Sensitivity Test Scenario	M11 Junctions 6 to 8 Improvement Scenario
1	M11 Junctions 6 to 8 Do-Minimum. DfT Forecast with Heathrow R3 in 2030	Existing motorway without widening but with planned maintenance and other nearby committed schemes.
2	M11 Junctions 6 to 8 Improvements – Dynamic Use of Hard Shoulder. DfT Forecast with Heathrow R3 in 2030	Hard shoulder running with Active Traffic Management (ATM) and the minimum improvements needed to achieve safe operation.
3	M11 Junctions 6 to 8 Improvements – D4M Widening. DfT Forecast with Heathrow R3 in 2030	Widening to dual four lane motorway including concrete central reserve barrier and minimum acceptable environmental mitigation.
4	M11 Junctions 6 to 8 Do-Minimum without M11 Junctions 8 to14 Improvements and without A120 Braintree to A12 upgrade. DfT Forecast with Heathrow R3 in 2030	Existing motorway without widening but with planned maintenance.

3 M11 Junctions 6 to 8 Do-Minimum Sensitivity Test

- 3.1 This sensitivity test examined the effect of the DfT's G2 forecasts on forecast traffic flows in the Do-Minimum scenario of no improvements between M11 Junctions 6 and 8.
- 3.2 Table 3 and Table 4 show that flows on the M11 between Junctions 6 and 8 in the Do-Minimum scenario are very high in all periods. This is especially so in the morning peak southbound and the evening peak northbound between Junctions 6 and 7.

Table 3 Average September Weekday M11 Traffic Flow Forecasts (2030) (vehicles)

	Northbound	Southbound
Morning Peak		
Junction 7 to Junction 8	5270	5880
Junction 6 to Junction 7	5230	6260
Inter-Peak		
Junction 7 to Junction 8	5220	5130
Junction 6 to Junction 7	5460	5070
Evening Peak		
Junction 7 to Junction 8	5180	4800
Junction 6 to Junction 7	5980	4600

Green – Less than 4275 vehicles (less than 75%)
 Yellow – Between 4275 and 4845 vehicles (75% - 85%)
 Amber – Between 4845 and 5415 vehicles (85% - 95%)
 Red – Greater than 5415 vehicles (greater than 95%)

Table 4 Average September Weekday Volumes/Capacity Ratios (2030)

	Northbound	Southbound
Morning Peak		
Junction 7 to Junction 8	92%	103%
Junction 6 to Junction 7	92%	110%
Inter-Peak		
Junction 7 to Junction 8	92%	90%
Junction 6 to Junction 7	96%	89%
Evening Peak		
Junction 7 to Junction 8	91%	84%
Junction 6 to Junction 7	105%	81%

V/C < 75% Green (i.e. no problem)
 75% < V/C < 85% Yellow (i.e. just below threshold value)
 85% < V/C < 95% Amber (i.e. just above threshold value)
 95% < V/C Red (i.e. serious capacity problem)

Sensitivity Tests

- 3.3 Table 5 indicates that speeds in the Do-Minimum scenario are mainly between 80kph and 90kph which suggests some issues with congestion in all time periods.

Table 5 Average September Weekday Traffic Speed Forecasts (2030) (kph)

	Northbound	Southbound
Morning Peak		
Junction 7 to Junction 8	84	79
Junction 6 to Junction 7	85	90
Inter-Peak		
Junction 7 to Junction 8	85	87
Junction 6 to Junction 7	82	97
Evening Peak		
Junction 7 to Junction 8	85	90
Junction 6 to Junction 7	76	99

Speed > 90kph - Green (no problem)
 90kph > Speed > 80kph - Yellow (just above threshold)
 80kph > Speed > 70kph - Amber (just below threshold)
 70kph > Speed - Red (serious delays)

- 3.4 Table 6 provides a comparison of the M11 Junctions 6 to 8 traffic flows in 2030 with BAA Airport Forecasts against DfT Airport Forecasts. The resulting percentage differences are very small, which indicates that the traffic forecasts are not sensitive to the DfT Airport Forecasts when compared with the BAA Airport Forecasts.

Table 6 Comparison of Do-Minimum with BAA Airport Forecasts against DfT Airport Forecasts (2030) (vehicles)

		Northbound	Southbound
Morning Peak			
Junction 7 to Junction 8	BAA Do-Minimum	5290	5880
	DfT Standard Do-Minimum	5270	5880
	% Difference	-0.4%	0.0%
Junction 6 to Junction 7	BAA Do-Minimum	5250	6250
	DfT Standard Do-Minimum	5230	6260
	% Difference	-0.4%	0.2%
Inter-Peak			
Junction 7 to Junction 8	BAA Do-Minimum	5250	5150
	DfT Standard Do-Minimum	5220	5130
	% Difference	-0.6%	-0.4%
Junction 6 to Junction 7	BAA Do-Minimum	5490	5100
	DfT Standard Do-Minimum	5460	5070
	% Difference	-0.5%	-0.6%
Evening Peak			
Junction 7 to Junction 8	BAA Do-Minimum	5200	4830
	DfT Standard Do-Minimum	5180	4800
	% Difference	-0.4%	-0.6%
Junction 6 to Junction 7	BAA Do-Minimum	6000	4620
	DfT Standard Do-Minimum	5980	4600
	% Difference	-0.3%	-0.4%

4 M11 Junctions 6 to 8 Dynamic Use of Hard Shoulder (DHS) Sensitivity Test

- 4.1 This sensitivity test examined the effect of the DfT's G2 forecasts on forecast traffic flows in the DHS scenario between M11 Junctions 6 and 8.
- 4.2 Table 7 and Table 8 indicate that capacity is increased with the introduction of the DHS which results in more traffic using this section of the M11. However, the road is able to cope much better than in the Do-Minimum scenario due to the provision of an extra lane in each direction.

Table 7 Average September Weekday M11 Traffic Flow Forecasts (2030) (vehicles)

	Northbound	Southbound
Morning Peak		
Junction 7 to Junction 8	5925	6739
Junction 6 to Junction 7	5944	7302
Inter-Peak		
Junction 7 to Junction 8	6019	5637
Junction 6 to Junction 7	6340	5513
Evening Peak		
Junction 7 to Junction 8	5822	5282
Junction 6 to Junction 7	6690	5019

Green – Less than 5700 vehicles (less than 75%)
 Yellow – Between 5700 and 6460 vehicles (75% - 85%)
 Amber – Between 6460 and 7220 vehicles (85% - 95%)
 Red – Greater than 7220 vehicles (greater than 95%)

Table 8 Average September Weekday Volumes/Capacity Ratios (2030)

	Northbound	Southbound
Morning Peak		
Junction 7 to Junction 8	78%	89%
Junction 6 to Junction 7	78%	96%
Inter-Peak		
Junction 7 to Junction 8	79%	74%
Junction 6 to Junction 7	83%	73%
Evening Peak		
Junction 7 to Junction 8	77%	70%
Junction 6 to Junction 7	88%	66%

V/C < 75% Green (i.e. no problem)
 75% < V/C < 85% Yellow (i.e. just below threshold value)
 85% < V/C < 95% Amber (i.e. just above threshold value)
 95% < V/C Red (i.e. serious capacity problem)

- 4.3 Table 9 indicates that traffic speeds increase significantly with the introduction of DHS on the M11 between Junctions 6 and 8.

Table 9 Average September Weekday Traffic Speed Forecasts (2030) (kph)

	Northbound	Southbound
Morning Peak		
Junction 7 to Junction 8	97	90
Junction 6 to Junction 7	94	86
Inter-Peak		
Junction 7 to Junction 8	97	95
Junction 6 to Junction 7	92	95
Evening Peak		
Junction 7 to Junction 8	97	96
Junction 6 to Junction 7	90	97

Speed > 90kph - Green (no problem)
 90kph > Speed > 80kph - Yellow (just above threshold)
 80kph > Speed > 70kph - Amber (just below threshold)
 70kph > Speed - Red (serious delays)

Sensitivity Tests

4.4 Table 10 provides a comparison of the M11 Junctions 6 to 8 traffic flows in 2030 with BAA Airport Forecasts against DfT Airport Forecasts. The resulting percentage differences are very small, which indicates that the traffic forecasts are not sensitive to the DfT Airport Forecasts when compared with the BAA Airport Forecasts.

Table 10 Comparison of DHS with BAA Airport Forecasts against DfT Airport Forecasts (2030) (vehicles)

		Northbound	Southbound
Morning Peak			
Junction 7 to Junction 8	BAA Forecast DHS	5988	6782
	DfT Forecast DHS	5925	6739
	% Difference	-1.1%	-0.6%
Junction 6 to Junction 7	BAA Forecast DHS	6000	7394
	DfT Forecast DHS	5944	7302
	% Difference	-0.9%	-1.2%
Inter-Peak			
Junction 7 to Junction 8	BAA Forecast DHS	6069	5716
	DfT Forecast DHS	6019	5637
	% Difference	-0.8%	-1.4%
Junction 6 to Junction 7	BAA Forecast DHS	6388	5600
	DfT Forecast DHS	6340	5513
	% Difference	-0.7%	-1.6%
Evening Peak			
Junction 7 to Junction 8	BAA Forecast DHS	5871	5344
	DfT Forecast DHS	5822	5282
	% Difference	-0.8%	-1.1%
Junction 6 to Junction 7	BAA Forecast DHS	6725	5067
	DfT Forecast DHS	6690	5019
	% Difference	-0.5%	-1.0%

5 M11 Junctions 6 to 8 Dual Four Lane (D4M) Widening Sensitivity Test

- 5.1 This sensitivity test examined the effect of the DfT's G2 forecasts on forecast traffic flows in the D4M Widening scenario between M11 Junctions 6 and 8.
- 5.2 Table 11 and Table 12 indicate that D4M widening results in more traffic being attracted to the M11 than in the DHS scenario meaning that the flow is closer to capacity; however, congestion is still lower than in the Do-Minimum scenario.

Table 11 Average September Weekday M11 Traffic Flow Forecasts (2030) (vehicles)

	Northbound	Southbound
Morning Peak		
Junction 7 to Junction 8	6052	7026
Junction 6 to Junction 7	6462	8128
Inter-Peak		
Junction 7 to Junction 8	6180	5782
Junction 6 to Junction 7	6607	5709
Evening Peak		
Junction 7 to Junction 8	6472	5295
Junction 6 to Junction 7	7644	5156

Green – Less than 5700 vehicles (less than 75%)
 Yellow – Between 5700 and 6460 vehicles (75% - 85%)
 Amber – Between 6460 and 7220 vehicles (85% - 95%)
 Red – Greater than 7220 vehicles (greater than 95%)

Table 12 Average September Weekday Volumes/Capacity Ratios (2030)

	Northbound	Southbound
Morning Peak		
Junction 7 to Junction 8	80%	92%
Junction 6 to Junction 7	85%	107%
Inter-Peak		
Junction 7 to Junction 8	81%	76%
Junction 6 to Junction 7	87%	75%
Evening Peak		
Junction 7 to Junction 8	85%	70%
Junction 6 to Junction 7	101%	68%

V/C < 75% Green (i.e. no problem)

75% < V/C < 85% Yellow (i.e. just below threshold value)

85% < V/C < 95% Amber (i.e. just above threshold value)

95% < V/C Red (i.e. serious capacity problem)

- 5.3 Table 13 indicates that D4M Widening provides more capacity resulting in increase speeds compared to the Do-Minimum. The extra capacity attracts more additional traffic than in the DHS scenario and so speeds do not increase as much as with DHS.

Table 13 Average September Weekday Traffic Speed Forecasts (2030) (kph)

	Northbound	Southbound
Morning Peak		
Junction 7 to Junction 8	93	87
Junction 6 to Junction 7	90	92
Inter-Peak		
Junction 7 to Junction 8	92	94
Junction 6 to Junction 7	89	99
Evening Peak		
Junction 7 to Junction 8	90	97
Junction 6 to Junction 7	80	101

Speed > 90kph - Green (no problem)

90kph > Speed > 80kph - Yellow (just above threshold)

80kph > Speed > 70kph - Amber (just below threshold)

70kph > Speed - Red (serious delays)

Sensitivity Tests

5.4 Table 14 provides a comparison of the M11 Junctions 6 to 8 traffic flows in 2030 with BAA Airport Forecasts against DfT Airport Forecasts. The resulting percentage differences are very small, which indicates that the traffic forecasts are not sensitive to the DfT Airport Forecasts when compared with the BAA Airport Forecasts.

Table 14 Comparison of D4M assignments with BAA Airport Forecasts against DfT Airport Forecasts (2030)

		Northbound	Southbound
Morning Peak			
Junction 7 to Junction 8	BAA Forecast D4M	6121	7061
	DfT Forecast D4M	6052	7026
	% Difference	-1.1%	-0.5%
Junction 6 to Junction 7	BAA Forecast D4M	6529	8242
	DfT Forecast D4M	6462	8128
	% Difference	-1.0%	-1.4%
Inter-Peak			
Junction 7 to Junction 8	BAA Forecast D4M	6248	5848
	DfT Forecast D4M	6180	5782
	% Difference	-1.1%	-1.1%
Junction 6 to Junction 7	BAA Forecast D4M	6689	5769
	DfT Forecast D4M	6607	5709
	% Difference	-1.2%	-1.0%
Evening Peak			
Junction 7 to Junction 8	BAA Forecast D4M	6524	5381
	DfT Forecast D4M	6472	5295
	% Difference	-0.8%	-1.6%
Junction 6 to Junction 7	BAA Forecast D4M	7703	5242
	DfT Forecast D4M	7644	5156
	% Difference	-0.8%	-1.7%

Sensitivity Tests

6 M11 Junctions 6 to 8 Do Minimum without M11 Junctions 8 to 14 Improvements and without A120 Braintree to A12 upgrade

- 6.1 This sensitivity test examined the effect on M11 Junctions 6 to 8 forecast traffic flows in the scenario that neither the M11 between Junctions 8 and 14 nor the A120 between Braintree and the A12 are improved by 2030.
- 6.2 Table 15 and Table 16 indicate that by removing the assumed improvements to the M11 between Junctions 8 and 14 and the upgrade of the A120 between Braintree and the A12, traffic has rerouted away from Junctions 6-8 of the M11 resulting in a reduction in congestion.

Table 15 Average September Weekday M11 Traffic Flow Forecasts (2030) (vehicles)

	Northbound	Southbound
Morning Peak		
Junction 7 to Junction 8	5080	5590
Junction 6 to Junction 7	5120	6190
Inter-Peak		
Junction 7 to Junction 8	4890	4810
Junction 6 to Junction 7	5230	4840
Evening Peak		
Junction 7 to Junction 8	4940	4550
Junction 6 to Junction 7	5810	4350

Green – Less than 4275 vehicles (less than 75%)

Yellow – Between 4275 and 4845 vehicles (75% - 85%)

Amber – Between 4845 and 5415 vehicles (85% - 95%)

Red – Greater than 5415 vehicles (greater than 95%)

Sensitivity Tests

Table 16 Average September Weekday Volumes/Capacity Ratios (2030)

	Northbound	Southbound
Morning Peak		
Junction 7 to Junction 8	89%	98%
Junction 6 to Junction 7	90%	109%
Inter-Peak		
Junction 7 to Junction 8	86%	84%
Junction 6 to Junction 7	92%	85%
Evening Peak		
Junction 7 to Junction 8	87%	80%
Junction 6 to Junction 7	102%	76%

V/C < 75% Green (i.e. no problem)

75% < V/C < 85% Yellow (i.e. just below threshold value)

85% < V/C < 95% Amber (i.e. just above threshold value)

95% < V/C Red (i.e. serious capacity problem)

- 6.3 Table 17 indicates that speeds increase slightly compared to the Do-Minimum due to the absence of the specified road improvement schemes in the surrounding area.

Table 17 Average September Weekday Traffic Speed Forecasts (2030) (kph)

	Northbound	Southbound
Morning Peak		
Junction 7 to Junction 8	86	82
Junction 6 to Junction 7	86	90
Inter-Peak		
Junction 7 to Junction 8	88	90
Junction 6 to Junction 7	85	98
Evening Peak		
Junction 7 to Junction 8	87	92
Junction 6 to Junction 7	78	100

Speed > 90kph – Green (no problem)

90kph > Speed > 80kph – Yellow (just above threshold)

80kph > Speed > 70kph – Amber (just below threshold)

70kph > Speed – Red (serious delays)

Sensitivity Tests

6.4 Table 18 provides a comparison of the M11 Junction 6 to 8 traffic flows in 2030 using DfT Airport Forecasts, with and without improvements to the M11 between Junctions 8 and 14 and upgrade to the A120 between Braintree and the A12. The resulting percentage differences are limited to 6%, which indicates that the traffic forecasts are relatively insensitive to the presence or otherwise of these major local improvements.

Table 18 Comparison of Do-Minimum assignment against Do-Minimum without M11 Junction 8 to 14 improvements and without A120 Braintree to A12 upgrade both with DfT Airport Forecasts) (2030) (vehicles)

		Northbound	Southbound
Morning Peak			
Junction 7 to Junction 8	Do Minimum	5270	5880
	Test Do Minimum	5080	5590
	% Difference	-4%	-5%
Junction 6 to Junction 7	Do Minimum	5230	6260
	Test Do Minimum	5120	6190
	% Difference	-2%	-1%
Inter-Peak			
Junction 7 to Junction 8	Do Minimum	5220	5130
	Test Do Minimum	4890	4810
	% Difference	-6%	-6%
Junction 6 to Junction 7	Do Minimum	5460	5070
	Test Do Minimum	5230	4840
	% Difference	-4%	-5%
Evening Peak			
Junction 7 to Junction 8	Do Minimum	5180	4800
	Test Do Minimum	4940	4550
	% Difference	-5%	-5%
Junction 6 to Junction 7	Do Minimum	5980	4600
	Test Do Minimum	5810	4350
	% Difference	-3%	-5%

7 Conclusions

- 7.1 Three additional sensitivity tests have been carried out comparing the effects of the BAA and DfT Airport Forecasts on the M11 Junctions 6 to 8 forecast traffic.
- 7.2 A further sensitivity test has been carried out on M11 Junctions 6 to 8 forecast traffic in 2030 comparing the absence and presence of improvements to the M11 between Junctions 8 and 14 and upgrade to the A120 between Braintree and the A12. This test used the DfT Airport Forecasts.
- 7.3 Table 19 summarises the results of the sensitivity tests and indicates the maximum change in forecast flows on the M11 between Junctions 6 and 8 in 2030.

Table 19 Summary of Sensitivity Test Results

Test	Sensitivity Test Scenario	Maximum % Change
1	M11 Junctions 6 to 8 Do-Minimum	-0.6%
2	M11 Junctions 6 to 8 Improvements – Dynamic Use of Hard Shoulder (DHS)	-1.6%
3	M11 Junctions 6 to 8 Improvements – D4M Widening	-1.7%
4	M11 Junctions 6 to 8 Do-Minimum without M11 Junctions 8 to 14 Improvements and without A120 Braintree to A12 upgrade	-6.0%

- 7.4 As a result of these tests, it is concluded that the traffic forecasts are not sensitive to the use of the DfT Airport Forecasts when compared to the BAA Airport Forecasts.
- 7.5 In addition, the traffic forecasts are relatively insensitive to the presence or absence of improvements to the M11 north of Junction 8 and the A120 between Braintree and the A12.

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