HIGHWAYS AGENCY

DD19

A453 Widening
M1 Junction 24 to A52 Nottingham

PROOF OF EVIDENCE

TRAFFIC AND ECONOMIC ASPECTS

BY

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Inquiry commencing 10/11/09

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1. PERSONAL INTRODUCTION

Introduction

1.1 My name is Colin Robert Shields. I am currently employed as a Director at the Leicester office of WYG.

Qualifications and Experience

1.2 WYG is a multi-discipline consultancy providing transport planning, engineering, environmental, town planning and project management services from over 30 offices located throughout the United Kingdom and overseas.

1.3 I am a Chartered Engineer, a Chartered Environmentalist and a Member of the Institution of Civil Engineers. I hold the degrees of Bachelor of Arts in Geography and Master of Science in Transport Engineering and Operations.

1.4 I have twenty one years' experience in the transport planning, economic and traffic engineering aspects of major infrastructure and land use developments. I have been employed by WYG since July 1999 and in that time I have worked on the scheme design and appraisal of a wide variety of infrastructure projects for both the public and private sector. Recent projects I have worked on for the Highways Agency include: the A1 Morpeth to Felton dualling in Northumberland, the M1 Junction 19 improvement in Leicestershire, the M40 Junction 15 improvement in Warwickshire, the A45/A46 Tollbar End Improvement in Coventry and the A46/A607 Hobby Horse improvement in Leicestershire.

Involvement in the Scheme

1.5 I have been the Team Leader for the traffic and economic aspects of the A453 Widening Scheme (subsequently referred to as A453W) since Laing O'Rourke (LOR) were appointed as the Early Contractor Involvement (ECI) contractor in March 2006. As part of the ECI team WYG was appointed as designer to LOR.

1.6 Since March 2006 I have been responsible for the preparation of all the related traffic and economics work and subsequent reports. I attended the 2007 and 2009 public exhibitions and have been involved with numerous stakeholder consultations. I am therefore familiar with the site and the surrounding area and have made myself aware of the relevant policy background and issues relating to this Inquiry.

2.0 SCOPE OF THE EVIDENCE

Introduction

2.1 Background to the scheme is provided in Mr Howarth's Highway Design evidence [DD21; DD22].

Scope of my Evidence

2.2 My evidence describes the existing traffic flow and safety conditions on this stretch of the A453 and identifies and quantifies the problems being encountered by users. It confirms that the scheme addresses these problems. My evidence describes the transport model built to forecast future conditions, to inform the design and to prove the transport economic efficiency of the scheme. It confirms that the scheme addresses the problems identified. My evidence also provides a safety assessment to demonstrate how beneficial the scheme would be in safety terms.

2.3 My evidence provides supporting information for other witnesses on the scheme's impacts and should be considered in conjunction with that evidence.

Outline

2.4 The sections of my evidence are structured as follows:

2.5 Section 3 describes existing transport conditions and transport surveys collected for the transport model building.

2.6 Section 4 describes the base year transport model.

2.7 Section 5 describes the model forecasting and identifies how the scheme addresses existing and future transport problems.

2.8 Section 6 reports on the forecast safety assessment.

2.9 Section 7 provides the results of the transport economic efficiency assessment.

2.10 Section 8 details further modelling work carried out.

2.11 Section 9 provides a summary of the main points of my evidence.

3.0 EXISTING TRANSPORT CONDITIONS

A453 Multi Modal Study Findings

3.1 As reported in Mr Briggs' Policy and Plans evidence [DD24; DD25] in 2000 the Government Office for the East Midlands (GOEM) commissioned the A453 Multi-Modal Study (MMS) [DD13], which included a specific objective to assess the levels and causes of congestion. The MMS aimed to identify the existing problems and issues within and around the study area. Information was collected from a number of sources, including local authorities, local transport providers and other interest groups. The MMS identified a wide range of problems and issues. In summary they were:

- Congestion and serious delay in the peak hours on the A453 through Clifton (partly due to the three pedestrian crossings), but also between Clifton and the M1 on the days with heaviest traffic.
- Serious delays and area-wide congestion in cases of incidents or during roadworks.
- Secondary congestion on roads connecting with, or forming alternative routes to, the A453 because of traffic seeking to avoid delays on the A453.

- Congestion and resulting poor access in Kegworth.
- Accidents on the A453 generally and between the M1 and Clifton in particular.
- Poor local access and difficulties in maintaining schedules for commercial vehicles due to congestion.
- Poor reliability of rail freight services.
- Noise, severance, poor access and poor air quality for people living in the vicinity of the A453 and the adjacent area because of heavy traffic and congestion.
- Lack of rail freight infrastructure.
- Rat-running on local minor roads including those within the Clifton housing area.
- General trend of declining use of public transport, cycling and walking throughout the study area.
- Poor information on, and reliability of, public transport.
- Poor standard of public transport vehicles and cleanliness on some services.
- Poor standard of highway infrastructure and the need for major maintenance works.
- Fears about personal security on journeys other than by car.
- Intimidating conditions and fears about safety for pedestrians and cyclists.
- The transport implications of large-scale development around M1 Junction 24 and East Midlands Airport.
- The multiple role of the A453 as a strategic national route, a major access to Nottingham and other major local traffic generators, part of the local rural road network serving villages and farms, and a local distributor road for the large residential area of Clifton.
- Economic factors encouraging more and longer journeys by car, especially commuting.

3.2 The A453W scheme was part of an integrated package of transport measures approved by GOEM in 2002 to be taken forward. The first element of work WYG carried out upon appointment in March 2006 was an extensive data collection exercise to assist with assessing the existing situation and to help with the development of a base transport model.

Transport Survey Data Collection

3.3 Transport surveys were undertaken in March 2006, prior to the Nottingham Trent University Easter break. The transport data collected included:

- Data from Permanent Automatic Traffic Counts
- Automatic Traffic Counts
- 12 hour Classified Link Counts
- 12 hour Classified Turning Counts
- Peak period Queue Length and Delays
- Peak period Journey Time Surveys
- Public Transport Surveys

3.4 Additional data was collected from the following sources:

- Nottingham Express Transit (NET)
- Nottingham City County
- Nottinghamshire County Council
- Derby City Council (which holds data for Derbyshire County within the data collection area)
- Leicestershire County Council
- M1 Widening Scheme Project Team
- Highways Agency Journey Time Database
- Department for Transport (DfT) Census database

3.5 Details of the transport data collected are presented in the Report of Transport Surveys [DD32].

3.6 Personal Injury Accident (PIA) data was obtained from the Maintenance Area Contractor, AMScott, for the A453 between M1 Junction 24 in the south-west and the A52 in the north-east. The time period covered was between 1st January 2003 to 31st December 2007. Details of the Accident data collected are presented in the Report of Transport Surveys Accident Addendum [DD33].

3.7 For the purposes of the Non Motorised User (NMU) Audit additional pedestrian, cyclist and horse rider surveys were carried out at various locations on the Public Rights of Way network in the rural and urban sections of the scheme. The counts were carried out on a weekday in March 2006 and a Saturday in June 2006 for a 12 hour period. Details of the NMU survey data collected is presented in the Non Motorised User Context Report [DD34].

Key findings – Traffic flows and journey time reliability on the rural section

3.8 Traffic on the rural section averages 23,000 vehicles per day (two way). Of this flow approximately 19% are Heavy Goods Vehicles. This is higher than the national average of 10% on rural Trunk Roads.

3.9 Technical Advice (TA) 46/97 in the Design Manual for Roads and Bridges (DMRB) Volume 5 section 1 part 3 [DD176] gives flow ranges for various standards of rural carriageway and provides guidance over which each carriageway standard is likely to be economically justified. A 7.3m wide single carriageway has a flow range of 13,000 vehicles/day (two way). It can be seen therefore that the counted 2006 flows exceed the DMRB economic flow value. TA 46/97 also sets out Congestion Reference Flows (CRF) which are congestion thresholds for different types of carriageway standards. For a 7.3m wide single carriageway Trunk Road TA 46/97 indicates a CRF of 22,000 vehicles/day. Therefore, the counted 2006 flows exceed the congestion reference flow indicated in DMRB.

3.10 There is significant peak period congestion at Junction 24 of the M1 and long queues can be observed particularly in the AM peak on the A453 approach to this junction. The queues on the A453 from Nottingham regularly block back beyond the Parkway rail station traffic signal junction in the peak periods. Traffic flow on the rural section is also regularly impeded on the uphill sections travelling towards Nottingham which can cause reductions in the speeds of vehicles, particularly Heavy Goods Vehicles. The existing at grade priority junctions exacerbate the problem as right turning vehicles into side roads can cause traffic to stop on the A453. The observed peak period queues and delays on the rural section results in unreliable journey times. This is confirmed by the journey time surveys which showed considerable variation throughout the day.

3.11 There are very few segregated crossing points for pedestrians, cyclists and equestrians on the rural section of the A453 which makes it very difficult to cross the A453 with these heavy traffic flows and the high speeds observed outside of the peak periods.

Key findings – Traffic flows and journey time reliability on the urban section

3.12 Traffic flows through the urban section are substantially higher than for the rural section as a result of local vehicles joining the A453 from the Clifton area. Traffic on the urban section averages 30,000 vehicles per day (two way), of which approximately 12% are Heavy Goods Vehicles. The highest peak period flow is 1267 vehicles/hour (one way in the busiest direction).

3.13 TA 79/99 DMRB Volume 5 section 1 part 3 [DD176] gives flow ranges for various standards of urban carriageway and provides guidance over which each carriageway standard is likely to be economically justified. A 7.3m wide urban single carriageway has a flow range of 1,300 vehicles/hour (one way in the busiest direction). It can be seen therefore that 2006 counted flows are very close to the DMRB urban design flow value and as described in the following paragraphs extensive peak period queues and delays regularly occur on the urban section.

3.14 Significant queues and delays regularly occur in the peak periods at the Crusader junction due to the flow exceeding the capacity of both the link and junction. Capacity is also affected by the interruptions to traffic flow from the un-coordinated pedestrian crossing on the A453 to the north east of Crusader at the Man of Trent. As a result queues have been observed to regularly block back on the A453 from the Crusader junction south west beyond the A453 junction with Barton Lane particularly in the AM peak.

3.15 Due to this long queue on the A453, Nottingham bound vehicles are observed to take an alternative route along Barton Lane and Clifton Lane to the Crusader junction to avoid this queue. This also serves to compound the queue problem on the A453 since these vehicles then turn right towards the A453 and hence increase the circulating flow across the A453 arm thus reducing the gaps that this traffic has and hence reducing further the capacity of this approach. This also places additional traffic on Clifton Lane.

3.16 I am also aware of wider alternative routes (via Kegworth and Gotham) used by drivers to avoid the queues on the A453 approach to Crusader. The additional traffic through these villages is considered to be undesirable and we have been made aware that this is a key issue by people living in these locations.

3.17 Between the Crusader and the Farnborough Road junctions traffic is stationary or in a slow moving queue during both peak periods. This is due to disruptions to flows caused by vehicles turning right into or out of side road junctions, traffic travelling towards Nottingham being regularly impeded on the uphill section by Nottingham Trent University and also by the interruptions to traffic flow from the uncoordinated pedestrian crossings (which due to the large number of pedestrians in the area are regularly demand activated) by Glapton Lane and Sunninghill Drive.

3.18 Extensive peak period queuing has been observed to regularly occur on both A453 approaches to the Farnborough Road signal junction. Coming from the direction of the A52 the queues regularly extend back towards the Silverdale junction and coming from the direction of the Green Lane junction the queues regularly extend back towards the Nottingham Trent University North Gate entrance. The queues at this junction are due to the insufficient capacity within the link and the junction itself.

3.19 The observed long peak period queues and delays results in unreliable journey times. This is confirmed by the journey time surveys which showed considerable variation throughout the day. The urban section of the road carries a large number of bus routes. Details of the bus routes are given in the Non Motorised User Context Report [DD34]. The queues and delays therefore impact on bus journey time and reliability.

3.20 Lack of convenient and safe crossing points for pedestrians and cyclists make it very difficult to cross the A453 in the urban section with these heavy traffic flows.

Key findings – Accidents

3.21 Overall the A453 currently has a poor safety record with a recorded accident level 33% higher than the observed national average for similar rural roads and 23% higher than the observed national average for similar urban roads. A breakdown of the total number of PIAs on the A453 (between M1 Junction 24 and the A52 in Nottingham) and their severity is shown in Table 1 below:

Table 1 - Total Number of Accidents and Casualties (2003-2007)

Year	Slight		Serious		Fatal		Total	
	Accidents	Casualties	Accidents	Casualties	Accidents	Casualties	Accidents	Casualties
2003	23	31	6	6	0	0	29	**37**
2004	32	79	9	14	2	2	43	**95**
2005	22	32	3	3	0	0	25	**35**
2006	30	59	7	11	0	0	37	**70**
2007	27	33	6	7	0	0	33	**40**
Totals	**134**	**234**	**31**	**41**	**2**	**2**	**167**	**277**

3.22 Two fatal accidents were recorded on the A453 during this 5 year period of which one accident involved a car travelling at excessive speed hitting a pedestrian on a pedestrian crossing (at Farnborough Road junction). The second involved a motorcycle overtaking a HGV and colliding with an oncoming vehicle (between Barton Lane and Crusader).

Rural section accidents

3.23 On the rural section there are accident cluster sites at the junctions of the A453 with the entrance to Ratcliffe on Soar power station and the Barton Lane junction. Major contributory factors include:

- Poor turn or manoeuvre
- Vehicle following too closely behind the vehicle in front.

Urban section accidents

3.24 On the urban section the safety record of the road is poor and frequent accidents add to delays, resulting in traffic diverting onto unsuitable minor roads. There are currently four demand activated pedestrian crossings and a major signal controlled junction, which cater for pedestrian movements across the A453. Accidents involving pedestrians attempting to cross the road are high. 15 accidents involved pedestrians (12 of these were in the urban section) and a further 8 involved cyclists (all in the urban section). A child was the casualty in 25% of the accidents involving cyclists and nearly 50% of those involving pedestrians. NMU survey results (within the NMU Context Report [DD34]) indicate that only 18% of NMUs surveyed were children. Therefore, there is a key safety issue for vulnerable road users. Also, a high number of accidents resulting from right turn manoeuvres are a reflection of the large number of minor roads and accesses that connect to the A453 through Clifton and the lack of safe right turn facilities.

Key findings – Non motorised users

3.25 The NMU surveys typically indicated no usage or very low NMU flows on the rural section both on a weekday and weekend. Given the few grade separated opportunities for NMUs to cross the A453 and the heavy flows indicated in paragraph 3.8 above, then low NMU usage in the area is not unsurprising.

3.26 The NMU surveys indicated very high pedestrian and cycle flows on the urban section on a weekday. Given the large number of residential properties, adjacent community facilities, the Nottingham Trent University and high frequency bus services (with 6 bus stops on this section) then this is not unexpected. With these high numbers of pedestrians and cyclists the demand activated pedestrian crossings are observed to be regularly used which as detailed in paragraphs 3.14, 3.17 and 3.18 above impacts on the capacity of the road particularly during peak periods.

3.27 Of concern also are the number of accidents involving pedestrians and cyclists as detailed in paragraph 3.24 above and those involving vulnerable road users.

Existing Transport Conditions Summary

3.28 The A453 is currently congested in the peak periods, which causes journey time unreliability and vehicles re-routing to unsuitable routes.

3.29 Pedestrian and cycle flows in the rural section are low. In the urban section they are high.

3.30 Overall the A453 currently has a poor safety record. There are particular concerns with the accident record on the rural section at the power station access and the Barton Lane junction. There are particular concerns with the number of pedestrian and cycle accidents in the urban section.

3.31 Overall, the transport data collected was considered to provide a robust input into the transport model building stage of the work and for the accident data to be used in the safety assessment.

4.0 THE BASE YEAR TRANSPORT MODEL

Background to the Transport Model

4.1 A transport model has been developed to assist with the design and appraisal of the A453W scheme. The model has been built and validated in accordance with DfT Web based Transport Appraisal Guidance (WebTAG) and DMRB criteria. Full details of the model building and validation is given in the Local Model Validation Report (LMVR) [DD10]. The LMVR confirms that the transport model is capable of replicating existing traffic conditions and hence is fit for purpose to evaluate future year conditions both with and without the A453W scheme.

4.2 Pell Frischmann (PF) consultants developed a multi modal study (MMS) model of the A453 on behalf of the Government Office of the East Midlands (GOEM) as part of the A453 MMS. The highway and public transport assignment models were developed using the VISUM software. The base year for this model was 2000.

4.3 In 2005 Pell Frischmann (PF) carried out a review of alternative modelling approaches for the traffic and economic assessments of the A453W scheme and concluded that the MMS model did not meet Order Publication Report requirements at its current stage of development. Also in 2005, under the HA Traffic Appraisal Modelling and Economics (TAME) consultancy framework, Mott MacDonald (MM) carried out a review of the A453 MMS model and concurred with the PF findings.

4.4 Therefore, upon appointment as the ECI contractor, one of the first tasks was for WYG to update the existing A453 MMS model. Details of the update work carried out are summarised below and reported in more detail in the LMVR [DD10].

Model Update

4.5 The model study area remains as defined in the A453 MMS modelling work and embraces the geographic area within which reassignment effects due to the proposed scheme are likely to be significant. The modelled highway network in the study area extends from the A52 to the north and east including the A52 Nottingham Ring Road, Junction 23A of the M1 with the A42 in Leicestershire to the south and Derby City to the west, including the A453, M1, A52, A42, A6, A5111, A46, A50 trunk routes within this area and all significant local roads, for example the A6005 and local roads through Clifton. Detailed modelling of junctions covers the junctions of the A453, the A52 and the A6005 between the M1 and the Clifton Boulevard section of the A52 Ring Road. Major junctions near Trent Bridge in West Bridgford have also been modelled in order to better simulate the effects of congestion in that area. The remaining highway network within the study area is modelled on a link only basis.

4.6 Train lines and stations and bus routes and stops are modelled in the area contained within the quadrant between Nottingham City to the North, Leicester to the south and Derby to the west. These represent the competing routes using other modes of transport. All route and timetabling information was updated to the current situation where data was available.

4.7 The local and wider geographic area has been divided into a system of zones to enable an accurate representation of sources of trip productions and attractions. Within the central internal area the zones are less coarse than zones more remote from the study area, to facilitate a realistic reproduction of observed traffic movements. Moving outwards from the area local to the A453 the zones become progressively coarser. The size of a zone varies according to its level of influence on movements within the study area. Zone connectors allow the loading of traffic or public transport movements onto the model networks.

4.8 In order to update the model to a 2006 base year, the transport surveys detailed in section 3 of my evidence were used.

4.9 To ensure compliance with WebTAG Variable Demand Modelling requirements, a demand model using the DIADEM software was built for the forecast trip matrix development.

4.10 The 2006 base VISUM models were constructed for the following three time-periods:

- AM Peak (07:30-08:30)
- Inter Peak (average hour from 10:00 to 16:00)
- PM Peak (16:30-17:30)

4.11 Network changes were made to reflect changes in conditions in the highway and public transport networks that had occurred between 2000 and 2006. Junction modelling was introduced on the A453, A52 and A6005 between the M1 and the A52 ring road and in West Bridgford to allow more accurate assessment of junction delays.

4.12 The year 2000 base matrices were updated to a 2006 base level using the count data collected as described in section 3 above. The base matrix was updated using a process called matrix estimation.

4.13 The results from the base model assignment, calibration and validation showed that all three (AM peak, Inter peak and PM peak) models demonstrated good convergence levels and were considered stable. All 3 highway and public transport models calibrated within DMRB standards. All 3 highway models validated within DMRB link flow standards and DMRB journey time standards.

4.14 In accordance with WebTAG guidance, realism testing on the A453W transport model was carried out. The detail of the realism testing methodologies applied to the A453W transport model and the results from these tests have been reported in the Local Model Validation Report [DD10]. Realism testing is designed to demonstrate that the Variable Demand Modelling part of the model is behaving as expected. As reported in the LMVR the demand elasticities were found to be within the required range for fuel cost elasticity realism testing and journey time elasticity realism testing and for each demand segment.

4.15 As a result of this base year model validation, it was considered that the A453 multi modal model represented a robust basis for use in future year transport forecasting and for the purpose of operational, economic and environmental assessments.

5. MODEL FORECASTING

Background

5.1 The forecast modelling work was carried out in accordance with DfT WebTAG guidance and DMRB criteria. Full details of the forecasting work is given in the Transport Forecasting Report [DD11].

Summary of forecasting procedure

5.2 In accordance with current guidance, forecast models were constructed for the Opening Year of 2012 and the Design Year of 2027 for design and environmental assessment purposes. Transport models for 2017 and 2031 were produced for economic assessment purposes to supplement the information from the 2012 and 2027 forecasts.

5.3 The Do Minimum (without scheme) modelled network was updated from the base model to include all of the known committed infrastructure improvements encompassed in the modelled network for both private and public transport.

5.4 The Do Something (with the scheme) modelled network incorporated the changes to the Do Minimum modelled network plus the proposed A453W scheme including the alterations to junctions along the route. A description of the scheme is given in Mr Howarth's Highway Design evidence [DD21; DD22].

5.5 The future year matrices were first estimated by adding committed development trips to the base year 2006 matrices and applying background growth to the overall matrix total. The future variable demand forecasting was then undertaken using DIADEM software, linked with the existing highway assignment models using VISUM.

5.6 Convergence statistics for the forecast assignments and for the Variable Demand Modelling demonstrated a good level of convergence, and were considered stable and therefore a reliable basis for producing transport forecasts.

5.7 The resulting network speeds were found to be intuitive, with speeds decreasing as traffic levels grow. On the whole, network speeds were higher in the Do Something when compared to the Do Minimum.

Transport Forecasting Results – Flows on A453

5.8 For ease of understanding the various traffic flows from the three time periods and the five assessment years, the results from the model flows are presented in terms of Average Annual Daily Traffic (AADT) flows for the scheme opening year (2012) and the scheme deign year (2027). As detailed in the Transport Forecasting Report these were derived from the three modelled time periods.

5.9 Tables 2 and 3 below summarise (rounded) AADT flow levels for 2012 and 2027 with (Do Something) and without (Do Minimum) the scheme at different locations on the A453:

Table 2 – A453 Link Flows – 2012 AADT

Link	Do Minimum	Do Something
M1 J24 to Kegworth Road Junction	25,000	35,000
Kegworth Road to West Leake Lane Junction	24,000	33,000
Southwest of Crusader Roundabout	20,000	34,000
Crusader Roundabout to Green Lane Junction	27,000	41,000
Southwest of Farnborough Road Junction	32,000	44,000

Table 3 – A453 Link Flows – 2027 AADT

Link	Do Minimum	Do Something
M1 J24 to Kegworth Road Junction	31,000	47,000
Kegworth Road to West Leake Lane Junction	30,000	45,000
Southwest of Crusader Roundabout	21,000	42,000
Crusader Roundabout to Green Lane Junction	29,000	48,000
Southwest of Farnborough Road Junction	34,000	50,000

5.10 Comparing these flows with the 2006 observed levels quoted in paragraphs 3.8 and 3.12 (average of 23,000 and 30,000 vehicles/day in the rural/urban sections respectively) indicates only a marginal increase in traffic on the A453 without the scheme in 2012 and a small increase by 2027. This reflects the fact that the A453 is currently congested and cannot accommodate any significant increase in traffic. However, these increases will make congestion even worse on the A453. With the scheme a large increase in flow on the A453 is predicted which reflects traffic diverting onto the A453 from unsuitable routes (as described in paragraphs 3.15 and 3.16) as well as traffic transferring from other routes such as the A6005 and the A52. This is discussed further in paragraph 5.11 below.

Transport Forecasting Results – Flows in wider area

5.11 Tables 4 and 5 below summarise the 2012 and 2027 (unrounded) AADT Do Minimum and Do Something flows on a selection of links in the wider area:

Table 4 - Wider Area Flows – 2012 AADT

Location	Do Minimum	Do Something	Difference	Difference (%)
Kegworth Road	1,055	664	-391	-37%
Kingston Lane, north of Kegworth	7,496	5,783	-1,713	-23%
Gotham Road, north of Kingston on Soar	6,955	5,638	-1,317	-19%
Kegworth Road, Gotham	7,479	6,288	-1,191	-16%
Nottingham Road, north of Gotham	11,837	11,043	-794	-7%
Nottingham Road, south of Clifton	16,805	11,245	-5,560	-33%
A6005, Beeston	23,500	22,956	-544	-2%
A52, Stapleford	52,369	49,983	-2,386	-5%
A60, Ruddington	23,620	21,371	-2,249	-10%

Table 5 - Wider Area Flows – 2027 AADT

Location	Do Minimum	Do Something	Difference	Difference (%)
Kegworth Road	1,240	835	-405	-33%
Kingston Lane, north of Kegworth	8,863	6,034	-2,829	-32%
Gotham Road, north of Kingston on Soar	8,591	5,987	-2,604	-30%
Kegworth Road, Gotham	10,064	9,227	-837	-8%
Nottingham Road, north of Gotham	12,277	11,651	-626	-5%
Nottingham Road, south of Clifton	18,226	11,853	-6,373	-35%
A6005, Beeston	26,440	25,857	-583	-2%
A52, Stapleford	59,391	56,035	-3,356	-6%
A60, Ruddington	23,682	22,028	-1,654	-7%

5.12 In the Do Minimum situation traffic flows on the alternative routes and local roads remain high. Tables 4 and 5 above demonstrate that, in the Do Something, traffic is drawn away from alternative routes and from local, rat running routes. The local route of Gotham Road for example, experiences a considerable reduction in traffic as a result of the scheme.

Transport Forecasting Results – Journey times

5.13 An analysis of modelled journey times indicates significant time savings in the Do Something when compared to the Do Minimum network scenario in all time periods. For example, in the scheme opening year of 2012, a 5 minute time saving per vehicle is predicted travelling eastbound on the A453 between M1 Junction 24 and Farnborough Road in the AM peak.

Transport Forecasting Results – Public Transport

5.14 The overall scale of the changes to the public transport flows is relatively limited and does not show a significant impact on the public transport demands between the Do Minimum and Do Something. As such, a shift away from public transport to car trips is not predicted as a result of the A453W scheme.

Transport Forecasting Results – Link Operational assessments

5.15 TA 46/97 DMRB Volume 5 section 1 part 3 [DD176] gives flow ranges for various standards of rural carriageway and provides guidance over which each carriageway standard is likely to be economically justified. A dual two lane All Purpose carriageway has a flow range of 11,000 to 39,000 vehicles/day (two way) at scheme opening. As shown in Table 2 the highest daily flow on the dual carriageway section of the A453 at scheme opening year is 35,000 vehicles/day (two way). It can be seen therefore that the dual carriageway will be operating well within its economic flow range. TA 46/97 also sets out Congestion Reference Flows (CRF) which are congestion thresholds for different types of carriageway standards. For a dual two lane All Purpose carriageway Trunk Road, TA 46/97 indicates a CRF of 68,000. Therefore, as can be seen from Tables 2 and 3 the 2012 and 2027 flows are well within the Congestion Reference Flow indicated in DMRB.

5.16 TA 79/99 DMRB Volume 5 section 1 part 3 [DD176] gives flow ranges for various standards of urban carriageway and provides guidance over which each carriageway standard is likely to be economically justified. A 4 lane 14.6m wide single carriageway has a flow value of 2,100 vehicles/hour (one way busiest direction) at scheme opening year. As indicated in the Transport Forecasting Report [DD 11] the highest peak period flow on the urban section is 2,143 vehicles (one way busiest direction) and therefore the highest predicted urban flow only marginally exceeds the link capacity value indicated in DMRB for this type of road. However, as recognised in TA 79/99 the key constraint for capacity on urban roads is the performance of junctions at either end of the link. As detailed in paragraph 5.17 below the junctions within the Urban section have been tested and all operate within capacity. Therefore, it is considered the scheme will have sufficient capacity.

Transport Forecasting Results – Junction Operational assessments

5.17 Detailed capacity assessments of the proposed new rural and urban junctions on the scheme have been carried out. On the whole the results indicate that all of the proposed junctions will operate within capacity in 2012 and 2027.

Model Forecasting Summary

5.18 The model statistics for each of the forecast years exhibit a good level of convergence. The estimates of future year traffic are considered a robust basis for the purpose of operational, economic and environmental assessments.

5.19 The operational assessments demonstrate that the scheme meets its economic efficiency objective by reducing congestion and improving the reliability of journey times. Furthermore, traffic flows on adjacent local roads currently used as alternative routes to the A453, will be reduced thus meeting the scheme's Safety objective. As such I consider that there is a compelling case for acquisition in the public interest.

6 SAFETY ASSESSMENT

Background

6.1 The forecast change in the number of personal injury accidents was assessed. The following is a brief description of the method used and the findings. A more detailed description can be found in the Economic Assessment Report [DD12].

6.2 A spreadsheet COst Benefit Analysis (COBA) based methodology was used as opposed to using the COBA software since COBA uses predefined link classifications to predict accident rates. These predefined classifications do not cover the 4 lane single carriageway road type proposed for the urban section of the scheme. Predicted accident rates for 4 lane single carriageway link types were derived from observed data collated at existing sites and reported on in the 4 lane Single Carriageway Accident Rates Technical Note [DD36]. The procedure carried out by the spreadsheet assessment to derive the accident benefits of the scheme and in the immediate study area, followed the process used by the COBA program.

6.3 The assessment area for the Safety assessment covered the alternative routes to the A453 in the study area and the local roads around the A453, in addition to the A453 itself.

6.4 For the assessment, the opening year of 2012 and a 60 year assessment period was used.

Safety Assessment Results

6.5 The results for the safety analysis are summarised in **Table 6** below:

Table 6 – Accident Saving Summary

Scenario	Number of Accidents	Accidents by Severity		Cost £m
		KSI	Slight	
Do Minimum	30,340	4,267	26,073	1543.6
Do Something	29,887	4,092	25,795	1492.7
Accident Savings	**453**	**175**	**278**	**£50.9m**

NB: (i) All costs are £ thousands 2002 prices, discounted to 2002,
(ii) KSI stands for killed or seriously injured.

6.6 Analysis of the results indicates a significant benefit in terms of a reduction in accidents across the study area. The largest savings in terms of numbers and costs of accidents are on the local roads in the A453 area between the M1 and Clifton Boulevard and on the M1 itself. This is due to reductions in the traffic flows on these routes, which have an existing high accident rate and reductions in the traffic flows on alternative, longer distance routes.

Safety Assessment Summary

6.7 The safety assessment demonstrates a significant accident saving in the study area and hence the scheme is considered to meet its safety objective. As such I consider that there is a compelling case for acquisition in the public interest.

7 TRANSPORT ECONOMIC EFFICIENCY ASSESSMENT

Introduction

7.1 The scheme being promoted by the Highways Agency is justified in terms of the monetary benefits it will bring, including a reduction in the costs of travel. The following is a brief description of the economic assessment method used and the findings. A more detailed description can be found in the Economic Assessment Report [DD12]. All the work was carried out in accordance with DMRB and WebTAG guidance.

Methodology

7.2 The following economic assessment programs have been used to assess the different economic benefits and disbenefits of the scheme:

7.3 Transport User Benefit Appraisal (TUBA). This was used to calculate travel cost changes between the with (Do Something) and without (Do Minimum) scheme.

7.4 The Safety Cost Benefit Appraisal was carried out using the spreadsheet calculations based on the COBA methodology described in section 6 of my evidence.

7.5 Queues and Delays at Roadworks (QUADRO) was used to quantify the travel cost and accident changes during construction of the scheme and for the maintenance period of the scheme.

7.6 The outputs from these three assessments were used to prepare the monetary economic values presented in the Transport Economic Efficiency (TEE) Tables.

7.7 TUBA, COBA and QUADRO calculate the costs to users on the network over a 60 year assessment period with and without the scheme. TEE is calculated as the difference in costs between the two cases. TEE costs are calculated based on a number of factors that include the value of the occupant's time, the cost of fuel, vehicle wear and tear costs and operating costs. The savings in travel time can occur on links and at junctions.

As instructed by WebTAG, accident benefits are excluded from the TEE benefit summary but are included in the Analysis of Monetorised Costs and Benefits tables.

Costs for building the scheme were provided by the Highways Agency as detailed in Mr Pizzey's Government Policy and Scheme Overview evidence [DD17].

For the assessment, the 2012 opening year, 2017 intermediate year, 2027 design year, 2031 economic projection year and a 60 year assessment period have been used. TUBA, QUADRO and COBA apply a discount rate to costs and benefits to derive a 2002 base. This ensures all costs and benefits are compared on a common basis. A discount rate of 3.5% was used after the current year (2008) of appraisal, followed by 3% thereafter up to the end of the 60 year period.

The discounting procedure results in 2002 costs and benefits from which the overall costs of the scheme are presented as the Present Value Costs (PVC) and the benefits of the scheme are presented as the Present Value Benefits (PVB). The PVB minus the PVC gives the Net Present Value (NPV) which is used to determine whether a scheme is economically viable. The PVB divided by the PVC gives the Benefit Cost Ratio (BCR) which is also used to determine whether a scheme is economically viable.

TEE Results

The TUBA, COBA Safety analysis and QUADRO results were combined and are summarised in Table 7 below:

Table 7 – Combined TUBA, Safety and QUADRO Analysis Results

	£k
Consumer User Benefits	96,119
Business User Benefits	168,423
Carbon Benefits	-932
Accident Benefits	55,954
Net Present Value Costs (PVC)	98,381
Net Present Value of Benefits (PVB)	319,563
Net present Value (NPV) [PVB - PVC]	221,182
Benefit to Cost Ratio (BCR) **[PVB ÷ PVC]**	3.25

NB:
(i) All costs are £ thousands 2002 prices, discounted to 2002
(ii) Please note: totals are calculated prior to rounding
(iii) The accident benefits are derived from the COBA spreadsheet and QUADRO assessments
(iv) TUBA monetorised Carbon emissions are due to increased fuel usage.

7.13 As can be seen from Table 7 above, the largest benefits are gained from the time savings to businesses and consumers.

7.14 The BCR can be used as a guide to indicate whether the scheme meets it's objectives in terms of safety and economy. In accordance with the DfT Guidance on Value for Money (15th December 2004) [DD37] the specification by the DfT is that a scheme provides 'High' value for money if the BCR exceeds the criteria of 2. Therefore, the A453W Scheme is considered to give a High value for money and indicates that the scheme is economically robust.

Transport Economic Efficiency summary

7.15 The economic assessment demonstrates that the Scheme gives a high economic rate of return and therefore is considered to be economically robust and the scheme is considered to meet its economic efficiency objective. As such I consider that there is a compelling case for acquisition in the public interest.

8 FURTHER MODELLING WORK

Background

8.1 Subsequent to the DfT and Highways Agency approval of the modelling and economics work in December 2008 and publication of the scheme Draft Orders in January 2009, a number of changes arose in the WebTAG guidance as regards the modelling and economics work. As a result, further modelling work was requested by the HA. This section details the further work and the results from this.

Changes in WebTAG

8.2 There are several WebTAG Units which at the time of the approval of the modelling work by the Highways Agency and DfT were draft. These became mandatory on 6th April 2009 and the Highways Agency subsequently requested that further modelling work was undertaken to incorporate these changes. The WebTAG changes are summarised below:

8.3 Values of Time (VOT) and Vehicle Operating Costs (VOC) are utilised both in the variable demand process, directly in the assignment process and in the Economy element of the economic assessment. Revision of WebTAG Unit 3.5.6 Values of Time and Operating Costs [DD68] which includes the VOT and VOC values, required a sensitivity test to be carried out on the modelling procedure and the economic assessment to be revised.

8.4 Treatment of Uncertainty in Model Forecasting (WebTAG Unit 3.15.5) [DD69] recommends that to account for uncertainty, sensitivity tests should be carried out on the core modelled scenario for both the ‘with’ and ‘without’ scheme scenarios. These sensitivity tests are carried out in order to derive a range in forecasting results, and the associated economic assessment, to cover the effects of uncertainty. WebTAG indicates that a broad spectrum of uncertain elements are inherent in forecasting, especially for appraisal in the more distant future. The following are identified as some of the most significant from previous studies:

- National economic uncertainty as to future levels of GDP growth and fuel price, both of which have a substantial impact on rates of traffic growth (at least in the short term).
- Political or commercial uncertainty as to whether individual large developments, or other transport projects other than those being appraised, will go ahead.
- Local economic or planning uncertainty, e.g. as to the success of local regeneration initiatives.

8.5 As agreed with the HA and the local authorities, two sensitivity test scenarios (high and low) were established (in addition to a review of the approved Core scenario).

8.6 In terms of dealing with Uncertainties over Demographic, Economic and Behavioural Trends this was addressed using high and low reference traffic growth scenarios generated as detailed in WebTAG guidance. This states that "analysis of the uncertainty in the NTM suggests that an appropriate allowance for this is to look at a range about the central forecast of ±2.5% for forecasts one year ahead, rising with the square root of the number of years to ±15% for forecasts 36 years ahead (i.e. 5% four years ahead, 7.5% nine years ahead, 10% sixteen years ahead, 12.5% twenty five years ahead)."

8.7 In terms of dealing with Factors Affecting Underlying Demand and supply, data was summarised and categorised by likelihood using the following definitions of probability:

- Near Certain: The outcome will happen or there is a high probability that it will happen.
- More Than Likely: The outcome is likely to happen but there is some uncertainty.
- Reasonably Foreseeable: The outcome may happen, but there is significant uncertainty.
- Hypothetical: There is considerable uncertainty whether the outcome will ever happen.

8.8 As agreed with the HA and the local authorities the uncertainty modelling carried out is summarised in Table 8 below:

Table 8 Summary of Uncertainty Modelling

Scenario	**Land use and Infrastructure**
Review of Core	Near Certain, More than Likely and TEMPRO Central Growth
Low	Near Certain and TEMPRO Low Growth
High	Near Certain, More than Likely and Reasonably Foreseeable and TEMPRO High Growth

8.9 A formal uncertainty log was established combining the land use data and the infrastructure development information categorised by likelihood.

8.10 The WebTAG modelling update work also included changes arising from the DfT Paper entitled Britain's Transport infrastructure Motorways and Major Trunk Roads (January 2009) [DD38] In relation to the M1 Widening Contract 1 scheme, this paper announced that funding would be made available to complete Junctions 25 to 28, already under construction. In relation to the M1 Widening Contract 2 (M1WC2) project, the DfT paper indicated that Junctions 28 to 31 are to be improved by Hard Shoulder Running (HSR), rather than widening, with construction beginning in 2015. In relation to the remainder of the former M1 Widening Contract 2, the DfT paper lists further locations for HSR including the M1 between J24 and J25 and that major junction improvements will be looked at on the M1 J21 to 21A and J23a to 24. The DfT paper indicated that the timing of these schemes would be prioritised after 2014. The HA subsequently confirmed that the motorway widening proposals are likely to take the form of:

- no changes between junctions 21A and 23A before 2020
- HSR between junctions 28 and 31 would be in place by 2012
- an offline solution for junction 21A would be in place by 2017/2018 taking the form of that proposed in the M1WC2 drawings
- M1WC2 proposals would be implemented for junctions 23A to 24 by 2015
- HSR between junctions 24-25 would take place by 2015.

8.11 The results from the modelling and economic assessments based on the WebTAG update are presented in the Transport Forecasting and Economics WebTAG update Report [DD35].

8.12 The results indicate that for the Core scenario traffic flows are broadly similar to those approved in December 2008 and that the results from the economic assessments are broadly similar providing a slightly higher BCR of 3.3.

8.13 For the sensitivity tests, as expected traffic levels are generally lower than the Core scenario in the Low Growth scenario and higher than the Core scenario in the High Growth scenario. The scheme economics for the Low Growth scenario are lower than the Core (giving a BCR of 2.1). The scheme economics for the High Growth scenario are higher than the Core (giving a BCR of 7.1).

9.0 SUMMARY AND CONCLUSIONS

9.1 Results from the transport studies carried out indicate that the A453 is currently congested particularly in the peak periods, which causes journey time unreliability and vehicles re-routing on to unsuitable routes. Traffic flows exceed the capacity flow level that can be handled by a single carriageway design. Pedestrian and cycle flows in the rural section are low and in the urban section they are high. Overall the A453 currently has a poor safety record and a higher accident rate than that to be expected for this type of road. There are particular concerns with the accident record on the rural section at the power station access and the Barton Lane junction. There are particular concerns with the number of pedestrian and cycle accidents in the urban section.

9.2 Using survey data collected in March 2006, a transport model has been developed to assist with the design and appraisal of the A453W scheme. The model has been built and validated in accordance with DfT WebTAG and DMRB criteria. The model demonstrates that it is capable of replicating existing traffic conditions and hence in my opinion I consider the model to be fit for purpose to evaluate future year conditions both with and without the A453W scheme.

9.3 In accordance with current guidance, forecast transport models were constructed for the Opening Year of 2012 and the Design Year of 2027 for design and environmental assessment purposes. Transport models for 2017 and 2031 were produced for economic assessment purposes to supplement the information from the 2012 and 2027 forecasts.

9.4 The Do Minimum (i.e. without the scheme) model was updated from the base model to include all known committed infrastructure and land use developments. The Do Something (i.e. with the scheme) model was updated from the Do Minimum model to incorporate the A453W scheme.

9.5 The model statistics for each of the forecast years exhibited a good level of convergence and hence the estimates of future year traffic are considered a robust basis for the purpose of operational, economic and environmental assessments.

9.6 The future year models indicate only a marginal increase in traffic on the A453 without the scheme in 2012 and a small increase by 2027. This reflects the fact that the A453 is currently congested and cannot accommodate any significant increase in traffic. However, these increases will make congestion even worse on the A453. With the scheme a large increase in flow on the A453 is predicted which reflects traffic diverting onto the A453 from unsuitable routes as well as traffic transferring from other routes such as the A6005 and the A52. An analysis of modelled journey times indicates significant time savings in the Do Something when compared to the Do Minimum network scenario in all time periods.

9.7 Detailed assessments of the capacity of the proposed links and junctions on the scheme demonstrate that the scheme will have sufficient capacity for the 2012 and 2027 assessment years. In my opinion the operational assessments demonstrate that the scheme meets its economic efficiency objective by reducing congestion and improving the reliability of journey times and as such I consider that there is a compelling case for acquisition in the public interest.

9.8 A spreadsheet COst Benefit Analysis (COBA) based methodology was used to assess the safety benefits of the scheme. The assessment area for the Safety assessment covered the alternative routes to the A453 in the study area and the local roads around the A453 in addition to the scheme itself. Analysis of the results indicates a significant benefit in terms of a reduction in accidents across the study area. A total of 453 accidents will be saved over a 60 year assessment period of which 175 Killed or Seriously Injured accidents and 278 slight accidents will be saved. The largest savings in terms of numbers and costs of accidents are on the local roads in the A453 area between the M1 and Clifton Boulevard and on the M1 itself. This is due to reductions in the traffic flows on these routes, which have a high accident rate and reductions in the traffic flows on alternative, longer distance routes. In my opinion the safety assessment demonstrates that the scheme meets its Safety objective and as such I consider that there is a compelling case for acquisition in the public interest.

9.9 The economic benefits and disbenefits of the scheme were calculated using:

- Transport User Benefit Appraisal (TUBA) to calculate travel cost changes between the with and without scheme.
- Safety Cost Benefit Appraisal using the spreadsheet calculations based on the COBA methodology
- Queues and Delays at Roadworks (QUADRO) to quantify the travel cost and accident changes during construction of the scheme and for the maintenance period of the scheme.

9.10 The results from the economic assessment indicate that the scheme has a BCR of 3.25 which provides High value for money. In my opinion the A453W Scheme gives a high economic rate of return and the scheme is considered to meet its economic efficiency objective. As such I consider that there is a compelling case for acquisition in the public interest.

9.11 Subsequent to the DfT and HA approval of the modelling and economics work in December 2008 and publication of the scheme Draft Orders in January 2009, a number of changes arose in the WebTAG guidance as regards the modelling and economics work. As a result, further modelling and economic assessment work was carried out. The key changes arose from revised Values of Time (VOT) and Vehicle Operating Costs (VOC) and also the need to take into account Uncertainty in Modelling, whereby sensitivity tests are carried out on the core modelled scenario to derive a range in forecasting results, and the associated economic assessment, to cover the effects of uncertainty. As part of this modelling update work a review of the assumptions in the Core model was also carried out to include, for example, changes announced for the M1 Widening project.

9.12 The results indicate that for the Core scenario traffic flows are broadly similar to those previously approved and that the results from the economic assessments are broadly similar providing a slightly higher BCR of 3.3. For the sensitivity tests, as expected traffic levels are generally lower than the Core scenario in the Low Growth scenario and higher than the Core scenario in the High Growth scenario. The scheme economics for the Low Growth scenario are lower than the Core (giving a BCR of 2.1). The scheme economics for the High Growth scenario are higher than the Core (giving a BCR of 7.1). As such I consider that with the revised Core and sensitivity testing modelling my conclusions remain unchanged as regards to the scheme meeting its economic efficiency objective by reducing congestion, improving the reliability of journey times and providing High value for money and to the scheme meeting its safety objective by reducing accidents.