

Welsh Government

**M4 Corridor Enhancement
Measures**

**Traffic Modelling Background
Information**

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Glossary of Terms

1 History of the Traffic Model

A traffic model was developed in 2006 using SATURN software to inform the New M4 Project. This traffic model was based on trip origin-destination data which was largely collected during roadside interview surveys (RSI surveys) in 2005. Similarly, traffic count and journey time data were collected in 2005 which were used to calibrate and validate the base year traffic model. The base year traffic model was validated in accordance with criteria given in the Design Manual for Roads and Bridges¹ and was also the subject of an independent audit by Transport Research Laboratory (TRL). This audit found the 2005 base year traffic model to be fit for purpose. The development of the 2005 base year traffic model is documented in the Local Model Validation Report (LMVR)².

The SATURN model was used to produce traffic forecasts for 2016 and 2031. These traffic forecasts were developed to inform the operational, environmental and economic assessments of the then proposed New M4 motorway. The forecast scenarios with these schemes in place were compared against a baseline ‘Do Minimum’ scenario which included all committed highway schemes at the time of forecasting. The traffic forecasts were also the subject of an independent audit by TRL and found to be satisfactory.

A glossary of technical terms used in this document is given in Appendix B.

2 Current Usage of the Traffic Model

The Design Manual for Roads and Bridges³ states that where traffic survey data used in modelling is more than six years old, it is necessary to revalidate the model. However, before the modelling work began on the M4 CEM package options, it was agreed with the Welsh Government, that appropriate comparison of the relative performance of the different highway options is required at this time. Thus, for the purpose of comparative assessment of the M4 Corridor Enhancement Measures presented in the Formal Consultation process, the 2005 base year traffic model represents a satisfactory basis for the traffic forecasting undertaken.

Once the results of the formal public consultation process are known, further traffic survey work will be carried out to enable the traffic modelling to be updated.

3 Technical Details of the Traffic Model

A SATURN traffic model is made up of two components:

- A representation of the current/future year highway network; and

¹ Design Manual for Roads and Bridges, Volume 12, Section 2, Part 1, Chapter 4, Table 4.1

² “New M4 Project – Magor to Castleton – Local Model Validation Report, Draft 2”, Arup, August 2007

³ Design Manual for Roads and Bridges, Volume 12, Section 1, Part 1, Paragraphs 2.2.31, 8.4.6 and 11.4.24

- Traffic demand, representing the vehicles on the model highway network travelling between their origin and destination. The 2005 base year model demand reflects the travel patterns as observed during the data collection exercise. These are then projected forward to provide a ‘forecast’ of the likely traffic demand in future years.

In the case of the M4 traffic model, the traffic demand has been split into 5 categories:

- Cars travelling on employers’ business;
- Cars commuting to/from work;
- Cars travelling for other purposes;
- Light Goods Vehicles (LGVs); and
- Heavy Goods Vehicles (HGVs).

The original M4 traffic forecasts were prepared using variable demand modelling techniques in accordance with Department for Transport guidance. However, in order to expedite the CEM study, the traffic forecasting to assess the relative performance of the different options was undertaken using a traditional fixed demand model, in which (unlike variable demand modelling) the growth in travel demand is assumed not to vary in response to changing travel costs, which would provide a consistent basis for comparison. The Highway Network used in the modelling.

The highway network represented in the traffic model forecasts has been updated to represent the Do Minimum scenario and the core highway measures presented in Packages 1 to 3 for the Formal Consultation process. Supporting measures from these packages have not been included in the traffic forecasting as these could be delivered independently or as part of the package. This approach also ensures that non-highway supporting measures are appraised on a consistent basis with the highway based supporting measures.

The highway measures included under Package 4 are not ‘core measures’ and the impact of public transport and other non-highway measures on road traffic volumes is difficult to quantify at this stage. Therefore traffic modelling has not been undertaken to assess the impact of Package 4 on road travel.

The ‘Alternatives considered’ have been discarded from the M4 CEM at an earlier stage in programme development, thus neither are these subject to traffic modelling.

The M4 CEM Appraisal Handbook provides further details of the components of each of the Packages, the Alternatives Considered and the Do Minimum scenario.

4 Traffic Demand

The original traffic forecasts were developed from the validated 2005 base year model for two future years, 2016 and 2031.

The forecast traffic demand was made up of three components, namely:

- the base year matrix;
- traffic generated by new developments within the study area; and
- background traffic growth.

Generally, when preparing traffic forecasts, the traffic generated by developments should be taken into account, with overall growth across the study area constrained to background traffic growth projections.

Planning data on proposed developments in the study area were obtained from Newport City Council and Monmouthshire County Council in 2007. A list of development sites taken into account in the M4 traffic forecasting is given in Appendix A. The background growth of car trips was based on traffic growth forecasts from the Department for Transport. National growth factors from the National Road Traffic Forecasts (NRTF 1997⁴) were used for LGVs and HGVs.

There is usually some degree of uncertainty surrounding whether or not developments will be built and if so what size they will be as well as what future year traffic growth will be. Consequently trip matrices were produced for a low and a high growth scenario, and a central growth scenario, which is an average of the two. All of the appraisals undertaken for the M4 CEM are based on the central growth traffic forecasts.

In the intervening period since the traffic forecasts were developed, revised traffic forecasts for Great Britain have been produced in response to the economic downturn.

Recent comparison of the traffic growth projections for Newport indicates that the traffic model is predicting significantly higher rates of traffic growth than the revised projections.

5 Use of the M4 Traffic Model Forecasts for M4 CEM Appraisals

The M4 traffic model forecasts have provided the basis of the appraisal of the M4 CEM Package 1, 2 and 3 highway measures, where the model networks have been updated to reflect the Do Minimum scenario and the core measures in each of these packages, respectively.

Given the proposal to implement the packages in phases, and the need to assess the benefits of each phase of package implementation against the Goals of the M4 CEM Programme, traffic forecasts are required for intervening years between 2016 and 2031 to reflect the step changes as new highway schemes become operational. The traffic demand for these intervening years has been derived by interpolating between the 2016 and 2031 demand.

The forecast traffic demand used in the CEM appraisals is likely to be high compared to current traffic growth projections, especially if Newport does not achieve the level of new development planned for.

⁴ National Road Traffic Forecasts, Great Britain 1997, Department for Transport

This is likely to result in an over-prediction of economic benefits of any proposed schemes. However, an appraisal based on the traffic forecasts will provide an indication of the relative performance of the different CEM under consideration.

Appendix A

Developments Included in Traffic Forecasts

Table A1 Future Year Developments

Reference Number	Input	Size	Planning Status in 2007	Comments	Land Use	Development Scenario
001	Newport City Centre Redevelopment		Detailed Planning Consent	Planning permission granted to Modus Corovest John Frost Square for 41,300 sq metres retail, 1,100 sq metres Restaurants, 100 bed hotel, cinema, 241 Apartments. 07/0112 Reserved Matters approval. Due to go unconditional October 2007	Mixed	2016 low growth
002	Modus City Centre Redevelopment	200 residential units	Outline Planning Consent	Granted outline planning consent. City centre redevelopment not going to be allocated any traffic generation over and above traffic growth. See details of Modus Corovest scheme.	Residential (flats)	2016 low growth
003	Newport City Spires Development (Cambrian Road)	1.2ha for hotel, offices, residential & car parking by 2016	Detailed Planning Consent	Planning permission for redevelopment of Cambrian Retail Centre, includes 6000 sq metres of offices. New planning application currently being considered. Anticipated start on site January 2008.	Mixed	2016 low growth
004	Gwent Europark	28ha warehousing by 2016	Detailed Planning Consent	Valid outline planning permission. Detailed Approval Tesco Warehouse Phase 2 22,138sq metres (300 jobs), Wilkinson (1,000 Jobs) and Tesco Phase 1 already built; Planning application also for distribution depot for Home Retail Group 69442m2 (700 jobs)	B8 Warehousing	2016 low growth

Reference Number	Input	Size	Planning Status in 2007	Comments	Land Use	Development Scenario
005	Langstone Business Park	2ha B1 employment by 2016	Under construction	Planning permissions on undeveloped sites. Under construction and currently being marketed.	Employment (B1 office)	2016 low growth
006	Sites around junction of Spytty Road and Corporation Road	100,000 sq ft GFA	Detailed Planning Consent	Three sites for commercial development – retail, showrooms, builders merchant depot etc. One with planning permission, one subject of planning application BQ Retail Granted May 07. B&Q likely to start on site late 2007	Retail	2016 low growth
007	George Street offices	B1 by 2016 180,000 sq ft GFA	Under construction	0.3ha under construction; remainder with planning permission or subject of projects. Approvals to date Red Cross 1,014sq m, WISP 5,310sq m, Bailey Developments 2,680sq m and Whiteheads 1,000 sq m.	Employment (B1 office)	2016 low growth
008	Dumfries Place/Uskway	0.8ha office/retail site by 2016	Detailed Planning Consent	Planning application for 4152 sq metres of offices and 1521 sq metres food store. Application Granted. Site currently being marketed.	Mixed	2016 low growth
009	Glebelands housing	153 houses by 2016	Under construction	School on site, housing to follow as part of the same contract.	Residential (houses)	2016 low growth
010	Housing opposite Town Reach	486 flats by 2016	Detailed Planning Consent	Got planning approval May 07. Part of Planning approval for Rodney Road which is opposite Town Reach (486 units). Due to start on site August 2007.	Residential (flats)	2016 low growth
011	Duffryn remainder housing	139 houses by 2016	Detailed Planning Consent	Housing land been sold with planning permission to Barratts	Residential (houses)	2016 low growth

Reference Number	Input	Size	Planning Status in 2007	Comments	Land Use	Development Scenario
012	Pirelli Site, Corporation Road	1.8ha for small industrial units by 2016	Under construction	Planning permission for 45 units totalling 3995 sq metres. Currently on site. Strong demand for industrial units should see them occupied by mid 2008.	Employment (B2 industrial units)	2016 low growth
013	Site of St Josephs school, housing	153 houses by 2016	Under construction	Currently on site. Due for completion in 2007	Residential (houses)	2016 low growth
014	New Asda retail	3,716 sq metres retail	UDP Allocation	Planning application pending. There is a design issue that needs to be resolved, but proposal within designated district centre so likely to be approved.	Retail	2016 low growth
016	Crindau retail	7,000 sq metres GFA retail	Detailed Planning Consent	Planning is based on the relocation of the existing Sainsbury's store. S106 has been signed and the development is proceeding	Retail (food store)	2016 low growth
017	Former Pirelli works housing	300 houses by 2016	UDP Allocation	Flood defence works due to go on site August 2007 with completion date mid 2008.	Residential (houses)	2016 low growth
018	Duffryn Employment (Quinn Development)	300 jobs – radiator factory 400 jobs – other factory	under construction/ detailed planning consent	53,625 sq m reuse of LG building plus 28,250sq m extension. Second Phase 800,000 sq m (200 jobs) submitted May 07	Employment (B2 industrial estate)	2016 low growth

Reference Number	Input	Size	Planning Status in 2007	Comments	Land Use	Development Scenario
019	Cleppa 4 & Celtic Springs Business Parks	Variety of employment sites.	Under construction	Under development. Residual of business parks with outline planning permissions. Includes Prison Service 3,250sq m (600 jobs). National Statistics relocation from London, an extension of existing site (600 jobs). Wales & West Utility (250 jobs). Hotel 50 employees, 145 bedrooms. Children's nursery 88 places. Day surgery 30,000 sq ft 30-50 jobs. Further 59,000 sq ft of B1 offices. In addition there is a further (plot 4000) 15 acres of site most likely to be developed for B1 offices. Cleppa 4 site: B1 offices for EADS 600 employees on site by 2016 and further 1.5 acres of site for B1 development. All sites expected to be completed by 2016.	Employment (B1 office) and various others	2016 low growth
020	Spytty Pill/Corporation Rd housing	348 houses by 2016	Under construction	Taylor Woodrow 231 houses under construction; land adjacent to Portskewett Street outline permission for 117 units.	Residential (mixed)	2016 low growth
021	Housing north of Spytty Pill	191 houses by 2016	Under construction	Persimmon Homes 191 houses under construction	Residential (mixed)	2016 low growth
022	East Newport housing north of railway line	1100 houses by 2016	Outline Planning Consent	Outline planning application. Pending for 1100 houses.	Residential (houses)	2016 low growth
023	East Newport housing south of railway line	800 houses by 2016	Outline Planning Consent	Outline planning application. Granted May 07 to St Modwen Developments.	Residential (houses)	2016 low growth

Reference Number	Input	Size	Planning Status in 2007	Comments	Land Use	Development Scenario
024	East Newport employment (B1, B2, B8)	40ha	Outline Planning Consent	Outline planning application Granted May 07 to St Modwen Developments.	Employment	2016 low growth
025	Old Town Dock housing	1400 houses by 2016 80 bed hotel	Detailed Planning Consent	This is a phase of the Master Plan which estimates 1400 units in total. Planning approval granted to Redrow for 399 dwellings, planning approval granted to Westmark for 154 units, Edward Ware application in for 200 units.	Residential (mixed)	2016 low growth
026	Old Town Dock Student accommodation	441 student halls rooms		Should generate low traffic volumes	Student Accommodation	2016 low growth
027	Housing at Monmouthshire Bank Sidings	450 houses by 2016	UDP Allocation	Allocated in UDP. Planning application pending. Outline submitted May 07. However site is under consideration for possible hospital. Significant proportion still likely to go for housing	Residential (houses)	2016 low growth
028	Lysaght Institute housing	450 units by 2016	Speculative	Flood defence works due to go on site August 2007 with completion date mid 2008. Likely to proceed shortly. Planning application submitted, supported by NCC.	Residential (houses)	2016 low growth
029	University Campus (Riverfront)	Phase 1 7,500sqm (2010)	Phases 1. UDP allocation	No start date is identified. Car parking will be minimal based on its City Centre location. The student numbers are not known. There are no planning approvals, although the site is allocated in the City Centre SPG as Education/Cultural Use	Education	2016 low growth

Reference Number	Input	Size	Planning Status in 2007	Comments	Land Use	Development Scenario
030	Housing on former Tredegar Park Golf Course	150 houses by 2016	Outline Planning Consent	Outline planning permission for 150 housing units.	Residential (houses)	2016 low growth
031	Hartridge School Housing	300 houses		Land to be developed to fund construction of new Hartridge School. Very likely.	Education	2016 low growth
040	Traston Road – Falcon Steel B2	Falcon Steel - 180 jobs by 2016	UDP Allocation, Falcon Steel to develop site	Allocated in Newport UDP 1996-2011 Adopted Plan for B1, B2 & B8 uses. There is now a proposal from Falcon Steel for a three-phased development eventually employing 180. It is envisaged that this is likely to be the main development on this site and any remaining area will be small.	Employment (B2 Industrial Estate)	2016 low growth
056	Charnwood Development - Phase 1	2323 sqm	Revised Planning application due to be submitted Aug 2007	Phase 1 of office development opposite Brewery in Magor. Monmouthshire CC are likely to give planning consent once issue regarding protected land for possible New M4 has been resolved.	Employment (B1 office) and various others	2016 low growth
032	Tatton Road, Queensway Meadows – B1, B2 & B8	17.2 ha by 2016	Outline Planning Consent	Valid outline planning permission for B1, B2 and B8 use. However, emerging ideas on delivering small industrial units as there is a strong market for these.	Employment (B2 industrial units)	2016 high growth
033	Housing at Monmouthshire Bank Sidings	225 houses by 2016	UDP Allocation	Allocated in UDP. Planning application pending. Outline submitted May 07 However site is under consideration for possible hospital. Significant proportion still likely to go for housing	Residential (houses)	2016 high growth

Reference Number	Input	Size	Planning Status in 2007	Comments	Land Use	Development Scenario
034	Housing at Whiteheads Works	400 houses by 2016	UDP Allocation	Allocated in UDP. Planning application pending. However site is under consideration for possible hospital. Significant proportion still likely to go for housing	Residential (houses)	2016 high growth
035	St Cadocs Hospital Housing	250 houses by 2016	UDP Allocation	Allocated in UDP, subject to hospital trust. Railway Station associated with this. Local objections may delay development	Residential (houses)	2016 high growth
036	Crindau houses	420 by 2016	UDP Allocation	Allocated in UDP. Assume 420 houses by 2016	Mixed	2016 high growth
037	Crindau Marina		UDP Allocation	Allocated in UDP. Assume no traffic generation specific to marina.	Mixed	2016 high growth
038	University Campus (Riverfront)	Phase 2 7,500sqm (2013)	Phases 2 reasonably foreseeable Campus hypothetical	No start date is identified. Car parking will be minimal based on its City Centre location. The student numbers are not known. There are no planning approvals, although the site is allocated in the City Centre SPG as Education/Cultural Use	Education	2016 high growth
039	Housing at Orb works S. of Spytty Pill	350 houses by 2016	Outline Planning Consent	Outline planning consent subject to 106 agreement.	Residential (Houses)	2016 high growth
041	Newport Docks	19 ha by 2016	UDP Allocation	There are three current projects on the 19ha. One of which has progressed to a planning permission. Development of new businesses has been strong since 2002.	Employment (B2 Industrial Estate)	2016 high growth

Reference Number	Input	Size	Planning Status in 2007	Comments	Land Use	Development Scenario
042	Quaypoint mixed use development	19.2 ha, 60% by 2016	B2/B8 more than likely Everything else Reasonably Foreseeable	Planning application for industrial units and hotel submitted. Planning application for whole development likely to be staged. Difficulties due to land ownership; may need to go down CPO route, which could be long and lengthy; overall 60% likelihood of proceeding by 2016.	Mixed	2016 high growth
043	Duffryn Employment - Office	49,000 sq m offices (source NCC)		Helical Government Project is promoting Business park (49,000 sq m) within the site allocated as HYNIX /LG Phase 2 which has Planning permission for integrated electronics manufacturing plant. This is dependent on securing a Government Department pre-let.	Employment (B1 office)	2016 high growth
044	Crindau employment	16 ha B1	Hypothetical	Adopted UDP allocates for B1, commercial, leisure & retail uses.	B1	2016 high growth
045	'Hynix' development	25 ha site with former semiconductor buildings by 2016	UDP Allocation	Planning permission for integrated electronics plant. Other uses currently being considered include data centre (computer servers) with relatively low employment density up to 150 jobs	Employment (B2)	2016 high growth
057	Charnwood Development - Phase 2 onwards	21368 sqm of B1 offices; 836 sqm childcare nursery; hotel/restaurant with 100 beds	Hypothetical	Monmouthshire CC have seen proposals, but no planning permission yet. Andy Boyd from Savill's says there is a high likelihood of the development going ahead with GFA's as proposed. Not sure whether planning consent will be on an incremental basis	Employment (B1 office), hotel/restaurant and nursery	2016 high growth

Reference Number	Input	Size	Planning Status in 2007	Comments	Land Use	Development Scenario
046	Housing by bus depot/athletic club	160 houses by 2031	UDP Allocation	In UDP, no planning application submitted as yet. Likely to be used to fund a new depot	Residential (flats)	2031 low growth
047	East Newport housing south of railway line	3200 houses 2016 - 2031	Outline Planning Consent	Outline planning application. Development includes 2 schools plus village centre etc by 2028 Granted May 07 to St Modwen Developments.	Residential (houses)	2031 low growth
048	Queensway Meadows West	3.3 ha of sites by 2031	Outline Planning Consent	Three small sites available for industrial developments. Whole estate has outline planning permission for B1, B2 and B8 development. One site subject of current planning application. Likely to be developed incrementally over a prolonged period	Employment (B2 Industrial Estate)	2031 low growth
049	Existing Sainsbury's site following relocation to Crindau		UDP Allocation	The section 106 for the relocation of Sainsbury's is based on the existing store site changing to residential use. There are no specific proposals in the UDP for the existing store. The change of use to residential use will be implemented through the S106 Agreement and so likely to be triggered by Sainsbury's relocation to Crindau.	Leave as in Base Model	2031 low growth
050	Crindau houses	250 during period 2016 - 2031	UDP Allocation	Allocated in UDP. A further 250 houses by 2031, along with hotel, pub and restaurant.	Mixed	2031 low growth

Reference Number	Input	Size	Planning Status in 2007	Comments	Land Use	Development Scenario
051	Quaypoint mixed use development	19.2 ha, 40% during 2016-2028	B2/B8 more than likely Everything else Reasonably Foreseeable	Planning application for industrial units and hotel submitted. Planning application for whole development likely to be staged. Difficulties due to land ownership; may need to go down CPO route, which could be long and lengthy; overall 60% likelihood of going ahead.	Mixed	2031 high growth
052	Queensway Meadows East	35.3 ha between 2016-2028	UDP Allocation	Allocated in Newport UDP 1996-2011 Adopted Plan for large projects in national interest that outweigh environmental concerns. Policy constraints mean that this is unlikely to go ahead before 2016.	Employment (B2 Industrial Estate)	2031 high growth
054	Newport Docks	3 ha 2016-2031	UDP Allocation	There are three current projects on the 19ha site. One of which has progressed to a planning permission. Development of new businesses has been strong since 2002.	Employment (B2 Industrial Estate)	2031 high growth
055	Housing by bus depot/athletic club	80 houses by 2031	UDP Allocation	In UDP, no planning application submitted as yet. Likely to be used to fund a new depot	Residential (flats)	2031 high growth

Appendix B

Glossary of Terms

Glossary

Base year traffic model	A representation of existing traffic conditions as observed during traffic count and journey time surveys undertaken in the base year.
Design Manual for Roads and Bridges	The Design Manual for Roads and Bridges (DMRB) was introduced in 1992 in England and Wales, and subsequently in Scotland and Northern Ireland. It provides a comprehensive online manual system which accommodates current Standards, Advice Notes and other published documents relating to Trunk Road Works.
Do Minimum scenario	The future year situation with 'minimum intervention' from the Overseeing Authority, taking into account any committed transport schemes and national/local traffic growth projections.
Fixed demand modelling	Simple traffic growth projections with no suppression or induction to represent changes in demand in response to changes in transport conditions.
Local Model Validation Report	<p>The Local Model Validation Report (LMVR) serves two broad purposes. First it summarises the accuracy of the base from which forecasts are to be prepared. This is required because the accuracy of forecasts is directly related to the accuracy of the base. Second, where modelling methods have been used, the LMVR should demonstrate that the model accurately represents an existing, independently observed situation. This is needed to give confidence in the results produced by the model when used in forecasting mode. The preparation of an LMVR is mandatory for all trunk road schemes.</p> <p>Further information on the requirements of the LMVR is given in DMRB Volume 12, Section 2, Part 1, Appendix B.</p>
Origin-Destination data	Information on the origins and destinations of trips that use the road network within the study area, usually collected by roadside interview, number plate recognition or household surveys.
Roadside Interview Surveys	Driver interviews conducted at the roadside to obtain information about the trips that pass through that point on the road network, such as trip origin, destination and purpose etc.
SATURN software	SATURN (Simulation and Assignment of Traffic to Urban Road Networks) is a traffic assignment, simulation and analysis suite that has been developed over a period of more than 30 years by the Institute for Transport Studies at the University of Leeds. It is widely used for transport studies.

Traffic forecasts	A projection from the base year traffic model to provide a representation of likely future traffic conditions for a given scenario
Traffic Model	A computer representation of a highway network and the traffic that travels on it. It is used to provide an indication of current and future operating conditions across the modelled network.
Traffic model calibration	The process of adjustment to model parameters, network and demand to reflect the data as well as is necessary to satisfy the model objectives.
Traffic model validation	Validation consists of an independent check of the calibrated model; this requires that part of the data be set aside and not used during model calibration, so that it may be used subsequently to make the independent check.
Transport Research Laboratory	UK's Transport Research Laboratory, providing independent and impartial research, consultancy, testing and certification for all aspects of transport.
Variable demand modelling	Any change to transport conditions will, in principle, cause a change in demand (suppression or induction). The purpose of variable demand modeling is to predict and quantify these changes.