Department for Infrastructure

The Roads (Northern Ireland) Order 1993
The Local Government Act (Northern Ireland) 2014

A29 COOKSTOWN BYPASS SCHEME

PUBLIC INQUIRY

October 2024

Proof of Evidence

Traffic and Economic Assessment

By

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1 QUALIFICATIONS AND EXPERTISE

1.1 Personal Details

1.1.1 My name is Gokuldas Gopalakrishnan. I am a Technical Director at WSP and appointed to assist the Department for Infrastructure (DfI) ("the Department") to deliver the A29 Cookstown Bypass Project ("the Proposed Scheme" or "the Bypass"). I am a Chartered Engineer, Fellow of the Chartered Institution of Highways & Transportation and a Fellow of the Chartered Institute of Logistics and Transport. I hold a degree in Civil Engineering and a post graduate degree in Transportation Engineering and Management.

1.1.2 I have over 22 years of multinational experience within the field of Transportation Engineering encompassing transport planning, traffic modelling and economic appraisal of projects.

1.1.3 I have worked for WSP (formerly Mouchel) since 2007 where I am a Technical Director, responsible for the management and delivery of a range of transport infrastructure projects for public and private sector clients. I have extensive experience as a Project Manager and as a technical lead for highways schemes promoted by Department for Infrastructure (DfI), National Highways and various local authorities.

1.2 Project Role

1.2.1 Since 2019, I have acted as Project lead for all aspects of the traffic and economic appraisal of the A29 Cookstown bypass study. I have been responsible for the production of a number of key reports as part of the scheme design process including the Data Collection Report, Local Model Validation Report, Traffic Forecasting Report and Economic Appraisal Report, together with contributions to other key documents including the Stage 2 and 3 Scheme Assessment Reports.

2 SCOPE OF EVIDENCE

2.1.1 The scope of my evidence is limited to Traffic and Economic Assessment Sections of the A29 Cookstown Bypass Scheme: Stage 3 Scheme Assessment Report.

2.1.2 The method adopted for the traffic and economic assessment of the Proposed Scheme is in accordance with the requirements of the Department for Transport (DfT) Transport analysis guidance (TAG).

2.1.3 My evidence will address the particulars of the Traffic and Economic Appraisal Studies as described broadly under the following headings:

- Existing traffic conditions in the A29 corridor
- Traffic model development and validation
- Traffic forecasting; and
- Economic appraisal

3 EXISTING CONDITIONS AND KEY OBJECTIVES

3.1 Background

3.1.1 The Regional Development Strategy for Northern Ireland 2035 (RDS) guides the future development of Northern Ireland. The RDS recognises the key role that the Regional Strategic Transport Network (RSTN) has to play in achieving the social, economic and development goals in Northern Ireland.

3.1.2 An improvement to the A29 trunk road was included in the Investment Delivery Plan (IDP) as a strategic road improvement in the forward planning schedule. The schedule identifies major highway schemes which could be started in the next 10 years, subject to clearing the statutory procedures, satisfactory economic appraisal and the availability of funds.

3.2 Existing Traffic Conditions

3.2.1 The A29 is a trunk road, which routes directly through Cookstown town centre, facilitating the movement of strategic traffic generated on the west side of Lough Neagh on a north-south route corridor.

3.2.2 The different uses of the highway network conflict in the town centre, where shopping, personal business, employment and other local trips wishing to access the centre, demand the same road space required to service through traffic.

3.2.3 South of the town centre, between the junction of the A29 Killymoon Street / Sweep Road / Castle Road and the junction of the A29 William Street / A29 James Street / Molesworth Street, the A29 is a wide single carriageway. The central area has been utilised to provide localised sheltered island areas for pedestrians crossing the road and right turn lanes for vehicular traffic. The road frontage for this section is predominantly residential. Parallel on-street parking is provided on both sides of the road. During the traffic survey period (September – October 2023) the average 24-hr weekday flow recorded on Chapel Street was 15,580 vehicles.

3.2.4 The middle section is the town centre and is defined by the junction of the A29 William Street / A29 James Street / Molesworth Street and the junction of Orritor Street / Coagh Street / A29 William Street. The road standard for this section changes to a dual 2-lane carriageway. This section supports the core retail and business area of the town. On-street parking is provided on both sides of the dual carriageway, with parking being limited to short-stay, Monday to Saturday between 9:00am and 6:00pm. There are 128 parking bays at 90° angles to the kerbside, which requires the drivers to reverse into the nearside traffic lane when leaving the parking bay.

3.2.5 In the north, between the junction of Orritor Street / Coagh Street / A29 William Street and the junction of the A29 / Lissan Road / Morgans Hill Road, the A29 is a wide single carriageway with a mixture of parallel on-street parking provision and parking bays at 90º to the kerbside on both sides of the road. The frontage development is predominantly residential. The observed average weekday 24-hr traffic flow on this section, during the survey period, was approximately equal to 15,960 vehicles.

3.2.6 Westland Road, which runs almost parallel to the A29 and connects directly to A505 Drum Road (to Omagh) provides an alternative, reasonably direct, link between the north and the south of the town. During the 2023 surveys, 2-way daily flows of 14,180 vehicles were recorded on Westland Road south of its junction with Fairhill Road. Heavy goods vehicles and other commercial traffic also use Westland Road to access the main industrial sites in Cookstown, to the south and west of the town at the Ballyreagh Business Park and the Derryloran Industrial Estate on Sandholes Road.

3.3 Impact of Not Changing

3.3.1 The inadequacy of the existing A29 is widely recognised within RDS and RTS. Local people and the business community consider journey times along the A29 to be unreliable, due to congestion caused by bottlenecks at key junctions in the town.

3.3.2 If the Proposed Scheme is not provided, these problems are expected to remain or worsen:

- congestion at pinch points is likely to worsen
- journey times are expected to increase and become more unreliable
- economic growth in the North and South of the province could be inhibited
- Road safety and the quality of life for many residents could deteriorate

3.3.3 The new bypass will facilitate/provide the movement of people and goods along a modern, high-quality corridor and will improve access to north and south provinces, market towns and tourist areas. Consequently, the Proposed Scheme would assist with the delivery of economic and growth objectives for NI.

3.4 Regional Objectives

3.4.1 The appraisal of proposals for improvement works are assessed against the following four criteria, as set out in TAG:

- Economy - to support sustainable economic activity and get good value for money.
- Environment - to protect the built and natural environment.
- Social - to improve safety, accessibility, and integration.
- Public Accounts - to consider the cost to the broad transport budget.

3.5 Scheme Specific Objectives

3.5.1 The A29 Cookstown Bypass project specific Scheme Objectives are to:

- Relieve traffic congestion within Cookstown.
- Reduce journey travel times along the A29 corridor.
- Improve the road network between the north and south of the province.
- Improve road safety.
- Improve the quality of life for the majority of residents.
- Improve the town centre environment.
- Minimise the impact on the natural and built environment.
- Enhance the economic growth of the area.
- Achieve value for money as demonstrated through a net positive return on investment.

4 TRAFFIC DATA COLLECTION

4.1 Data Collection

4.1.1 A range of data was required for the development and validation of the Cookstown traffic model. Data was collected from a number of existing sources as well as traffic surveys carried out in spring 2019, in accordance with guidance set out in TAG (applicable at the time of base model development). Any relevant existing data has also been obtained from the Department to inform the base model development.

4.1.2 The survey data comprises the following elements used for various parts of the model building process, as described:

- **Automatic Traffic Counts (ATC):** A total of 42 sites were surveyed for approximately 3 weeks. The information was used for,
  a. Model calibration and validation.
  b. Expansion of Road Side Interview surveys data.
  c. Identifying the peak periods of traffic demand.
  d. 16-hour, 18-hour, AADT and AAWT conversion factors.
- **Manual Classified Junction Turning Counts (JTC):** These comprised classified counts at 21 locations to derive full turning movements, for use in model calibration including deriving vehicle class proportions and high-level checks of route choice.
- **Car Park Interviews (CPI):** The Car Park Interview (CPI) surveys were undertaken at four car parks. These car par park interviews are carried out together with supporting Manual Classified Counts (MCC) entry/exit counts. This data provided trip origins for journeys to the principal town centre car parks and was used as a source of data for developing the trip matrices.
- **Road Side Interview Surveys (RSI):** These comprised nine sites designed to capture origins and destinations of trips entering and exiting Cookstown by the radial routes. They were used as a source of data for developing and calibrating the trip matrices.
- **Journey Time Surveys (JTS):** Journey Time surveys were carried out by the Moving Car Observer method using GPS logging on key routes within the study area. This data was used for model validation.

4.1.3 Further details of the traffic surveys including locations, survey programme, survey methodology and the analyses undertaken are presented in the A29 Traffic Data Collection Report (Ref :718314-2700-R-0003).

4.1.4 To better understand the implications of the changes brought about by the unexpected event of Covid-19 pandemic on the A29 scheme assessment, additional data was collected in September and October 2023. This is further explained in Section 6.12.

5 OVERVIEW OF THE TRAFFIC MODELLING PROCESS

5.1 Introduction

5.1.1 The role of the traffic model is to provide a ‘depiction’ of the local road network and current traffic demands within the area affected by the proposed Bypass. Based on contemporary traffic surveys and present-day conditions, the base year traffic model represents the current road network and the traffic movements being made. The base year model is accurate or valid when it can reproduce the patterns and routings of this traffic and its travel times across the network, to the level of accuracy specified within TAG.

5.1.2 The model is then developed to predict future changes (such as growth in traffic volumes) and identify the impacts of these changes on the local road system, for a range of proposals, such as A29 Cookstown Bypass. The model is used to predict the changes in travel times and cost attributable to increased traffic flows and hence congestion or the effects of a new road which provides additional network capacity.

5.1.3 Outputs from the model include the predicted traffic demands on the new road (for engineering design), the savings in journey times and accidents (for economic appraisal) and the changes in traffic flow as they affect the local communities (for environmental appraisal).

5.2 Components of the Traffic Model

5.2.1 The computer-based traffic simulation model consists of a ‘network’ (representing the physical highway infrastructure), a ‘matrix’ (representing vehicular journeys made on the network) and an ‘assignment procedure’ (representing drivers’ route choice on the network).

5.2.2 The network is made up of a series of what are termed ‘links’ and ‘nodes’. The links represent lengths of road and the nodes represent the intersection points or junctions between links. Nodes can be actual junctions or points at which the road characteristics change, for example, a change in the speed limit. Both the links and nodes are given specific characteristics within the traffic model. These include, for example, the type of road (speed limit, width, etc.) or the type of junction (traffic signals, roundabouts or priority control) together with their traffic capacities. The network is developed using GIS systems for accurate referencing of junction locations, road alignments and other geometric data.

5.2.3 The matrix consists of numbers of journeys between various origins and destinations. To enable referencing of trip ends (origins and destinations), the study area is divided into geographic areas called zones. Each trip has an origin zone and a destination zone represented by a cell in the matrix. The zones can be relatively small, covering only a few streets in the area of greatest interest and/ or densely developed areas. Areas less densely developed or further away from the scheme are divided into larger zones. Trips are loaded onto the highway network by means of centroid (or zone) connectors. These are notional links with no capacity constraint.

5.2.4 Having developed a network and a matrix, a procedure known as assignment is used to distribute the matrix of trips onto the highway network. In simplistic terms, an assignment procedure calculates journey costs (based on travel distances and times) along all reasonable routes for each origin-destination pair. The Origin / Destination movements are then assigned to the appropriate minimum ‘cost’ routes which are determined as function of the times and distances on each network link.

5.2.5 The model calibration process involves the construction of the Base Year model and the adjustment of the model parameters to provide the best fit against the observed or assembled local data.

5.2.6 Model validation is a checking stage whereby attributes of the model are compared against independent data, which is data not used in the model calibration process. Typically, validation checks take the form of comparisons between observed and modelled traffic flows and journey times throughout the study area of the model.

6 DEVELOPMENT OF THE BASE YEAR MODEL

6.1 Overview

6.1.1 To facilitate a robust assessment and appraisal of the options identified for the A29 Cookstown Bypass Scheme at SAR2 stage, a traffic model for A29 Cookstown Bypass was developed representing a base year of 2019. The development of the traffic model followed guidance set out in TAG.

6.2 Methodology

6.2.1 The model study area was defined to capture the likely impacts of the proposed A29 Cookstown Bypass as well as the impacts of any other proposed local interventions within Cookstown and its immediate surroundings. The model study area centres on Cookstown, with the model network extending across a wider area to include relevant local and strategic alternative routes.

6.2.2 The traffic model is set up to model highway assignment only based on fixed demand approach. Due to the nature and the objectives of the proposed scheme, the traffic model is not set up to model public transport demand nor to assess the variable demand impacts of the proposed scheme.

6.2.3 The performance of the traffic model is reported in 'A29 Cookstown Bypass, Local Model Validation Report – Ref 718314-2700-R-0004' (LMVR) dated November 2019, which describes in detail the work carried out in the development and validation of the traffic model. It presents the various data sources used for the model development and explains the methods used for the development of the trip matrices and highway network. The LMVR presents the results of the model calibration and validation with reference to the UK Department for Transport's (DfT) Transport Analysis Guidance (TAG - Transport analysis guidance - GOV.UK (www.gov.uk)) and demonstrates that the model produces an accurate representation of observed traffic conditions in Cookstown, including the routes most likely to be impacted by the proposed scheme in future scenarios.

6.3 Modelled periods

6.3.1 The model reflects the typical traffic conditions during the morning, average inter-peak and evening peak hours. The peak hour with respect to both the AM peak and PM peak period were established with reference to traffic flow profiles. The traffic flow dataset was drawn from the Automatic Traffic Counters (ATCs) carried out as part of the 2019 survey programme. On the basis of this analysis, and in keeping with national methodologies for forecasting which usually operate on whole hour periods, the following three time periods were identified for the model development:

- AM Peak hour: 08:00 – 09:00.
- PM Peak hour: 17:00 – 18:00 and
- Average Inter-peak hour: 10:00 - 16:00.

6.4 Vehicle Classes and Trip Purposes

6.4.1 Separate demand matrices were developed for various combinations of vehicle type and trip purpose. This recognises the different characteristics of trips and facilitates distinction in some of the modelling processes.

6.4.2 The combination of vehicle types and trip purposes are known as user classes and are defined as follows:

- Cars – Commute (journey from home to work and vice versa)
- Cars – Employers Business
- Cars – Other trip purposes
- Light Goods Vehicles (LGVs)
- Heavy Goods Vehicles (including Medium Goods Vehicles) (HGVs)

6.4.3 The disaggregation of trip demands to different user classes was undertaken based on journey purpose data collected in Roadside Interview Surveys (RSI) and Car Park Interview (CPI) surveys. This disaggregation of trips provides insights on the demand matrices in varying spatial, temporal and purpose/segment resolution.

6.4.4 Standard values of Passenger Car Unit (PCU) were obtained from TAG Unit M3.1 D.7.2 (January 2014) and used within the model.

6.5 Model Zoning System

6.5.1 A detailed zone system was developed for Cookstown Town Centre and the road network within the detailed study area. Zones were then drawn progressively larger and less detailed further away from the study area and represent the remainder of Northern Ireland.

6.5.2 The zone system was designed to be consistent with the NI District boundaries and the census zoning system at Super Output Area (SOA) level. Within Cookstown, the finer Small Area (SA) boundaries were adopted where practical. Where necessary these were broken down further, based on the local land use as illustrated in Figure 6-1

6.5.3 A subset of 'empty' model zones was also developed and included within the base model. In the base model, these 'empty' zones have no assigned trips or defined geographical coverage, but were reserved for representing any significant proposed developments in the forecast scenarios. Their inclusion in the base model serves to ensure consistency between the base and forecast future year networks.

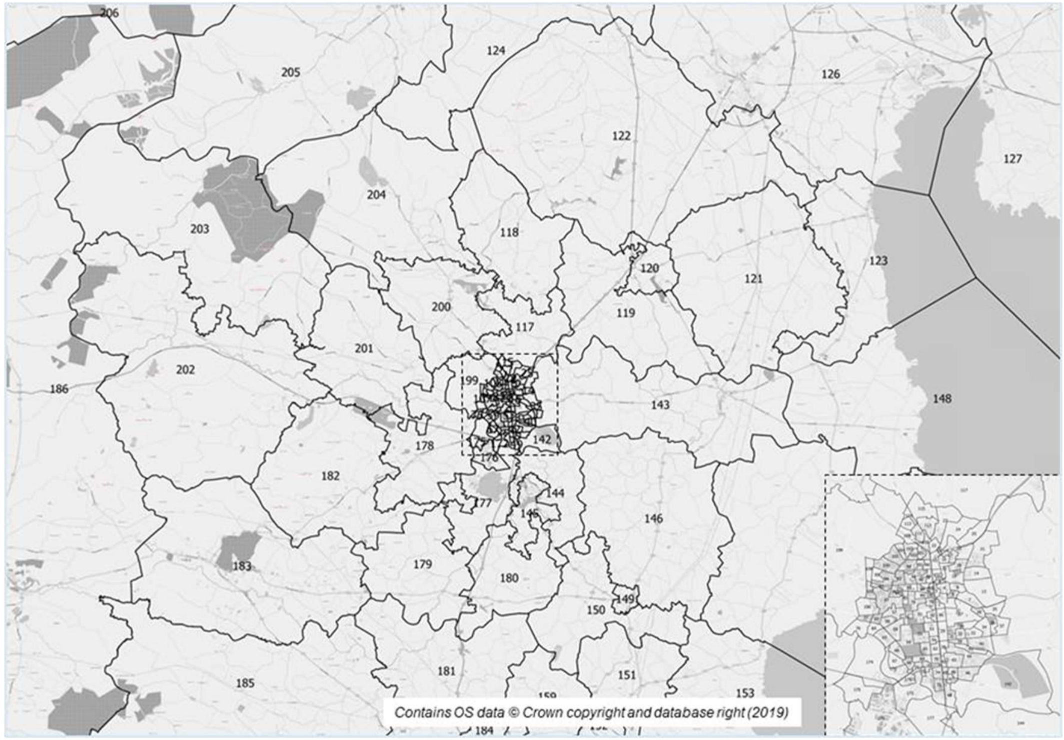


Figure 6-1 - Model Zones

6.6 Model Network

6.6.1 The model network incorporates major and principal routes within the study area, local roads within Cookstown and local routes within the wider study area. As such, the model network provides an accurate representation of the existing highway network in Cookstown and the surrounding area. The extent of the highway network is shown in Figure 6-2 below.

6.6.2 The model comprises a simulation network to cover the entire study area (shown as the Area of Detailed Modelling in Figure 6-2); and a buffer network covering the wider external area. The simulation area encompasses the entire study area, whilst the external area has been represented within the buffer network. The simulation area incorporates detailed representation of junctions to facilitate the modelling of queues and delays and to take account of roads that are used as alternatives (rat-runs).

6.6.3 Bus routes information was obtained from the websites of public transport operator Translink together with bus service frequencies. Within the A29 Cookstown Bypass model, buses are represented explicitly as fixed flows along the defined bus routes based on the bus service frequencies.

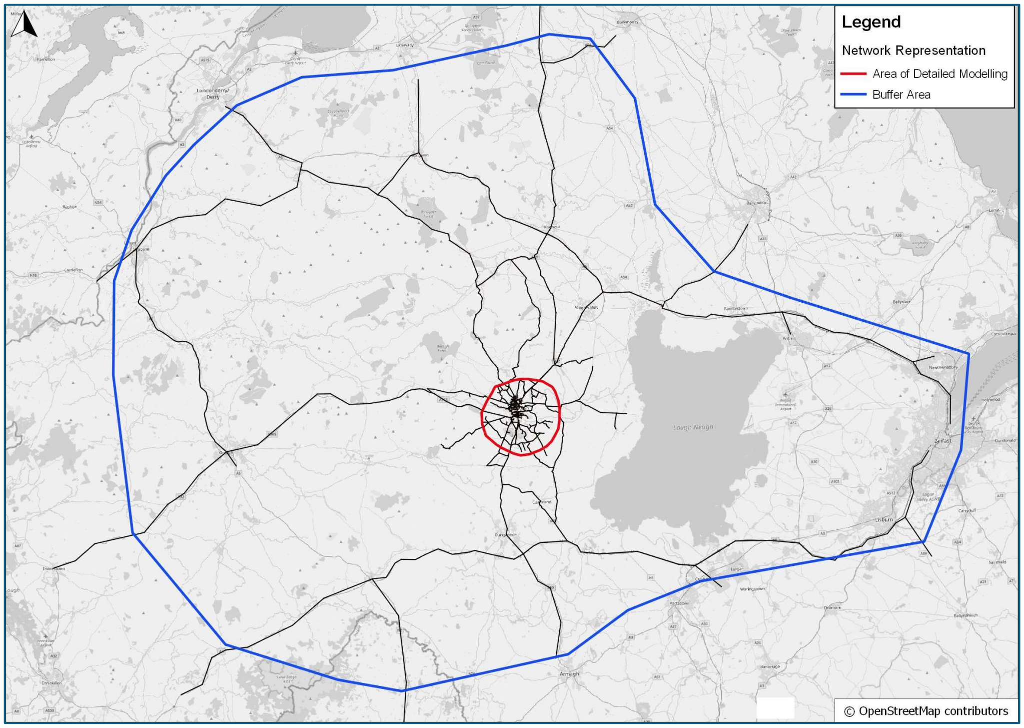


Figure 6-2 - Model Network Representing Level of Detail

6.7 Development of Base Year Demand Matrix

6.7.1 The base matrices were developed using RSI and CPI as the primary source. The RSI and CPI provided origin / destinations (O/Ds) for trips to and from the study area. The RSI data also provided partial information on trips passing through the study area.

6.7.2 Due to potential overlap between elements of the RSI and CPI data with an internal trip-end, measures to avoid any double counting were implemented during matrix merging.

6.7.3 It is acknowledged that there were some unobserved elements within the RSI and CPI data, such as data on shorter distance internal to internal movements - particularly within Cookstown town centre. A synthetic matrix was developed based on TEMPRO-NI v.7.3 to infill the unobserved internal to internal trips.

Table 6-1 - Prior Matrix Summary by Purpose and Period (PCU/hour)

Time Period	Commute	Business	Other	LGV	HGV	Total
AM peak	3,005	505	1,686	431	374	6,001
Inter peak	629	317	3,450	358	443	5,197
PM peak	2,082	343	3,624	618	281	6,948

6.8 Traffic assignment

6.8.1 The traffic model has been constructed in the SATURN modelling suite using an assignment process based upon Wardrop's Equilibrium Theory. The principle behind the Theory states that traffic arranges itself on a network so that the cost of travel on a route between an origin and destination is equal to or less than all other potential but unused routes.

6.8.2 Model convergence has been assessed against criteria as set out in TAG Unit M3-1 'Highway Assignment Modelling' (January 2014), Section 2. Model convergence guidance, also outlined in TAG Unit M3-1, seeks to ascertain the stability of the assignment. Essentially this means that as SATURN loops between assignment and convergence, gradually getting closer to convergence, the assignment of trips to links between loops becomes more consistent and less likely to be re-assigned.

6.9 Model calibration

6.9.1 Model calibration is the iterative process of reviewing and adjusting the model's network and/or trip matrices so that modelled traffic flows, speeds, junction delays and routeings through the network provide a reliable match to observed data. The calibration procedure involved the following processes:

- Checks to ensure that link speeds, capacities and number of lanes on the network were realistic.
- Checks to ensure that junction attributes matched on-ground conditions and that delay calculations at junctions were realistic.
- Adjustment and checking of the network to ensure plausible routeing of traffic (HGV restrictions).
- Refinement of network parameters (e.g. capacities) to match modelled data e.g. traffic flows and journey times, to observed data.
- Use of matrix estimation (ME) to adjust the prior trip matrices to match observed traffic counts.

6.9.2 Matrix estimation is a process that adjusts the travel pattern for compatibility with the observed traffic counts to produce a matrix which 'best fits' the observed counts. The matrix estimation procedure was undertaken within SATURN in accordance with TAG Unit M3.1 (January 2014).

6.9.3 The matrix of trips input to matrix estimation is known as the 'prior' matrix and the matrix of trips output from matrix estimation is termed the 'post' matrix. The post matrix will therefore contain a better representation of the individual trip movements on counted links, compared to the prior matrix.

6.9.4 The matrix estimation process utilised observed traffic count data derived from the ATC data collected in 2019. In accordance with guidance set out in section 8.3.5 of TAG Unit M3 (January 2014), the counts used for ME were grouped and applied at the screenline level (screenlines would generally intercept trip movements between sectors). The model calibration and validation screenlines are shown in Figure 6-3.

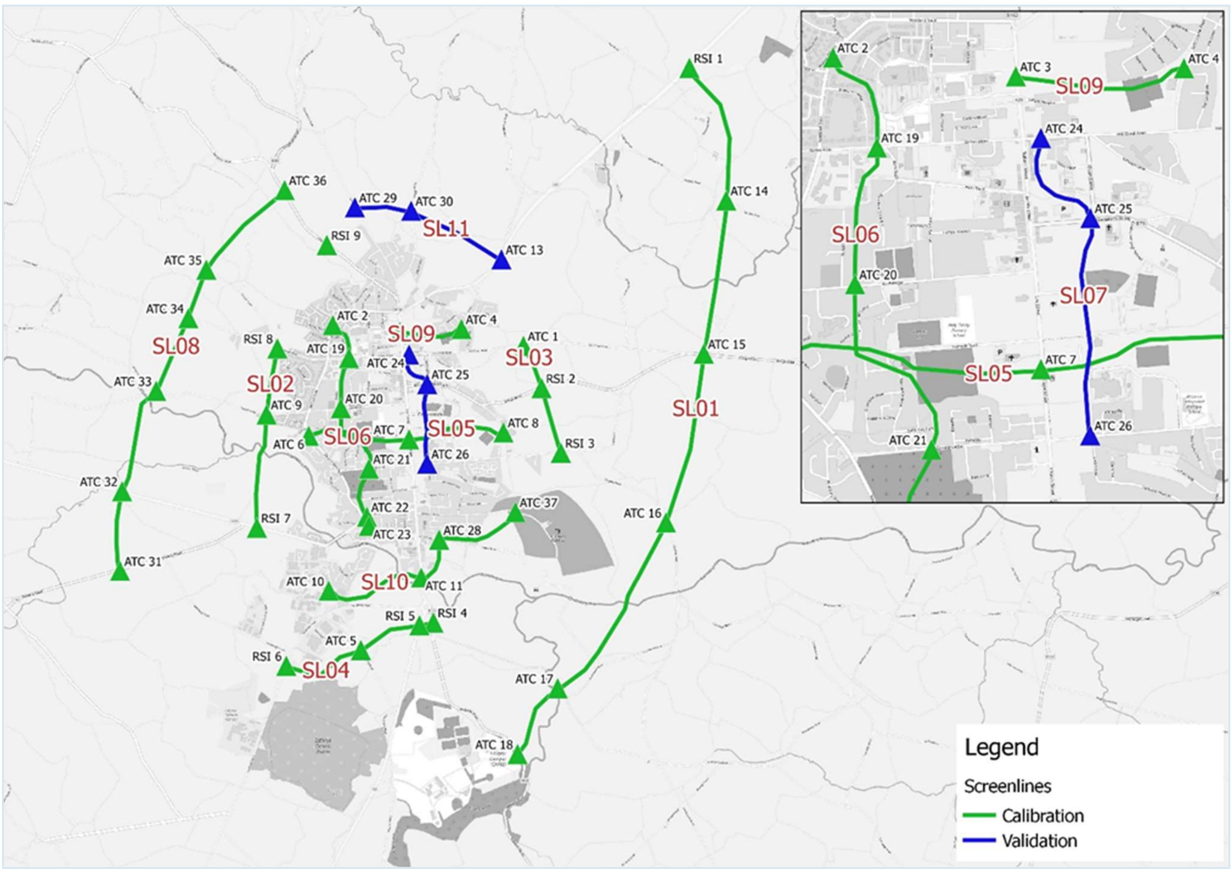


Figure 6-3 - Study Screenlines

6.9.5 The matrix estimation is shown to increase total demands by around 600 PCUs in each modelled period, as presented in Table 6-2 below. A more detailed analysis of the changes in trip patterns was carried out through a sector to sector analysis. More than 90% of all sector to sector movements across all three time periods show a change of less than 15 PCUs or 5% as presented in Table 6-3. This is within the matrix estimation guidance set out in Section 8.3 of TAG Unit M3.1. More comprehensive results are presented in the 'A29 Cookstown Bypass, Local Model Validation Report – Ref 718314-2700-R-0004' (LMVR).

Table 6-2 - Matrix Totals Before and After Matrix Estimation (in PCU/Hr)

Time Period	Prior	Post	Abs Change	% Change
AM peak	6,001	6,685	684	+11.4%
Inter-Peak	5,197	5,736	539	+10.4%
PM Peak	6,948	7,540	592	+8.5%

Table 6-3 - Summary of Sector-to-Sector Comparison

Time Period	Number of sector movements with <5% change or <15 PCUs change	% of sector movements with <5% change or <15 PCUs change
AM peak	361	90%
Inter-Peak	379	95%
PM Peak	366	92%

6.9.6 TAG acceptability criteria model calibration of links are presented in Table 6-4

Table 6-4 - TAG Calibration Criteria

Criteria	Description of Criteria	Acceptability Guideline
1	Individual flows within 100 veh/h of counts for flows less than 700 veh/h	> 85% of cases
	Individual flows within 15% of counts for flows from 700 veh/h to 2,700 veh/h	> 85% of cases
	Individual flows within 400 veh/h of counts for flows more than 2,700 veh/h	> 85% of cases
2	GEH* < 5 for individual flows	> 85% of cases

** GEH error statistic is a non-linear formula used to compare two sets of traffic volumes*

6.9.7 There were 74 calibration counts used in the base year model for the AM and PM peaks as well as inter-peak. Table 6-5 shows that in all time periods, the model meets the TAG criteria for flow calibration.

6.9.8 Table 6-5 shows that in all time periods, the model meets the TAG criteria for flow calibration. 91% of links meet the TAG GEH criteria in the AM peak, but the inter peak and PM peak are just short of meeting the TAG GEH criteria. In the interpeak, five links achieve GEH < 5.5 and in the PM peak, four links achieve GEH < 5.5, if we considered these links are close to meeting the GEH requirements then all three-time period would also meet the TAG GEH criteria.

Table 6-5 - Number/Percentage of Links Meeting TAG Criteria

Time Period	No. of links meeting criteria 1	% links meeting criteria 1	No. of links meeting criteria 2	% links meeting criteria 2	No. of links meeting either criterion	% links meeting either criterion
AM Peak	71	96%	67	91%	72	**97%**
IP Peak	68	92%	62	84%	68	**92%**
PM Peak	68	92%	59	80%	68	**92%**

6.9.9 Overall, by considering either criterion a high level of matrix calibration has been achieved across all three modelled time periods following the application of matrix estimation.

6.10 Model validation

6.10.1 Validation of the model was based upon a comparison of observed and modelled traffic flow and journey time data. It is important to note that the data used to validate the model is entirely independent from data used to calibrate the model.

6.10.2 The validation of traffic flows involved a comparison of observed and modelled flows across two screenlines. These were designed to capture traffic movements likely to be affected by the proposed scheme and focused on the north and east parts of the study area. They therefore represent a robust test of the trip matrix and model assignment. The validation screenline locations are displayed in Figure 6-3 above.

6.10.3 The validation criterion and acceptability guidelines for link flows and turning movements are defined in section 3.2.8 of TAG Unit M3.1 (January 2014) as per Table 6-4 above.

6.10.4 There were 12 validation counts used in the base year model for the AM, PM and inter-peak. The results presented in Table 6-6 show that, for the AM peak and PM peak, 100% of links meet the TAG link flow criteria. In the interpeak only one link does not meet the TAG link flow criteria.

6.10.5 More comprehensive results are presented in the ‘A29 Cookstown Bypass, Local Model Validation Report – Ref 718314-2700-R-0004’ (LMVR).

Table 6-6 - Summary of Validation for Links on Screenlines

Validation Criteria	AM Peak	IP Peak	PM Peak
No. of links meeting criteria 1	12	11	12
% links meeting criteria 1	100%	92%	100%
No. of links meeting criteria 2	12	8	9
% links meeting criteria 2	100%	67%	75%
No. of links meeting either criteria	12	11	12
% links meeting either criteria	100%	92%	100%

6.11 Journey time validation

6.11.1 Validation of journey time is carried out to determine how well model journey times match observed times. The observed data gathered during the Journey Time Survey, using a moving observer GPS methodology, was used to for the validation process.

6.11.2 The validation was assessed using the TAG validation guidelines as set out in section 3.2.10 of TAG Unit M3.1 (January 2019). The TAG guidance advises that modelled times along 85% of routes should be within 15% of surveyed times (or 1minute, if higher than 15%).

6.11.3 In terms of journey time validation, the TAG guidelines have been satisfied for all the modelled time periods. The AM peak and the inter-peak both achieved 100% compliance with PM peak passing at 88%, with one journey time route marginally failing to meet the TAG criteria.

6.11.4 Further details about the base year model calibration and validation have been reported in the ‘A29 Cookstown Bypass, Local Model Validation Report’ – Ref 718314-2700-R-0004, dated November 2019.

6.12 Base Model Verification

6.12.1 The DfT and DfI both recognise the need for proportionality in traffic forecasting. Following the unexpected event of Covid-19 pandemic, and subsequent to the development of the updated traffic forecasts, in April 2023, the DfT issued guidance on accounting for the Covid pandemic in traffic models. Where model rebasing was impractical or required disproportionate effort, the guidance provided three alternative methodologies for assessing the extent of the divergence of travel patterns and traffic volumes from the equivalent pre-pandemic projections.

6.12.2 The most robust method suggested in TAG Unit M4 (May 2023) Appendix B involves creating a forecast to the present day and comparing this forecast to locally observed traffic data to check the model against observations to verify its suitability. Within the guidance, it is acknowledged that full alignment to validation standards is not expected, but that some level of suitability is required.

6.12.3 In line with this guidance, volumetric traffic data was collected in autumn 2023 to inform the performance of the traffic model against the observed post-Covid traffic data. This model verification exercise followed the most robust of the three suggested methodologies and found only relatively minor divergence between the pre-pandemic projections and local volumetric traffic data from 2023.

6.12.4 The forecasting assumptions used in the traffic forecasts which have informed the SAR3 assessment are consistent with those used in the 2023 model verification work. The traffic forecasts were prepared in accordance with the advice set out in TAG Unit M4 dated May 2019, which was applicable until December 2022 and covered the period of SAR3 model forecast development.

6.12.5 The findings of the verification assessment show that across all explicitly modelled peak time periods the model provides a relatively good match against most of the 2023 observed traffic count data for the total volume. It should be noted that the results are from a model verification exercise rather than from recalibration and revalidation of the existing model.

6.12.6 This confirmed the model’s suitability as a tool to be used for the assessment and appraisal of the A29 Cookstown Bypass scheme at SAR3 stage. The results of the model verification exercise are reported in Stage 3 Scheme Assessment Report (Ref: 718314-0000-R-022), Appendix B.

6.12.7 In summary, the 2019 base model validation and the 2023 model verification both demonstrated that the A29 base year traffic model adequately meets the TAG criteria. On this basis, this model is considered to be an appropriate tool and can be used with confidence to assess the A29 Cookstown Bypass Scheme.

7 TRAFFIC FORECASTING

7.1 Methodology

7.1.1 The 2019 base year traffic model formed the basis for the development of the future year traffic models to support the design and appraisal of the A29 Bypass and Sandholes Link Road Scheme. The future year models were developed for a scheme opening year of 2027 and a design year of 2042.

7.1.2 The forecast model comprises a process of predicting the future flows on the highway network across the study area and includes the following main components:

- Estimate of future highway supply
- Estimate of future travel demand
- A mechanism of assigning demand to the highway network

7.1.3 To address uncertainty, a range of demand scenarios were developed for the purpose of the Stage 3 testing. This includes a Core growth scenario as well as High and Low growth scenarios. Table 7-1 outlines the forecast traffic models developed for testing the different growth scenarios.

Table 7-1 – Forecast Model Scenarios

Scenario	ID	Years	Assignment Network and Demand Description
Do-Minimum	DM-Core	2027, 2042	No significant changes in network as compared to base, assigned to 2027 and 2042 Core demands.
Do-Minimum High Growth	DM-HG	2027, 2042	No significant changes in network as compared to base, assigned to 2027 and 2042 High Growth demands.
Do-Minimum Low Growth	DM-LG	2027, 2042	No significant changes in network as compared to base, assigned to 2027 and 2042 Low Growth demands.
Do-Something Core	DS-Core	2027, 2042	Addition of Preferred Route scheme (bypass) along with improvement of Sandholes Link Road, assigned to 2027 and 2042 Core demands.
Do-Something High Growth	DS-HG	2027, 2042	Addition of Preferred Route scheme (bypass) along with improvement of Sandholes Link Road, assigned to 2027 and 2042 High Growth demands.
Do-Something Low Growth	DS-LG	2027, 2042	Addition of Preferred Route scheme (bypass) along with improvement of Sandholes Link Road, assigned to 2027 and 2042 Low Growth demands.

7.1.4 The traffic forecasts were prepared in accordance with the advice set out in TAG Unit M4 (May 2019), the version applicable at the time of forecast model development for SAR3. They were principally determined using local information collected from Mid Ulster Council on proposed and committed transport interventions and development growth combined with factors obtained from TEMPRO-NI v7.3 and RTF2018 (versions applicable at the time of SAR3 forecast model development).

7.2 Future Year Network

7.2.1 The two key factors affecting the future supply are:

- Network wide changes in transport costs represented by economic parameters (including values of time, vehicle operating costs and vehicle occupancies)
- Local network changes resulting from other transport interventions identified within the Uncertainty Log

7.2.2 The Uncertainty Log is a record of assumptions made in the model that will affect travel demand and supply and can include local highways improvement schemes or proposed residential, commercial, or industrial developments. The Uncertainty Log has been developed in consultation with the development team in Mid Ulster Council.

7.2.3 Since the Stage 2 assessment, existing and proposed speed limits within the Cookstown area have been updated. These speed limit alterations were added to the Do-Minimum networks where appropriate. These changes also applied to the Do-Something forecast networks.

7.2.4 Background growth in traffic and the resulting re-routings due to demand changes, led to the need to optimise some signals for predicted 2027 and 2042 traffic flow levels. The same optimised signal timing has been carried out from DM through all DS scenarios for both model years. Economic parameters have been updated in line with TAG Databook v1.18 (May 2022) for each modelled user class, time period and forecast year.

7.2.5 Do-Something networks were developed from the Do-Minimum networks, adding the Stage 3 Bypass alignment and Sandholes Link Road.

7.3 New Developments

7.3.1 Details of prospective developments were collated from the relevant documentation published within the Mid Ulster planning portal and Cookstown Area Plan 2010, and recorded within the Uncertainty Log together with their prescribed level of uncertainty and expected size.

7.3.2 In line with guidance from TAG Unit M4 Table A1, only those developments located within the core study area and whose likelihood was assessed to be either ‘near certain’ or ‘more than likely’ were considered in the demand forecasts.

7.3.3 Figure 7-1 below shows the significant new development zones considered, exclusively based on development trips from the Uncertainty Log. These zones were added to the model to accurately account for the increase of trips and ensure trips are added to the network in the correct location.

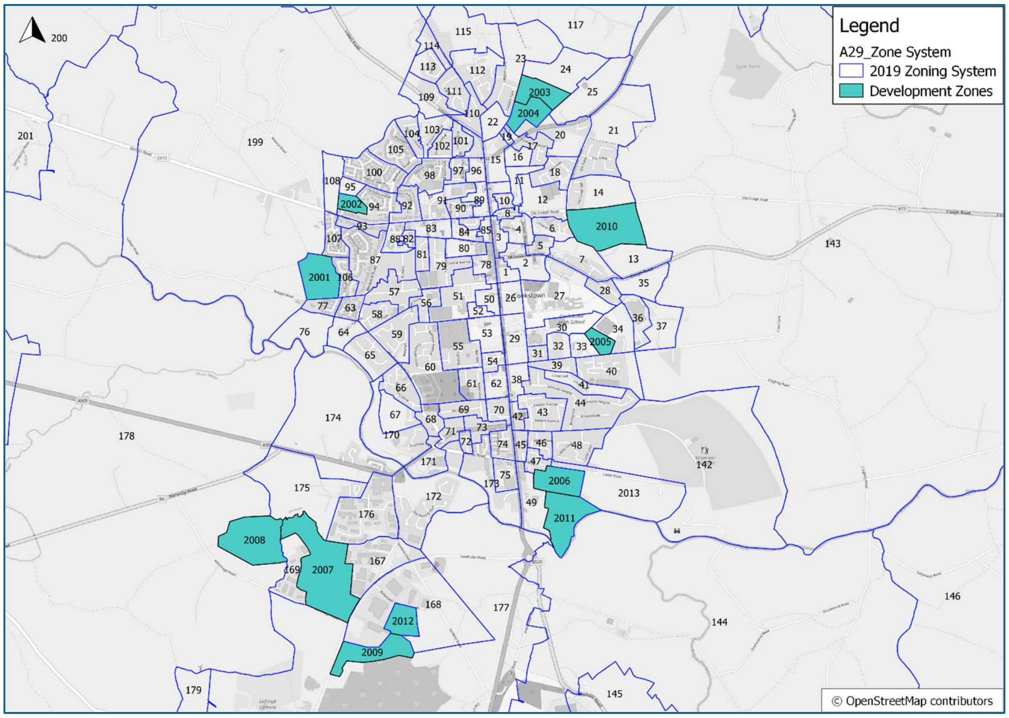


Figure 7-1 – New Development Zones in SATURN Model

7.3.4 For each proposed development, TRICS database (the UK and Ireland's national system of trip generation analysis) was used to estimate trip generation and, arrival and departure profiles. For the economic developments, "Employment Density Guide 2015" by Homes & Communities Agency has been used to estimate employment density and the resulting trip generation was calculated based on TRICS data.

7.4 Traffic Growth and Future Year Matrices

7.4.1 The trip end growth forecasts from TEMPRO-NI v7.3 were used to factor the car base year trip matrices using growth factors for each time period, trip purpose, and vehicle type, through a Furness procedure. The final forecast matrices were produced using trip generation from new developments constrained to TEMPRO-NI traffic growth, as recommended in TAG. This ensured that all new trip generation was accurately allocated to new developments within Cookstown, but overall growth was controlled to TEMPRO-NI and therefore aligned to the national growth projections.

7.4.2 Impacts of future fuel pricing and income changes on car user demand were incorporated through the application of fuel and income factors, derived from Table M4.2.1 in the TAG Data Book v 1.18 (May 2022).

7.4.3 LGV and HGV growth was based on projections of goods vehicle growth for England published by the Department for Transport, as RTF-2018, which was applicable at the time of traffic forecast development. To account for variation in demand growth between Northern Ireland and England, a secondary factor was applied to RTF-2018 LGV and HGV growth factors, based on a comparison of TEMPRO-NI total vehicle growth projections with the equivalent TEMPRO (GB) projections.

7.4.4 The traffic forecasting undertaken for the SAR3 assessment made use of high and low growth sensitivity testing around demand forecasts. The High and Low growth sensitivity tests assess the proposed scheme's robustness in the light of uncertainty in demand levels.

7.4.5 The tests comprise a proportion of base year demand to be added to or subtracted from the core scenario (loosely described as the ±2.5% rule). In line with TAG the supply (network) for High and Low growth scenario tests have not been changed from the Core scenario. Table 7-2 presents the resulting increase to the hourly matrix totals for each forecast year including the High and Low growth forecasts.

Table 7-2 – Summary of Matrix Total changes

Demand Scenario	2019-2027 AM	2019-2027 IP	2019-2027 PM	2019-2042 AM	2019-2042 IP	2019-2042 PM
Low	133	194	221	1090	1196	1423
Core	606	600	754	1890	1874	2327
High	1079	1005	1288	2692	2562	3231

7.5 Analysis of Forecast Results

7.5.1 The traffic model is strategic in nature and represents average peak and inter-peak period conditions on an average weekday. As such, some of the extreme variations observed in Cookstown due to the different uses of the existing A29 are not always fully reflected in the traffic model outputs. The scheme impacts are therefore assessed against an equivalent Do-Minimum scenario, both representing average conditions and thereby allowing a like for like comparison to be made. These include comparisons of traffic flows along the key links, journey times and network wide performance (in terms of average speed, PCU kilometres and vehicle hours).

Traffic Flow Summary

7.5.2 Figure 7-2 and Figure 7-3 show the comparison of flows (vehicles/hr) between the Do-Minimum (DM) models and Do-Something (DS) models for the Core, High Growth and Low Growth scenarios. The figures also present the Average Annual Daily Traffic (AADT) for comparison.

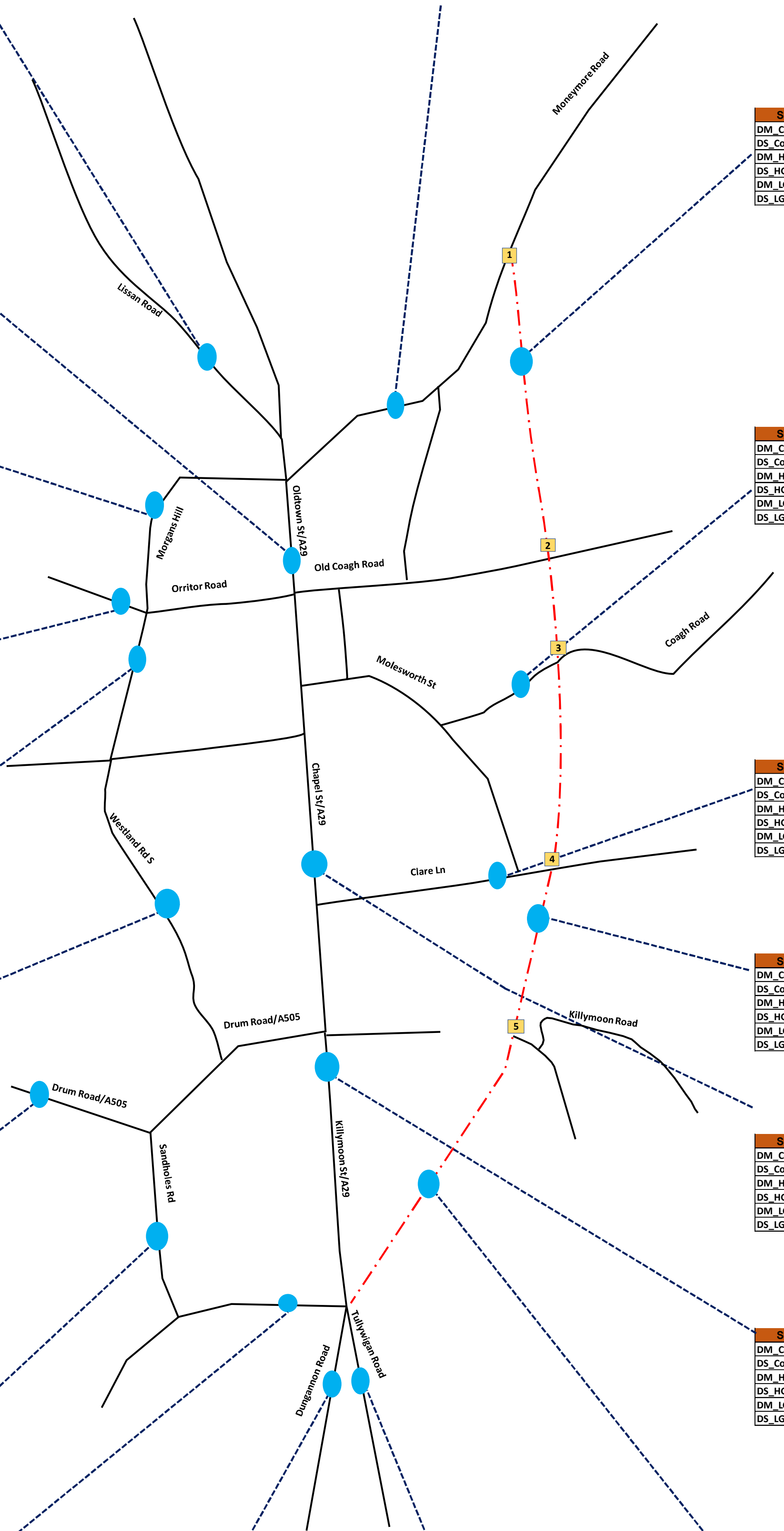
7.5.3 AADT flows on the proposed Bypass in the Core Scenario are predicted to range between 12,660 vehicles and 15,380 vehicles in the opening year and range between 16,090 vehicles and 19,500 vehicles in the design year, representing an increase of approximately 27% between 2027 and 2042.

7.5.4 The Bypass scheme attracts traffic away from the existing A29 that runs through the centre of town between A29/B162/Moneymore Road roundabout to the north of the town and Loughry roundabout to the south. AADT on the current A29 shows a pattern of relief in the opening year Core forecasts with a flow reduction of 44% on the northern section (between Moneymore Road and Orritor Street), and a reduction of 49% on the southern section (between A505 Drum Road and Loughry roundabout). In the design year, the flow reductions are estimated to be 41% on the northern section, and 54% on the southern section.

7.5.5 Another part of the town centre that forecasts a reduction in traffic levels when comparing between Do-Minimum and Do Something scenarios is Westlands Road running to the west of the town. Due to delays in the town centre in the Do-Minimum scenario, without the Proposed Scheme traffic is shown to use Westlands Road as an alternative route between the north and south of the town. The bypass will provide a more appropriate alternative route and divert traffic away from Westlands Road. This results in a flow reduction for the Core scenario of around 27% on the northern section (between Orritor Road and Fairhill Road) and about 22% on the southern section (between Fairhill Road and A505 Drum Road). The range of flow reduction is similar for both opening and design years.

7.5.6 In the opening year of the Proposed Scheme, traffic flow on Sandholes Link Road is predicted to decrease by approximately 21%. By the design year, the decrease is lower at 13%. This decrease in the Do-Something scenario compared to the Do-Minimum is due to traffic that previously used Westlands Road and Sandholes Road to avoid routeing through the town centre, now accesses the Bypass exclusively and no longer uses Sandholes Link Road as a rat run.

7.5.7 The combination of lowering delays and traffic levels within the town centre provides journey time reductions for local traffic, improves environmental emissions within the town centre and provides safer journey options for pedestrians and cyclists.



Scenario	AM	IP	PM	AADT
DM_Core	340	220	340	3490
DS_Core	330	220	320	3410
DM_HG	380	230	360	3790
DS_HG	370	230	340	3690
DM_LG	310	200	310	3230
DS_LG	310	200	300	3190

Scenario	AM	IP	PM	AADT
DM_Core	1210	810	1280	12850
DS_Core	790	530	880	8550
DM_HG	1260	860	1330	13560
DS_HG	840	570	940	9160
DM_LG	1150	740	1180	11970
DS_LG	730	480	820	7850

Scenario	AM	IP	PM	AADT
DM_Core				
DS_Core	1160	830	1180	12660
DM_HG				
DS_HG	1240	890	1260	13510
DM_LG				
DS_LG	1080	770	1100	11780

Scenario	AM	IP	PM	AADT
DM_Core	1040	760	1030	11380
DS_Core	530	420	640	6380
DM_HG	1110	810	1080	12090
DS_HG	580	450	690	6870
DM_LG	980	700	960	10560
DS_LG	500	380	590	5880

Scenario	AM	IP	PM	AADT
DM_Core	960	800	1110	11670
DS_Core	590	530	700	7520
DM_HG	990	850	1170	12300
DS_HG	630	560	740	8010
DM_LG	920	750	1030	10990
DS_LG	550	500	670	7090

Scenario	AM	IP	PM	AADT
DM_Core	170	130	200	2030
DS_Core	170	140	210	2070
DM_HG	180	140	220	2180
DS_HG	180	150	220	2220
DM_LG	150	120	190	1870
DS_LG	160	130	190	1970

Scenario	AM	IP	PM	AADT
DM_Core	600	410	600	6390
DS_Core	480	360	450	5250
DM_HG	630	460	620	6910
DS_HG	510	380	490	5600
DM_LG	550	390	560	5960
DS_LG	440	340	420	4910

Scenario	AM	IP	PM	AADT
DM_Core	600	400	570	6210
DS_Core	400	310	460	4710
DM_HG	690	460	610	6990
DS_HG	430	340	500	5110
DM_LG	530	360	530	5580
DS_LG	370	290	420	4390

Scenario	AM	IP	PM	AADT
DM_Core	980	860	1050	12060
DS_Core	690	630	750	8750
DM_HG	1020	890	1100	12520
DS_HG	720	670	780	9220
DM_LG	940	820	990	11490
DS_LG	670	590	730	8300

Scenario	AM	IP	PM	AADT
DM_Core				
DS_Core	1340	1080	1300	15380
DM_HG				
DS_HG	1420	1160	1360	16290
DM_LG				
DS_LG	1260	1010	1220	14380

Scenario	AM	IP	PM	AADT
DM_Core	1290	1160	1480	16340
DS_Core	980	900	1170	12710
DM_HG	1370	1200	1540	17030
DS_HG	1030	950	1220	13400
DM_LG	1220	1090	1380	15360
DS_LG	940	850	1120	12120

Scenario	AM	IP	PM	AADT
DM_Core	1160	1090	1220	14770
DS_Core	730	650	760	8980
DM_HG	1180	1120	1240	15040
DS_HG	770	690	810	9520
DM_LG	1140	1060	1220	14450
DS_LG	680	600	710	8350

Scenario	AM	IP	PM	AADT
DM_Core	790	590	930	9160
DS_Core	830	630	1020	9830
DM_HG	840	610	960	9510
DS_HG	880	660	1080	10400
DM_LG	740	560	890	8700
DS_LG	790	590	960	9220

Scenario	AM	IP	PM	AADT
DM_Core	1060	920	840	12060
DS_Core	590	470	380	6160
DM_HG	1110	960	860	12570
DS_HG	610	490	400	6440
DM_LG	1020	880	840	11660
DS_LG	570	450	410	6000

Scenario	AM	IP	PM	AADT
DM_Core	890	600	770	9020
DS_Core	760	400	740	7090
DM_HG	940	610	750	9170
DS_HG	810	420	800	7600
DM_LG	850	590	720	8710
DS_LG	710	370	690	6590

Scenario	AM	IP	PM	AADT
DM_Core				
DS_Core	1360	1080	1300	15370
DM_HG				
DS_HG	1440	1150	1360	16280
DM_LG				
DS_LG	1280	1000	1220	14380

Scenario	AM	IP	PM	AADT
DM_Core	510	200	430	4040
DS_Core	750	390	830	7280
DM_HG	540	220	510	4530
DS_HG	800	420	870	7740
DM_LG	480	190	440	3920
DS_LG	700	360	780	6800

Scenario	AM	IP	PM	AADT
DM_Core	1010	810	840	11110
DS_Core	970	840	860	11280
DM_HG	1070	850	860	11670
DS_HG	1010	890	900	11920
DM_LG	950	770	790	10510
DS_LG	910	790	810	10600

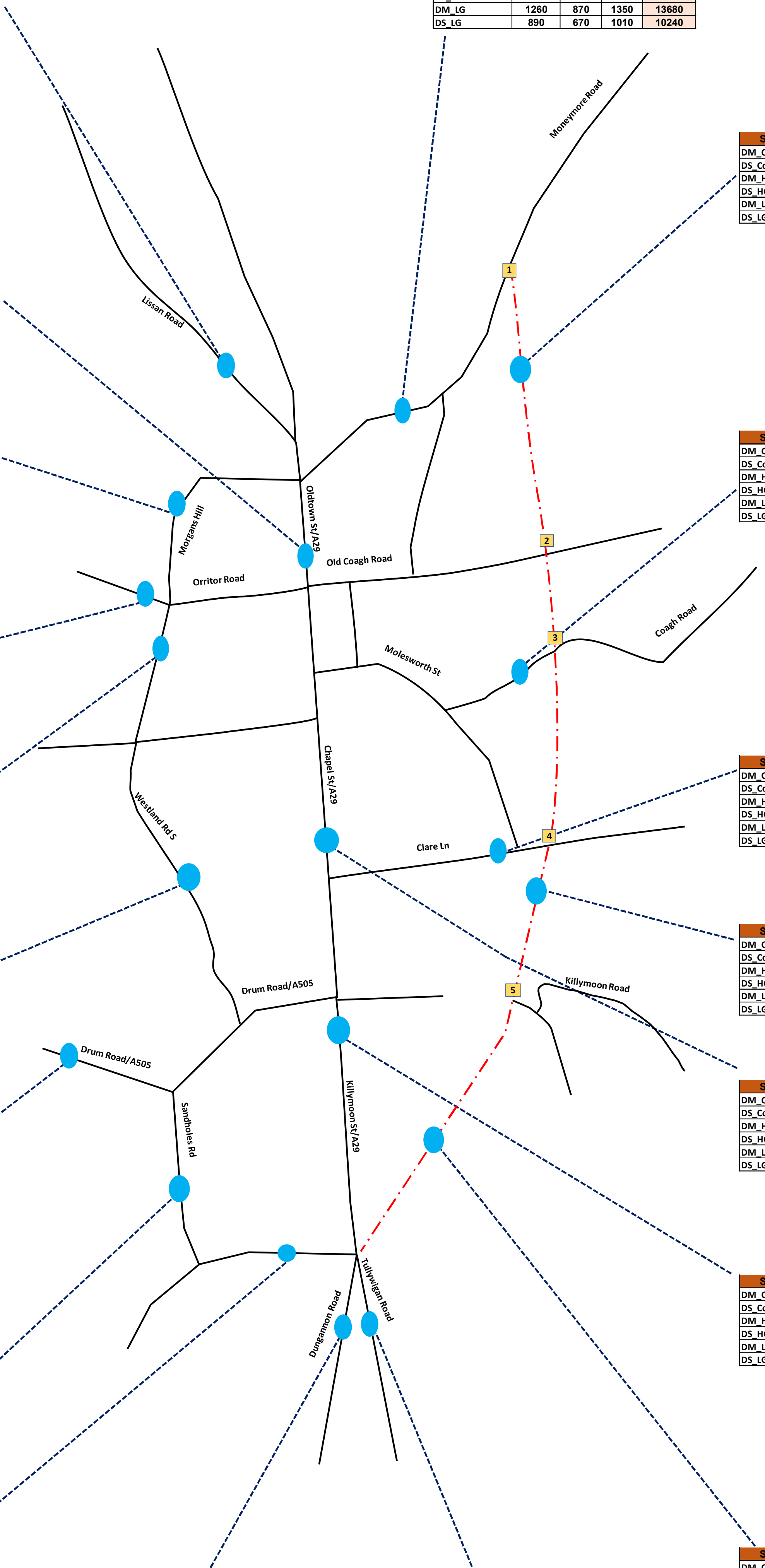
Scenario	AM	IP	PM	AADT
DM_Core	570	470	690	7040
DS_Core	660	560	790	8230
DM_HG	600	500	740	7430
DS_HG	700	600	810	8680
DM_LG	540	450	670	6680
DS_LG	630	530	770	7820

AG At Grade
GS Grade Separated

Scenario	1	2	3	4	5
DM	AG	AG	AG	AG	AG
DS	AG	GS	GS	AG	AG

●	Data Points	■	Junction

Figure 7-2 – Flow Comparison for DS Schemes - 2027



Scenario	AM	IP	PM	AADT
DM_Core	1330	950	1390	14600
DS_Core	990	750	1090	11310
DM_HG	1380	1020	1410	15300
DS_HG	1060	820	1170	12270
DM_LG	1260	870	1350	13680
DS_LG	890	670	1010	10240

Scenario	AM	IP	PM	AADT
DM_Core	440	280	420	4430
DS_Core	420	280	410	4350
DM_HG	480	310	530	5130
DS_HG	480	310	500	5010
DM_LG	370	250	380	3910
DS_LG	370	250	370	3870

Scenario	AM	IP	PM	AADT
DM_Core				
DS_Core	1420	1090	1450	16090
DM_HG				
DS_HG	1540	1190	1550	17430
DM_LG				
DS_LG	1270	990	1330	14550

Scenario	AM	IP	PM	AADT
DM_Core	1240	930	1190	13650
DS_Core	630	560	750	8000
DM_HG	1390	1050	1270	15180
DS_HG	710	610	840	8870
DM_LG	1090	840	1120	12320
DS_LG	570	500	670	7170

Scenario	AM	IP	PM	AADT
DM_Core	1040	950	1220	13420
DS_Core	730	660	860	9320
DM_HG	1060	1010	1230	13930
DS_HG	800	720	930	10150
DM_LG	1000	870	1180	12550
DS_LG	660	610	780	8500

Scenario	AM	IP	PM	AADT
DM_Core	220	190	310	2910
DS_Core	220	180	280	2700
DM_HG	260	210	370	3290
DS_HG	250	190	330	3060
DM_LG	200	170	250	2530
DS_LG	190	160	230	2360

Scenario	AM	IP	PM	AADT
DM_Core	710	510	670	7600
DS_Core	570	420	540	6180
DM_HG	790	570	710	8380
DS_HG	630	470	600	6890
DM_LG	640	460	620	6890
DS_LG	510	390	480	5620

Scenario	AM	IP	PM	AADT
DM_Core	800	580	720	8460
DS_Core	470	380	560	5740
DM_HG	880	670	800	9640
DS_HG	530	430	650	6450
DM_LG	690	490	650	7380
DS_LG	430	340	480	5080

Scenario	AM	IP	PM	AADT
DM_Core	1030	970	1170	13380
DS_Core	770	710	830	9760
DM_HG	1050	1000	1210	13780
DS_HG	820	740	880	10280
DM_LG	1010	920	1100	12710
DS_LG	720	660	790	9110

Scenario	AM	IP	PM	AADT
DM_Core				
DS_Core	1620	1440	1550	19530
DM_HG				
DS_HG	1720	1550	1590	20690
DM_LG				
DS_LG	1480	1320	1460	17980

Scenario	AM	IP	PM	AADT
DM_Core	1470	1330	1630	18520
DS_Core	1100	1040	1300	14410
DM_HG	1540	1420	1700	19570
DS_HG	1160	1100	1360	15220
DM_LG	1360	1230	1540	17230
DS_LG	1040	960	1220	13440

Scenario	AM	IP	PM	AADT
DM_Core	1210	1160	1270	15510
DS_Core	790	680	850	9600
DM_HG	1270	1200	1300	16090
DS_HG	870	750	950	10620
DM_LG	1170	1120	1270	15140
DS_LG	720	610	770	8690

Scenario	AM	IP	PM	AADT
DM_Core	890	660	1090	10430
DS_Core	940	740	1160	11310
DM_HG	960	710	1150	11110
DS_HG	1000	790	1240	12100
DM_LG	810	620	990	9600
DS_LG	860	670	1080	10370

Scenario	AM	IP	PM	AADT
DM_Core	1200	1020	920	13380
DS_Core	590	470	380	6110
DM_HG	1240	1060	940	13910
DS_HG	610	500	380	6410
DM_LG	1130	960	940	12870
DS_LG	590	430	390	5840

Scenario	AM	IP	PM	AADT
DM_Core	1010	690	700	9790
DS_Core	910	490	870	8530
DM_HG	1060	770	730	10650
DS_HG	980	540	910	9170
DM_LG	950	640	780	9520
DS_LG	800	440	800	7690

Scenario	AM	IP	PM	AADT
DM_Core	610	280	630	5500
DS_Core	900	500	920	8750
DM_HG	720	330	730	6430
DS_HG	1000	550	870	9250
DM_LG	570	250	570	5000
DS_LG	810	450	910	8080

Scenario	AM	IP	PM	AADT
DM_Core				
DS_Core	1640	1430	1550	19490
DM_HG				
DS_HG	1740	1540	1590	20640
DM_LG				
DS_LG	1500	1310	1460	17950

Scenario	AM	IP	PM	AADT
DM_Core	1130	910	930	12480
DS_Core	1060	980	1020	13060
DM_HG	1190	990	1000	13420
DS_HG	1120	1060	1130	14190
DM_LG	1070	850	910	11780
DS_LG	1020	900	950	12160

Scenario	AM	IP	PM	AADT
DM_Core	600	520	830	7850
DS_Core	690	650	790	8990
DM_HG	650	540	940	8510
DS_HG	680	690	820	9330
DM_LG	560	500	710	7290
DS_LG	660	590	770	8390

AG At Grade
GS Grade Separated

Scenario	1	2	3	4	5
DM	AG	AG	AG	AG	AG
DS	AG	GS	GS	AG	AG

Data Points			Junction

Figure 7-3 – Flow Comparison for DS Schemes - 2042

Network Wide Impacts

7.5.8 SATURN provides summary network statistics on the overall performance of each model. These statistics were compared to provide a comparison between the Base, Do-Minimum (DM), Do-Something (DS), Core Growth, High Growth and Low Growth scenarios. This provides insight on how the Bypass and Sandholes Link Road schemes affect overall network performance for the different growth scenarios.

7.5.9 The base year's summary of Passenger Car Units Kilometres (PCU-kms), Passenger Car Units Hours (PCU-Hrs) and Average Speed (Km/h) within the Simulation area is presented in Table 7-3.

Table 7-3 – Base 2019 – PCU KM, PCU Hours and Average Speed

Time Period	Simulation Travel Time (PCU-hrs)	Simulation Travel Distance (PCU-kms)	Simulation Average Speed (km/h)
AM	932	37,837	41
IP	729	29,958	41
PM	995	39,702	40

7.5.10 Table 7-4 below summarises the changes in traffic levels between the 2019 base year and the future Do-Minimum scenario for each forecast year. Although the increase in vehicle kilometres and vehicle hours are due to the effect of traffic growth, the PCU hours are increasing disproportionately when compared to the PCU kilometres travelled, suggesting an increasing delay in the network without any interventions in place more importantly in 2042.

Table 7-4 – Growth in Travel Time and Travel Distance 2019 to 2042

Scenario	Time Period	Simulation Travel Time (Total PCU-hrs)		Simulation Travel Distance (Total PCU-kms)	
		2019-2027	2019-2042	2019-2027	2019-2042
DM Core	AM	7%	29%	8%	25%
	IP	9%	32%	9%	28%
	PM	10%	36%	9%	29%

7.5.11 Table 7-5 below summarises the networkwide changes in terms of PCU hours, PCU kilometres and average speeds between DM and the DS Core, LG, and HG scenarios for 2027. Table 7-6 below presents similar statistics for 2042. These two tables show a significant increase in average speed across the whole network when the Bypass and Sandholes Link Road schemes are introduced.

Table 7-5 – DM Vs DS – PCU KM, PCU Hours and Average Speed – 2027

Network Statistics	DM Core	DS Core	DM HG	DS HG	DM LG	DS LG
	AM					
Travel Time (PCU-hrs)	997	878	1,083	945	919	813
Travel Distance (PCU-kms)	40,770	42,597	43,417	45,301	38,153	39,811
Average Speed (km/h)	40.9	48.5	40.1	47.9	41.5	49.0
	IP					
Travel Time (PCU-hrs)	794	699	853	749	735	650
Travel Distance (PCU-kms)	32,663	33,894	34,688	36,091	30,581	31,702
Average Speed (km/h)	41.1	48.5	40.6	48.2	41.6	48.8
	PM					
Travel Time (PCU-hrs)	1,095	964	1,191	1,038	993	892
Travel Distance (PCU-kms)	43,298	45,230	46,173	48,124	40,465	42,330
Average Speed (km/h)	39.5	46.9	38.8	46.3	40.8	47.5

Table 7-6 – DM Vs DS – PCU KM, PCU Hours and Average Speed – 2042

Network Statistics	DM Core	DS Core	DM HG	DS HG	DM LG	DS LG
	AM					
Travel Time (PCU-hrs)	1,207	1,047	1,370	1,177	1,062	929
Travel Distance (PCU-kms)	47,210	49,337	51,825	53,763	42,811	44,759
Average Speed (km/h)	39.1	47.1	37.8	45.7	40.3	48.2
	IP					
Travel Time (PCU-hrs)	959	842	1,080	929	857	756
Travel Distance (PCU-kms)	38,234	40,290	41,820	43,906	34,780	36,619
Average Speed (km/h)	39.9	47.9	38.7	47.3	40.6	48.4
	PM					
Travel Time (PCU-hrs)	1,357	1,171	1,534	1,306	1,183	1,042
Travel Distance (PCU-kms)	51,280	53,157	56,054	57,688	46,178	48,442
Average Speed (km/h)	37.8	45.4	36.5	44.2	39.0	46.5

7.5.12 Table 7-7 below summarises the changes in travel time and travel distance per vehicle between the DM and Do-Something Core, HG and LG scenarios for 2027 and 2042. The reduction in travel time is facilitated by the increase in speed on the proposed route and also due to the reduction in the junction delays via the town centre routes. The slight increase in vehicle kilometre is caused by some of the trips travelling longer to access the scheme to take advantage of the shorter journey times.

Table 7-7 – Change in PCU KM, PCU Hours between DM and DS – 2027 and 2042

Network Statistics	2027			2042		
	Core	High	Low	Core	High	Low
AM						
Travel Time	-11.9%	-12.7%	-11.6%	-13.2%	-14.1%	-12.5%
Travel Distance	4.5%	4.3%	4.3%	4.5%	3.7%	4.6%
Average Speed	18.58%	19.45%	18.07%	20.46%	20.90%	19.60%
IP						
Travel Time	-12.0%	-12.2%	-11.5%	-12.2%	-13.9%	-11.8%
Travel Distance	3.8%	4.0%	3.7%	5.4%	5.0%	5.3%
Average Speed -	18.00%	18.72%	17.31%	20.05%	22.22%	19.21%
PM						
Travel Time	-12.0%	-12.8%	-10.2%	-13.7%	-14.8%	-11.9%
Travel Distance	4.5%	4.2%	4.6%	3.7%	2.9%	4.9%
Average Speed -	18.73%	19.33%	16.42%	20.11%	21.10%	19.23%

7.5.13 When compared to the change in PCU-km and PCU-hours for 2027, the results for 2042 are of a similar proportion. This suggests that the schemes have sufficient capacity to offset the increase of demand in 2042 and provide the same travel time savings, this is also the case for the High Growth scenario.

7.5.14 When examining the average speed across the network for forecast scenarios, a reduction in congestion and delays is typically reflected by an increased average network speed, representing a more efficient network. The increase in speed is notable in all three time periods and in the opening year and design year. The increase in average speed is due to journey time savings across the entirety of the simulation area.

7.5.15 Additional journey time analysis was conducted comparing journey times along the existing A29 before and after the introduction of the bypass. Table 7-8 below provides the journey time in seconds for the opening and design years for the Core Scenario. This shows that the bypass would reduce the travel time, by more than half between Moneymore Road and Dungannon Road, with the greatest savings forecast in the 2042 PM peak. Traffic that continues to use the existing A29 will also experience a reduction in journey time of up to 2.5 minutes in the opening year and up to 4 minutes in the design year.

Table 7-8 – Journey Time(s) between - Moneymore Road to Dungannon Road

Route Taken	DM 2027	DS 2027	DM 2042	DS 2042
AM				
Existing A29 (NB)	675	622	718	659
Existing A29 (SB)	705	625	757	641
A29 Bypass (NB)	N/A	312	N/A	351
A29 Bypass (SB)	N/A	310	N/A	330
IP				
Existing A29 (NB)	676	613	705	619
Existing A29 (SB)	654	612	687	623
A29 Bypass (NB)	N/A	298	N/A	309
A29 Bypass (SB)	N/A	288	N/A	299
PM				
Existing A29 (NB)	769	621	866	640
Existing A29 (SB)	690	649	736	674
A29 Bypass (NB)	N/A	311	N/A	327
A29 Bypass (SB)	N/A	288	N/A	299

7.6 Killymoon Roundabout

7.6.1 During the public information day held in April 2024 various concerns have been raised around the access arrangement from the proposed bypass to Killymoon Golf Club and Killymoon Castle.

7.6.2 Construction of an overbridge at Killymoon Road (Killymoon Road over the Bypass) was previously proposed at SAR2 (under Purple A route). However, due to various constraints including road safety point of view, the overbridge was replaced by a roundabout.

7.6.3 The following three different access arrangements were considered at Killymoon before the current preferred three Arm Roundabout was chosen

1. Three Arm Roundabout (Option P)
2. Four Arm Roundabout (Option A)
3. Overbridge (Option B)

7.6.4 Table 7-9 below summarises the changes in travel time and travel distance from Killymoon Golf club to different locations within Cookstown. This data has been presented for 2027 and 2042 for the DM and three different options considered.

Table 7-9 – Travel time and travel distance from Killymoon Golf club

Destination	Option	Dist (km)	Journey Times 2027 (min)			Journey Times 2042 (min)		
			AM	IP	PM	AM	IP	PM
Loughry Roundabout	DM	2.3	04:17	04:05	04:09	04:38	04:11	04:20
	Opt P	1.7	02:07	01:57	01:55	02:19	02:03	02:00
	Opt A	1.7	02:02	01:54	01:54	02:11	02:00	02:00
	Opt B	2.3	03:40	03:36	03:47	03:42	03:38	03:44
Central Cookstown	DM	2.5	04:27	04:22	04:27	04:31	04:27	04:32
	Opt P	3.4	05:21	05:15	05:23	05:27	05:21	05:29
	Opt A	2.5	04:35	04:32	04:35	04:37	04:34	04:37
	Opt B	2.5	04:21	04:18	04:21	04:22	04:19	04:22

7.6.5 The overbridge option (Option B) provides no direct access to the Golf Course for the external trips traveling on the Proposed Scheme, so when compared to other options this results in an increased distance and time to access the Golf Course and the Castle.

7.6.6 When compared to the preferred option, both Options A and B show a reduction in travel time (about one minute) and distance (about one kilometre) for the trips to and from the Golf Course towards the town centre

7.6.7 Despite the similar travel distance, the 4-arm roundabout (Option A) would result in a greater travel time needed to reach the Central Cookstown when compared to the overbridge option (Option B). This is due to the increased traffic flows causing additional delays along Killymoon Road and congestion at the Killymoon Road junction with the existing A29.

7.6.8 Option A might be attractive in terms of accessibility, as it would provide both access to the Bypass as well as a direct link to the town centre via the existing Killymoon Road from the Golf Course and the Castle. But this must be weighed against the overall safety, environmental and social costs associated with the increased traffic along Killymoon Road. Killymoon Road is a narrow residential road that is ill-suited for strategic traffic consisting of heavy goods vehicles and a significant volume of cars.

7.6.9 Option B might also be attractive purely from accessibility from the town centre, as it retains the existing access arrangement to the Golf Course via the existing Killymoon Road. But this must be weighed against the physical constraints and the costs associated with the construction and maintenance of the proposed overpass.

7.7 Overall Summary

7.7.1 The Do-Minimum scenarios show that without significant intervention the issue of congestion and traffic volumes within the town centre becomes progressively more severe as demand increases in the future forecast years. As the traffic volume increases it adds strain on the operation of the signalised junctions within Cookstown which could lead to an increase in delays and journey times.

7.7.2 The introduction of the bypass and Sandholes Link Road schemes show a significant improvement in network-wide performance when compared to the Do-Minimum scenarios. One of the key impacts is the rerouting of traffic away from the town centre resulting in less congestion and an improved town centre environment.

7.7.3 The improvements to congestion and journey times are proportional to the level of demand. Additionally testing of the high growth scenario showed that, the scheme has sufficient capacity to accommodate higher demands.

8 ECONOMIC APPRAISAL

8.1 Methodology

8.1.1 The economic appraisal of a highway scheme is an assessment of the net benefits to users and the wider community as a result of road network alteration, set against the construction and operational costs, incurred over a 'whole life' period.

8.1.2 The economic assessment of the A29 Cookstown Bypass comprises the direct economic impacts on road users, government and other related economic impacts and is in accordance with 'The Green Book - Appraisal and Evaluation in Central Government'.

8.1.3 The economic assessment process involved estimating the benefits and cost of the following components for the 60-year appraisal period (all discounted to the present value year, defined by the DfT as 2010).

- **Scheme Cost:** Defined as the total amount of money spent in constructing and maintaining the scheme. It includes the preparation cost (planning and designing), land acquisition cost, construction costs, supervision, and maintenance costs over the 60-year period
- **Scheme Benefits:** The core (established) scheme benefits comprise of four components:
  4. Economic benefits to road users, including time savings and vehicle operating costs (referred to as economic efficiency benefits)
  5. Accident savings and associated economic benefits
  6. Monetised benefits/disbenefits from changes to air quality, noise, and greenhouse gas emissions
  7. Benefits /disbenefits to road users during periods of maintenance and during construction of the scheme.

8.1.4 The benefits from these four categories were combined and compared to scheme costs to produce a Benefit to Cost Ratio (BCR), so that the Proposed Scheme could be assessed in Value for Money (VfM) terms.

8.1.5 Other potential benefits classified by DfT as 'evolving and indicative benefits' are not considered within the scheme appraisal.

8.2 Transport Users Benefit Assessment

8.2.1 The calculation of transport economic efficiency impacts on road users (excluding accident benefits) was undertaken using the Department for Transport's (DfT) TUBA (Transport Users Benefit Appraisal) program. TUBA v1.9.17 (version applicable at the time of the assessment) was used to assess the road user benefits arising from changes in journey times and vehicle operating costs which are calculated separately for Business Users and Consumer Users.

8.2.2 For the appraisal of road user benefits, standard values of time, operating cost and other related economic parameters for traffic appraisal are applied, using the standard 'economic parameter data' based on TAG Data Book v1.18 (May 2022).

8.2.3 The journey time and vehicle operating costs represent the economic benefits that accrue to road users as a result of the scheme. They include savings in journey time and changes in vehicle operating costs, to Business Users and Consumer Users. The vehicle operating costs are both distance and speed related, and include fuel costs and non-fuel costs e.g. tyres, maintenance or depreciation.

8.2.4 The benefits are calculated for all users of the network and include those who travel on the new road and those travelling on all existing roads. For example, while users of the Scheme could experience time savings, users of the existing road network will also experience time savings as a result of traffic relief offered by the increased network capacity.

8.2.5 The transport user benefits of the scheme calculated from TUBA are presented in Table 8-1 below.

Table 8-1 – Transport User Benefits Assessment - TUBA (£000s)

User Classification	Low	Core	High
Consumer Benefits Commuting	26,421	31,622	33,162
Consumer Benefits Other	28,690	35,467	42,348
Business User Benefits	36,103	42,590	48,280
Total Benefits	**91,214**	**109,679**	**123,789**

8.2.6 Table 8-1 presents the scheme benefits for the three different forecast growth scenarios, disaggregated by user type. Business Users are shown to gain the greatest benefit from the scheme due to their relatively high values of time. The scheme also offers considerable benefits to commuters and other consumer users.

8.2.7 The bypass offers a high capacity, more efficient route around the town when compared to the current A29 route through the town. User benefits are accrued by traffic routing along the bypass and away from the congested town centre. The removal of strategic traffic from the town centre would assist in reducing congestion within the town centre, generating benefits to local residents and other road users making trips within Cookstown.

8.3 Accident Assessment

8.3.1 An assessment of accident benefits was undertaken using COBALT (Cost and Benefit to Accidents – Light Touch), version 2.3, a DfT cost benefit analysis program that assesses the monetary benefits from accident savings. The program forecasts the number of Personal Injury Accidents (PIA) and casualties by severity and also forecasts the changes in the monetised accident costs for inclusion in the Analysis of Monetised Costs and Benefits (AMCB) table.

8.3.2 Accident data was obtained for the Cookstown area between 17th April 2013 and 31st March 2021. The full data set for the five-year period between 2015 and 2019 was used in the accident assessment. 2020-21 data was discarded as this data was largely impacted by the Covid-19 travel restrictions. COBALT default accident rates were used across the network for links where actual observed accident data were unavailable. COBALT was run in combined link and junction mode using link specific accident rates; other inputs like forecast AADT traffic volumes and link lengths were obtained from the traffic model.

8.3.3 The COBALT analysis indicates that the combination of the Bypass and Sandholes Link Road schemes provide a net reduction in the number of accidents and the scheme offers approximately £13 million in accident savings for the Core growth scenario as illustrated in Table 8-2 below.

Table 8-2 – Accident Savings and Benefits (£000s)

Scheme	Forecasted Accidents	Accident Saved by Scheme	Casualties Saved by Scheme	Accident Costs	Savings in Accident Costs
DM Low	2829	-	-	113,604	-
DM Core	3095	-	-	124,070	-
DM High	3372	-	-	134,932	-
DS Low	2452	376	472	101,285	12,318
DS Core	2691	404	506	110,906	13,165
DS High	2937	435	542	120,818	14,115

8.4 Construction Impact Assessment

8.4.1 TAG recommends impacts to road user during construction are assessed using appropriate models. The construction scenarios for the Cookstown Bypass and Sandholes Link Road have been modelled using the traffic model and the impacts were monetised using TUBA.

8.4.2 Indicative Traffic Management (TM) sequences were identified for the construction of the scheme, with some of the phasing overlapping each other to create eight TM scenarios. Each of the proposed traffic management phases were coded into the traffic model to simulate the physical changes to the network brought about by the construction works. Results from the TM scenario models were assessed against an equivalent 2027 DM model scenario using TUBA to monetise the impact of delays to users caused by the construction works. The overall road user disbenefit during constriction is estimated to be around £0.8 million.

8.5 Maintenance Impact Assessment

8.5.1 The introduction of the Proposed Scheme will provide additional road capacity around Cookstown, and it will provide a natural alternate in case of any maintenance to the existing A29 and surrounding networks. This will help reduce the user delay during any regular maintenance schedules across the appraisal period.

8.5.2 These potential benefits have been excluded from the scheme assessment. Consequently, their exclusion from the BCR calculation results in a conservative BCR estimate for the Proposed Scheme.

8.6 Monetised Environmental Impact Assessment

8.6.1 Following TAG Unit A3 - Environment Impact Appraisal, the impacts of a proposed transport scheme on greenhouse gas (GHG) emissions, local air quality and noise assessments were undertaken. The resulting benefits and disbenefits are presented in Table 8-3.

Table 8-3 – Impact of GHG, Air quality and Noise assessments (£000)

Environmental Impact Category	Quantified Benefits (£000)
Greenhouse Gases	3,282
Local Air Quality	5,225
Noise	8,291
Total	**16,798**

8.7 Scheme Investment costs

8.7.1 For the economic appraisal, a whole life Present Value Cost (PVC) of the scheme is required. This includes Capital cost (or investment cost) and Operation and Maintenance (O&M) costs for a standard base year of 2010. The derivation of PVC for the Proposed Scheme was undertaken following guidance in TAG Unit A1.2 (Scheme Costs) and includes the following components:

- Deriving base investment and operating cost estimates
- Account for real cost increase
- Identifying adjustment for risk and optimism bias
- Re-basing the price base to 2010 base year
- Discounting to 2010 base year
- Converting to market prices

8.7.2 The main components of the capital or investment costs for the scheme are:

- Preparation and supervision costs
- Land and property costs, including compensation
- Construction costs, including main works, ancillary works, statutory undertakings, site supervision and testing

8.7.3 The capital expenditure and the O&M costs are prepared in 2022 price base and the corresponding PVC estimates are presented in Table 8-4 below.

Table 8-4 – Capital Cost Estimate and Present Value Cost (£000s)

Cost Elements	Capital Costs	O&M Cost
Cost at 2022 Prices	58963	21443
Including real inflation	58590	21443
Deflated to 2010 Prices	45087	15167
Discounted to 2010 Values	25631	3121
Market prices adjusted PVC	**30501**	**3714**

8.8 Economic Assessments

8.8.1 A full cost benefit analysis was carried out to assess the Proposed Scheme options in VfM terms. The appraisal included an assessment of economic benefits to road users referred to as the Transport Economic Efficiency (TEE) benefits; an assessment of accident savings; and the monetised benefits from changes to greenhouse gas emissions, air quality and noise.

8.8.2 The benefits from these three categories were combined to give a Present Value Benefit (PVB). These were compared to costs (PVC) to produce a Net Present Value (NPV) and a Benefit to Cost Ratio (BCR). The NPV and BCR values are presented in Table 8-5 Analysis of Monetised Costs and Benefits (AMCB) Table below. This informed the Value for Money assessment which was undertaken with reference to the Value for Money Framework published by the DfT in July 2017.

Table 8-5 – Analysis of Monetised Costs and Benefits (2010 prices in £000)

Benefit and Cost Category	Low Growth	Core	High Growth
Local Air Quality	5,225	5,225	5,225
Greenhouse Gases	3,282	3,282	3,282
Noise	8,291	8,291	8,291
Accidents	12,318	13,165	14,115
Economic Efficiency: Consumer (Commuting)	26,421	31,622	33,162
Economic Efficiency: Consumer (Other)	28,690	35,467	42,348
Economic Efficiency: Business and Providers	36,103	42,590	48,280
Indirect Taxation Revenues	-1,955	-2,563	-3,116
Construction and Maintenance	-783	-783	-783
Present Value of Benefits (PVB) (£000)	117,592	136,296	150,803
Broad Transport Budget	34,215	34,215	34,215
Present Value of Costs (PVC) (£000)	34,215	34,215	34,215
Net Present Value (NPV) (£000)	**83,377**	**102,081**	**116,588**
BCR	**3.44**	**3.98**	**4.41**

8.8.3 The overall balance between benefits and costs is positive across all the growth scenarios. The calculated BCR for the Core scenario is 3.98. The Low growth scenario produces a BCR value of 3.44 and the High growth scenario produces a BCR of 4.41.

8.8.4 The NPV of the scheme ranges between £83M and £116M across different growth scenarios, for the core growth it is about £102M, which confirms the investment continues to provide a positive return.

8.8.5 With reference to the DfT Value for Money categorisation the scheme represents a High VfM with a BCR of 3.98. This was also the case for the Low Growth demand scenario with a BCR of 3.44. The High Growth scenario represented a Very High VfM with a BCR of 4.41. Additional VfM sensitivity testing undertaken do not provide sufficient evidence to change the VfM category, meaning that the scheme is very likely to represent a High VfM.

8.8.6 One further sensitivity test was undertaken to reflect the updates to economic parameters and traffic growth projections released by the DfT and DfI after the completion of traffic forecasting for SAR3. These include:

- an update to TEMPro-NI v 8.0 which was made available by DfI in summer 2023;
- DfT release of National Road Traffic Projections (NRTP) 2022, which replaced the previous RTF18 projections; and
- an update to the DfT's Fuel and Income factors affecting forecast travel demand.

8.8.7 To test the cumulative impact of these changes the SAR3 traffic model was rerun updating the above parameters and an economic assessment was undertaken. The economic assessment of this sensitivity test was limited to the appraisal of transport economic efficiency benefits, accident benefits and indirect tax revenues only, which form in excess of 85% of core scheme benefits, all this is reported in greater detail in Appendix E of the SAR3.

8.8.8 The outputs of this additional sensitivity test show that even with the updated economic parameters and demand projections, the scheme BCR remain within the range of Low and High Growth assessments (presented above) and that the scheme would continue to provide High VfM.

9 CONCLUSION

9.1.1 My evidence has described the data collection surveys undertaken to define baseline conditions, the development, validation and application of the traffic model, the results of the traffic forecasting and economic assessments of the Proposed Scheme including the results of sensitivity tests.

9.1.2 This evidence has demonstrated that a robust traffic model has been developed to assess the current and future traffic movements in the A29 corridor. The model has been developed as per DfT guidance and has been successfully validated in accordance with criteria given in TAG.

9.1.3 The model has been used to predict future traffic volumes on the strategic road network within Cookstown, more specifically along the proposed A29 Cookstown Bypass. Traffic forecasts have been prepared for both with and without the Proposed Scheme. This has shown that the Proposed Scheme is likely to provide substantial relief to the existing A29 and other routes within Cookstown and to reduce future journey times by appreciable amounts.

9.1.4 The traffic model has also been used for the economic appraisal of the Proposed Scheme in accordance with TAG and other standard industry practice. This includes road user benefits and an assessment of accidents. The Proposed Scheme is predicted to bring significant time savings and reduction in accidents over the 60-year appraisal period.

9.1.5 The overall BCR for the Proposed Scheme has been assessed to be 3.98, using the latest scheme costs, which indicates that the Proposed Scheme is viable and represents a High Value for Money category.

9.1.6 Sensitivity tests have also been undertaken based on TAG Uncertainty principles, which have provided a range of BCR between 3.44 and 4.41, (High VfM to Very High VfM). This has demonstrated that the economic case for the scheme remains robust over a range of alternative growth assumptions.