A614 / A6097 Major Road Network Improvement Scheme

Traffic & Economic Assessment Report

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1. Introduction

1.1 Nottinghamshire County Council (NCC) is promoting junction improvements at a series of locations on the A614 – A6097 corridor as a single scheme package. These junctions are:

- A614 / A616 / A6075 roundabout (hereafter referred to as the Ollerton roundabout);
- A614 / Eakring Road / Deerdale Lane crossroads (hereafter referred to as Deerdale Lane);
- A614 / Mickledale Lane crossroads (hereafter referred to as Mickledale Lane);
- A614 / Mansfield Road roundabout (hereafter referred to as the White Post roundabout);
- A614 / A6097 junction priority junction (hereafter referred to as the Warren Hill junction); and
- A6097 / A612 Nottingham Road / Southwell Road roundabout (hereafter referred to as the Lowdham Roundabout).
- A6097 / Kirk Hill // East Bridgford Road (hereafter referred to as Kirk Hill Junction).

1.2 The locations of the junctions are shown in Figure 1-1.

Figure 1-1: Junction Locations

1.3 The options considered, scheme development and design considerations are presented in the Options Assessment Report (OAR).

1.4 This report sets out the traffic forecasting calculations, and the economic assessment for the scheme. It calculates both the value of benefits and costs of the scheme and presents an overall *Benefit to Cost* ratio.

1.5 The outputs from the work detailed in this report will be used to support an application for funding from the Department for Transport's (DfT) Major Road Network (MRN) programme.

2. Traffic Demand and Junction Modelling

Introduction

2.1 The relationship between the appraisal process and decision-making process is set out in the Department for Transport's Transport Analysis Guidance (TAG).

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/712693/tag-tpm-guidance-senior-responsible-officer-may-18.pdf

2.2 The TAG guidance identifies three stages of appraisal:

- Stage 1 – Option Development;
- Stage 2 – Further Appraisal
- Stage 3 – Implementation and Benefits Management, Monitoring and Evaluation

2.3 The six junctions identified as part of the improvement package are in Stage 1 of the appraisal process.

2.4 There are 3 approaches that could be taken to determining the economic assessment of this scheme:

- Using a macroscopic model such as SATURN; or
- Using a microsimulation model; or
- Using the outputs from isolated junction models.

2.5 No suitable existing macro or microscopic model is available for the study area. The models that do cover the geographic region are strategic in nature and are not suitable for the assessment of modest junction improvements with local connections. Highways England's Midlands Regional Transport Model (MRTM) covers the geographic area of the scheme and Nottingham City Council's East Midlands Gateway Model (EMGM) covers the A614 between A614/A617 Lockwell Hill junction and A6097 but excludes the Deerdale Lane, Mickledale Lane and Ollerton junctions. Both models would require significant work to disaggregate the coarse zoning systems around the scheme to enable suitable representation of peak hour turning movements at the scheme junctions to provide robust assessment. Both models would also require extensive network updates to represent the local highway network and loading points. The model updates would require a new Base Year calibration and validation against TAG criteria. Local development assumptions in the area surrounding the scheme would need to be incorporated into the bespoke forecasting procedures.

2.6 The work identified to update the MRTM and EMGM is not considered proportionate and could not be delivered within the delivery timeframe.

2.7 Whilst the distance between the northern and southern most junctions is 14.5 miles, there is little route choice involved for which macroscopic models are most often deployed. Route choice comparisons are presented in Appendix A. The development of a new macroscopic model would require the collection of new trip demand data at a disaggregate level to ensure local trip patterns are reflected appropriately. The development of a new macroscopic model is not considered proportional to the size of the scheme, in accordance with TAG Unit M1, sections 2.3 to 2.4.

2.8 Similarly, the development of a new 14.5-mile micro-simulation corridor model, is not considered to be proportionate.

2.9 TAG unit M2 – Variable Demand Modelling, May 2019, section 2.2 discusses the requirement for Variable Demand Modelling. Paragraph 2.2.1 states:

It may be acceptable to limit the assessment of a scheme to a fixed demand assessment if the following criteria are satisfied:

- *The scheme is quite modest either spatially or financially and is also quite modest in terms of its effect on travel costs. Schemes with a capital cost of less than £5 million can generally be considered as modest; or the following two points:*
  - *There is no congestion or crowding on the network in the forecast year (10 to 15 years after opening), in the absence of the scheme; and*
  - *The scheme will have no appreciable effect on travel choices (e.g. mode choice or distribution) in the corridor(s) containing the scheme.*

2.10 TAG unit M2 – Variable Demand Modelling, paragraph 2.2.4 notes that:

In order to establish a case for omitting variable demand in the model, preliminary quantitative estimates of the potential effects of variable demand on both traffic levels and benefits should be made.

2.11 TAG unit M2 – Variable Demand Modelling, paragraph 2.2.5 also notes that:

An existing variable demand model of the area should be used for the purpose of testing if one is available.

2.12 Of the three criteria identified in TAG M2, paragraph 2.2.1, the cost of the combined improvement package is well in excess of £5m. There is predicted to be journey time delays at several of the scheme junctions in the forecast scenarios. However, the scheme is unlikely to have appreciable effect on travel choice given the limited public transport options along the corridor and the lack of route choice (detailed in Appendix A).The preliminary estimates of the potential effects of variable demand set out TAG M2, paragraphs 2.24 and 2.2.5 is dependent on a suitable variable demand model of the area. As discussed in paragraph 2.5 above, the two available models that cover the geographic area of the scheme do not have a suitable level of detail to reflect the potential variable demand effects resulting from the scheme. To upgrade the existing models to a suitable standard would require significant work as set out in paragraph 2.5 above. The use of a fixed trip assessment is considered the most appropriate assessment approach, particularly given the lack of a suitable macro transport model.

2.13 Of the six junctions to be improved, the closest pair is 1km apart. The distance between the scheme junctions mean that the delay at each junction is considered independent of the adjacent junction and given, the lack of alternative route choice, the preferred and proportionate methodology would be to assess each junction in isolation before combining the costs and benefits to present an overall package of improvements.

2.14 A limitation of this approach is that the full trips lengths are not modelled within the isolated junction models meaning the economic assessment may overestimate benefits relating to the change in fuel consumption (vehicle operating costs, greenhouse gases and indirect taxes). This is discussed in detail in Section 3 in more detail. So as not to overestimate, assessments based on the change in fuel consumption have been excluded from the economic appraisal, providing a robust assessment.

2.15 The use of isolated junction models and a fixed trip assessment will not capture the effects of rerouting but as noted above, there is limited route choice along the corridor (presented in Appendix A) meaning the effects of reassignment in both the Do Minimum and Do Something scenarios is expected to be minimal.

2.16 To provide additional assurance to the decision to use a fixed trip assessment, sensitivity testing was undertaken using the Midlands Connect Highway Model (MCHM). This work, presented in Appendix B, uses MCHM to look at potential Variable Demand and reassignment impacts, noting the model does not represent the A614/A6097 in sufficient detail to support detailed scheme appraisal (The MCHM contains representation of only three of the scheme junctions).

2.17 The work concludes that:

- Fixed demand assignment testing of the improvements produces minor re-routing responses along the scheme corridor, principally due to the lack of other routing options to cross the River Trent.

- Increases in demand along the scheme corridor arising from the fixed demand assignments are small, but most prominent on the A6097 Oxton Bypass.
- VDM elicits minimal change in either the matrices or the assignment, when the pre and post VDM matrices are assigned and the model outputs compared.
- The reassignment and VDM impacts are not considered material in either the economic or environmental appraisal. As such, a fixed-trip assessment is considered appropriate.

2.18 The approach to scheme appraisal has therefore been to:

- Confirm the feasibility of options at each junction location via initial assessment using isolated junction modelling (i.e. ARCADY, PICADY and LINSIG) – reported in the Option Assessment Report;
- Prepare indicative design drawings of the preferred option – reported in the Option Assessment Report;
- Use the indicative design drawings to prepare a construction cost estimate (including an allowance for land, utilities and services);
- Apply local future growth to existing Manual Classified Turning Counts and Queue Surveys at each of the scheme junctions to produce an Opening Year and Design Year traffic forecasts;
- Use isolated junction models (i.e. ARCADY, PICADY and LINSIG) to identify:
    - Baseline delays;
    - Future years Do Minimum delays (ie without scheme);
    - Future years Do Something (i.e. with option delays)
- Monetise delays from the isolated junction models using the values of time in the WebTAG databook and expand over a 60 year assessment period using the DfT's latest TUBA software (version 1.9.12, January 2019).
- Use existing accident records to inform a COBALT accident appraisal at each junction.
- The Present Value of Benefits and Present Value of Costs (assuming a 2010 base year) has been calculated to identify the scheme BCR. Whilst each junction has been assessed individually, the PVB and PVC from each junction have been combined to present an overall economic appraisal of the A614/A6097 Improvements.

2.19 This approach was discussed with the Department for Transport in a project inception meeting held on 14th November 2018 and in subsequent meetings and correspondence throughout 2020.

Baseline Traffic Conditions

Traffic Survey Data

2.20 According to the document, *How the National Road Traffic Estimates are Made* (DfT, 2007), traffic counts are normally undertaken during the 'neutral' months of March, April, May, June, September and October (but outside of school holidays). This is to ensure seasonal impacts are minimised.

2.21 The Manual Classified Counts (MCCs) undertaken to support this study were undertaken on the following dates:

- Ollerton Roundabout – 29th June 2017;
- Deerdale Lane – 27th September 2017;
- Mickledale Lane - 27th September 2017;
- White Post – 11th October 2018;
- Warren Hill – 20th September 2018; and
- Lowdham – Thursday 7th June 2018.
- Kirk Hill – Wednesday 9th October 2019

2.22 For the MCCs, all possible traffic movements were recorded in 15 minutes intervals, between the times of 07:00 – 19:00hrs. The following classifications were used:

- PC – Pedal cycles using the road; this does not include cyclists using the pavement.
- MC – Two wheeled motorcycles;
- Car – Including taxis, state cars, 'people carriers' and other passenger vehicles (for example, minibuses and camper vans) with a gross vehicle weight of less than 3.5 tonnes, normally ones which can accommodate not more than 15 seats. Three- wheeled cars, motor invalid carriages, Land Rovers, Range Rovers and Jeeps and smaller ambulances are included. Cars towing caravans or trailers are counted as one vehicle;
- LGV – Light Goods Vehicle. Includes all goods vehicles up to 3.5 tonnes gross vehicle weight (goods vehicles over 3.5 tonnes have sideguards fitted between axles), including those towing a trailer or caravan. This includes all car delivery vans and those of the next larger carrying capacity such as transit vans. Included here are small pickup vans, three-wheeled goods vehicles, milk floats and pedestrian controlled motor vehicles. Most of this group are delivery vans of one type or another;
- OGV1 – Other Goods Vehicles Category 1. Includes all rigid vehicles over 3.5 tonnes gross vehicle weight with two or three axles. Includes larger ambulances, tractors (without trailers), road rollers for tarmac pressing, box vans and similar large vans. A two or three axle motor tractive without a trailer is also included;
- OGV2 – Other Goods Vehicles Category 2. Includes all rigid vehicles with four or more axles and all articulated vehicles. Also included in this class are OGV1 goods vehicles towing a caravan or trailer;
- PSV – Buses and Coaches. Includes all public service vehicles and works buses with a gross vehicle weight of 3.5 tonnes or more, usually vehicles with more than 16 seats.

2.23 Queue length surveys were also conducted. The queue length data was collected on the following dates:

- Ollerton Roundabout – 29th June 2017;
- Deerdale Lane – 27th September 2017;
- Mickledale Lane - 27th September 2017;

- White Post – 12th December 2018;
- Warren Hill – 20th September 2018; and
- Lowdham – Thursday 13th December 2018.
- Kirk Hill – 9th, 10th and 11th October 2019

2.24 The length of queues was recorded at each junction between 07:00 – 10:00hrs & 16:00 – 19:00hrs, every five minutes.

2.25 Table 2.1 to Table 2.6 present the observed base year MCC data and a summary of the queue data. The validity and appropriateness of the MCC data and queue surveys was reviewed against long term permanent automatic traffic counts which are discussed in more detail below. Queue surveys were logic checked against live and 'typical' traffic sources (Google Traffic), as well as Trafficmaster delay plots (presented in Appendix C) to ensure the queue data was representative. In addition, the project team have a thorough local knowledge of the A614/A6097 corridor having delivered multiple improvements along the route in recent years and were therefore able to apply logic checks to the data used in the assessment.

Table 2.1: Ollerton – Inflow by approach arm (pcu/hr) and queues (pcu)

Approach arm	Base Year – AM			Base Year - IP			Base Year - PM		
	Inflow	Average Queue	Max Queue	Inflow	Average Queue	Max Queue	Inflow	Average Queue*	Max Queue*
A614 (N)	495	17	44	379	-	-	511	17	40
A616 (E)	751	5	11	690	-	-	1094	60	80
A614 (S)	863	19	43	629	-	-	699	85	96
A6075	396	15	34	287	-	-	349	6	13
A616 (W)	361	14	48	223	-	-	297	4	17
Total	**2,866**	**70**	**180**	**2,207**	**-**	**-**	**2,950**	**171**	**246**

Table 2.2: Deerdale Lane – Inflow by approach arm (pcu/hr) and queues (pcu)

Approach arm	Base Year – AM			Base Year - IP			Base Year - PM		
	Inflow	Average Queue	Max Queue	Inflow	Average Queue	Max Queue	Inflow	Average Queue	Max Queue
A614 (N)	977	0	0	589	0	0	869	0	0
Deerdale lane (E)	107	8	13	101	8	19	132	10	18
A614 (S)	874	5	8	594	3	9	888	4	12
Eakring Road	8	0	0	9	0	0	8	0	0
Total	**1,965**	**13**	**21**	**1,293**	**11**	**28**	**1,896**	**14**	**30**

Table 2.3: Mickledale Lane – Inflow by approach arm (pcu/hr) and queues (pcu)

Approach arm	Base Year – AM			Base Year - IP			Base Year - PM		
	Inflow	Average Queue	Max Queue	Inflow	Average Queue	Max Queue	Inflow	Average Queue	Max Queue
A614 (N)	957	0	0	595	0	0	885	0	0
Mickledale Lane	157	13	19	114	9	17	146	11	20
A614 (S)	898	4	8	635	5	12	989	10	17
Inkersall Lane	6	0	0	9	0	0	3	0	0
Total	2,018	17	27	1,353	14	29	2,023	21	37

Table 2.4: White Post – Inflow by approach arm (pcu/hr) and queues (pcu)

Approach arm	Base Year – AM			Base Year - IP			Base Year - PM		
	Inflow	Average Queue	Max Queue	Inflow	Average Queue*	Max Queue*	Inflow	Average Queue	Max Queue
A614 (N)	910	63	157	604	9	43	877	14	43
Mansfield Road (E)	209	2	7	153	0	7	229	1	9
A614 (S)	996	20	43	608	2	21	1,060	17	38
Mansfield Road (W)	295	3	9	133	1	7	155	4	23
Total	**2,410**	**88**	**216**	**1,498**	**12**	**78**	**2,321**	**37**	**113**

*Note: Only queue data for 1000hrs – 1200hrs was available for the interpeak period.

Table 2.5: Warren Hill – Inflow by approach arm (pcu/hr) and queues (pcu)

Approach arm	Base Year – AM			Base Year - IP			Base Year - PM		
	Inflow	Average Queue	Max Queue	Inflow	Average Queue	Max Queue	Inflow	Average Queue	Max Queue
A614 (N)	1,136	0	0	509	0	0	747	0	0
A6097	382	2	8	237	1	3	449	3	16
A614 (S)	516	0	0	309	0	0	625	0	0
Total	**2,034**	**2**	**8**	**1,055**	**1**	**3**	**1,821**	**3**	**16**

Table 2.6: Lowdham – Inflow by approach arm (pcu/hr) and queues (pcu)

Approach arm	Base Year – AM			Base Year - IP			Base Year - PM		
	Inflow	Average Queue	Max Queue	Inflow	Average Queue	Max Queue	Inflow	Average Queue	Max Queue
A6097 (W)	1,227	68	107	635	10	23	894	9	22
Southwell Road	405	61	122	341	3	16	426	5	19
A6097 (E)	1,131	27	52	796	13	80	1,346	14	50
A612	661	14	78	559	9	78	820	189	205
Total	**3,424**	**169**	**359**	**2,331**	**34**	**197**	**3,485**	**217**	**297**

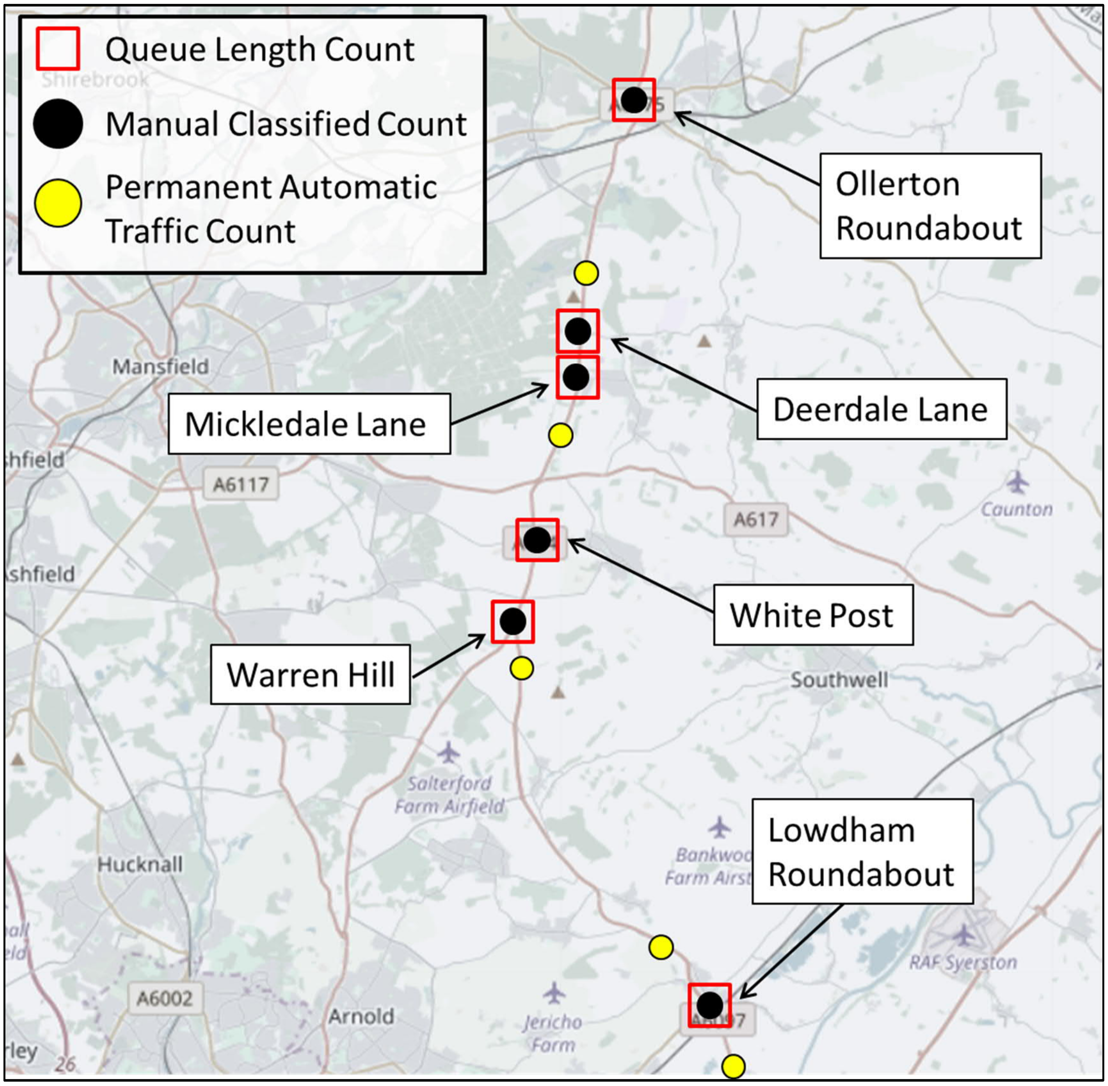
2.26 Baseline turning movements at the scheme junctions, highlighting the major movements, are presented in Appendix D. This data is provided by vehicle type, direction and time of day.

2.27 In addition, Automatic Traffic Count (ATC) data was also available from permanent count locations on the A614 / A6097. The following count locations were examined within the study:

- A614 Bilsthorpe (N) – Site ID: 000030306363
- A614 Bilsthorpe (S) – Site ID: 000030306359
- A6097 Warren Hill (S) – Site ID: 000035206253
- A6097 Lowdham (N) – Site ID: 000030806547
- A6097 Lowdham (S) – Site ID: 000030006745

2.28 Figure 2-1 locates all count site locations used within the study.

Figure 2-1: Count Site Locations



2.29 For the purpose of the study, all raw traffic count data has been converted into Passenger Car Units (PCUs), to represent the impact of the particular mode on the highway network in comparison to a single car. The following PCU factors have been used:

- Bicycle: 0.2
- Motorcycle: 0.4
- Car: 1.0
- Light Goods Vehicle (LGV): 1.0
- Single-Unit Trucks / Medium Goods Vehicle (MGV):1.5
- Public Service Vehicles (including Buses): 2.0
- Articulated Trucks / Heavy Goods vehicle (HGV): 2.3

Peak Hours

2.30 The manual classified count (MCC) surveys at the six junctions were recorded in 15-minute intervals. Analysis of the MCC data was undertaken to identify the busiest 60-minute segment in both the AM (07:00 – 10:00hrs) and the PM (16:00 – 19:00hrs) peak periods. Table 2.7 shows the analysis for each junction.

Table 2.7: Network Peak Hour

Junction	Peak traffic flow hour (AM Peak)	Peak traffic flow hour (PM Peak)
Ollerton Roundabout	07:45 – 08:45	16:15 – 17:15
Deerdale Lane	07:30 – 08:30	16:45 – 17:45
Mickledale Lane	07:15 – 08:15	16:45 – 17:45
White Post	07:15 – 08:15	16:30 – 17:30
Warren Hill	07:30 – 08:30	16:30 – 17:30
Lowdham Roundabout	07:45 – 08:45	17:00 – 18:00
Kirk Hill	07:45 - 08:45	16:45 – 17:45
Average Network Peak Hour	**07:30 – 08:30**	**16:30 – 17:30**

2.31 From the individual junction peak hours, a common network peak hour was identified by selecting the hour period which incorporated the majority of the individual junction peak hours identified in Table 2.7. The network peak hours were identified as 07:30 – 08:30hrs and 16:30 – 17:30hrs. All but one of the junction peak hours fell within 15-minutes of these network peak hours. These network peak hours were used as the AM and PM peak hours on which the analysis was based. This approach ensures consistency of traffic flows along the route used in the appraisal. In the AM peak, the junctions where the individual peak fell outside of this hour all had 45 minutes of the individual peaks included in the network peak hour. In the PM peak, the junctions which have an individual peak which fell outside of the network had 45 minutes of the individual peak hour included in the network peak hour, with the exception of Lowdham which has 30 minutes represented. The impact of this approach is a small underestimation of the peak hour demands which would underestimate the potential benefits of the scheme. This network-wide approach is a proportionate and robust approach to transport economic assessment.

2.32 Table 2.8 to Table 2.13 below present the observed inflows to each junction within the four 15-minute periods of the junction peak hours identified in Table 2.7. This shows that the use of an average peak hour for all junctions will not materially affect the appraisal.

Table 2.8: Ollerton – 15-minute profile within junction peak hour

AM Time Period	AM Inflow (veh/hr)	PM Time Period	PM Inflow (veh/hr)
0745 - 0800	641	1615 - 1630	599
0800 - 0815	645	1630 - 1645	596
0815 - 0830	661	1645 - 1700	616
0830 - 0845	603	1700 - 1715	679

Table 2.9: Deerdale – 15-minute profile within junction peak hour

AM Time Period	AM Inflow (veh/hr)	PM Time Period	PM Inflow (veh/hr)
0730 - 0745	536	1645 - 1700	511
0745 - 0800	473	1700 - 1715	477
0800 - 0815	536	1715 - 1730	510
0815 - 0830	497	1730 - 1745	459

Table 2.10: Mickledale – 15-minute profile within junction peak hour

AM Time Period	AM Inflow (veh/hr)	PM Time Period	PM Inflow (veh/hr)
0715 - 0730	532	1645 - 1700	561
0730 - 0745	551	1700 - 1715	500
0745 - 0800	497	1715 - 1730	546
0800 - 0815	541	1730 - 1745	498

Table 2.11: White Post – 15-minute profile within junction peak hour

AM Time Period	AM Inflow (veh/hr)	PM Time Period	PM Inflow (veh/hr)
0715 - 0730	587	1630 - 1645	562
0730 - 0745	642	1645 - 1700	619
0745 - 0800	642	1700 - 1715	607
0800 - 0815	643	1715 - 1730	616

Table 2.12: Warren Hill – 15-minute profile within junction peak hour

AM Time Period	AM Inflow (veh/hr)	PM Time Period	PM Inflow (veh/hr)
0730 - 0745	523	1630 - 1645	472
0745 - 0800	518	1645 - 1700	489
0800 - 0815	493	1700 - 1715	453
0815 - 0830	422	1715 - 1730	455

Table 2.13: Lowdham – 15-minute profile within junction peak hour

AM Time Period	AM Inflow (veh/hr)	PM Time Period	PM Inflow (veh/hr)
0745 - 0800	817	1700 - 1715	918
0800 - 0815	886	1715 - 1730	904
0815 - 0830	952	1730 - 1745	805
0830 - 0845	945	1745 - 1800	822

2.33 In addition to the AM and PM peak hours, the assessment is also concerned with traffic conditions during the Inter Peak and Off Peak hours. The Inter peak is defined as the average hour between 10:00 – 16:00hrs, whilst the Off Peak is defined as the average hour between 22:00 – 06:00hrs.

2.34 Given this, the following time periods were examined throughout the study:

- AM Peak: 07:30 – 08:30hrs;
- PM Peak: 16:30 – 17:30hrs;
- Inter Peak: 10:00 – 16:00 (average hour);
- Off Peak: 22:00 – 06:00 (average hour);

Baseline Traffic Flows

2.35 As the MCCs only recorded vehicles passing through the junction, vehicles that were recorded as queuing at the end of each of the peak sixty-minute periods have also been added to the recorded traffic flow (proportioned to each individual turning movement) so that the full demand through each junction is identified. This ensures that any new scheme can be designed to cater for the full hourly demand.

2.36 To account for any seasonality effects associated with the month of collection of the MCC surveys, a seasonality factor was applied at this stage which was based on long-term traffic count data provided by NCC for the A614 corridor.

Baseline = (Junction MCC + Queuing Traffic at Period End) * Seasonality Factor

2.37 The seasonality factor was calculated by finding the average two-way weekday flow for each month at 5 permanent count sites on the A614 / A6097 corridor (identified in Figure 2-1 above). This was used to find the percentage difference between the AAWT (Average Annual Weekday Traffic) flow and the monthly average, which was then applied to the months of traffic data collection to account for any seasonality impacts associated with differing months of data collection.

2.38 The seasonality factor was calculated to be 4.1%.

2.39 The approach to using long term traffic data to derive a seasonality factor is consistent with DMRB, Volume 12, Section 1, Part 1 guidance.

2.40 Diagrams showing the traffic flow through each of the study area junctions are shown in Appendix E. Appendix F presents total base year flows for links approaching each junction and the observed turning movements at each junction by vehicle type and time period.

2.41 To examine the temporal variation of traffic flows along the corridor, permanent count site data available through the C2 database has been examined for the period 1st January 2018 – 31st December 2018 (i.e. the most up-to-date full year of traffic data). The following permanent counts sites have been examined to represent the full corridor:

- A614 Bilsthorpe (N) – Site ID: 000030306363
- A614 Bilsthorpe (S) – Site ID: 000030306359
- A6097 Warren Hill (S) – Site ID: 0000352206253
- A6097 Lowdham (N) – Site ID: 000030806547
- A6097 Lowdham (S) – Site ID: 000030006745

2.42 The average hourly weekday traffic flows (excluding bank holidays) have been calculated across the five sites to show the temporal variation in traffic flows on the corridor across the day. Figure 2-2 shows the variation across the day in the northbound direction, whilst Figure 2-3 shows the southbound. Figure 2-4 summarises the two-way flow.

Figure 2-2: Average weekday hourly traffic flow across the A614 / A6097 corridor – Northbound

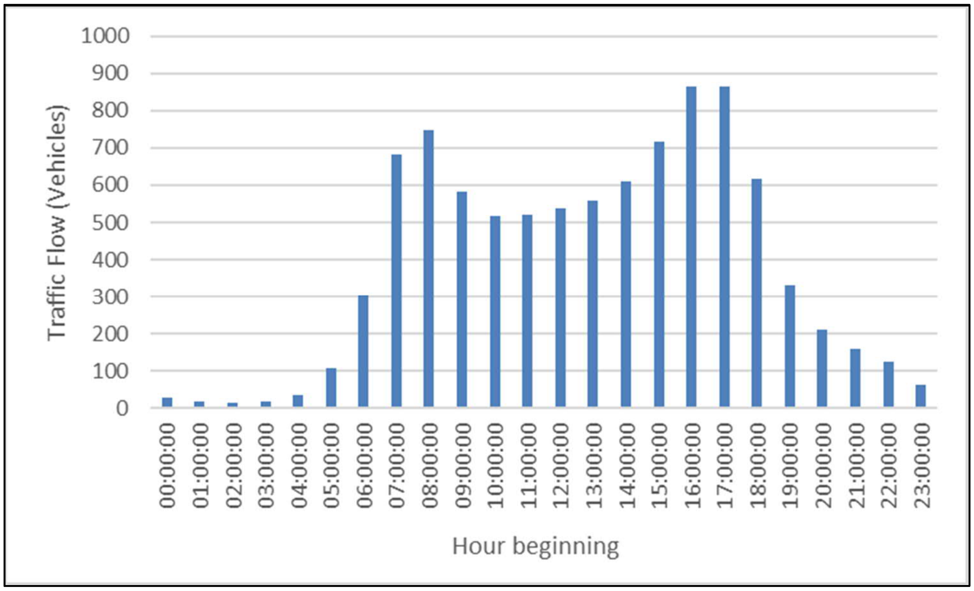


Figure 2-3: Average weekday hourly traffic flow across the A614 / A6097 corridor – Southbound

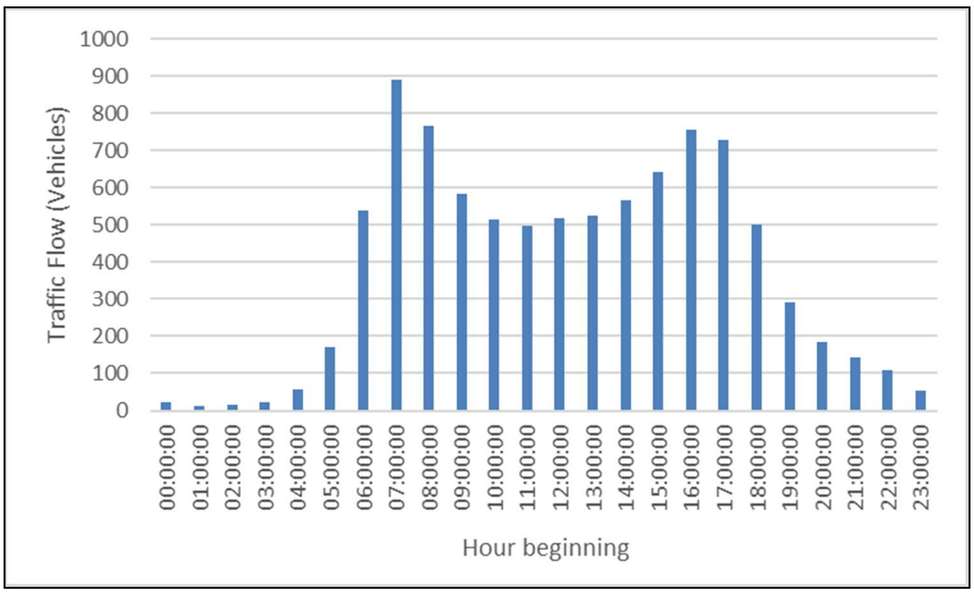
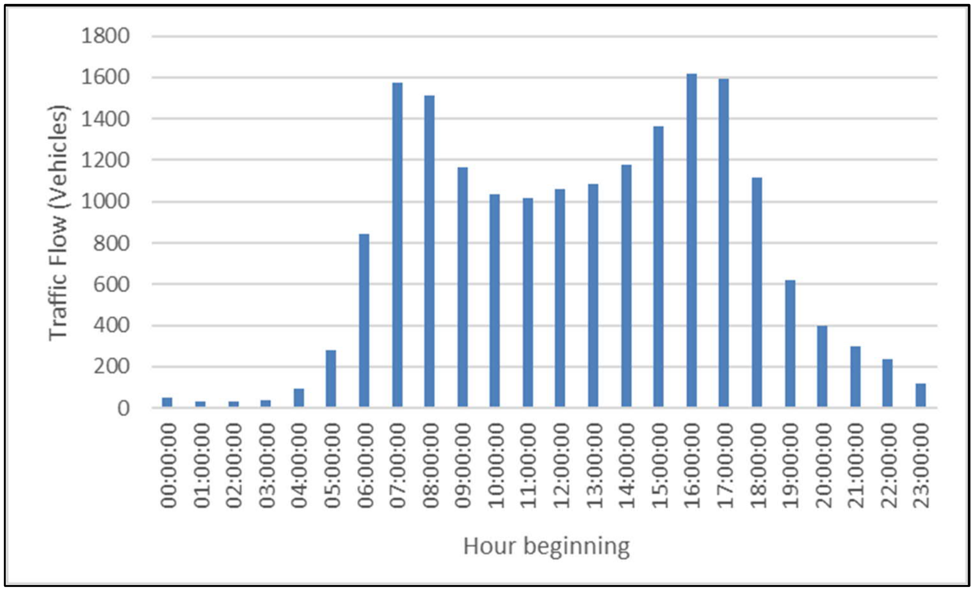


Figure 2-4: Average weekday hourly traffic flow across the A614 / A6097 corridor – Two-way



2.43 The data in Figures 2.2 to 2.4 identifies two clear peak periods across the corridor, typically between 0700 – 0900 hrs in the morning and 1600 – 1800 hrs in the evening. The network peak hours used throughout this report (identified as 0730 – 0830 and 1630 – 1730 in Table 2.1) fall within these peak periods.

2.44 Furthermore, the graphs indicate that traffic flows along the A614 – A6097 corridor are tidal, whereby traffic flows are higher in the morning peak in the southbound direction, whilst in the evening peak traffic flows are greatest in the northbound direction.

2.45 The C2 data was also utilised to show variation across the year, with the average weekday flows per month shown in Figure 2-5 for the northbound and Figure 2-6 for the southbound. The two-way average traffic flows by month are shown in Figure 2-7.

Figure 2-5: Average monthly (weekday) traffic flow across the A614 / A6097 corridor – Northbound

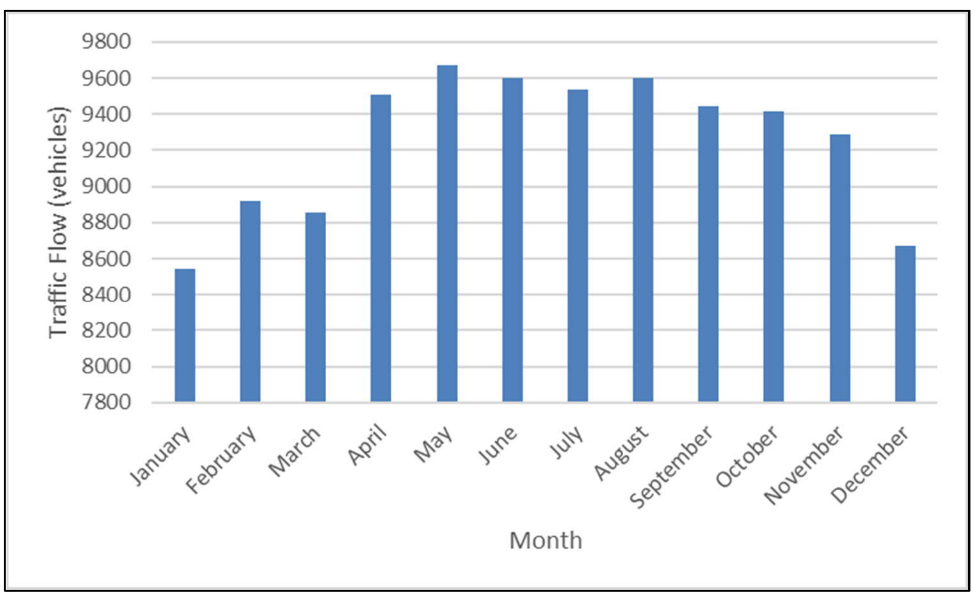


Figure 2-6: Average monthly (weekday) traffic flow across the A614 / A6097 corridor – Southbound

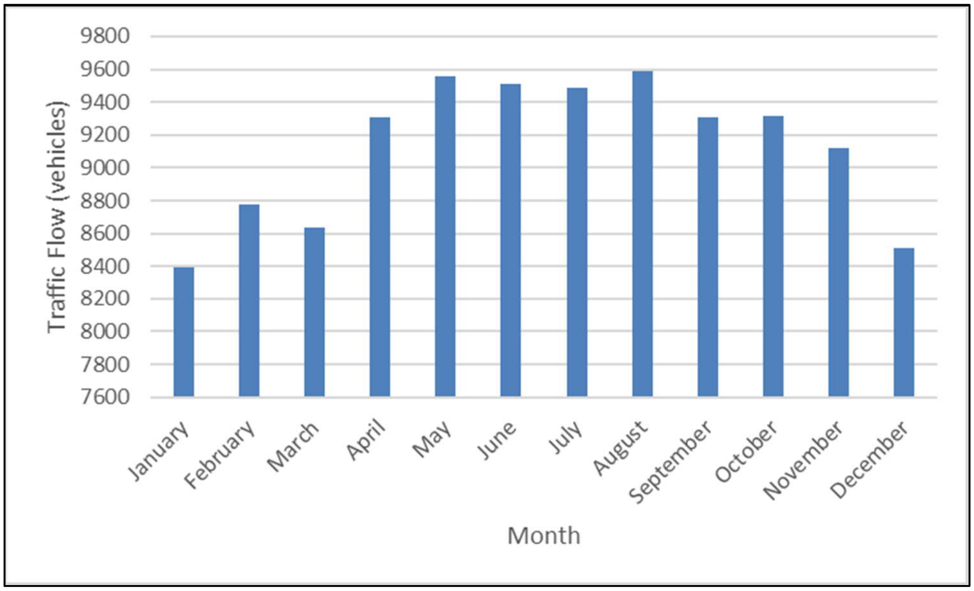
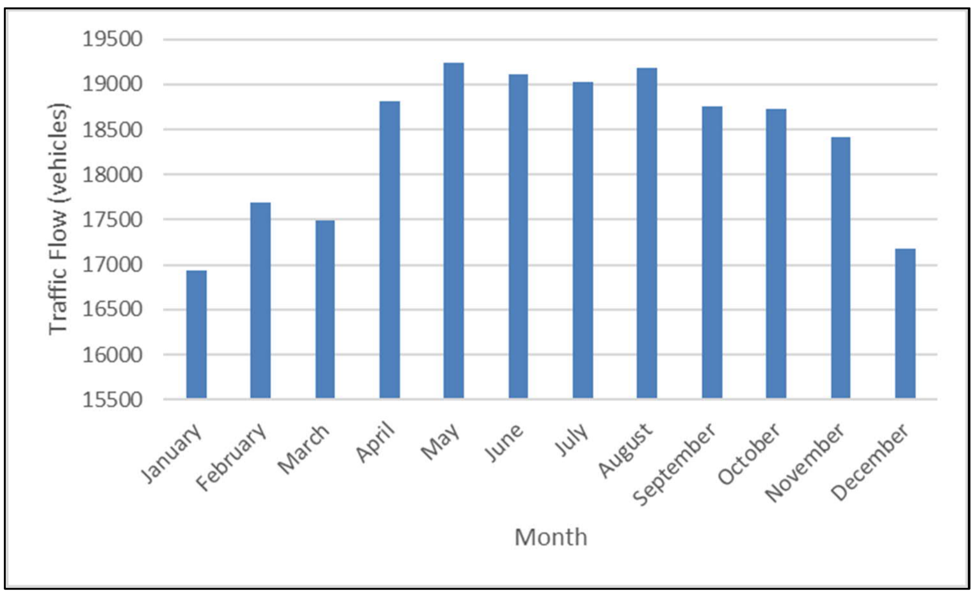


Figure 2-7: Average weekday hourly traffic flow across the A614 / A6097 corridor – Two-way



2.46 Figure 2-5 to Figure 2-7 identify that traffic flows are greatest in the summer months, with the two-way traffic flow highest in May. January and December see the lowest traffic flow.

2.47 To show annual changes to traffic flows across the corridor, historic count data available through the DfT manual count point database has been utilised for three sites across the network corridor:

- A614 Bilsthorpe (S) – Site number 17302;
- A614 White Post – Site number 47379; and
- A6097 Epperstone By-Pass – Site number 27820.

2.48 Figure 2-8 shows the Annual Average Daily Flow in the northbound direction as an average across the three sites, whilst Figure 2-9 shows the southbound direction. The variation in two-way flow is shown in Figure 2-10.

Figure 2-8: Average Annual Daily Flow, averaged for the three sites on the corridor - Northbound

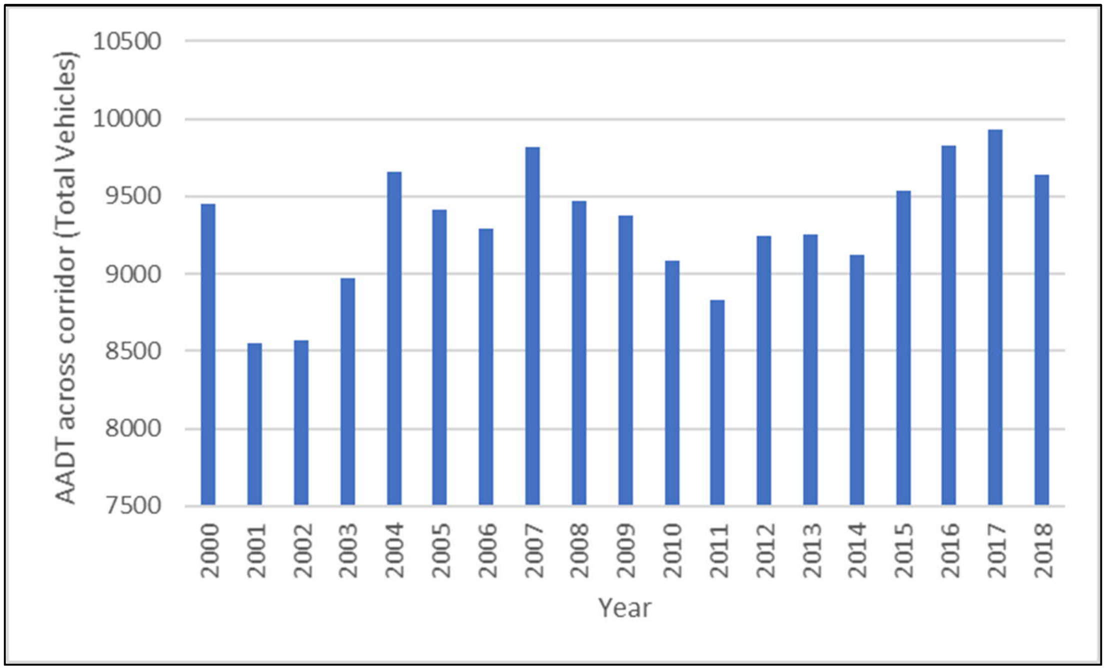


Figure 2-9: Average Annual Daily Flow, averaged for the three sites on the corridor – Southbound

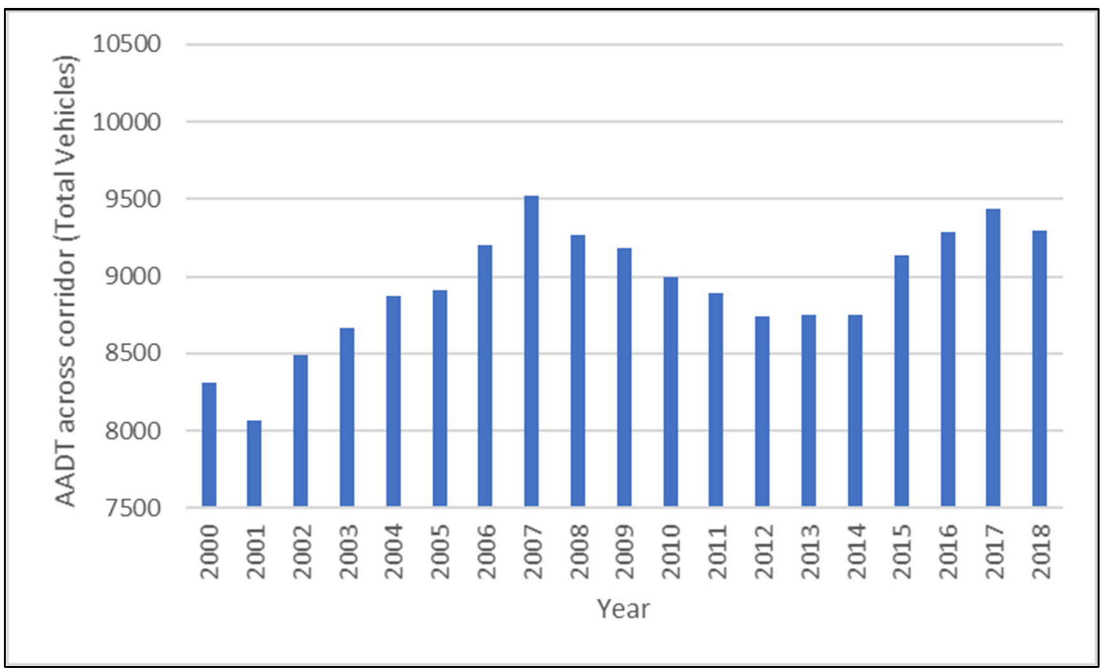
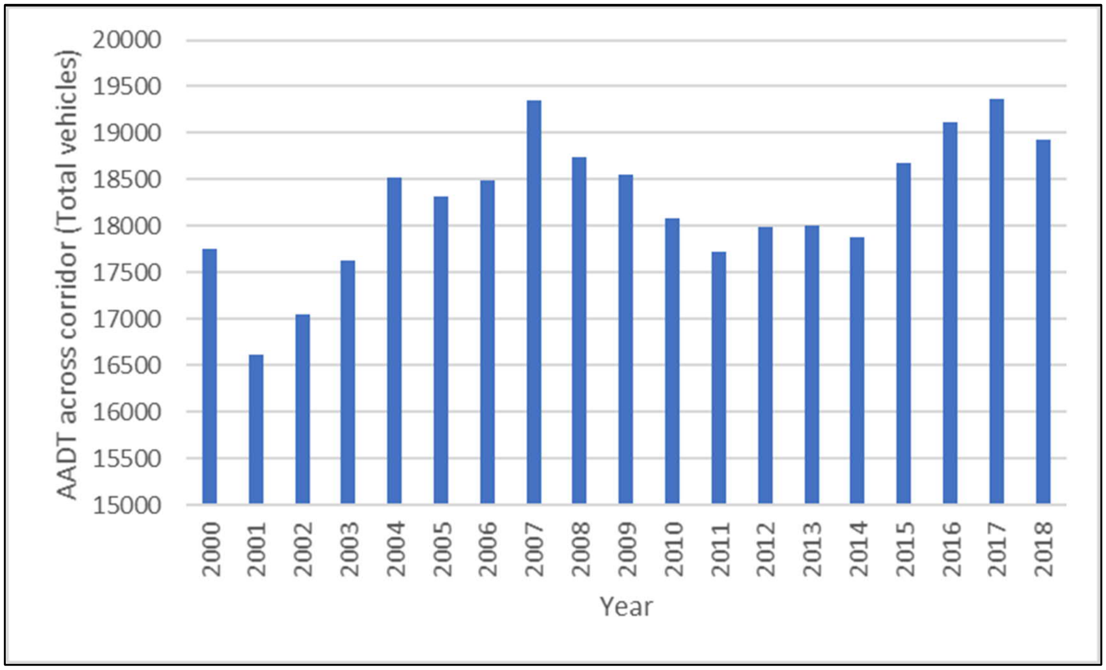


Figure 2-10: Average Annual Daily Flow, averaged for the three sites on the corridor – Two-way



2.49 The data presented in Figure 2-8 to Figure 2-10 shows no obvious temporal relationship, with AADT flows observed to vary year-on-year.

Public Transport Flows

2.50 The number of buses routing through each of the junctions recorded during the MCC counts are shown Table 2.14. Full junction diagrams are shown in Appendix G, which show the turning movements of buses at each of the junctions.

Table 2.14: Buses routing through each scheme junction – derived from MCC data

Junction	Buses routing through junction		
	AM	PM	IP
Ollerton	26	9	17
Deerdale Lane	10	2	6
Mickledale Lane	12	4	6
White Post	12	9	8
Warren Hill	6	6	5
Lowdham	18	8	10
Kirk Hill	5	5	2

2.51 The following services route along or through the study area:

- 14 / 15 / 15A - Stagecoach (Mansfield / Walesby / Kirton). Routes through:
  - Ollerton Roundabout
- Sherwood Arrow – Stagecoach (Worksop / Retford / Ollerton / Nottingham). Routes through:
  - Ollerton Roundabout
  - Deerdale Lane
  - Mickledale Lane
  - White Post
  - Warren Hill
- 28 – Stagecoach (Mansfield / Blidworth / Farnsfield / Southwell / Averham / Newark). Routes through:
  - White post
- 27x / 28 – Stagecoach (Mansfield / Blidworth / Bilsthorpe / Eakring). Routes through:
  - White post
- 29 – Stagecoach (Mansfield / Blidworth / Farnsfield / Southwell / Upton / Newark). Routes through:
  - White Post
- The Calverton – Trent Barton (Calverton / Arnold / Nottingham)
- 26 / 26A / N26 – Nottingham City Transport (Southwell / Brackenhurst / Lowdham / Burton Joyce / Nottingham) Route through:
  - Lowdham
- 354 – Nottsbus Connect (Newark - Elston - Bingham - Orston) Route through:
  - Kirk Hill

2.52 Services operating only one day per week (such as Shopper services) have not been included due to their low frequency.

2.53 Appendix H shows a map of bus services within the study area

2.54 Personal Service Vehicles (PSVs), including buses, have been accounted for within junction modelling by using Passenger Car Units (PCUs) as the unit of traffic volume. Each bus was assigned a PCU value of 2, which accounts for the greater impacts larger vehicles have upon traffic variables (e.g. capacity, road surface degradation etc.).

2.55 In addition, buses (and other large vehicles) have also been accounted for within junction design (described in detail within the Options Appraisal Report (OAR)).

Pedestrians and cyclists

2.56 No specific pedestrian and cyclists baseline data has been collected due to the rural location of the junctions and low numbers expected. However, camera surveys were utilised for turning counts at the key junctions of Ollerton, Deerdale, Mickledale and Lowdham. A review of the camera footage has been undertaken and the numbers for the whole day are shown in Table 2.15 Please note that these are limited as the camera survey was setup to capture turning counts, but it is considered that the data shows the relative low number of pedestrian and cyclists across all these junctions. As part of the detailed design further surveys will be commissioned at Lowdham due to the higher numbers observed, however, a formal controlled toucan crossing is proposed as part of the new junction layout.

Table 2.15: Pedestrians and Cyclists at each junction – derived from camera survey

Junction	Pedestrians	Cyclists	Date of Camera Survey
Ollerton	15	2	(29th June 2017)
Deerdale Lane	4	6	(27th September 2017)
Mickledale Lane	0	7	(27th September 2017)
Lowdham	34	71 (carriageway) 34 (off-carriageway)	(7th June 2018)

2.57 Pedestrian and cyclists' trips across all junctions are low and the number of trips local to the junctions is not available. Controlled crossing facilities for pedestrians and cyclists are included at the following locations:

- Ollerton roundabout on the A614 southern arm and across the A6075.
- Lowdham, roundabout on the A6097 northern arm, this is the key desire route between Burton Joyce / Bulcote and Lowdham and links an existing shared use footway / cycleway

Traffic Forecast Scenarios

2.58 The following future year traffic forecasting scenarios have been developed:

- Opening Year Forecast - 2023;
- Design Year Forecast (Non Dependent) - 2037; and
- Design Year Forecast (Dependent) – 2037.

2.59 The 2023 Opening Year forecasts have been prepared to reflect the expected construction program of the six junctions which make up the scheme package.

2.60 A 2037 Design Year forecast has been produced for design purposes, which assumes all identified development is built out (Design Year Forecast (Dependent) – 2037); whilst a further 2037 forecast (Design Year Forecast (Non Dependent) – 2037) has been produced which excludes any dependent development for use in the economic assessment (i.e. this report).

2.61 There are no programmed transport schemes along the A614/A6097 corridor and no major nearby schemes that are likely to impact the A614/A6097. As such the surrounding existing transport network is representative of the future year transport network. There are no interim improvements planned at any of the scheme junctions.

Committed Development

2.62 To suitably forecast the future traffic on the network, it is necessary to consider the additional traffic generated by the development of new housing and employment sites on, or nearby, the corridor.

2.63 TAG unit M4, Forecasting and Uncertainty, May 2018, section 2.2 and Table A2 defines the criteria for including known development in a core forecast. This should only include schemes where the likelihood of them going ahead is near certain, or more than likely

2.64 Following discussion with Nottinghamshire County Council, it was agreed to include the following committed developments, deemed to be near certain, or more than likely, in the traffic forecasts:

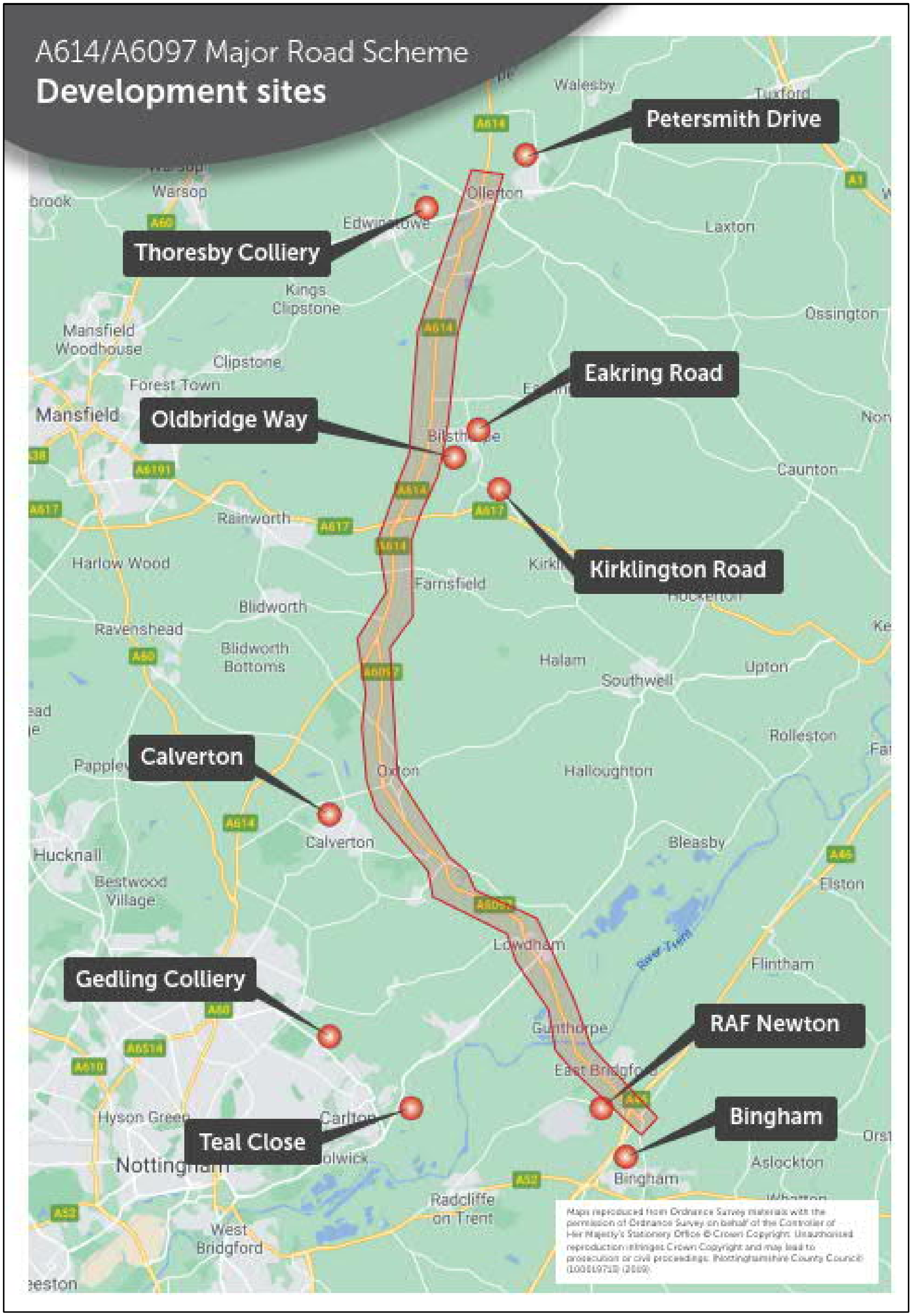
- Newark & Sherwood District Council:
  - Land north of Petersmith Drive;
  - Thoresby Colliery;
  - Land East of Eakring Road (Bilsthorpe Village);
  - Kirklington Road (Bilsthorpe Village);
  - Oldbridge Way (Bilsthorpe Village);
- Rushcliffe Borough Council:
  - Land at the former RAF Newton;
  - Chapel lane, Bingham;
- Gedling Borough Council:
  - Park Road, Calverton;
  - Land at Teal Close; and
  - Land at Chase Farm (Former Gedling Colliery).

2.65 Table 2.16 shows the development size for each committed development, as well as whether there are any planning conditions attached to the application, whilst Figure 2-11 locates the sites within the context of the A614 / A6097 corridor.

Table 2.16: Committed Development

Development	Planning Application Reference	Number of dwellings	Employment land	Planning Constraints?
Petersmith Drive	17/00595	305	N/A	N/A
Thoresby Colliery	16/02173	800	32,375m²	Constrained to 150 dwellings and 8,094m² employment development until improvements to Ollerton Roundabout occur
Eakring Road	17/01139	85	N/A	N/A
Kirklington Road	18/00931	136	N/A	N/A
Oldbridge Way	16/01618	113	N/A	N/A
Bingham	10/01962	1,000	55,740m²	N/A
RAF Newton	10/02105	500	15,800m²	N/A
Calverton	2018/0607	650	N/A	N/A
Teal Close	2013/0546	830	18,000m² + Car Home, Schools and Shops	Constrained to 325 dwellings until Lowdham Roundabout is upgraded
Gedling Colliery	2015/1376	1,050	N/A	N/A

Figure 2-11: Committed Development Locations



2.66 Table 2.17 shows the planning status of the most recent (and relevant) application for each development site. The decision to include each site within the Forecasting Year Core Scenario has been made in accordance with Table A2 within the Department for Transport's TAG Unit M4 document (*Forecasting and Uncertainty*).

Table 2.17: Development Planning Status

Development	Planning application	Planning Status	Decision date
Petersmith Drive	Full planning permission for residential development of 305 dwellings and associated development.	Application permitted	16th August 2018
Thoresby Colliery	Outline planning permission for residential development up to 800 dwellings, employment sites (4,855sqm B1a, 13,760sqm B1c, 13,760sqm B2), Country Park, Local Centre etc.	Application permitted	12th March 2019
	Reserved matters application for Phase 1 residential development (143 dwellings).	Application permitted	4th December 2019
Eakring Road	Outline planning permission for residential development up to 85 dwellings, 280sqm retail development and associated works.	Application permitted	1st June 2018
Kirklington Road	Outline planning permission for residential development up to 85 dwellings, 280sqm retail development and associated works.	Application pending	N/A
Oldbridge Way	Full planning permission for residential development of 120 dwellings and ancillary works	Application pending	N/A
Bingham	Reserved matters application for Phase 1 (317 residential dwellings) including associated infrastructure	Application permitted (conditional)	12th February 2018
	Reserved matters application for Phase 2 (733 residential dwellings) including associated infrastructure	Application permitted (conditional)	1st February 2019
RAF Newton	Outline planning permission (with all matters reserved) for 500 dwellings, 50 live/work units, 5.22ha new employment, 1000sqm A1,A3 and A4 uses and community uses.	Application permitted (with section 106)	30th January 2014
	Variation of conditions to enable demolition of existing buildings	Application permitted (conditional)	29th July 2015
Calverton	Outline planning application for up to 365 dwellings (all matters reserved except access).	Application pending	N/A
Teal Close	Reserved matters application for access, appearance, landscaping etc. related to the Local centre and employment area	Application pending	N/A
	Outline planning application for residential development (up to 830 dwellings), employment uses, community hub, primary school, hotel, care home and associated infrastructure.	Application permitted	30th June 2014
Gedling Colliery	Planning application for the construction of an access road junction from the Gedling Access Road	Application permitted	2nd August 2019
	Demolition of existing structures and phased development of 1,050 dwellings, local centre with retail units, health centre, and new primary school.	Application permitted	3rd March 2017

Dependent Development

2.67 TAG unit A2.2, Induced Investment (May 2020), notes that:

"Dependent development refers to new development that is dependent on the provision of a specific transport scheme and for which, with the new development but in the absence of the transport scheme, the existing transport network would not provide a reasonable level of service to existing and/or new users. This has the implication that the development would not be delivered in the absence of the specific transport scheme. It is also noted that the development may have planning permission conditional on a transport investment, but this is not a prerequisite for it to be considered dependent."

2.68 As noted in Table 2.16 above, the development sites at Thoresby Colliery and Teal Close have planning conditions as part of their planning approval, limiting the amount of development that can be delivered prior to the improvements at Ollerton and Lowdham.

2.69 TAG unit A2.2, May 2020 notes that the level of dependency of a site is dependent on the proportion of development that may be accommodated before breaching an acceptable level of service on the transport network.

2.70 TAG Unit A2.2, paragraph 3.1.6 states:

"There is no precise definition of reasonable level of service, such that decisions about dependency are judgement based. However, if additional traffic can be accommodated by the network without significant increases in the costs of travel for existing users, then the network can be assumed to provide a reasonable level of service. "

2.71 TAG Unit A2.10, paragraph A2.10 states:

"… it is assumed that in the baseline scenario the network provides a reasonable level of service. Clearly if that is not the case then the new development is likely to be wholly dependent on some form of transport scheme. However, it must be demonstrated that the baseline scenario does not provide a reasonable level of service before this conclusion can be reached."

2.72 Appendix I demonstrates that the Ollerton and Lowdham junctions are overcapacity in the Base Year. Any increase in trip demand in those parts of the existing highway network will result in unreasonable levels of service. Treating any of the dependent development sites as non-dependent would result in a deterioration of an already poor level of service on the local highway network. The Thoresby Colliery and Teal Close sites are therefore considered dependent.

2.73 This is consistent with TAG Unit A2.2 which notes: *"A dependency is likely to occur where a development will breach 'a reasonable level of service' on the transport network."*

2.74 As noted in TAG Unit A2.1, Wider Economic Impacts Appraisal, Table 2 (May 2019), the Level 1 assessment of transport user benefits exclude Dependent Development from the traffic forecasts. As such, the 'Non-Dependent' traffic forecasts exclude the impacts of dependent development and have been used to assess the transport user benefits of the scheme.

2.75 Additional Induced Investment benefits associated with the change in land value arising from the associated change in land use accrued as part of the scheme in relation to the Thoresby Colliery and Teal Close sites are presented in Section 10.

2.76 Noting that dependent development should not be included in the assessment of transport user benefits, a forecast scenario *including* the trips associated with the dependent development sites has been produced for the purposes of junction design. This forecast has only been used to ensure the proposed junction designs have sufficient capacity and is not used in the assessment of transport user benefits.

2.77 Junction modelling of Ollerton and Lowdham using the dependent development forecast demands demonstrate that the proposed improvements provide sufficient capacity to accommodate the dependent development and meets the planning conditions allow the full developments to go ahead. This is shown in Table 2.18 below which show the RFC of the improved junctions forecast to operate within capacity, or approaching capacity, in the scheme design year.

Table 2.18: Dependent Development Junction Modelling – 2037 Design Year

	2037 Design Year – Dependent Development					
	Lowdham Do Something			Ollerton - Do Something		
	Max Queue (PCU)	RFC	Junction Delay (s)	Max Queue (PCU)	RFC	Junction Delay (s)
AM	16.5	0.96	30.55	5.9	0.85	11.33
PM	30.2	1.00	29.51	8.2	0.9	15.45
IP	1.3	0.57	4.24	1.5	0.61	4.58
OP	0.1	0.05	1.86	0.1	0.05	1.96

Core Traffic Forecast Methodology

2.78 Data on future trip generation and traffic distribution was taken wherever possible directly from the Transport Assessments supporting the various planning applications.

2.79 Trip distribution data was not available for the Kirklington Road, Oldbridge Way and Gedling Colliery developments.

2.80 To calculate trip distribution for Gedling Colliery, the gravity model contained within the Calverton Transport Assessment was used, given the similar nature and location of the two developments. The gravity model used within the Calverton Transport Assessment was developed by RPS Group plc and approved by Nottinghamshire County Council as part of the planning application process. The model calculates attraction to key destinations (as a percentage) as a function of employment population and distance to the key destination. Trips are then assigned to the network using an online route planner to determine the most likely routes travellers would use to travel to the key destination. The Calverton Transport Assessment gravity model is shown in Figure 2.12.

Figure 2-12: Calverton Gravity model (used to estimate trip generation at Gedling Colliery) – produced by RPS Group plc

Transport Assessment

Settlement	Employment Population (P)	Distance km	Distance Miles (D)	P/D^2	%
Calverton	2,333	3	1.865	671.095	6.94%
Newark On Trent	21,144	29	18.024	65.088	0.67%
Grantham	20,958	40	24.860	33.911	0.35%
Nottingham	332,733	11	6.837	7119.059	73.61%
Mansfield	80,065	13	8.080	1226.502	12.68%
Derby	129,129	35	21.753	272.898	2.82%
Loughborough	37,425	48	29.832	42.052	0.43%
Lincoln	68,474	59	36.669	50.925	0.53%
Leicester	246,503	58	36.047	189.705	1.96%
				9671.236	

2.81 To calculate trip distribution for the Kirklington Road and Oldbridge Way developments, the 2011 Journey to Work census has been used which shows the volume and destination of inflows and outflows to the Newark and Sherwood District Council area. A route planner was then used to determine the most likely routes used by traffic to get to / from these points. The 2011 Journey to Work census data, whilst being 8 years old, is considered the most suitable source of data for traffic distribution since it presents the most extensive database on trip origins and destinations to date.

2.82 The trip distributions for the AM and PM inflow and outflow (derived from 2011 Journey to Work census data) is shown in Table 2.19.

Table 2.19: Trip distribution calculated from 2011 Journey to Work census data – applied to Kirklington Road and Oldbridge Way

Key Origin / Destination	Inflow	Outflow
Nottingham	8.2%	21.7%
Mansfield	25.4%	19.5%
Ashfield	7.3%	11.0%
Bassetlaw	10.5%	10.7%
Gedling	10.0%	9.2%
Rushcliffe	7.0%	6.9%
South Kesteven	7.9%	6.7%
Lincoln	10.1%	6.0%
North Kesteven	9.5%	5.7%
Bolsover	4.0%	2.6%

2.83 For any developments where trip distribution data was not available along the full length of the A614/A6097 corridor, traffic has been assigned along the remainder of the corridor using the observed turning movement proportions from the MCCs at each junction.

2.84 For each junction approach arm the percentage of total vehicles (in PCUs) making each turning movement is calculated (for example on Mickledale Lane in the AM Peak, 22% of traffic routes right (to A614 (N)) and 78% routes left (to A614 (S)). When development traffic reaches each junction, it is routed according to the baseline turning movement proportions. For example, should 100 vehicles be travelling along Mickledale Lane from the Oldbridge Way development, 22 are expected to route right and 78 left. The resulting traffic volume is then routed according to the MCC turning proportions at each junction until the end of the corridor. Appendix J shows the distribution of traffic for each development site along the A614 – A6097 corridor by time period.

2.85 For clarity, Table 2.20 summarises the source of trip generation and traffic distribution data for each development site by time period respectively.

Table 2.20: Trip generation and traffic distribution data source for each proposed development

Development	Trip Generation data source	Trip distribution data source	Trip distribution along corridor
Petersmith Drive	Taken from TA (February 2017)	Taken from TA (February 2017)	Partial distribution data along A614 – A6097 corridor. Remainder has been assigned according to MCC turning movement proportions.
Thoresby Colliery	Taken from TA (December 2016)	Taken from TA (December 2016)	Partial distribution data along A614 – A6097 corridor. Remainder has been assigned according to MCC turning movement proportions.
Eakring Road	Taken from TA (June 2017)	Taken from TA (June 2017)	Partial distribution data along A614 – A6097 corridor. Remainder has been assigned according to MCC turning movement proportions.
Kirklington Road	Taken from TA (May 2018)	Calculated via 2011 census data to identify key destinations and percentage of trips routing to these. Assigned using an online route planner. (Calculated for this study by AECOM)	Distribution along A614 – A6097 corridor identified through census data / route planner.
Oldbridge Way	Taken from TA (October 2016)	Calculated via 2011 census data to identify key destinations and percentage of trips routing to these. Assigned using an online route planner. (Calculated for this study by AECOM)	Distribution along A614 – A6097 corridor identified through census data / route planner.
Bingham	Taken from TA (October 2010)	Taken from TA (October 2010)	Partial distribution data along A614 – A6097 corridor. Remainder has been assigned according to MCC turning movement proportions.
RAF Newton	Taken from TA (December 2010)	Taken from TA (December 2010)	Partial distribution data along A614 – A6097 corridor. Remainder has been assigned according to MCC turning movement proportions.
Calverton	Taken from TA (May 2018)	Taken from TA (May 2018)	Partial distribution data along A614 – A6097 corridor.

			Remainder has been assigned according to MCC turning movement proportions.
Teal Close	Taken from TA (April 2013)	Taken from TA (April 2013)	Partial distribution data along A614 – A6097 corridor. Remainder has been assigned according to MCC turning movement proportions.
Gedling Colliery	Taken from TA (December 2015)	Gravity model contained within the Calverton Transport Assessment used to assign development trips (due to the similar location and nature of the two sites).	Partial distribution data along A614 – A6097 corridor based upon Calverton Gravity Model. Remainder has been assigned according to MCC turning movement proportions.

2.86 The transport assessments identified have all presented their development trip generations as total vehicles rather than by vehicle type. For this purpose, the A614/A6097 forecasts have been developed as a total vehicle forecast then converted to PCU's by applying observed HGV proportions along the corridor. This approach reflects the volumetric increase in HGVs but retains the observed proportions.

2.87 Only AM and PM trip generation were provided in the Transport Assessments, and as such it was necessary to calculate the IP and OP values.

2.88 To calculate the IP trip generation, the Trip Rate Information Computer System (TRICS) was used to generate trip rates for the following land uses associated with the committed developments:

- Residential
- B1 (Office)
- B2 (Industrial Estate)
- B8 (Commercial Warehousing)
- Drive Thru
- Pub / Restaurant

2.89 Average arrival / departure trip rates were extracted from TRICs version 7.5.3. Sites within Greater London and Ireland were excluded from the database due to a large number of Public Transport users within Greater London and a heavy reliance upon private vehicles in Ireland. The TRICS output data is available in Appendix K.

2.90 The hourly trip rate was extracted for each land use, and an average AM, PM and IP trip rate calculated. The IP ratio was calculated as follows, with the resulting IP trip rate ratios provided in Table 2.21.

IP ratio = IP trip generation rate / (AM trip generation rate + PM trip generation rate)

Table 2.21: Inter Peak ratio for each land-use type

	Arrivals	Departures
Residential	0.368939	0.308237
B1	0.174709	0.210784
B2	0.492047	0.463687
B8	0.438953	0.457143
Employment average	**0.36857**	**0.377205**
Drive Thru	0.539977	0.561618
Pub / Restaurant	0.462056	0.440971

2.91 The IP ratios were then applied to the AM and PM trip generation values at each development, for each land use type respectively. Where the employment split had not yet been defined for commercial developments, the employment average IP ratio was used.

2.92 Due to the absence of data on the TRICS database for the Off-Peak period, permanent count sites along the A614 / A6097 (aforementioned and shown in Figure 2-1) were used to calculate an OP factor. Using the average weekday hourly flow, an average Inter Peak flow and Off Peak flow was generated. From this, an Off Peak ratio was calculated as follows, with resulting outputs shown in Table 2.22.

OP ratio = Off Peak average flow / Inter Peak average flow

Table 2.22: Off Peak Ratio

Permanent Count Site Location	Interpeak Average	Off Peak Average	OP Ratio
Bilsthorpe (N)	1273	141	0.1108
Bilsthorpe (S)	1327	136	0.1025
Warren Hill (S)	450	46	0.1025
Lowdham (N)	1072	94	0.0880
Lowdham (S)	1495	127	0.0849
Average			**0.0978**

2.93 The OP factor was then applied to the IP trip generation values to determine the trip generation from each development.

2.94 To identify the level of development in the 2023 Opening Year, the percentage built out at each development was calculated, based upon the Local Plan publication housing trajectory supplied by NCC. This is shown in Appendix L. Table 2.23 shows the cumulative and percentage build out for each development for the 2023 Opening Year.

Table 2.23: Build Out Rate

Development	Cumulative Build Out	Percentage Build out (%)
	2023	**2023**
Petersmith Drive	200	66%
Thoresby Colliery	150	100%

Eakring Road	85	100%
Kirklington Road	100	74%
Oldbridge Way	113	100%
Bingham	450	45%
RAF Newton	300	60%
Calverton	390	60%
Teal Close	240	74%
Gedling Colliery	240	23%

2.95 The percentage build out rates for each development have then been applied to the Development Flows at each development, to yield the development flows in 2023.

2.96 Appendix M shows the traffic flows associated with the identified development in the AM, PM, IP and OP time periods, considering dependent and non-dependent development forecasting scenarios respectively. Also provided in Appendix J are site specific flow diagrams are included to illustrate the trip generations and distributions associated with each development site.

2.97 To account for any additional future growth, the NTEM database was used to calculate ‘topping up’ factors that were applied estimate future year Opening Year and Design Flows.

2.98 NTEM is a database developed by the Department fort Transport (DfT) as part of the National Transport Model (NTM). The NTEM database can be interrogated to find the forecast year trip-end growth projections for travel including by car, thus allowing local area traffic models to be developed on a consistent basis with regards to future year national growth.

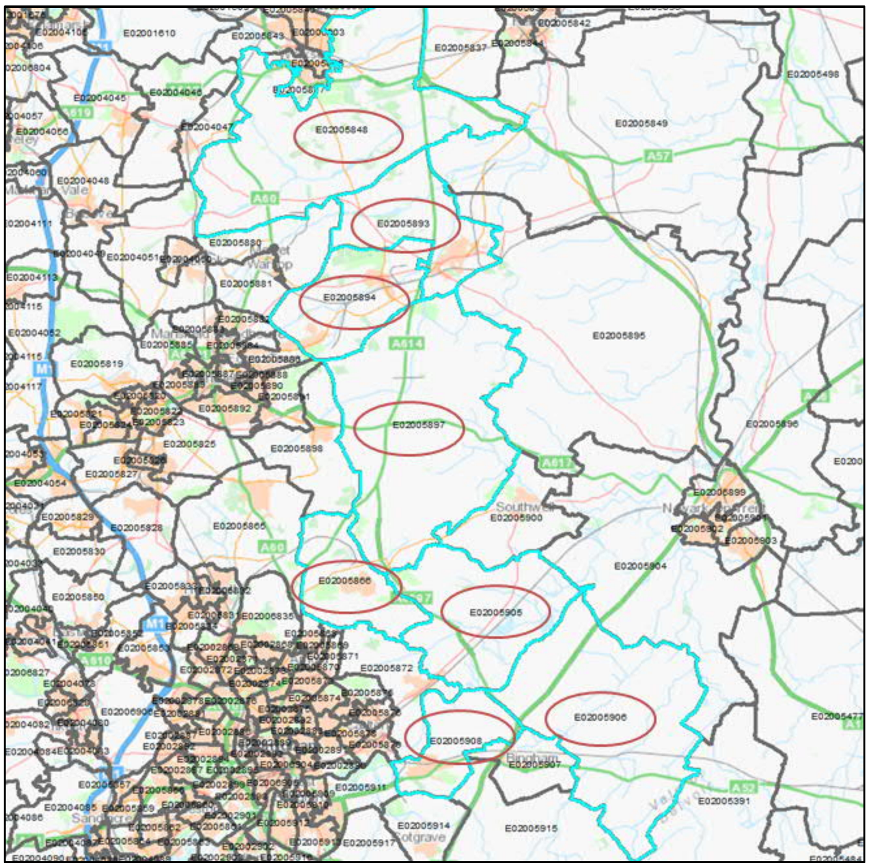
2.99 The forecast outputs from NTEM for a specific area are based upon National Planning Policy aspirations regarding future employment and housing levels that have been input to the NTM.

2.100 Forecast outputs from NTEM are extracted from the flowing districts:

- E02005848 – Bassetlaw 014
- E02005893 – Newark and Sherwood 001
- E02005894 – Newark and Sherwood 002
- E02005897 – Newark and Sherwood 005
- E02005866 – Gedling 002
- E02005905 – Newark and Sherwood 013
- E02005908 – Rushcliffe 003

2.101 Figure 2-13 identifies these NTEM districts.

Figure 2-13: NTEM Growth Factor districts



2.102 The NTEM rate from each individual district was combined into an average growth rate for the A614/A6097 corridor in each time period, as shown in Table 2.24.

2.103 The growth in vehicle numbers expected from committed development along the A614 / A6097 corridor relative to the baseline is shown in Table 2.25 for each forecast scenario. This 'Development Growth' considers the expected increase in vehicle numbers from the baseline attributed to the proposed development only (i.e. it does not consider any likely background growth associated with population growth etc).

2.104 Subtracting the NTEM growth from the expected development growth shows the time periods where expected growth from development is lower than NTEM growth (highlighted in bold in Table 2.26). In this instance, the traffic flows in each scenario have been 'topped up' to NTEM levels in order capture all expected growth in traffic flow across the network.

2.105 For the purposes of economic assessment, 'topping up' has been excluded in the Design Year as the Dependent Development growth (excluded from the economic assessment) will account for the shortfall between Committed Development and NTEM levels in the Design Year in the AM and IP periods.

2.106 In the PM peak, the 'with dependent development' forecast is slightly below NTEM forecast growth. No additional NTEM growth has been applied to the PM 'non-dependent' forecast on the assumption that this is a robust approach for economic appraisal (future year PM Do Minimum delays may be slightly underestimated). The 'with dependent development' forecast has been topped up to NTEM growth forecasts to ensure the proposed design contains sufficient capacity for additional growth elsewhere in the district.

2.107 As such, the 2023 Opening Year PM scenario and 2037 Dependent PM scenario have had a 'topping up' factor applied.

Table 2.24: NTEM Growth

	AM	PM	IP
Opening Year (2023)	8.2%	9.2%	8.1%
Non-Dependent Growth (2037)	22.1%	24.8%	21.9%
Dependent Growth (2037)	22.1%	24.8%	21.9%

Table 2.25: Development Growth

	AM	PM	IP
Opening Year (2023)	9.5%	8.4%	8.8%
Non-Dependent Growth (2037)	13.5%	11.8%	12.4%
Dependent Growth (2037)	25.5%	23.1%	23.8%

Table 2.26: Topping Up factor (NTEM Growth – Development Growth)

	AM	PM	IP
Opening Year (2023)	-	**0.8%**	-
Non-Dependent Growth (2037)	-	-	-
Dependent Growth (2037)	-	**1.7%**	-

2.108 It is noted that the NTEM forecasts represent the predicted car growth in the region, whereas the A614 forecasts have been produced at an all vehicle level (for the reasons set out in paragraph 2.75). As the expected development growth (non-dependent and dependent) has not been constrained to NTEM and in all but one case exceeds NTEM growth, the comparison is useful. In the cases where forecasts are below NTEM and have not had a 'topping up' factor applied, forecast could be an underestimation of demand. This is a robust approach for economic appraisal (future year PM Do Minimum delays may be slightly underestimated).

Ollerton Reassignment

2.109 It was noted that the improvements to Ollerton roundabout had a small potential for possible reassignment of local traffic likely currently routing through the village to avoid journey time delays at peak times. An assessment of through traffic was identified in a Nottinghamshire County Council analysis of matched registration survey conducted in 2017. This assessment was used to make allowance for potential reassignment onto the A614 corridor in the Do Something scenario for use in the Noise & Air Quality assessment.

2.110 The 2023 Opening Year traffic forecasts, used within the Economic Assessment are shown in Appendix N.

2.111 The 2037 Design Year traffic forecasts, used within the Economic Assessment, are contained within Appendix O.

Traffic Forecast Summary

2.112 Table 2.27 to Table 2.32 provide a summary of how peak hour demand at the scheme junctions are fore-cast to grow in future.

Table 2.27: Ollerton Junction

	Time period	Total Junction Inflow (pcu/hr)
Base Year (2018)	AM	2,866
	PM	2,950
Opening Year (2023)	AM	3,210
	PM	3,138
Design Year (2037)	AM	3,223
	PM	3,253

Table 2.28: Deerdale Lane Junction

	Time period	Total Junction Inflow (pcu/hr)
Base Year (2018)	AM	1,965
	PM	1,896
Opening Year (2023)	AM	21,36
	PM	1,393
Design Year (2037)	AM	2,210
	PM	2,092

Table 2.29: Mickledale Lane Junction

	Time period	Total Junction Inflow (pcu/hr)
Base Year (2018)	AM	2,018
	PM	2,023
Opening Year (2023)	AM	2,204
	PM	2,226
Design Year (2037)	AM	2,281
	PM	2,262

Table 2.30: White Post Junction

	Time period	Total Junction Inflow (pcu/hr)
Base Year (2018)	AM	2,410
	PM	2,321
Opening Year (2023)	AM	2,663
	PM	2,566
Design Year (2037)	AM	2,760
	PM	2,628

Table 2.31: Warren Hill

	Time period	Total Junction Inflow (pcu/hr)
Base Year (2018)	AM	2,034
	PM	1,821
Opening Year (2023)	AM	2,276
	PM	2,050
Design Year (2037)	AM	2,372
	PM	2,116

Table 2.32: Lowdham Junction

	Time period	Total Junction Inflow (pcu/hr)
Base Year (2018)	AM	3,424
	PM	3,485
Opening Year (2023)	AM	3,651
	PM	3,712
Design Year (2037)	AM	3,807
	PM	3,820

Table 2.33: Kirk Hill Junction

	Time period	Total Junction Inflow (pcu/hr)
Base Year (2018)	AM	2,800
	PM	2,250
Opening Year (2023)	AM	2,695
	PM	3,200
Design Year (2037)	AM	2,929
	PM	3,303

2.113 Table 2.34 to Table 2.25 below present the total volumes for each approach at each junction in both the opening year and design year. Further detail is also provided in Appendix P which present the opening year and design year turning matrices by time period.

Table 2.34: Ollerton – Inflow by approach arm (pcu/hr)

	2023				2037 (exc Dependent Development)			
From\To	AM	IP	PM	OP	AM	IP	PM	OP
A614(N)	524	399	546	39	535	408	553	40
A616(E)	817	725	1145	71	848	739	1154	73
A614(S)	947	682	781	66	981	701	802	68
A6075	475	333	423	32	478	336	424	32
A616(W)	375	233	315	23	381	237	320	23
TOTAL	**3138**	**2372**	**3210**	**231**	**3223**	**2421**	**3253**	**236**

Table 2.35: Deerdale Lane – Inflow by approach arm (pcu/hr))

	2023				2037 (exc Dependent Development)			
From\To	AM	IP	PM	OP	AM	IP	PM	OP
A614(N)	1071	646	976	64	1108	667	976	66
Deerdale Lane (E)	127	111	147	11	131	113	147	11
A614(S)	938	636	969	62	971	655	969	64
Total	**2136**	**1393**	**2050**	**137**	**2210**	**1435**	**2092**	**141**

Table 2.36: Mickledale – Inflow by approach arm (pcu/hr)

	2023				2037 (exc Dependent Development)			
From\To	AM	IP	PM	OP	AM	IP	PM	OP
A614(N)	1045	644	956	63	1084	665	977	65
Mickledale Lane	191	130	169	13	194	133	172	13
A614(S)	968	686	1091	67	1003	707	1113	69
Total	**2204**	**1460**	**2216**	**143**	**2281**	**1505**	**2262**	**147**

Table 2.37: White Post – Inflow by approach arm (pcu/hr)

	2023				2037 (exc Dependent Development)			
From\To	AM	IP	PM	OP	AM	IP	PM	OP
A614(N)	1056	678	976	66	1102	704	1001	69
Mansfield Road(E)	216	158	238	15	219	160	239	16
A614(S)	1087	678	1191	66	1128	704	1226	69
Mansfield Road (W)	305	137	160	13	311	139	162	14
Total	**2663**	**1651**	**2566**	**161**	**2760**	**1707**	**2628**	**167**

Table 2.38: Warren Hill – Inflow by approach arm (pcu/hr)

	2023				2037 (exc Dependent Development)			
From\To	AM	IP	PM	OP	AM	IP	PM	OP
A614(N)	1286	582	845	57	1341	611	876	60
A6097(SE)	450	283	530	28	490	307	565	30
A614(S)	539	333	675	33	541	335	674	33
Total	**2276**	**1198**	**2050**	**117**	**2372**	**1254**	**2116**	**123**

Table 2.39: Lowdham – Inflow by approach arm (pcu/hr)

	2023				2037 (exc Dependent Development)			
From\To	AM	IP	PM	OP	AM	IP	PM	OP
A6097(NE)	1320	683	963	67	1368	711	990	69
Southwell Road	412	352	444	35	417	358	449	36
A6097(SE)	1214	857	1451	83	1280	906	1511	89
A612	705	588	854	58	742	612	870	60
Total	**3651**	**2480**	**3712**	**243**	**3807**	**2587**	**3820**	**254**

Table 2.40: Kirk Hill – Inflow by approach arm (pcu/hr)

	2023				2037 (exc Dependent Development)			
From\To	AM	IP	PM	OP	AM	IP	PM	OP
A6097(NE)	1326	734	1239	63	1458	825	1286	70
Southwell Road	213	122	214	10	222	130	220	12
A6097(SE)	994	720	1433	61	1079	794	1459	68
A612	162	74	314	7	170	79	338	7
Total	**2695**	**1650**	**3200**	**141**	**2929**	**1828**	**3303**	**157**

2.114 The total inflows presented in Table 2.21 to Table 2.5 were reviewed against base year movements and local knowledge of the junctions and appear logical and were considered suitable for use in scheme appraisal.

Annual Average Daily Traffic (AADT)

2.115 Network AADT values were computed via a factor calculated using long term permanent ATC data along the A614/A6097 corridor. The ATC sites provide hourly flow, by direction for every day of the year. Five count sites that had a full year (2018) available were used in the assessment (Figure 2.1):

- A614 Bilsthorpe (N) – Site ID: 000030306363
- A614 Bilsthorpe (S) – Site ID: 000030306359
- A6097 Warren Hill (S) – Site ID: 0000352206253
- A6097 Lowdham (N) – Site ID: 000030806547
- A6097 Lowdham (S) – Site ID: 000030006745

2.116 The average daily (24hr) traffic was derived from the long-term data across the 5 count sites that had a full year (2018) available. In addition, the average weekday AM, Inter-peak and PM peak hours were derived

2.117 The relationship between the observed average daily flow and observed average weekday peak hours was used to produce a factor that could be applied to the A614/A6097 traffic forecast to produce an Annual Average Daily Traffic volumes. The average two-way 24 hour flow was divided by the sum of the average weekday Peak Hours (AM, PM, IP and OP) to calculate an AADT factor, as shown below:

AADT Factor = Average 24 hour flow / (Average Weekday AM Peak flow + Average Weekday PM Peak flow + Average Weekday IP Peak flow + Average Weekday OP Peak flow)

AADT Factor = 3.876

2.118 To calculate the forecast AADT flows on the A614 / A6097 network, the sum of the AM, PM, IP and OP peak periods forecasts was multiplied by the AADT Factor (3.876). A worked example is presented in Appendix Q.

2.119 The resulting AADT flows are shown in Appendix R. These values were subsequently used in the COBALT analysis.

National Economic Uncertainty

2.120 Traffic demand is driven not only by demographic changes such as an increase in population, but also by GDP growth and fuel price, both of which affect the utility for travel. Models that rely on NTEM will not fully reflect the uncertainty of these national trends.

2.121 To account for this, the DfT's TAG Unit M4 (May 2019) at section 4 recommends that a proportion of the model's base year matrix, on a cell-by-cell basis, is either added (High Growth) or subtracted (Low Growth) from the CS Reference case matrix. This proportion is defined as 2.5% multiplied by the square root of the number of years between the base year and the forecast year.

2.122 Table 2.41 shows the proportions of the base matrices that were added or subtracted from the CS Reference Case matrices on a cell-by-cell basis.

Table 2.41: High/Low Growth Scenario Proportions

Base	Forecast year	Base to Forecast year.	Square Root of forecast year.	High	Low
2018	2023	5	2.27	+5.590%	-5.590%
2018	2037	19	4.36	+10.900%	-10.900%

Local Uncertainty

2.123 In addition to National Uncertainty, there is also uncertainty in Local Planning assumptions. There is uncertainty that the number of development proposals under a High Growth Scenario would increase and under a Low Growth Scenario would decrease. Both the demand and supply can be combined in the context of local uncertainty.

2.124 To account for local uncertainty both a low development scenario and high development scenario were produced.

The High Alternative Growth Scenario

2.125 Some developments may be more likely to be delivered under a high growth development scenario. Of the potential developments identified in the corridor (paragraph 2.64 and Table 2.17), all were considered to be "Near Certain" or "More than Likely". Therefore no additional local development assumptions were incorporated into the High Growth Scenario.

2.126 The High Growth Scenario should incorporate highway improvements that are considered to be optimistic. There are no additional highway scheme along the corridor that would impact the forecasts

2.127 Presented in Table 2.42 to Table 2.48 are the total volumes for each approach at each junction in both the opening year and design year under a high growth scenario.

Table 2.42: Ollerton High Growth – Inflow by approach arm (pcu/hr)

	2023				2037 (exc Dependent Development)			
From\To	AM	IP	PM	OP	AM	IP	PM	OP
A614(N)	997	717	825	69	1185	855	1061	84
A616(E)	497	349	445	34	810	855	696	50
A614(S)	395	244	333	24	438	520	384	27
A6075	551	420	577	42	630	273	675	46
A616(W)	860	763	1212	74	980	476	1391	83
TOTAL	**3300**	**2493**	**3392**	**243**	**4043**	**2979**	**4207**	**290**

Table 2.43: Deerdale Lane High Growth – Inflow by approach arm (pcu/hr))

	2023				2037 (exc Dependent Development)			
From\To	AM	IP	PM	OP	AM	IP	PM	OP
A614(N)	1125	678	1008	67	1380	820	1232	80
Deerdale Lane (E)	134	116	153	12	149	131	176	13
A614(S)	992	668	1003	65	1179	800	1247	79
Total	**2251**	**1462**	**2164**	**144**	**2708**	**1751**	**2655**	**172**

Table 2.44: Mickledale High Growth – Inflow by approach arm (pcu/hr)

	2023				2037 (exc Dependent Development)			
From\To	AM	IP	PM	OP	AM	IP	PM	OP
A614(N)	1099	677	1011	66	1343	814	1231	80
Mickledale Lane	200	136	179	14	218	150	200	14
A614(S)	1017	722	1152	71	1204	854	1408	83
Total	**2316**	**1535**	**2342**	**151**	**2765**	**1818**	**2839**	**177**

Table 2.45: White Post High Growth – Inflow by approach arm (pcu/hr)

	2023				2037 (exc Dependent Development)			
From\To	AM	IP	PM	OP	AM	IP	PM	OP
A614(N)	1107	712	1030	70	1201	770	1097	75
Mansfield Road(E)	228	167	252	16	242	177	264	17
A614(S)	1142	712	1257	70	1236	770	1341	75
Mansfield Road (W)	321	144	170	14	343	153	179	15
Total	**2798**	**1734**	**2708**	**170**	**3023**	**1871**	**2881**	**183**

Table 2.46: Warren Hill High Growth – Inflow by approach arm (pcu/hr)

	2023				2037 (exc Dependent Development)			
From\To	AM	IP	PM	OP	AM	IP	PM	OP
A614(N)	1350	610	891	60	1465	667	958	65
A6097(SE)	471	296	558	29	532	333	614	33
A614(S)	568	350	714	34	597	369	743	36
Total	**2389**	**1257**	**2162**	**123**	**2594**	**1369**	**2314**	**134**

Table 2.47: Lowdham High Growth – Inflow by approach arm (pcu/hr)

	2023				2037 (exc Dependent Development)			
From\To	AM	IP	PM	OP	AM	IP	PM	OP
A6097(NE)	1390	720	1017	70	1577	820	1180	80
Southwell Road	436	370	470	36	482	411	535	41
A6097(SE)	1277	902	1534	88	1444	1021	1770	100
A612	741	619	904	61	881	720	1067	70
Total	**3844**	**2611**	**3925**	**255**	**4384**	**2972**	**4552**	**291**

Table 2.48: Kirk Hill High Growth – Inflow by approach arm (pcu/hr)

	2023				2037 (exc Dependent Development)			
From\To	AM	IP	PM	OP	AM	IP	PM	OP
A6097(NE)	1382	766	1295	65	1577	893	1404	76
Southwell Road	223	128	224	11	242	143	241	12
A6097(SE)	1035	752	1495	64	1166	862	1597	73
A612	169	77	329	7	186	87	370	8
Total	**2809**	**1723**	**3343**	**147**	**3171**	**1985**	**3612**	**169**

The Low Alternative Growth Scenario

2.128 This scenario represents the utility of travel under a low economic growth outcome.

2.129 TAG Unit M4, paragraph 4.2.8 notes that in the low growth scenario, excluding some of the less likely sources of growth that were included in the core scenario may be appropriate. Given the potential developments identified in the corridor (paragraph 2.64 and Table 2.17), all were considered to be "Near Certain" or "More than Likely", the local development assumptions in the Low Growth Scenario remain the same as the Core Scenario.

2.130 The supply network under this Low Growth Scenario is unchanged from the Core Scenario in accordance with TAG Unit M4, paragraph 4.2.10.

2.131 The supply network under this Low Growth Scenario is unchanged from the Core Scenario in accordance with TAG Unit M4, paragraph 4.2.10.

2.132 Table 2.49 to Table 2.55 below present the total volumes for each approach at each junction in both the opening year and design year under a Low Growth Scenario.

Table 2.49: Ollerton Low Growth – Inflow by approach arm (pcu/hr)

	2023				2037 (exc Dependent Development)			
From\To	AM	IP	PM	OP	AM	IP	PM	OP
A614(N)	900	647	739	63	887	633	726	63
A616(E)	453	316	401	31	434	304	387	30
A614(S)	355	221	298	22	341	211	287	21
A6075	496	378	514	36	482	365	498	35
A616(W)	775	686	1080	67	767	665	1036	65
TOTAL	**2979**	**2248**	**3032**	**219**	**2911**	**2178**	**2934**	**214**

Table 2.50: Deerdale Lane Low Growth – Inflow by approach arm (pcu/hr)

	2023				2037 (exc Dependent Development)			
From\To	AM	IP	PM	OP	AM	IP	PM	OP
A614(N)	1016	613	901	60	1002	603	882	59
Deerdale Lane (E)	121	105	137	10	120	103	133	10
A614(S)	889	603	896	59	877	591	874	58
Total	**2026**	**1321**	**1934**	**129**	**1999**	**1297**	**1889**	**127**

Table 2.51: Mickledale Low Growth – Inflow by approach arm (pcu/hr)

	2023				2037 (exc Dependent Development)			
From\To	AM	IP	PM	OP	AM	IP	PM	OP
A614(N)	993	611	902	60	979	601	881	59
Mickledale Lane	183	123	160	12	178	121	156	12
A614(S)	919	651	1030	64	907	640	1006	63
Total	**2095**	**1385**	**2092**	**136**	**2064**	**1362**	**2043**	**134**

Table 2.52: White Post Low Growth – Inflow by approach arm (pcu/hr)

	2023				2037 (exc Dependent Development)			
From\To	AM	IP	PM	OP	AM	IP	PM	OP
A614(N)	1005	644	927	63	1003	638	902	62
Mansfield Road(E)	204	150	225	15	197	143	216	14
A614(S)	1031	644	1132	63	1019	638	1117	62
Mansfield Road (W)	288	130	152	13	279	124	130	12
Total	**2528**	**1567**	**2436**	**153**	**2498**	**1544**	**2365**	**151**

Table 2.53: Warren Hill Low Growth – Inflow by approach arm (pcu/hr)

	2023				2037 (exc Dependent Development)			
From\To	AM	IP	PM	OP	AM	IP	PM	OP
A614(N)	1223	554	804	54	1218	556	753	54
A6097(SE)	429	270	505	26	448	282	523	28
A614(S)	511	316	640	31	485	302	618	29
Total	**2162**	**1139**	**1948**	**111**	**2151**	**1139**	**1894**	**111**

Table 2.54: Lowdham Low Growth – Inflow by approach arm (pcu/hr)

	2023				2037 (exc Dependent Development)			
From\To	AM	IP	PM	OP	AM	IP	PM	OP
A6097(NE)	1252	648	908	63	1234	641	894	63
Southwell Road	390	332	418	33	373	320	403	32
A6097(SE)	1151	813	1369	79	1157	818	1363	80
A612	668	556	803	54	670	550	779	53
Total	**3461**	**2349**	**3498**	**229**	**3434**	**2329**	**3439**	**228**

Table 2.55: Kirk Hill Low Growth – Inflow by approach arm (pcu/hr)

	2023				2037 (exc Dependent Development)			
From\To	AM	IP	PM	OP	AM	IP	PM	OP
A6097(NE)	1270	702	1183	60	1339	757	1168	65
Southwell Road	193	117	204	10	202	118	199	10
A6097(SE)	953	688	1365	59	992	727	1321	61
A612	155	70	299	6	154	71	306	6
Total	**2571**	**1577**	**3051**	**135**	**2687**	**1673**	**2994**	**142**

Junction Modelling

2.133 Computer models of the existing junction layouts and proposed schemes have been prepared by Nottinghamshire County Council's delivery partner, VIA East Midlands Ltd. ARCADY has been used to assess the capacity of roundabout junctions; PICADY has been used to assess the capacity of priority junctions (T-junctions and crossroads); and LINSIG has been used to assess the highway capacity of signalised junctions.

2.134 In the base models, the geometry required by the J9 models (ARCADY for roundabouts and PICADY for priority junctions) was measured from OS survey base drawings.

2.135 Queue surveys were carried out at the Ollerton and Lowdham roundabouts and at Deerdale Lane and the survey data used to validate the existing ARCADY and PICADY models for these junctions.

2.136 The results of the modelling for the opening year scenarios in the AM and PM peaks for the 2 roundabouts match within reasonable tolerance with the observed queue lengths. Notable observations include:

Ollerton: The Ollerton queue surveys demonstrate that the critical approaches in the AM were the A614 south and A616W, with consistent queues over a sustained period of time. The A614N approach was shown to queue extensively at times also, however, this was for shorter periods and fluctuated up (and back down) throughout the period. Consequently, the approaches which were critically assessed for queue length fit were the A614S (arm 2) and A616W (arm 4) approaches and the model fits this pattern. In the PM peak the critical approach is the A614S and, again, the model fits the observed queue lengths satisfactorily. The one difference is the queues on the A616W which were observed to be higher during a substantial part of the peak when compared to the model. This may be explained in part by the comment in the queue length survey regarding a Road Traffic Accident at the junction.

Lowdham: The queue survey shows the A612E approach to be the most under stress in the AM peak followed by the A6097N. This is mirrored in the Arcady model for the A612E. The A6097N shows lower queueing than noted on site, however, there was an element of exit blocking on the A6097 heading towards the river which may have affected the observed queues which could not be modelled in the isolated Arcady model. In the PM peak the predominant queue is on the A612W. The observed queues extended beyond the survey section for a substantial period of time. This behaviour is reflected in the model. The A6097S is the next worst performing arm and this is again reflected in the model.

Deerdale: The queue and delay surveys show the build up and discharge of vehicles for the movements which are required to give-way currently. In the AM peak the queueing is generally low, apart from the occasional build-up, the worst of which began at 07:31:32 where 10 vehicles were noted with the queue fully discharging after 6 minutes 41 seconds. The next peak appeared at 08:12:01 with a total discharge time of 2 minutes and 1 second; and a third occurrence at 08:34:10 where the full discharge time from the first vehicle appearing at the junction and the last discharging was 2 minutes 48 seconds. Other than these three occurrences the wait time at the give way line was minimal. For the right turn into Deerdale Lane, the wait time throughout the peak was minimal. In the PM peak there were only two periods of significant side road delay occurring at 17:01:20 and 17:17:56. Other than these two periods the side road performance was generally good with low levels of vehicle delays. Again, for the right turn in the delays were minimal. Given these low levels of queue overall, the model was not calibrated beyond ensuring that the geometric data used in the Picady model was correctly interpreted.

2.137 Input flow profiles were left at the default for the individual modelling programs and input flow data was based on PCU's. In all cases the modelling matched existing and therefore it is considered the tolerances stated
within the TEAR are acceptable.

2.138 The above software produces outputs in terms of overall vehicle delay, and this is the main output that has been used in the Transport Economic Efficiency (TEE) calculations contained in this report.

2.139 Table 2.56 shows the software used for each junction and provides references to the relevant Appendix within which a scheme drawing and the full results are contained. The optioneering process to develop the schemedesigns in reported in the A614/A6097 Major Road Network Improvement Scheme, Options Appraisal Report (60595614/OAR, December 2020).

2.140 The scheme at White Post is a road safety scheme involving anti-skid road surfacing and minor maintenance improvements. Warren Hill is a minor geometric alteration. Neither provide measurable capacity improvements and have not been appraised, though the scheme costs are reflected in the value for money analysis.

Table 2.56: Junction Layouts and Software Used to Assess Delay

Junction	Existing Layout	Proposed Layout	Appendix
Ollerton	Roundabout (ARCADY)	Roundabout (ARCADY)	Appendix S
Deerdale	Crossroads (PICADY)	Signals (LINSIG)	Appendix T
Mickledale Lane	Crossroads (PICADY)	Signals (LINSIG)	Appendix U
White Post	Not Assessed	Not Assessed	N/A
Warren Hill	Not Assessed	Not Assessed	N/A
Lowdham	Roundabout (ARCADY)	Roundabout (ARCADY)	Appendix V
Kirk Hill	Signals (LINSIG)	Signals (LINSIG)	Appendix W

2.141 Table 2.57 to Table 2.61 summarise the modelling outputs at each scheme junction. The worst performing arm is shown in each instance, with the exception of Junction Delays which presents the combined delays across all arms of the junction

2.142 Ollerton roundabout is noted to be overcapacity (with a Ratio to Flow Capacity (RFC) value of over 1.0) in the AM and PM Peak periods in the baseline scenario, whilst Lowdham is overcapacity in the PM Peak period.Warren Hill and White Post are noted to approaching capacity (RFC value of over 0.85% in the baseline.

2.143 For existing junctions, RFC values above 0.85 are likely to produce queues which increase slowly. Above an RFC value of 1.0, a junction is more than likely to be at capacity (with resulting larger increases in queue length).

Table 2.57: ARCADY Outputs – Ollerton Roundabout

	2023						2037					
	Do Minimum			Do Something			Do Minimum			Do Something		
	Max Queue (PCU)	RFC	Junction Delay (s)	Max Queue (PCU)	RFC	Junction Delay (s)	Max Queue (PCU)	RFC	Junction Delay (s)	Max Queue (PCU)	RFC	Junction Delay (s)
AM	67.5	1.13	85.92	1.9	0.66	5.29	89.1	1.17	112.92	2.2	0.69	5.61
PM	69.2	1.17	73.19	2.4	0.71	5.25	80.1	1.20	83.52	2.5	0.72	6.04
IP	3.9	0.81	9.82	0.9	0.48	3.61	4.5	0.83	10.75	0.9	0.48	3.69
OP	0.1	0.06	2.60	0	0.04	1.88	0.1	0.06	2.60	0	0.04	1.89

Table 2.58: PICADY / LINSIG Outputs – Deerdale Lane

	2023						2037					
	Do Minimum			Do Something			Do Minimum			Do Something		
	Max Queue (PCU)	RFC	Junction Delay (s)	Mean Max Queue (PCU)	Degree of Saturation (%)	Junction Delay (s)	Max Queue (PCU)	RFC	Junction Delay (s)	Mean Max Queue (PCU)	Degree of Saturation (%)	Junction Delay (s)
AM	0.4	0.28	1.22	8.7	50.80	5.51	0.4	0.31	1.32	9.2	52.50	44.01
PM	0.4	0.30	1.25	8	48.20	5.28	0.5	0.32	1.29	8.2	49.20	5.53
IP	0.2	0.16	1.03	5	33.30	2.37	0.2	0.17	1.04	5.2	34.30	2.53
OP	0	0.01	0.59	0.4	3.40	0.02	0.0	0.01	0.57	0.4	3.40	0.02

Table 2.59: PICADY / LINSIG Outputs – Mickledale Lane

	2023						2037					
	Do Minimum			Do Something			Do Minimum			Do Something		
	Max Queue (PCU)	RFC	Junction Delay (s)	Mean Max Queue (PCU)	Degree of Saturation (%)	Junction Delay (s)	Max Queue (PCU)	RFC	Junction Delay (s)	Mean Max Queue (PCU)	Degree of Saturation (%)	Junction Delay (s)
AM	0.6	0.39	1.86	9.6	55.10	7.09	0.7	0.41	1.99	10	57.10	7.69
PM	0.6	0.36	2.00	9.2	55.20	7.65	0.6	0.37	2.07	9.5	56.50	8.03
IP	0.2	0.18	1.51	5.5	37.20	3.03	0.3	0.19	1.55	5.8	38.50	3.24
OP	0.0	0.01	0.78	0.4	3.60	0.02	0.0	0.01	0.76	0.5	3.70	0.03

Table 2.60: ARCADY – Lowdham

	2023						2037					
	Do Minimum*			Do Something			Do Minimum*			Do Something		
	Max Queue (PCU)	RFC	Junction Delay (s)	Max Queue (PCU)	RFC	Junction Delay (s)	Max Queue (PCU)	RFC	Junction Delay (s)	Max Queue (PCU)	RFC	Junction Delay (s)
AM	6.6	0.9	24.62	5.4	0.85	12.35	13.9	1.00	40.22	7.9	0.9	17.09
PM	117.5	1.32	121.15	8	0.9	11.39	133.1	1.37	153.82	11.9	0.94	15.12
IP	1.4	0.58	5.53	1.1	0.52	3.75	1.6	0.61	5.99	1.2	0.55	3.97
OP	0	0.05	2.12	0	0.4	1.86	0.1	0.05	2.12	0.1	0.5	1.86

Table 2.61: LINSIG Outputs – Kirk Hill

	2023						2037					
	Do Minimum			Do Something			Do Minimum			Do Something		
	Mean Max Queue (PCU))	Degree of Saturation (%)	Junction Delay (s)	Mean Max Queue (PCU)	Degree of Saturation (%)	Junction Delay (s)	Mean Max Queue (PCU)	Degree of Saturation (%)	Junction Delay (s)	Mean Max Queue (PCU)	Degree of Saturation (%)	Junction Delay (s)
AM	120.4	5.00	89.68	16.4	66.9	16.26	190.7	136.60	163.15	18.9	72.1	18.26
PM	270.5	140.90	352.92	21.7	79.1	30.17	303	148.30	436.92	23.7	83.6	35.06
IP	14.1	53.30	5.15	6.7	33.6	4.74	13.1	55.70	6.70	6.1	33.9	5.75
OP	0.7	4.80	0.03	0.5	3.1	0.03	0.7	4.70	0.03	0.5	2.9	0.04

2.144 Presented in Table 2.57 to Table 2.61 are the volume to capacity ratio (RFC) for the worst performing arm of each junction, indicating where there is overcapacity (where the ratio flow to capacity value is over 1.0). A comparison of the RFC values between the Do Minimum and Do something values shows that with improvement all the junctions work within capacity (below RFC of 1.0) in the forecast year of 2037.

2.145 The scheme improvements, whilst providing localised capacity improvements, are not expected to materially impact the Strategic Road Network (SRN). The A46 (accessed from the A46/A6097 Saxondale grade separated junction) is 3.3 miles south of Lowdham Roundabout at the southern end of the A614 – A6097 corridor). To the north the A1 is 6.7miles north of the Ollerton roundabout. The limited route choice along the A614-A6097 corridor has supported a fixed trip appraisal methodology which assumes that no trips reassign into the corridor as a result of the scheme. This is supported by the strategic model testing using the MCHM which has demonstrated that reassignment and VDM impacts resulting from the scheme is not material.

3. Economic Appraisal Methodology

Value for Money

3.1 Value for money' is one of the key considerations of any decision involving the use of public funds across government. It is considered in the Economic Case of the 'Five Case Model' of decision-making recommended in the 'Green Book' methodology by Her Majesty's Treasury (HMT) and adopted by the Department for Transport (DfT) in the "Transport Business Case".

3.2 The DfT's approach to assessing and reporting a value for money case is detailed in the document "Value for Money Framework", (DfT, 2017).

3.3 This document notes that some methods for identifying outcomes, impacts and estimating their monetary values are more widely accepted than others, as they are well-researched, tried-and-tested, and robust. To reflect this in a way which is useful for decision-making, the DfT distinguishes between three 'types' of monetised impacts: established, evolving, and indicative monetised impacts. These are treated differently in the value for money assessment and presented separately in Value for Money Statements.

3.4 Table 3.1 below summaries the typical impacts of a transport scheme as set out in Box 4.4 of the Value for Money Framework document.

Table 3.1: Typical impacts of a Transport Scheme (DfT VfM Framework, 2017)

Established Monetised Impacts	**Evolving Monetised Impacts**	**Indicative Monetised Impacts**	**Non-monetised Impacts**
Included in initial and adjusted metrics	*Included in adjusted metrics*	*Considered after metric using switching values approach*	
Journey time savings	Reliability	Moves to more/less productive jobs	Security
Vehicle operating costs	Static clustering	Induced Investment	Severance
Accidents	Output in imperfectly competitive markets	Supplementary Economy Modelling	Accessibility
Physical Activity	Labour Supply		Townscape
Journey Quality			Historic Environment
Noise			Landscape
Air Quality			Biodiversity
Greenhouse Gases			Water environment
Indirect Tax			Affordability
			Access to services
			Option and non-use values

3.5 This document describes the approach and appraisal results of the established monetised impacts:

- Journey time savings
- Vehicle operating costs
- Accidents
- Noise
- Air Quality
- Greenhouse Gases (Carbon)
- Indirect Tax

3.6 This EAP document also describes the approach and appraisal results of the following indicative monetised impacts:

- Induced Investment
  - o Land Value Uplift associated with dependent development; and
  - o The Transport External Costs associated with dependent development.
  - o Land Amenity Value

Scheme Costs

3.7 Via East Midlands has provided estimates of the costs of delivering the six junctions within the scheme. These costs have also been reviewed by a contractor selected from the council's MHA framework.

3.8 Table 3.2 shows the anticipated construction start dates, and opening year of each of the junctions.

Table 3.2: Construction Start Dates and Opening Years

Junction	Construction Start Date	Opening Year
Ollerton	Sep-22	May-24
Mickledale	Mar-25	Dec-25
White Post	Jan-25	Jan-25
Warren Hill	Aug-25	Aug-25
Lowdham	Jun-24	Dec-24
Kirk Hill	Apr-23	Dec-23

3.9 Scheme estimates were provided in 2020 Q1 prices including a 15% investment cost optimism bias. The following items are included in the cost estimate:

- Construction Costs;
- Preparation;
- Supervision Costs; and
- Land,

3.10 The cost proforma summary, which includes an assessment of cost inflation, is presented in Appendix X.

3.11 Table 3.3 to Table 3.8 show the anticipated expenditure profiles for each of the junctions.

Table 3.3: Expenditure Profile (2020 Prices) - Ollerton

	2020	2021	2022	2023	2024	Total
Preparation	£299,228	£230,000	£77,509	-	-	£606,737
Construction	-	-	£3,157,096	£5,396,983	£2,248,743	£10,802,822
Supervision	-	-	£193,484	£115,000	£57,500	£365,984
Land	-	£460,000	£68,961	-	-	£528,961
Total	£299,228	£690,000	£3,497,050	£5,511,983	£2,306,243	£12,304,503

Table 3.4: Expenditure Profile (2020 Prices) – Deerdale Lane

	2020	2021	2022	2023	2024	Total
Preparation	-	£86,250	£86,250	-	-	£172,500
Construction	-	-	-	£5,077,659	£5,089,256	£10,166,915
Supervision	-	-	-	£115,000	£115,000	£230,000
Land	-	-	-	£250,341	-	£250,341
Total	-	£86,250	£86,250	£5,443,001	£5,204,256	£10,819,757

Table 3.5: Expenditure Profile (2020 Prices) – Mickledale Lane

	2020	2021	2022	2023	2024	Total
Preparation	£92,000	£138,000	£57,500	-	-	£287,500
Construction	-	-	-	-	£6,126,770	£6,126,770
Supervision	-	-	-	-	£57,500	£57,500
Land	-	-	£115,000	£119,940	-	£234,940
Total	£92,000	£138,000	£172,500	£119,940	£6,184,270	£6,706,710

Table 3.6: Expenditure Profile (2020 Prices) – White Post

	2020	2021	2022	2023	2024	2025	Total
Preparation	-	-	-	-	-	-	-
Construction	-	-	-	-	-	£309,063	£309,063
Supervision	-	-	-	-	-	-	-
Land	-	-	-	-	-	-	-
Total	-	-	-	-	-	£309,063	£309,063

Table 3.7: Expenditure Profile (2020 Prices) – Warren Hill

	2020	2021	2022	2023	2024	Total
Preparation	-	-	-	-	-	-
Construction	-	-	-	£278,156	-	£278,156
Supervision	-	-	-	-	-	-
Land	-	-	£28,750	-	-	£28,750
Total	-	-	-	-	-	£306,906

Table 3.8: Expenditure Profile (2019 Prices) - Lowdham

	2020	2021	2022	2023	2024	Total
Preparation	£126,500	£115,000	£57,500	-	-	£299,000
Construction	-	-	-	£3,291,338	£3,570,849	£6,862,187
Supervision	-	-	-	-	£78,484	£78,484
Land	-	-	£115,000	£31,285	-	£146,285
Total	£126,500	£115,000	£172,500	£3,322,623	£3,649,333	£7,385,956

Table 3.9: Expenditure Profile (2020 Prices) – Kirk Hill

	2020	2021	2022	2023	2024	Total
Preparation	£69,000	£92,000	£57,500	-	-	£218,500
Construction	-	-	-	£5,332,959	-	£5,332,959
Supervision	-	-	-	£78,484	-	£78,484
Land	-	-	£132,289	£155,211	-	£287,500
Total	£69,000	£92,000	£189,789	£5,566,654	-	£5,917,443

3.12 Table 3.10 below presents a summary of the cost estimates at each junction.

Table 3.10: Scheme Costs Estimates (2020 prices)

	Construction	Preparation	Land	Supervision	Total
Ollerton Roundabout	£10,802,822	£606,737	£528,961	£365,984	**£12,304,503**
Lowdham Roundabout	£6,862,187	£299,000	£146,285	£78,484	**£7,385,956**
Warren Hill	£278,156	£0	£28,750	£0	**£306,906**
Mickledale Lane	£6,126,770	£287,500	£234,940	£57,500	**£6,706,710**
Deerdale Lane	£10,166,915	£172,500	£250,341	£230,000	**£10,819,757**
White Post Roundabout	£309,063	£0	£0	£0	**£309,063**
Kirk Hill	£5,332,959	£218,500	£287,500	£78,484	**£5,917,443**
Total	**£39,878,872**	**£1,584,237**	**£1,476,777**	**£810,452**	**£43,750,338**

3.13 As part of the scheme design development, the updated cost estimates at Deerdale Lane junction has increased by £5.83m (excluding optimism bias) following the return of significant utility diversion cost estimates in October 2020. This, along with updated cost estimates for the other junctions results in a package cost estimate of £43.75m. This has resulted in a package that is not affordable. Given the large increase in cost, and the previous poor value for money case of the junction in isolation, the Deerdale Lane improvement has been removed from the package of measures. No further analysis of Deerdale Lane is presented.

Table 3.11: Scheme Costs Estimates (2020 prices) – Excluding Deerdale

	Construction	Preparation	Land	Supervision	Total
Ollerton Roundabout	£10,802,822	£606,737	£528,961	£365,984	**£12,304,503**
Lowdham Roundabout	£6,862,187	£299,000	£146,285	£78,484	**£7,385,956**
Warren Hill	£278,156	£0	£28,750	£0	**£306,906**
Mickledale Lane	£6,126,770	£287,500	£234,940	£57,500	**£6,706,710**
White Post Roundabout	£309,063	£0	£0	£0	**£309,063**
Kirk Hill	£5,332,959	£218,500	£287,500	£78,484	**£5,917,443**
Total	**£29,711,957**	**£1,411,737**	**£1,226,436**	**£580,452**	**£32,930,581**

3.14 The latest cost estimate for the package of measures is currently £32.94 million. The project requires a total contribution of £24.340 million from the DfT, with the remaining sum being funded by S106 contributions, Community Infrastructure Levy and County Council capital contributions. Section 106 contributions from developers including the promoter of the Thoresby Colliery redevelopment site at Edwinstowe (Harworth Group Plc) has paid a S106 contribution of £1.198 million. The total value from S106 contributions comes to £1.746 million (Including Harworth Group S106 contribution).

3.15 Discussions are ongoing with developers and district council partners regarding possible developer and Community Infrastructure Levy contributions to help meet the 15% local financial contribution ie any costs over and above the requested DfT contribution. Harworth Group Plc (the promoter of the Thoresby Colliery redevelopment site at Edwinstowe) for example has already paid a financial contribution of £1.198m. This contribution is based on an agreed proportion of the cost of the Ollerton roundabout element of the improvement package. All future developer contributions would be index linked. Nottinghamshire County Council has agreed to underwrite any shortfall in local funding in order to deliver the local contribution in full towards the proposed package of works.

3.16 The funding of the scheme is a combination of various financial contributions, including a maximum contribution of £24.34m from DfT with the remainder from S106 / CIL / Nottinghamshire County Council capital contributions.

3.17 The supplied expenditure profiles were calculated based upon cost estimates for each financial year prepared in 2020 Q1 prices including a 15% investment cost optimism bias and then inflated to outturn costs, using projected construction related inflation. These costs were then rebased to 2010 prices – all costs were in the factor cost units of account (sometimes referred to as resource costs). The costs were allocated to the calendar years of expenditure. Cost incurred in 2020 are considered historic and have been removed from the Present Value Cost (PVC) calculation.

3.18 The Present Value of Cost (PVC) in 2010 market prices, discounted to a 2010 present value year, has been calculated as:

- Ollerton: £6,806,000
- Mickledale Lane: £4,333,000
- White Post: £184,000
- Warren Hill: £196,000
- Lowdham: £4,242,000
- Kirk Hill: £3,444,000
- **Total: £19,205,000**

TUBA Assessment

3.19 The economic appraisal of the new scheme proposals was carried out using the DfT's TUBA software (Version 1.9.14).

3.20 This assessment uses 'economics_TAG_db1_9_13_1.txt' as the Economics Parameters file. While this is the most up to date economics file available, it must be noted this is based upon WebTAG Data Book (v1.13.1) July 2020 release.

3.21 The economic appraisal has been calculated for 60 years, as required by the DfT (TAG, Unit 3.5.4). The appraisal period was from 2023 to 2082. The opening years of the six junctions do not occur in a single year (see Table 3.2) although for the purposes of the TUBA assessment a common opening year of 2023 was used.

3.22 A discount rate of 3.5% for the first 30 years of appraisal and 3.0% for the second 30 years of appraisal has been used. All monetary values set down in this report are in 2010 market price units of accounting, discounted to 2010.

3.23 The delay in seconds from the junction model outputs was converted into hours and input into the TUBA model. The distance used nominal values (0.5km) because the approach speeds for the Do Minimum and Do Something scenarios, are assumed not change. The distance element of the calculation only affects VOC and Greenhouse Gas changes, which as discussed below, are not included in this assessment.

3.24 Table 3.12 to Table 3.14 show the split of vehicle types used based on the manual classified counts described in Sections 2.10 – 2.17 for each junction respectively.

3.25 Due to the absence of MCC count data in the Off Peak, the vehicle splits from the IP scenario have been taken to represent the likely vehicle splits in the OP period.

3.26 The TUBA input and full output data is available within the following appendices:

- Ollerton – Appendix Y
- Mickledale Lane – Appendix Z
- Lowdham – Appendix AA
- Kirk Hill – Appendix BB

Table 3.12: Vehicle type by period (%) for Ollerton

User Class	AM	PM	IP	OP
Cars	80.3%	85.5%	76.8%	76.8%
LGV	12.8%	11.1%	13.8%	13.8%
OGV1	3.8%	1.6%	5.5%	5.5%
OGV2	3.1%	1.9%	3.9%	3.9%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Table 3.13: Vehicle type by period (%) for Mickledale Lane

User Class	AM	PM	IP	OP
Cars	79.1%	82.4%	72.9%	72.9%
LGV	14.3%	13.7%	14.7%	14.7%
OGV1	3.6%	2.1%	7.3%	7.3%
OGV2	3.0%	1.8%	5.1%	5.1%
Total	100.0%	100.0%	100.0%	100.0%

Table 3.14: Vehicle type by period (%) for Lowdham

User Class	AM	PM	IP	OP
Cars	82.6%	84.5%	77.6%	77.6%
LGV	12.5%	12.3%	13.6%	13.6%
OGV1	3.0%	1.9%	5.7%	5.7%
OGV2	1.9%	1.4%	3.1%	3.1%
Total	100.0%	100.0%	100.0%	100.0%

Table 3.15: Vehicle type by period (%) for Kirk Hill

User Class	AM	PM	IP	OP
Cars	84.9%	86,6%	81.6%	86.1%
LGV	12.8%	10.5%	13.6%	5.5%
OGV1	0.8%	0.7%	1.6%	2.5%
OGV2	1.5%	2.2%	3.3%	5.9%
Total	100.0%	100.0%	100.0%	100.0%

3.27 Journey Purpose splits for work and non-work, detailed in Table A 1.3.4 from the July 2020 release of the WebTAG Databook (v1.13.1) was applied to Table 3.12 to Table 3.14 in order to split observed vehicle type proportions into TUBA User Classes. The results of this process are shown in Table 3.16 to Table 3.18 which lists the split of total vehicles into each relevant User Class by time period.

3.28 These factors were applied to the total demand flow matrices via the TUBA input files.

Table 3.16: Factor applied to Ollerton vehicle turning matrix

User Class	AM	PM	IP	OP
Car - business	0.0558	0.0437	0.0553	0.0331
Car - Commuting	0.3076	0.2784	0.0867	0.2211
Car - Other	0.4397	0.5325	0.6268	0.5146
LGV – Other	0.0154	0.0133	0.0165	0.0165
LGV - Business	0.1126	0.0973	0.1213	0.1213
OGV1 - Business	0.0382	0.0160	0.0547	0.0547
OGV2 - Business	0.0307	0.0188	0.0386	0.0386
Total	1.0000	1.0000	1.0000	1.0000

Table 3.17: Factor applied to Mickledale Lane vehicle turning matrix

User Class	AM	PM	IP	OP
Car - business	0.0550	0.0421	0.0524	0.0314
Car - Commuting	0.3030	0.2685	0.0823	0.2097
Car - Other	0.4332	0.5135	0.5947	0.4882
LGV – Other	0.0172	0.0164	0.0176	0.0176
LGV - Business	0.1261	0.1204	0.1288	0.1288
OGV1 - Business	0.0358	0.0211	0.0730	0.0730
OGV2 - Business	0.0297	0.0180	0.0513	0.0513
Total	1.0000	1.0000	1.0000	1.0000

Table 3.18: Factor applied to Lowdham vehicle turning matrix

User Class	AM	PM	IP	OP
Car - business	0.0574	0.0432	0.0558	0.0334
Car - Commuting	0.3164	0.2751	0.0876	0.2232
Car - Other	0.4523	0.5263	0.6328	0.5196
LGV – Other	0.0150	0.0147	0.0164	0.0164
LGV - Business	0.1100	0.1078	0.1199	0.1199
OGV1 - Business	0.0301	0.0185	0.0573	0.0573
OGV2 - Business	0.0188	0.0143	0.0302	0.0302
Total	1.0000	1.0000	1.0000	1.0000

Table 3.19: Factor applied to Kirk Hill vehicle turning matrix

User Class	AM	PM	IP	OP
Car - business	0.0590	0.0443	0.0586	0.0371
Car - Commuting	0.3252	0.2821	0.0920	0.2476
Car - Other	0.4649	0.5395	0.6649	0.5764
LGV – Other	0.0154	0.0126	0.0163	0.0066
LGV - Business	0.1126	0.0927	0.1192	0.0481
OGV1 - Business	0.0085	0.0065	0.0157	0.0252
OGV2 - Business	0.0145	0.0222	0.0332	0.0590
Total	1.0000	1.0000	1.0000	1.0000

Annualisation

3.29 TUBA bases its economic results on yearly data. The traffic model is based on hourly flows. Annualisation factors are used to convert modelled hourly traffic conditions (flows, delays, and journey times) into yearly travel benefits.

3.30 The annualisation process used to determine annualisation factors for use in the A614/A6097 appraisal is reported in Appendix CC.

3.31 Annualisation factors have been calculated for the year June 2017 to May 2018. Each junction has been calculated individually with multiple count locations where available. For annualisation factors to be calculated a count along a major road is needed that meets the following criteria:

- The count is in a prominent position in relation to the modelled area,
- a full year of traffic flow data exists (divided into hourly intervals) with few gaps; and
- the flows at the count location are high enough such that the count provides a good representation of the daily flow changes throughout the detailed modelled area.

3.32 In the year June 2017 to May 2018 there were 253 weekdays, 104 weekend days and 8 bank holidays. For the purposes of the Annualisation calculations weekend days and bank holidays were classified together.

3.33 From the annual two-way flow data, average hourly flows by time of day were calculated with the results shown below in Table 2 and Table 3. As the weekend flow profile does not follow the same pattern as the weekday flow profile the average flow on a weekend day between the hours of 07:00 – 19:00 is assumed to be comparable to an average weekday flow between the hours 10:00 – 16:00. Weekday and Weekend OP average flows (19:00 – 07:00) are assumed to be directly comparable.

3.34 The hourly two-way flows were plotted in ascending order and, using calculated annual average AM (weekday), IP (weekday and weekend), PM (weekday) and OP (weekday and weekend) hourly flows, annualisation factors were derived by calibrating the area under the curves in such a way as to approximate the number of observed trips to an acceptable level (detailed in Appendix CC).

3.35 The annualisation factors used in the appraisal are shown in Table 3.20

Table 3.20: Annualisation factors for Appraisal

Time period	Total hours
AM	648
PM	677
Interpeak	2,997
Offpeak	4,438
Total	**8,760**

Vehicle Operating Costs

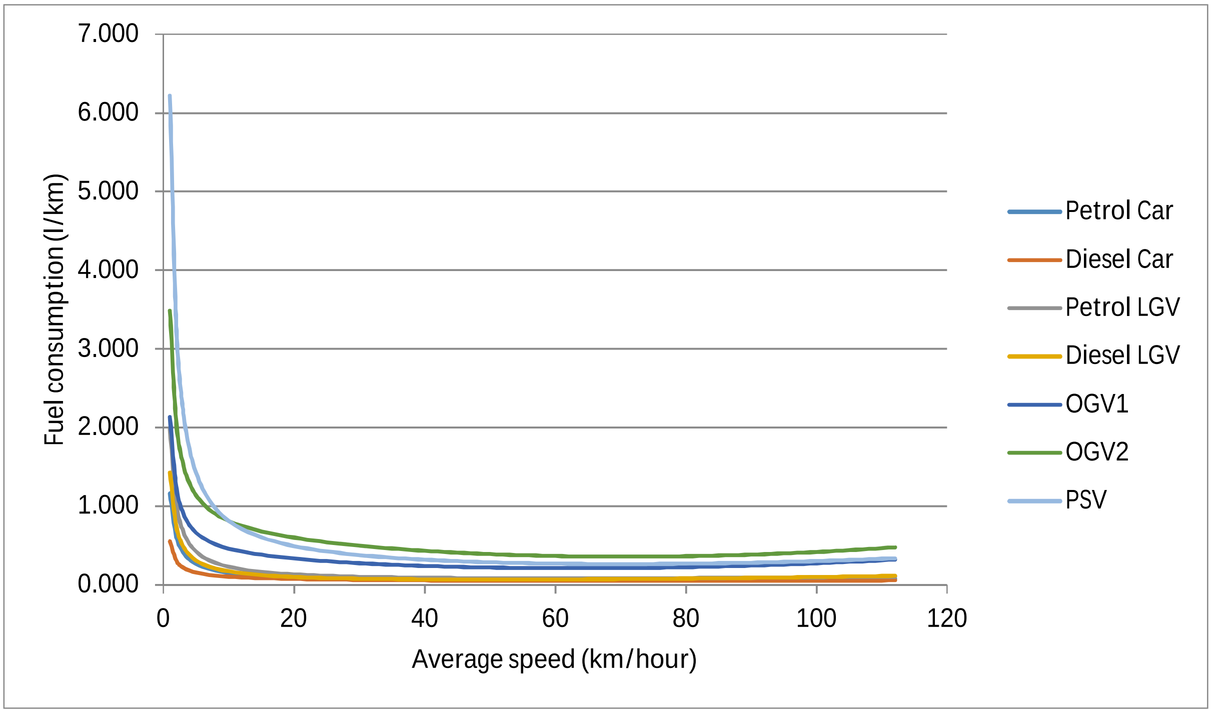
3.36 Vehicle operating cost savings (fuel and non-fuel) are calculated as part of the assessment of TEE benefits and costs using the total travel distance from the model output. Vehicle Operating Costs are directly related to fuel consumption and change in speeds between the DM and DS options.

3.37 As each junction within the scheme was modelled in isolation, only a nominal length has been modelled on each approach to the junction.

3.38 When considering changes in speed at an isolated junction, the average journey speed through a junction is likely to be low. A Do Something option is therefore more likely to have a proportionally greater effect when considering only the trips that pass through the junction, rather than when considering the change in the overall travel time of a full trip length. For instance, over a short distance, the impact of a small scheme junction improvement may change the average speed through the junction from 15kph to 20kph (33% increase in speed), however the impact of the same junction improvement may change the average speed of a 20 mile journey from 40kph to 42kph (5% increase in journey speed).

3.39 Based upon the fuel consumption curve taken from the WebTAG data book, Worksheet A1.3.8, as shown in Figure 3-1, it can be seen that the fuel consumption rises steeply at low speeds.

Figure 3-1: Fuel Consumption Curve



3.40 This steep change in fuel efficiency at low speeds is likely to over exaggerate the VOC benefits of the Junction Schemes, if partial trip lengths were to be used.

3.41 Because the full trip-length of journeys are not represented in the TEE analysis, it was therefore decided that the VOC benefits would be excluded from the junction economic appraisals. In the case where a scheme is predicted to improve journey times, and therefore make vehicle operating costs more efficient, it is considered that excluding the VOC costs will underestimate the economic benefits of the schemes.

Greenhouse Gases and Indirect Taxes

3.42 Indirect tax costs are a direct product of the change in vehicle operating costs, for the same reasons as those described in the previous paragraphs, these costs will not form part of the appraisal process and will be omitted from the AMCB Tables for the individual junctions. This approach will under-estimate the benefits of the scheme.

3.43 Greenhouse Gases have been assessed outside of TUBA. The TUBA greenhouse gas analysis has been excluded from economic appraisal.

Delays during Construction

3.44 An economic assessment of delays under construction was undertaken. The cost to road users of delays caused by the scheme construction was assessed and factored to the longest construction phase length at each junction undergoing construction activities. The Present Value Benefits (PVB) results for each junction and the combination of these results generated by the delays under construction produced a disbenefit value of -£15.809 million as seen in Figure 3-2. A Technical note was produced detailing the full results and is within Appendix DD.

Figure 3-2 Analysis of Monetised Cost and Benefits (AMCB) of delays during construction - (£'000s 2010 Market Prices, discounted to a 2010 present value year)

Number of weeks/months at each junction	20mo	20w	36w	30w	
	Results output from TUBA - per junction				
	Ollerton	**Mickledale**	**Lowdham**	**Kirkhill**	**Total**
Economic Efficiency: Consumer Users (Commuting)	-852	7	-2,468	-352	-3,665
Economic Efficiency: Consumer Users (Other)	-1,220	15	-5,339	-1,243	-7,788
Economic Efficiency: Business Users and Providers	-748	12	-3,601	-19	-4,357
Present Value of Benefits (PVB)	**-2,820**	**33**	**-11,409**	**-1,614**	**-15,809**

3.45 As shown in the table above, Mickledale Lane presents a positive benefit. During construction the minor arm of the 3-arm priority junction is closed, therefore, the junction acts as a free-flowing carriageway with a speed restriction imposed. Due to the reduced flow and delay due to turning movements the junction presented a slight positive benefit during construction. It is noted that Mickledale Phase 2 and 3 are very similar with minor arm, Mickledale Road closed. So as not to overestimate the benefits accrued, recognising that the adopted methodology does not reflected the cost of enforced rerouting due to road closures, Stage 4 has not been included in the delays during construction analysis. This is considered a robust approach.

3.46 The large disbenefits at Lowdham predominately occurring in phases 2 and 3 (Four-stage temporary traffic signals). Given the large disbenefits, it is anticipated that the Lowdham delays during construction can be reduced with more detailed consideration of the proposed traffic management (temporary 4-stage traffic signal) arrangement.

Maintenance

3.47 VIA East Midlands prepared an estimate of the ongoing yearly maintenance costs for the A614 MRN Improvement scheme. This estimate of maintenance costs represents the increase in maintenance costs, above existing commitments, to maintain and update the new junctions.

3.48 Table 3.21 shows a summary of the estimated operation and maintenance cost impact over the 60-year assessment period, in undiscounted costs, and with a year 1 price advised by VIA East Midlands to be at Q1 2020 prices.

Table 3.21: Maintenance Estimates (2020 prices)

	Maintenance
Ollerton Roundabout	£1,058,629
Lowdham Roundabout	£502,856
Mickledale Lane	£1,045,667
Kirk Hill	£803,309
Total	**£3,410,461**

3.49 It was assumed that maintenance costs increase at the same rate as the GDP deflator (i.e. there is zero change in real terms, once inflation has been accounted for). A factor of 0.868 (July 2016 figures) was applied to convert the 2019 prices to 2010 prices.

3.50 The factor costs were converted to market prices, by the TUBA software, which applies a factor of 1.19.

3.51 The stream of Maintenance costs by junction is presented in Appendix EE.

4. Core Travel Time Benefits

4.1 Table 4.1 to Table 4.4 show, in monetary terms, the change due to the Do-Something, relative to the Do-Minimum scenario, whilst Table 4.5 is the summation across all junctions. All values in the Transport Economic Efficiency (TEE) table are in 2010 market prices and discounted to a 2010 present value year.

4.2 The purpose of the Transport Economic Efficiency (TEE) table is to summarise and present transport user benefits. It shows the net user benefits by group (consumers and businesses, including transport operators), by mode of transport and by impact (time, vehicle operating costs, etc).

Table 4.1: TEE Table (£ thousands) - Ollerton

Impact	Total	Personal	Freight
Consumer- Commuting – Travel Time	6,719		
Consumer - Commuting – VOC	Not Assessed		
Consumer - Commuting – During Construction	-852		
NET CONSUMER IMPACT - COMMUTING	**5,867**		
Consumer - Other – Travel Time	9,116		
Consumer - Other – VOC	Not Assessed		
Consumer - Other – During Construction	-1,220		
NET CONSUMER IMPACT - OTHER	**7,896**		
Business – Travel Time	6,561	1,057	5,504
Business - VOC	Not Assessed		
Business – During Construction	-748		
Operating Costs	0		
Other Business – Developer contributions	-455		
NET BUSINESS IMPACT	**5,358**		
PRESENT VALUE OF TRANSPORT ECONOMIC EFFICIENCY BENEFITS	**19,121**		

Note: All entries are discounted to a 2010 present value year, in 2010 market prices, in £ thousands.

Table 4.2: TEE Table (£ thousands) – Mickledale Lane

Impact	Total	Personal	Freight
Consumer- Commuting – Travel Time	-1,282		
Consumer - Commuting – VOC	Not Assessed		
Consumer - Commuting – During Construction	7		
NET CONSUMER IMPACT - COMMUTING	**-1,275**		
Consumer - Other – Travel Time	-3,138		
Consumer - Other – VOC	Not Assessed		
Consumer - Other – During Construction	15		
NET CONSUMER IMPACT - OTHER	**-3,123**		
Business – Travel Time	-2,621	-318	-2,303
Business - VOC	Not Assessed		
Business – During Construction	12		
Operating Costs	0		
Other Business – Developer contributions	-79		
NET BUSINESS IMPACT	**-2,688**		
PRESENT VALUE OF TRANSPORT ECONOMIC EFFICIENCY BENEFITS	**-7,087**		

Note: All entries are discounted to a 2010 present value year, in 2010 market prices, in £ thousands.

Table 4.3: TEE Table (£ thousands) - Lowdham

Impact	Total	Personal	Freight
Consumer- Commuting – Travel Time	5,852		
Consumer - Commuting – VOC		Not Assessed	
Consumer - Commuting – During Construction	-2,468		
NET CONSUMER IMPACT - COMMUTING	**3,384**		
Consumer - Other – Travel Time	8,311		
Consumer - Other – VOC		Not Assessed	
Consumer - Other – During Construction	-5,339		
NET CONSUMER IMPACT - OTHER	**2,972**		
Business – Travel Time	4,973	813	4,159
Business - VOC		Not Assessed	
Business – During Construction	-3,601		
Operating Costs	0		
Other Business – Developer contributions	-335		
NET BUSINESS IMPACT	**1,037**		
PRESENT VALUE OF TRANSPORT ECONOMIC EFFICIENCY BENEFITS	**7,392**		

Note: All entries are discounted to a 2010 present value year, in 2010 market prices, in £ thousands.

Table 4.4: TEE Table (£ thousands) – Kirk Hill

Impact	Total	Personal	Freight
Consumer- Commuting – Travel Time	10,374		
Consumer - Commuting – VOC	Not Assessed		
Consumer - Commuting – During Construction	-352		
NET CONSUMER IMPACT - COMMUTING	**10,022**		
Consumer - Other – Travel Time	21,391		
Consumer - Other – VOC	Not Assessed		
Consumer - Other – During Construction	-1,243		
NET CONSUMER IMPACT - OTHER	**20,148**		
Business – Travel Time	1,723	218	1,505
Business - VOC	Not Assessed		
Business – During Construction	-19		
Operating Costs	0		
Other Business – Developer contributions	-255		
NET BUSINESS IMPACT	**1,449**		
PRESENT VALUE OF TRANSPORT ECONOMIC EFFICIENCY BENEFITS	**31,619**		

Note: All entries are discounted to a 2010 present value year, in 2010 market prices, in £ thousands.

Table 4.5: TEE Table (£ thousands) – All Junctions

Impact	Total	Personal	Freight
Consumer- Commuting – Travel Time	21,663		
Consumer - Commuting – VOC	Not Assessed		
Consumer - Commuting – During Construction	-3,665		
NET CONSUMER IMPACT - COMMUTING	**17,998**		
Consumer - Other – Travel Time	35,680		
Consumer - Other – VOC	Not Assessed		
Consumer - Other – During Construction	-7,788		
NET CONSUMER IMPACT - OTHER	**27,892**		
Business – Travel Time	10,636	1,770	8,865
Business - VOC	Not Assessed		
Business – During Construction	-4,357		
Operating Costs	0		
Other Business – Developer contributions	-1124		
NET BUSINESS IMPACT	**5,155**		
PRESENT VALUE OF TRANSPORT ECONOMIC EFFICIENCY BENEFITS	**51,046**		

Note: All entries are discounted to a 2010 present value year, in 2010 market prices, in £ thousands.

4.3 The Present Value of Transport and Economic Efficiency returned the following annualised and discounted user time benefits for the 60-year appraisal period is **£51.0 million**, showing that as a combined package, the scheme delivers positive TEE benefits, in a Core growth scenario.

5. High Growth Scenario Travel Time Benefits

5.1 Table 5.1 to Table 5.4 show, in monetary terms, the change due to the Do-Something, relative to the Do-Minimum in a High Growth scenario, whilst Table 5.5 is the summation across all junctions. All values in the Transport Economic Efficiency (TEE) table are in 2010 market prices and discounted to a 2010 present value year.

5.2 The purpose of the Transport Economic Efficiency (TEE) table is to summarise and present transport user benefits. It shows the net user benefits by group (consumers and businesses, including transport operators), by mode of transport and by impact.

Table 5.1: High Growth Scenario - TEE Table (£ thousands) - Ollerton

Impact	Total	Personal	Freight
Consumer- Commuting – Travel Time	16,553		
Consumer - Commuting – VOC	Not Assessed		
Consumer - Commuting – During Construction	-852		
NET CONSUMER IMPACT - COMMUTING	**15,701**		
Consumer - Other – Travel Time	22,627		
Consumer - Other – VOC	Not Assessed		
Consumer - Other – During Construction	-1,220		
NET CONSUMER IMPACT - OTHER	**21,407**		
Business – Travel Time	19,118	2,975	16,143
Business - VOC	Not Assessed		
Business – During Construction	-748		
Operating Costs	0		
Other Business – Developer contributions	-455		
NET BUSINESS IMPACT	**17,915**		
PRESENT VALUE OF TRANSPORT ECONOMIC EFFICIENCY BENEFITS	**55,023**		

Note: All entries are discounted to a 2010 present value year, in 2010 market prices, in £ thousands.

Table 5.2: High Growth Scenario - TEE Table (£ thousands) – Mickledale Lane

Impact	Total	Personal	Freight
Consumer- Commuting – Travel Time	-525		
Consumer - Commuting – VOC	Not Assessed		
Consumer - Commuting – During Construction	7		
NET CONSUMER IMPACT - COMMUTING	**-518**		
Consumer - Other – Travel Time	-2,370		
Consumer - Other – VOC	Not Assessed		
Consumer - Other – During Construction	15		
NET CONSUMER IMPACT - OTHER	**-2,355**		
Business – Travel Time	-2,057	-228	-1,829
Business - VOC	Not Assessed		
Business – During Construction	12		
Operating Costs	0		
Other Business – Developer contributions	-79		
NET BUSINESS IMPACT	**-2,124**		
PRESENT VALUE OF TRANSPORT ECONOMIC EFFICIENCY BENEFITS	**-4,998**		

Note: All entries are discounted to a 2010 present value year, in 2010 market prices, in £ thousands.

Table 5.3: High Growth Scenario - TEE Table (£ thousands) - Lowdham

Impact	Total	Personal	Freight
Consumer- Commuting – Travel Time	22,265		
Consumer - Commuting – VOC		Not Assessed	
Consumer - Commuting – During Construction	-2,468		
NET CONSUMER IMPACT - COMMUTING	**19,797**		
Consumer - Other – Travel Time	30,166		
Consumer - Other – VOC		Not Assessed	
Consumer - Other – During Construction	-5,339		
NET CONSUMER IMPACT - OTHER	**24,827**		
Business – Travel Time	18,393	3,051	15,342
Business - VOC		Not Assessed	
Business – During Construction	-3,601		
Operating Costs	0		
Other Business – Developer contributions	-335		
NET BUSINESS IMPACT	**14,457**		
PRESENT VALUE OF TRANSPORT ECONOMIC EFFICIENCY BENEFITS	**59,080**		

Note: All entries are discounted to a 2010 present value year, in 2010 market prices, in £ thousands.

Table 5.4: High Growth Scenario - TEE Table (£ thousands) – Kirk Hill

Impact	Total	Personal	Freight
Consumer- Commuting – Travel Time	7,664		
Consumer - Commuting – VOC	Not Assessed		
Consumer - Commuting – During Construction	-352		
NET CONSUMER IMPACT - COMMUTING	**7,312**		
Consumer - Other – Travel Time	12,875		
Consumer - Other – VOC	Not Assessed		
Consumer - Other – During Construction	-1,243		
NET CONSUMER IMPACT - OTHER	**11,632**		
Business – Travel Time	1,233	163	1,070
Business - VOC	Not Assessed		
Business – During Construction	-19		
Operating Costs	0		
Other Business – Developer contributions	-255		
NET BUSINESS IMPACT	**959**		
PRESENT VALUE OF TRANSPORT ECONOMIC EFFICIENCY BENEFITS	**19,903**		

Note: All entries are discounted to a 2010 present value year, in 2010 market prices, in £ thousands.

Table 5.5: High Growth Scenario - TEE Table (£ thousands) – All Junctions

Impact	Total	Personal	Freight
Consumer- Commuting – Travel Time	45,957		
Consumer - Commuting – VOC	Not Assessed		
Consumer - Commuting – During Construction	-3,665		
NET CONSUMER IMPACT - COMMUTING	**42,292**		
Consumer - Other – Travel Time	63,298		
Consumer - Other – VOC	Not Assessed		
Consumer - Other – During Construction	-7,788		
NET CONSUMER IMPACT - OTHER	**55,510**		
Business – Travel Time	36,687	5,961	30,726
Business - VOC	Not Assessed		
Business – During Construction	-4,357		
Operating Costs	0		
Other Business – Developer contributions	-1124		
NET BUSINESS IMPACT	**31,206**		
PRESENT VALUE OF TRANSPORT ECONOMIC EFFICIENCY BENEFITS	**129,009**		

Note: All entries are discounted to a 2010 present value year, in 2010 market prices, in £ thousands.

5.3 The Present Value of Transport and Economic Efficiency returned the following annualised and discounted user time benefits for the 60-year appraisal period is **£129.0 million**, showing that as a combined package, the scheme delivers positive TEE benefits under a high growth scenario.

6. Low Growth Scenario Travel Time Benefits

6.1 Table 6.1 to Table 6.4 show, in monetary terms, the change due to the Do-Something, relative to the Do-Minimum scenario in a Low Growth scenario, whilst Table 6.5 is the summation across all junctions. All values in the Transport Economic Efficiency (TEE) table are in 2010 market prices and discounted to a 2010 present value year.

6.2 The purpose of the Transport Economic Efficiency (TEE) table is to summarise and present transport user benefits. It shows the net user benefits by group (consumers and businesses, including transport operators), by mode of transport and by impact (time, vehicle operating costs, etc).

Table 6.1: Low Growth Scenario - TEE Table (£ thousands) - Ollerton

Impact	Total	Personal	Freight
Consumer- Commuting – Travel Time	1,558		
Consumer - Commuting – VOC		Not Assessed	
Consumer - Commuting – During Construction	-852		
NET CONSUMER IMPACT - COMMUTING	**7,06**		
Consumer - Other – Travel Time	2,416		
Consumer - Other – VOC		Not Assessed	
Consumer - Other – During Construction	-1,220		
NET CONSUMER IMPACT - OTHER	**1,196**		
Business – Travel Time	1,763	276	1,486
Business - VOC		Not Assessed	
Business – During Construction	-748		
Operating Costs	0		
Other Business – Developer contributions	-455		
NET BUSINESS IMPACT	**560**		
PRESENT VALUE OF TRANSPORT ECONOMIC EFFICIENCY BENEFITS	**2,462**		

Note: All entries are discounted to a 2010 present value year, in 2010 market prices, in £ thousands.

Table 6.2: Low Growth Scenario - TEE Table (£ thousands) – Mickledale Lane

Impact	Total	Personal	Freight
Consumer- Commuting – Travel Time	-1,179		
Consumer - Commuting – VOC	Not Assessed		
Consumer - Commuting – During Construction	7		
NET CONSUMER IMPACT - COMMUTING	**-1,172**		
Consumer - Other – Travel Time	-2,876		
Consumer - Other – VOC	Not Assessed		
Consumer - Other – During Construction	15		
NET CONSUMER IMPACT - OTHER	**-2,861**		
Business – Travel Time	-2,402	-291	-2,111
Business - VOC	Not Assessed		
Business – During Construction	12		
Operating Costs	0		
Other Business – Developer contributions	-79		
NET BUSINESS IMPACT	**-2,469**		
PRESENT VALUE OF TRANSPORT ECONOMIC EFFICIENCY BENEFITS	**-6,503**		

Note: All entries are discounted to a 2010 present value year, in 2010 market prices, in £ thousands.

Table 6.3: Low Growth Scenario - TEE Table (£ thousands) - Lowdham

Impact	Total	Personal	Freight
Consumer- Commuting – Travel Time	1,779		
Consumer - Commuting – VOC	Not Assessed		
Consumer - Commuting – During Construction	-2,468		
NET CONSUMER IMPACT - COMMUTING	**-689**		
Consumer - Other – Travel Time	2,679		
Consumer - Other – VOC	Not Assessed		
Consumer - Other – During Construction	-5,339		
NET CONSUMER IMPACT - OTHER	**-2,660**		
Business – Travel Time	1,626	263	1,362
Business - VOC	Not Assessed		
Business – During Construction	-3,601		
Operating Costs	0		
Other Business – Developer contributions	-335		
NET BUSINESS IMPACT	**-2,310**		
PRESENT VALUE OF TRANSPORT ECONOMIC EFFICIENCY BENEFITS	**-5,660**		

Note: All entries are discounted to a 2010 present value year, in 2010 market prices, in £ thousands.

Table 6.4: Low Growth Scenario - TEE Table (£ thousands) – Kirk Hill

Impact	Total	Personal	Freight
Consumer- Commuting – Travel Time	2,518		
Consumer - Commuting – VOC	Not Assessed		
Consumer - Commuting – During Construction	-352		
NET CONSUMER IMPACT - COMMUTING	**2,166**		
Consumer - Other – Travel Time	3,017		
Consumer - Other – VOC	Not Assessed		
Consumer - Other – During Construction	-1,243		
NET CONSUMER IMPACT - OTHER	**1,774**		
Business – Travel Time	318	43	275
Business - VOC	Not Assessed		
Business – During Construction	-19		
Operating Costs	0		
Other Business – Developer contributions	-255		
NET BUSINESS IMPACT	**44**		
PRESENT VALUE OF TRANSPORT ECONOMIC EFFICIENCY BENEFITS	**3,984**		

Note: All entries are discounted to a 2010 present value year, in 2010 market prices, in £ thousands.

Table 6.5: Low Growth Scenario - TEE Table (£ thousands) – All Junctions

Impact	Total	Personal	Freight
Consumer- Commuting – Travel Time	4,676		
Consumer - Commuting – VOC	Not Assessed		
Consumer - Commuting – During Construction	-3,665		
NET CONSUMER IMPACT - COMMUTING	**1,011**		
Consumer - Other – Travel Time	5,236		
Consumer - Other – VOC	Not Assessed		
Consumer - Other – During Construction	-7,788		
NET CONSUMER IMPACT - OTHER	**-2,552**		
Business – Travel Time	1,305	291	1,012
Business - VOC	Not Assessed		
Business – During Construction	-4,357		
Operating Costs	0		
Other Business – Developer contributions	-1124		
NET BUSINESS IMPACT	**-4,176**		
PRESENT VALUE OF TRANSPORT ECONOMIC EFFICIENCY BENEFITS	**-5,716**		

Note: All entries are discounted to a 2010 present value year, in 2010 market prices, in £ thousands.

6.3 The Present Value of Transport and Economic Efficiency returned the following annualised and discounted user time benefits for the 60-year appraisal period is **£-5.7 million**, showing that as a combined package, the scheme delivers negative TEE benefits for the Low growth scenario.

7. Road Safety

7.1 The purpose of the road safety assessment is to calculate the monetary benefits of the scheme arising from the change in collision costs between the Do Minimum (DM) and Do Something (DS) scenarios. This is done by calculating the total cost of collisions on the network for the DS and subtracting these from the total cost of collisions in the DM. The road safety assessment for the Scheme was carried out using the software COBALT (Cost and Benefit to Accidents – Light Touch) appraisal program, version 2013.02.

7.2 COBALT is software used to appraise the road safety benefits of a highway improvement. The aim of COBALT is to produce a monetised appraisal in accordance with the DfT's Transport Analysis Guidance (TAG).

7.3 The COBALT assessment was run as a single model, but within the model each junction was modelled in isolation. This methodology was adopted since the scheme includes three isolated junction improvements and personal injury collision rates will not change along the length of route between these junctions as a result of the scheme.

7.4 Table 7.1 shows the junction numbers used within the COBALT assessment for each junction.

Table 7.1: COBALT Junction numbers

Junction	Junction number (DM)	Junction number (DS)
Ollerton	1	2
Mickledale Lane	5	6
Lowdham	11	12

7.5 Observed road collisions data was obtained from NCC for the period January 2015 to December 2017 (inclusive). 2018 data was not available at the time of the assessment. This data was used to calculate an observed collision rate for each junction. This observed rate was used for the Do Minimum assessment.

7.6 For the Do Something assessment, default COBALT rates were applied for the proposed junction types for Ollerton & Lowdham. For Mickledale Lane, an alternative approach was adopted since NCC had recently upgraded a similar priority junction on the A614 (Rose Cottage, directly north of Deerdale Lane) to signal controlled, as proposed at Mickledale Lane. The similarity of schemes and traffic flows means that an observed rate at Rose Cottage is likely to be more representative that the COBALT default rates and has been applied to Mickledale Lane. Table 7.2 below summarises the junction characteristics at the two junctions:

Table 7.2: Junction Characteristics of Rose Cottage and Mickledale Lane junctions

Characteristic	Rose Cottage	Mickledale Lane
Number of Arms	3	3
A614 mainline speed limit	50mph	50mph
2018 12hr Junction Inflow (vehicles)	17,239	19,181
08:00-09:00 Junction Inflow (vehicles)	1,829	1,964
17:00-18:00 Junction Inflow (vehicles)	1,814	1,954

7.7 Table 7.3 shows the number of collisions at Rose Cottage and Mickledale Lane from 1999 (with data obtained from Crashmap over this longer duration). This shows the impact of the Rose Cottage signalisation scheme on collision numbers.

Table 7.3: Number of Collisions at Rose Cottage and Mickledale Lane junctions

Year	Rose Cottage	Mickledale Lane
1999	1	2
2000	0	1
2001	2	1
2002	2	2
2003	4	0
2004	1	0
2005	1	1
2006	1	1
2007	3	0
2008	4	1
2009	1	2
2010	1	0
2011	0	2
2012	2	1
Average collisions per year	**1.6**	**1.0**
2013	0	0
2014	0	2
2015	0	1
2016	0	3
2017	2	0
Average collisions per year	**0.4**	**1.2**

Rose Cottage Scheme

7.8 To calculate a rate from Rose Cottage, guidance has been taken from the Chapter 5 (The Valuation of Accidents at Junctions) of the COBA Manual. The annual number of accidents (A) is calculated according to the following formula:

$$A = a(f)^{b}$$

7.9 Whereby:

A = Annual number of accidents

a = accident rate coefficient attributed to specific junction type

f = Function of traffic flow

b = Coefficient attributed to specific junction type

7.10 Two collisions have been observed at Rose Cottage since its signalisation, which across a three-year appraisal period (2015 – 2017) yields 0.6667 annual accidents (A). For a junction of its type (3 arm signalised) traffic flow (f) is calculated using an inflow model, whereby the total inflow from all links in thousands of vehicles per annual average day is summated. The traffic flow (f) at Rose Cottage, observed from a 2019 traffic survey, was calculated as 20.547. The b coefficient has been taken directly from the COBA Manual, whereby a 3-arm signalised has a value of 0.610.

7.11 Inputting these values and rearranging the model yields an accident rate coefficient (a) for Rose Cottage of 0.105471.

$$a = A / (f)^b$$

$$a = 0.6667 / (20.547)^{0.610}$$

$$a = 0.105471$$

7.12 The post-signalisation accident rate coefficient (a) from Rose Cottage can be reasonably assumed to represent the typical accident rate at signalised junctions along the A614 corridor, and has been used for accident appraisal at Mickledale Lane in the DS scenario (replacing the default rate generated by COBALT).

7.13 COBALT requires two input files in order to produce its outputs. An economic parameters file, consisting of a series of data tables of standard parameters required to calculate personal injury collision impacts in line with WebTAG guidance, and a scheme specific input file, produced by the user, which contains data specific to the scheme being modelled, such as the scheme network and traffic flows.

7.14 COBALT link and junction types were classified by manually assigning a COBALT type to the model link or junction using observations on the type of link or junction, with characteristics gained from viewing Google Maps. A possible 15 different link types and 96 different junction types can be entered.

7.15 Where links or junctions changed in detail between the DM and DS scheme, these were entered twice:

- once in its ‘Without-Scheme’ state (e.g. priority junction); and
- once in its ‘With-Scheme’ state (e.g. signal controlled).

7.16 Annual Average Daily Traffic (AADT) flows (see Section 2.66 – 2.69 for AADT methodology) were entered for the base year (2018), opening year (2023), and future forecast year (2037). Junction flows were represented using AADT entry flows per approach arm. Given this is a fixed trip assessment, the AADT values for the DS and DM are the same.

7.17 Collision costs are calculated by COBALT for every year within the appraisal period of 2023 to 2082 and then summed to give total collision costs in the DM and DS over the whole 60-year appraisal period.

7.18 For each link and each year, a personal injury collision rate per million vehicle kilometres (mvkm), the total distance travelled in mvkm during that year and the monetary value of a single collision has been calculated. Multiplying through for each link and then summing across all links gives the DM or DS network collision costs in a particular year.

7.19 For consistency with other items of cost and benefit, all collision costs are valued in 2010 market prices and discounted to the 2010 present value year.

7.20 Table 7.4 presents the COBALT outputs for the A614 / A6097 corridor junction improvement scheme, whilst Table 6.3 and 6.4 presents the outputs for each individual junction for accident statistics and costs respectively. Full COBALT output data is available in Appendix FF. The data shows that the scheme will lead to a reduction in the number of ‘fatal’ and ‘serious’ collisions, however a worsening in the number of collisions classified as ‘slight’ is noted. This is discussed in more detail below.

7.21 The assessment returned the following annualised and discounted collision benefits for the 60-year appraisal period: **- £0.87M** (i.e. a disbenefit)

Table 7.4: Collision Risk and Valuation of Collisions (60 year appraisal period)

	Accidents	Casualties			Accident Costs (£, 000's)
		Fatal	Serious	Slight	
Without-Scheme (DM)	398.5	2.6	34.6	553.6	14,154
With-Scheme (DS)	473.5	1.2	28.6	629.3	15,023
Difference	**-75**	**1.4**	**5.9**	**-76.0**	**-869**

Table 7.5: Total accidents across 60 year appraisal by junction

Junction	Do Minimum (DM) accidents	Do Something (DS) accidents	Change in accidents
Ollerton	115.6	163.2	+47.6
Mickledale Lane	79.3	42.1	-37.2
Lowdham	115.3	179.9	+64.6
Total	**310.2**	**385.2**	**112.2**

Table 7.6: Total cost across 60 year appraisal by junction

Junction	Do Minimum (DM) cost (£millions)	Do Something (DS) cost (£millions)	Change in cost (£millions)
Ollerton	3,502.3	5,146.2	-1,643.9
Mickledale Lane	4,341.2	1,532.3	2,808.9
Lowdham	3,629.8	5,663.5	-2,033.7
Total	**11473.3**	**12342**	**-868.7**

7.22 It is noted that the larger accident disbenefits are associated with the improvements at Ollerton and Lowdham. The proposed junctions fulfil their primary objective of improving capacity. The observed accident rates used in the Do Minimum at the two junctions are much lower than the COBA default values. As such, any comparison against a national default rate will result in a disbenefit. Whilst both junctions will be enlarged to provide additional capacity, the geometry and layout of the proposed junctions are not a large change from the existing and as such it is unlikely that the scheme will lead to a large increase in accidents to the level predicted by COBALT.

7.23 One potential alternative assessment approach would be to use a post-opening observed accident rate from a similar scheme. A similar scheme was installed at the A614/A617 Lockwell Hill junction in 2013, however this was installed at a similar time to the A614 Safety Cameras with reduced speed limits along the A614. As such, the use of the Lockwell Hill post opening data may overestimate the accident benefits of the junction and is not deemed a suitable comparator.

7.24 For the purposes of a robust assessment, default rates at Ollerton and Lowdham have been retained in the economic appraisal. As such, this represents a 'worst case' assessment.

8. Economic Appraisal

Introduction

8.1 Although all the components of the appraisal have to be considered, two key indicators will stand out from this kind of economic assessment: the scheme's benefit to cost ratio (BCR), and its net present value (NPV).

8.2 The BCR identifies the ratio between the present value of benefits (PVB) and present value of costs (PVC). The higher the BCR the more benefits a scheme is forecast to deliver, compared with the scheme's costs.

Transport Economic Efficiency

8.3 Table 8.1 shows, in monetary terms, the change due to the Do-Something, relative to the Do-Minimum scenario. All values in the Transport Economic Efficiency (TEE) table are in 2010 market prices, and discounted to a 2010 present value year.

Table 8.1: Core Scenario - TEE Table (£ thousands) All Junctions

	With Scheme
Consumer- Commuting – Travel Time	21,663
Consumer - Commuting – VOC	Not Assessed
Consumer - Commuting – During Construction	-3,665
NET CONSUMER IMPACT - COMMUTING	**17,998**
Consumer - Other – Travel Time	35,680
Consumer - Other – VOC	Not Assessed
Consumer - Other – During Construction	-7,788
NET CONSUMER IMPACT - OTHER	**27,892**
Business – Travel Time	10,636
Business - VOC	Not Assessed
Business – During Construction	-4,357
Operating Costs	0
Other Business – Developer contributions	-1124
NET BUSINESS IMPACT	**5,155**
PRESENT VALUE OF TRANSPORT ECONOMIC EFFICIENCY BENEFITS	**51,046**

Note: All entries are discounted to a 2010 present value year, in 2010 market prices, in £ thousands.

Table 8.2: High Growth Scenario - TEE Table (£ thousands) All Junctions

	With Scheme
Consumer- Commuting – Travel Time	45,957
Consumer - Commuting – VOC	Not Assessed
Consumer - Commuting – During Construction	-3,665
NET CONSUMER IMPACT - COMMUTING	**42,292**
Consumer - Other – Travel Time	63,298
Consumer - Other – VOC	Not Assessed
Consumer - Other – During Construction	-7,788
NET CONSUMER IMPACT - OTHER	**55,510**
Business – Travel Time	36,687
Business - VOC	Not Assessed
Business – During Construction	-4,357
Operating Costs	0
Other Business – Developer contributions	-1124
NET BUSINESS IMPACT	**31,206**
PRESENT VALUE OF TRANSPORT ECONOMIC EFFICIENCY BENEFITS	**129,009**

Note: All entries are discounted to a 2010 present value year, in 2010 market prices, in £ thousands.

Table 8.3: Low Growth Scenario - TEE Table (£ thousands) All Junctions

	With Scheme
Consumer- Commuting – Travel Time	4,676
Consumer - Commuting – VOC	Not Assessed
Consumer - Commuting – During Construction	-3,665
NET CONSUMER IMPACT - COMMUTING	**1,011**
Consumer - Other – Travel Time	5,236
Consumer - Other – VOC	Not Assessed
Consumer - Other – During Construction	-7,788
NET CONSUMER IMPACT - OTHER	**-2,552**
Business – Travel Time	1,305
Business - VOC	Not Assessed
Business – During Construction	-4,357
Operating Costs	0
Other Business – Developer contributions	-1124
NET BUSINESS IMPACT	**-4,176**
PRESENT VALUE OF TRANSPORT ECONOMIC EFFICIENCY BENEFITS	**-5,716**

Note: All entries are discounted to a 2010 present value year, in 2010 market prices, in £ thousands.

Public Accounts

8.4 Table 8.4 to Table 8.9 show, in monetary terms, the Public Accounts for the improvement package, incorporating the costs of Warren Hill and White Post. Table 8.10 show, in monetary terms, the Public Accounts for all junctions.

Table 8.4: Public Accounts (£ thousands)-Ollerton

Funding	All modes	Road
Local Government		
Revenue	0	0
Operating Costs	0	0
Investment Costs	1527	1527
Developer Contributions	-455	-455
Grant/Subsidy Payments	0	0
NET IMPACT	**1,072**	**1,072**
Central Government Funding: Transport		
Revenue	0	0
Operating Costs	0	0
Investment Costs	5734	5734
Developer Contributions	0	0
Grant/Subsidy Payments	0	0
NET IMPACT	**5,734**	**5,734**
Central Government Funding: Non Transport		
Indirect Tax	Not Assessed	
Totals		
Broad Transport Budget	**6,806**	**6,806**
Wider Public Finances	**0**	**0**

Note: Costs appear as positive numbers. All entries are discounted to 2010 present values, in 2010 market prices.

Table 8.5: Public Accounts (£ thousands)-Mickledale Lane

Funding	All modes	Road
Local Government		
Revenue	0	0
Operating Costs	0	0
Investment Costs	657	657
Developer Contributions	-79	-79
Grant/Subsidy Payments	0	0
NET IMPACT	**578**	**578**
Central Government Funding: Transport		
Revenue	0	0
Operating Costs	0	0
Investment Costs	3755	3755
Developer Contributions	0	0
Grant/Subsidy Payments	0	0
NET IMPACT	**3,755**	**3,755**
Central Government Funding: Non Transport		
Indirect Tax	Not Assessed	
Totals		
Broad Transport Budget	**4,333**	**4,333**
Wider Public Finances	**0**	**0**

Note: Costs appear as positive numbers. All entries are discounted to 2010 present values, in 2010 market prices.

Table 8.6: Public Accounts (£ thousands)-Lowdham

Funding	All modes	Road
Local Government		
Revenue	0	0
Operating Costs	0	0
Investment Costs	937	937
Developer Contributions	-335	-335
Grant/Subsidy Payments	0	0
NET IMPACT	**602**	**602**
Central Government Funding: Transport		
Revenue	0	0
Operating Costs	0	0
Investment Costs	3640	3640
Developer Contributions	0	0
Grant/Subsidy Payments	0	0
NET IMPACT	**3,640**	**3,640**
Central Government Funding: Non Transport		
Indirect Tax	Not Assessed	
Totals		
Broad Transport Budget	**4,242**	**4,242**
Wider Public Finances	**0**	**0**

Note: Costs appear as positive numbers. All entries are discounted to 2010 present values, in 2010 market prices.

Table 8.7: Public Accounts (£ thousands)-Kirk Hill

Funding	All modes	Road
Local Government		
Revenue	0	0
Operating Costs	0	0
Investment Costs	805	805
Developer Contributions	-255	-255
Grant/Subsidy Payments	0	0
NET IMPACT	**550**	**550**
Central Government Funding: Transport		
Revenue	0	0
Operating Costs	0	0
Investment Costs	2894	2894
Developer Contributions	0	0
Grant/Subsidy Payments	0	0
NET IMPACT	**2,894**	**2,894**
Central Government Funding: Non Transport		
Indirect Tax	Not Assessed	
Totals		
Broad Transport Budget	**3,444**	**3,444**
Wider Public Finances	**0**	**0**

Note: Costs appear as positive numbers. All entries are discounted to 2010 present values, in 2010 market prices.

Table 8.8: Public Accounts (£ thousands)-Warren Hill

Funding	All modes	Road
Local Government		
Revenue	0	0
Operating Costs	0	0
Investment Costs	42	42
Developer Contributions	0	0
Grant/Subsidy Payments	0	0
NET IMPACT	**42**	**42**
Central Government Funding: Transport		
Revenue	0	0
Operating Costs	0	0
Investment Costs	154	154
Developer Contributions	0	0
Grant/Subsidy Payments	0	0
NET IMPACT	**154**	**154**
Central Government Funding: Non Transport		
Indirect Tax	Not Assessed	
Totals		
Broad Transport Budget	**196**	**196**
Wider Public Finances	**0**	**0**

Note: Costs appear as positive numbers. All entries are discounted to 2010 present values, in 2010 market prices.

Table 8.9: Public Accounts (£ thousands)-White Post

Funding	All modes	Road
Local Government		
Revenue	0	0
Operating Costs	0	0
Investment Costs	24	24
Developer Contributions	0	0
Grant/Subsidy Payments	0	0
NET IMPACT	**24**	**24**
Central Government Funding: Transport		
Revenue	0	0
Operating Costs	0	0
Investment Costs	160	160
Developer Contributions	0	0
Grant/Subsidy Payments	0	0
NET IMPACT	**160**	**160**
Central Government Funding: Non Transport		
Indirect Tax	Not Assessed	
Totals		
Broad Transport Budget	**184**	**184**
Wider Public Finances	**0**	**0**

Note: Costs appear as positive numbers. All entries are discounted to 2010 present values, in 2010 market prices.

Table 8.10: Public Accounts (£ thousands)-All Junctions

Funding	All modes	Road
Local Government		
Revenue	0	0
Operating Costs	0	0
Investment Costs	3,992	3,992
Developer Contributions	-1,124	-1,124
Grant/Subsidy Payments	0	0
NET IMPACT	**2,868**	**2,868**
Central Government Funding: Transport		
Revenue	0	0
Operating Costs	0	0
Investment Costs	16,337	16,337
Developer Contributions	0	0
Grant/Subsidy Payments	0	0
NET IMPACT	**16,337**	**16,337**
Central Government Funding: Non Transport		
Indirect Tax	Not Assessed	
Totals		
Broad Transport Budget	**19,205**	**19,205**
Wider Public Finances	**0**	**0**

Note: Costs appear as positive numbers. All entries are discounted to 2010 present values, in 2010 market prices.

Analysis of Monetised Cost and Benefits (AMCB)

8.5 Table 8.11 to Table 8.14 show the Analysis of Monetised Costs and Benefits (AMCB) summary table showing the PVB, PVC, NPV and BCR for the 60-year scheme analyses for each junction. Table 8.15 shows the Analysis of Monetised Costs and Benefits (AMCB) summary table showing the PVB, PVC, NPV and BCR for the 60-year scheme analyses for all junctions.

8.6 A single monetised noise impact of £0.29m has been calculated by VIA EM Environmental Team (December 2020) using the Core growth traffic forecasts at a Package level rather than for each junction therefore the monetised noise benefit is presented in the combined AMCB table for all three sensitivity growth forecasts. The associated TAG workbook are presented in Appendix GG.

8.7 A local air quality impact of £0.013m has been calculated separately for the Core forecasts, using the DfT's Air Quality Monetisation Spreadsheet. The associated TAG workbooks are presented in Appendix HH.

8.8 The Air Quality team has also provided a monetised carbon benefit of £0.40m (Lower Estimate), £0.87m (Core) and £1.39m (Upper Estimate) from the Defra Emission Factor Toolkit, using the Environmental Workbook traffic data which were extracted from the Core junction models. The Core value has been inserted into the AMCB Table for the full scheme in preference to the carbon value produced by TUBA. The associated TAG workbooks are presented in Appendix II.

Table 8.11: Core Scenario - Analysis of Monetised Cost and Benefits (AMCB)-Ollerton

Impact	With Scheme
Greenhouse Gases	302
Local Air Quality	2
Noise	Not Assessed
Travel Time Savings - Business	5,358
Travel Time Savings – Commuting & Other	13,763
Collisions	-1,644
Vehicle Operating Costs	Not Assessed
Indirect tax Revenue	Not Assessed
PVB	**17,781**
PVC	**6,806**
NPV	**10,975**
BCR	**2.61**

Notes: Note: Costs appear as positive numbers. All entries are discounted to 2010 present values, in 2010 market prices; except for the BCR figures. Summary does not include monetised journey time reliability benefits.

Table 8.12: Core Scenario - Analysis of Monetised Cost and Benefits (AMCB)-Mickledale Lane

Impact	With Scheme
Greenhouse Gases	-2
Local Air Quality	0
Noise	Not Assessed
Travel Time Savings - Business	-2,688
Travel Time Savings – Commuting & Other	-4,398
Collisions	2,809
Vehicle Operating Costs	Not Assessed
Indirect tax Revenue	Not Assessed
PVB	**-4,280**
PVC	**4,333**
NPV	**-8,613**
BCR	**-0.99**

Notes: Note: Costs appear as positive numbers. All entries are discounted to 2010 present values, in 2010 market prices; except for the BCR figures. Summary does not include monetised journey time reliability benefits.

Table 8.13: Core Scenario - Analysis of Monetised Cost and Benefits (AMCB)-Lowdham

Impact	With Scheme
Greenhouse Gases	216
Local Air Quality	7
Noise	Not Assessed
Travel Time Savings - Business	1,037
Travel Time Savings – Commuting & Other	6,356
Collisions	-2,034
Vehicle Operating Costs	Not Assessed
Indirect tax Revenue	Not Assessed
PVB	**5,582**
PVC	**4,242**
NPV	**1,340**
BCR	**1.32**

Notes: Note: Costs appear as positive numbers. All entries are discounted to 2010 present values, in 2010 market prices; except for the BCR figures. Summary does not include monetised journey time reliability benefits.

Table 8.14: Core Scenario - Analysis of Monetised Cost and Benefits (AMCB)-Kirk Hill

Impact	With Scheme
Greenhouse Gases	354
Local Air Quality	4
Noise	Not Assessed
Travel Time Savings - Business	1,449
Travel Time Savings – Commuting & Other	30,170
Collisions	Not Assessed
Vehicle Operating Costs	Not Assessed
Indirect tax Revenue	Not Assessed
PVB	**31,976**
PVC	**3,444**
NPV	**28,532**
BCR	**9.28**

Notes: Note: Costs appear as positive numbers. All entries are discounted to 2010 present values, in 2010 market prices; except for the BCR figures. Summary does not include monetised journey time reliability benefits.

Table 8.15: Core Scenario - Analysis of Monetised Cost and Benefits (AMCB)-All Junctions

Impact	With Scheme
Greenhouse Gases	870
Local Air Quality	13
Noise	286
Travel Time Savings - Business	5,155
Travel Time Savings – Commuting & Other	45,890
Collisions	-869
Vehicle Operating Costs	Not Assessed
Indirect tax Revenue	Not Assessed
PVB	**51,345**
PVC	**19,205**
NPV	**32,140**
BCR	**2.67**

Notes: Note: Costs appear as positive numbers. All entries are discounted to 2010 present values, in 2010 market prices; except for the BCR figures. Summary does not include monetised journey time reliability benefits.

8.9 The Department for Transport's "Value for Money Guidance" (2017, www.dft.gov.uk), describes how value for money can be categorised in four classes:

Figure 8-1: DfT Value for Money Guidance

Box 5.1 Standard Categories
(Transport cost outlays exceed revenues or cost savings)

VfM Category	Implied by…*
Very High	BCR greater than or equal to 4
High	BCR between 2 and 4
Medium	BCR between 1.5 and 2
Low	BCR between 1 and 1.5
Poor	BCR between 0 and 1
Very Poor	BCR less than or equal to 0

**Relevant indicative monetised and/or non-monetised impacts must also be considered and may result in a final value for money category different to that which is implied solely by the BCR. This chapter provides guidance on how to select the final value for money category.*

8.10 The BCR summarised in the AMCB table above, shows that the improvements deliver a positive economic case and represents High value for money. Other appraisal objectives, which have not been monetised, should be taken into account during the decision-making process.

8.11 Table 8.16 shows the Analysis of Monetised Costs and Benefits (AMCB) summary table showing the PVB, PVC, NPV and BCR for the 60-year scheme analyses under a High Growth Scenario.

Table 8.16: High Growth Scenario - Analysis of Monetised Cost and Benefits (AMCB) – All Junction

Impact	With Scheme
Greenhouse Gases	870
Local Air Quality	13
Noise	286
Travel Time Savings - Business	31,206
Travel Time Savings – Commuting & Other	97,802
Collisions	-869
Vehicle Operating Costs	Not Assessed
Indirect tax Revenue	Not Assessed
PVB	**129,308**
PVC	**19,205**
NPV	**110,103**
BCR	**6.73**

Notes: Note: Costs appear as positive numbers. All entries are discounted to 2010 present values, in 2010 market prices; except for the BCR figures. Summary does not include monetised journey time reliability benefits.

8.12 The BCR summarised in the AMCB table above, shows that the improvements deliver a positive economic case and represents Very High value for money under a High Growth Scenario. Other appraisal objectives, which have not been monetised, should be taken into account during the decision-making process.

8.13 Table 8.17 shows the Analysis of Monetised Costs and Benefits (AMCB) summary table under a Low Growth Scenario showing the PVB, PVC, NPV and BCR for the 60-year scheme analyses.

Table 8.17: Low Growth Scenario - Analysis of Monetised Cost and Benefits (AMCB) – All Junctions

Impact	With Scheme
Greenhouse Gases	870
Local Air Quality	13
Noise	286
Travel Time Savings - Business	-4,176
Travel Time Savings – Commuting & Other	-1,541
Collisions	-869
Vehicle Operating Costs	Not Assessed
Indirect tax Revenue	Not Assessed
PVB	**-5,417**
PVC	**19,205**
NPV	**-24,622**
BCR	**-0.28**

Notes: Note: Costs appear as positive numbers. All entries are discounted to 2010 present values, in 2010 market prices; except for the BCR figures. Summary does not include monetised journey time reliability benefits.

8.14 The BCR summarised in the AMCB table above, shows that the improvements deliver a negative economic case and represents Very Poor value for money under a Low Growth Scenario. Other appraisal objectives, which have not been monetised, should be taken into account during the decision-making process.

9. OBR Sensitivity Test

9.1 The DfT recently published updated versions of both the TAG Data Book (v1.14) and the Wider Impacts Dataset. These versions are consistent with the July 2020 Office for Budget Responsibility (OBR) forecasts and are intended for use as a sensitivity test in scheme appraisals.

9.2 The Forthcoming Change notice "TAG Data Book, appraisal software and TAG appraisal worksheets" states the requirement for scheme promoters to conduct sensitivity tests in modelling and appraisal using TAG Data Book v1.14. This requirement is in place until February 2021, when the updated OBR projections will be incorporated into formal guidance.

9.3 It is important to note that this appraisal-only sensitivity testing is likely to understate the full impact of the OBR updates, because no account is taken of the impact on demand.

9.4 Sensitivity testing has been undertaken by using the DfT's TUBA software (Version 1.9.14) and applying the economic parameters file 'Economics_TAG_db1_14_0.txt' which is consistent with TAG Data Book v1.14 July 2020.

9.5 Table 9.1 to Table 9.3 show, in monetary terms, the change due to the Do-Something, relative to the Do-Minimum scenario for the Low Growth, Core and High Growth scenarios across all junctions. All values in the Transport Economic Efficiency (TEE) table are in 2010 market prices and discounted to a 2010 present value year.

Table 9.1: Low Growth Scenario -TEE Table (£ thousands) All Junctions

Impact	Total	Personal	Freight
Consumer- Commuting – Travel Time	4,030		
Consumer - Commuting – VOC	Not Assessed		
Consumer - Commuting – During Construction	-3,665		
NET CONSUMER IMPACT - COMMUTING	**365**		
Consumer - Other – Travel Time	4,516		
Consumer - Other – VOC	Not Assessed		
Consumer - Other – During Construction	-7,788		
NET CONSUMER IMPACT - OTHER	**-3,272**		
Business – Travel Time	1,139	254	886
Business - VOC	Not Assessed		
Business – During Construction	-4,357		
Operating Costs	0		
Other Business – Developer contributions	-1,124		
NET BUSINESS IMPACT	**-4,342**		
PRESENT VALUE OF TRANSPORT ECONOMIC EFFICIENCY BENEFITS	**-7,248**		

Table 9.2: Core Scenario - TEE Table (£ thousands) All Junctions

Impact	Total	Personal	Freight
Consumer- Commuting – Travel Time	18,506		
Consumer - Commuting – VOC	Not Assessed		
Consumer - Commuting – During Construction	-3,665		
NET CONSUMER IMPACT - COMMUTING	**14,841**		
Consumer - Other – Travel Time	30,483		
Consumer - Other – VOC	Not Assessed		
Consumer - Other – During Construction	-7,788		
NET CONSUMER IMPACT - OTHER	**22,695**		
Business – Travel Time	9,083	1,512	7,570
Business - VOC	Not Assessed		
Business – During Construction	-4,357		
Operating Costs	0		
Other Business – Developer contributions	-1124		
NET BUSINESS IMPACT	**3,602**		
PRESENT VALUE OF TRANSPORT ECONOMIC EFFICIENCY BENEFITS	**41,139**		

Table 9.3: High Growth Scenario -TEE Table (£ thousands) All Junctions

Impact	Total	Personal	Freight
Consumer- Commuting – Travel Time	38,891		
Consumer - Commuting – VOC	Not Assessed		
Consumer - Commuting – During Construction	-3,665		
NET CONSUMER IMPACT - COMMUTING	**35,226**		
Consumer - Other – Travel Time	53,565		
Consumer - Other – VOC	Not Assessed		
Consumer - Other – During Construction	-7,788		
NET CONSUMER IMPACT - OTHER	**45,777**		
Business – Travel Time	30,981	5,036	25,944
Business - VOC	Not Assessed		
Business – During Construction	-4,357		
Operating Costs	0		
Other Business – Developer contributions	-1124		
NET BUSINESS IMPACT	**25,500**		
PRESENT VALUE OF TRANSPORT ECONOMIC EFFICIENCY BENEFITS	**106,504**		

9.6 Table 9.4 shows the Analysis of Monetised Costs and Benefits (AMCB) summary table under a Low Growth, Core and High Growth scenario showing the PVB, PVC, NPV and BCR for the 60-year scheme analyses.

Table 9.4: Analysis of Monetised Cost and Benefits (AMCB)

Impact	Low Scenario-With Scheme	Core Scenario-With Scheme	High Scenario-With Scheme
Greenhouse Gases	870	870	870
Local Air Quality	13	13	13
Noise	286	286	286
Travel Time Savings - Business	-4,342	3,602	25,500
Travel Time Savings – Commuting & Other	-2,907	37,536	81,003
Collisions	-869	-869	-869
Vehicle Operating Costs	Not Assessed	Not Assessed	Not Assessed
Indirect tax Revenue	Not Assessed	Not Assessed	Not Assessed
PVB	**-6,949**	**41,438**	**106,803**
PVC	**19,205**	**19,205**	**19,205**
NPV	**-26,154**	**22,233**	**87,598**
BCR	**-0.36**	**2.16**	**5.56**

9.7 Under the OBR sensitivity scenario the PVB and BCR summarised in the Table 9.4 above, would reduce slightly in all scenarios from those presented in section 8. The BCR summarised in the AMCB table above, shows that under the OBR sensitivity scenario, the improvements deliver a Very Poor value for money under a Low Growth Scenario, High value for money under a Core Scenario and Very High value for money under a High Growth Scenario. Other appraisal objectives, which have not been monetised, should be taken into account during the decision-making process.

10. Induced Investment

Induced Investment Introduction

10.1 The Department for Transport's appraisal process is based on the principles of the HM Treasury Green Book guidance, which advocates the use of cost-benefit (welfare) analysis to determine the value for money of investment spend. Welfare analysis captures a broad range of impacts, such as economic, environmental and social. The results of welfare analysis are reported in the Economic Case and inform the value for money assessment.

10.2 The method to estimate the incremental impact on scheme benefits arising from a transport scheme unlocking a development which would not have been possible in the absence of that investment is set out in TAG unit A2.2, Appraisal of Induced Investment (May 2020).

Land Value Uplift

10.3 TAG Unit A2.2, Appraisal of Induced Investment, May 2020 provides guidance on how to quantify and value induced investments impacts – changes in the level or location of private sector investment as a result of a transport investment – for their inclusion within transport appraisal as part of the value for money assessment; and as non-welfare metrics such as number of jobs and GDP. The assessment of Land Value Uplift associated with Dependent Development sites identified in Section 2 is in accordance with TAG Unit A2.2, Appendix D, Derivation of Land Value Uplift.

10.1 The Wider Economic Impacts Report (December 2020) contained in Appendix JJ of this report details:

- The methodology used to assess potential land value uplift associated with the scheme;
- A summary of the quantum of housing and employment land on the dependent sites;
- Key assumptions used in the assessment and sensitivity testing.

10.2 As noted in Table 3.1, the DfT's Value for Money Framework states that whilst benefits associated with Induced Investment should not be included in the initial benefit-cost metrics, it may be used to inform the scheme's value for money assessment. As such, Land Value Uplift benefits are excluded from the initial Analysis of Monetised Costs and Benefits but are presented to support the value for money case.

10.3 The Scheme is estimated to deliver £21.5m gross LVU, which is equivalent to £13.3m net additional Land Value Uplift.

Table 10.1: Land Value Uplift Summary (£millions)

	Gross impact of Scheme	Net impact of Scheme
Residential Land Value Uplift	£21.0m	£13.0m
Commercial Land Value Uplift	£0.5m	£0.3m
Total LVU	**£21.5m**	**£13.3m**

Source: Wider Economic Impacts Report, 2020; Values at 2010 prices

10.4 As noted, Land Value Uplift Benefits are excluded from the initial Analysis of Monetised Costs and Benefits but are presented in section 11 to inform the value for money case.

Transport External Costs

10.5 Transport External Costs refer to the impacts imposed by the transport users generated by the dependent development sites on all other transport users, such as increased levels of congestion.

10.6 The Dependent Development demand forecasts are detailed in Section 2.

10.7 The assessment of transport external costs of the dependent development requires two transport model runs:

- Scenario S - without the new housing but with the transport scheme; and
- Scenario R - with the new housing and with the transport scheme

10.8 The TEC assessment, in accordance with TAG Unit A2.2, paragraph 3.3.10 consisted:

- Scenario S – Core Scenario Demand assigned on to the Do Something junction models
- Scenario R –Dependent Development Demand assigned onto the Do Something junction models

10.9 A TEC analysis was undertaken using the Ollerton and Lowdham ARCADY models as detailed above. Outputs from the junction models for the 2023 opening year (Scenario S and R in 2023), 2037 non-dependent growth (Scenario S) and 2037 dependent growth scenarios (Scenario R).

10.10 The methodology as detailed in TAG guidance unit A2.2 (May 2020) and the Department for Transport TUBA software V1.9.14 was used to undertake this analysis, with the TUBA economic parameters file (23/08/2020 v2, TAG Data Book v1.13.1 July 2020).

10.11 The TEC are summarised for each junction in Table 1 below.

Table 10.2: A614 Transport External Costs (£millions)

	Ollerton TEC	Lowdham TEC	Combined TEC
Consumer User Benefits - Commuting	-0.868	-0.754	-1.622
Consumer User Benefits - Other	-2.652	-0.961	-3.613
Business User Benefits	-1.830	-0.641	-2.471
Net Present Value of Benefits (PVB)	**-5.350**	**-2.356**	**-7.706**
Notes: All entries are in market prices, at present values discounted to 2010, at 2010 market prices, in £ millions.			

10.12 The TAG assessment of Transport External Costs results in an overall disbenefit with Present Value of Benefits of -£7.706m.

10.13 These TEC impacts represent an increase in costs to existing road users as a result of the addition of new trips from the dependent development sites.

10.14 As noted in Table 2.1, the DfT's Value for Money Framework states that whilst benefits associated with Induced Investment should not be included in the initial benefit-cost results, it may be used to inform the scheme's value for money assessment. As such, monetised TEC impacts were excluded from the initial Analysis of Monetised Costs and Benefits but are presented to support the value for money case.

Land Amenity Value (LAV)

10.15 The 'amenity value' of a plot of land refers to the level of pleasantness of the area. TAG Unit A2.2 'Appraisal of Induced Investment, May 2020 provides guidance on how to quantify Land Amenity Value.

10.16 The TAG Data Book 'Valuing Dependent Development Workbook', incorporates estimates obtained by Department of Communities and Local Government (2001) and has been used as the basis of the LAV assessment of Thoresby Colliery and Teal Close development sites. The welfare impact from the change in land amenity value has been estimated as the difference between the present value benefits for different land types.

10.17 The LAV assessment is presented in the Wider Economic Impacts Report (Dec 2020) contained in Appendix JJ of this report.

10.18 At Thoresby Colliery, the development will take place on brownfield land and is anticipated to result in land amenity value gain. However, there is currently limited evidence available on the external amenity impact of development on brownfield land. As a conservative assumption and in line with the DCLG appraisal guide, it is assumed that the change in amenity value on the Thoresby Colliery site is zero.

10.19 At Teal Close, development will take place on agricultural land predominantly used to grow crops. This land is considered to have limited amenity value in terms of recreation or pleasantness of the area, and its agricultural uses are restricted to crops due history of site use for sewage sludge. 52 This type of land aligns with the definition for intensive agricultural land, with estimated land amenity value of £29,000 per hectare in perpetuity. The delivery of net additional 8.9ha of residential development at Teal Close is therefore estimated to amount to an amenity loss of £258,000 in present value (in 2010 prices).

Induced Investment Summary

10.20 TAG Unit A2.2, Table 2 sets out the formula for valuing the benefits of Dependent Development:

$$Total\ Benefits = LVU_D + Other - TEC - LAV - NTCI$$

Where:

LVU_D: Land Value Uplift adjusted for displacement (see paragraph 10.3);

Other: This includes Environmental Impacts, and Social and Distributional Impacts – TAG units A3 and A4 respectively (Not assessed);

TEC: Transport External Costs (see paragraph 10.5);

LAV: Land Amenity Value (see paragraph 10.15); and

NTCI: This refers to the costs associated with Non-Transport Complementary Interventions – the benefits are assumed to be captured by the land value uplift (no further assessment).

10.21 On this basis the total benefits of Dependent Development associated with the A614 Improvements are:

Table 10.3: A614 Induced Investment Benefits (£millions)

Induced Investment Benefits	Benefit (£m)
Land Value Uplift	£13.300m
Transport External Costs	-£7.706m
Land Amenity Value	-0.258m
Other	Not Assessed
Non-Transport Complementary Interventions	Not Assessed
Total Induced Investment	**£5.336M**
Notes: All entries are in market prices, at present values discounted to 2010, at 2010 market prices, in £ millions.	

11. Analysis of Monetised Costs and Benefits – Induced Investment

11.1 As noted in Table 3.1, the inclusion of indicative monetised impacts such as Induced Investment should be considered after the presentation of established and evolving monetised impacts. Section 8 presents the AMCB tables using the established monetised impacts. No evolving monetised impacts have been assessed at this stage.

11.2 Section 10 presents the Land Value Uplift (LVU) benefits and Land Amenity Values associated with the Scheme and the assessment of Transport External Costs (TEC). These were assessed using TAG Unit A2.2, Induced Investment, May 2020 and are both considered to be indicative monetised impacts. As such, the Induced Investment impacts have been excluded from the AMCB table in Section 8 but are included below to inform the Value for Money assessment.

11.3 Presented in Table 11.1 is the Analysis of Monetised Costs and Benefits (AMCB) summary table based upon the Core growth forecast assignments, taking the induced investment into account, and showing the PVB, PVC, NPV and BCR for the 60-year scheme analyses.

Table 11.1: Core Scenario with Induced Investment - Analysis of Monetised Cost and Benefits (AMCB) – All Junctions

Impact	With Scheme
Greenhouse Gases	870
Local Air Quality	13
Noise	286
Economic Efficiency – Business	5,155
Economic Efficiency – Commuting & Other	45,890
Collisions	-869
Induced Investment	5,336
Vehicle Operating Costs	Not Assessed
Indirect tax Revenue	Not Assessed
PVB	**56,681**
PVC	**19,205**
NPV	**37,476**
BCR	**2.95**

Notes: Note: Costs appear as positive numbers. All entries are discounted to 2010 present values, in 2010 market prices; except for the BCR figures. Summary does not include monetised journey time reliability benefits.

11.4 The BCR summarised in the AMCB table above, shows that the improvements deliver a positive economic case and represents High value for money under a Core Scenario with Induced Investment considered. Other appraisal objectives, which have not been monetised, should also be taken into account during the decision-making process.

High Alternative Growth – with Induced Investment

11.5 Table 11.2 shows the AMCB summary table based upon the High Growth Scenario, incorporating the induced investment benefits, and showing the PVB, PVC, NPV and BCR for the 60-year scheme analyses.

Table 11.2: High Growth Scenario with Induced Investment - Analysis of Monetised Cost and Benefits (AMCB) – All Junctions

Impact	With Scheme
Greenhouse Gases	870
Local Air Quality	13
Noise	286
Economic Efficiency – Business	31,206
Economic Efficiency – Commuting & Other	97,802
Collisions	-869
Induced Investment	5,336
Vehicle Operating Costs	Not Assessed
Indirect tax Revenue	Not Assessed
PVB	**134,644**
PVC	**19,205**
NPV	**115,439**
BCR	**7.01**

Notes: Note: Costs appear as positive numbers. All entries are discounted to 2010 present values, in 2010 market prices; except for the BCR figures. Summary does not include monetised journey time reliability benefits.

11.6 The BCR summarised in the AMCB table above, shows that the improvements deliver a positive economic case and represents Very High value for money under a High Growth Scenario with Induced Investment considered. Other appraisal objectives, which have not been monetised, should be taken into account during the decision-making process.

Low Alternative Growth – with Induced Investment

11.7 Table 11.3 shows the AMCB summary table based upon the Low Growth Scenario, incorporating the induced investment benefits, and showing the PVB, PVC, NPV and BCR for the 60-year scheme analyses.

Table 11.3: Low Growth Scenario with Induced Investment - Analysis of Monetised Cost and Benefits (AMCB) – All Junctions

Impact	With Scheme
Greenhouse Gases	870
Local Air Quality	13
Noise	286
Economic Efficiency – Business	-4,176
Economic Efficiency – Commuting & Other	-1,541
Collisions	-869
Induced Investment	5,336
Vehicle Operating Costs	Not Assessed
Indirect tax Revenue	Not Assessed
PVB	**-81**
PVC	**19,205**
NPV	**-19,286**
BCR	**-0.00**

Notes: Note: Costs appear as positive numbers. All entries are discounted to 2010 present values, in 2010 market prices; except for the BCR figures. Summary does not include monetised journey time reliability benefits.

11.8 The BCR summarised in the AMCB table above, shows that the improvements deliver a neutral economic case and represents Very Poor value for money under a Low Growth Scenario with Induced Investment considered. Other appraisal objectives, which have not been monetised, should also be taken into account during the decision-making process.

12. Summary and Conclusions

Summary

12.1 The economic assessment for the A614/A6097 Major Road Improvement Scheme was undertaken using the TUBA economic appraisal software and the COBALT accident appraisal software, for a 60-year appraisal period of 2023-2082 inclusive.

12.2 The economic assessment of the A614/A6097 Major Road Improvement Scheme was based upon the assignment of a forecast Core Growth Scenario, with sensitivity tests using Low alternative growth and High alternative growth assumptions. The Core Growth Scenario traffic forecast is based upon what the most likely land use and traffic growth assumptions.

12.3 Outputs from isolated junction models were used in the economic appraisal of the scheme to produce a monetised cost benefit analysis. The monetised cost benefit analysis of the scheme included the assessment of road user benefits and changes in revenues (i.e. indirect taxes), accident costs, and road-user costs during construction.

12.4 The assessments of Induced Investment (Land Value Uplift, Transport External Costs and Land Value Uplift) associated with Dependent Development sites identified in the Forecasting Package were documented.

Conclusions

12.5 The Core growth TEE benefits including the delays during construction, excluding accident benefits, carbon benefits, indirect tax revenue impacts and maintenance operations were £51.0 million (Table 4.5- 2010 market prices discounted to a 2010 present value year).

12.6 The High growth TEE benefits including the delays during construction, excluding accident benefits, carbon benefits, indirect tax revenue impacts and maintenance operations were £129.0 million (Table 5.5- 2010 market prices discounted to a 2010 present value year).

12.7 The Low growth TEE benefits including the delays during construction, excluding accident benefits, carbon benefits, indirect tax revenue impacts and maintenance operations were -£5.7 million (Table 6.5- 2010 market prices discounted to a 2010 present value year).

12.8 Accident costs over the appraisal period were appraised using the COBALT accident analysis software. Recorded accident data within Nottinghamshire were used to establish observed accident rates for each junction. For the Do Something assessment, default COBALT rates were applied for the proposed junction types for Ollerton & Lowdham. For Mickledale Lane, an alternative approach was adopted since NCC had recently upgraded a similar priority junction on the A614 (Rose Cottage, directly north of Deerdale Lane) to signal controlled, as proposed at Mickledale Lane.

12.9 The accident analysis showed that the implementation of the Scheme would result in a monetised benefit (refer to Table 7.4) of £-0.87 million in 2010 market prices discounted to a 2010 present value year.

12.10 Scheme cost estimates including developer contributions were provided by Nottinghamshire County Council in the form of a Most Likely Cost Estimate and were referred to as Investment Costs. The Present Value investment cost of the scheme (i.e. in 2010 market prices and discounted to a 2010 present value year) is £19.21 million (refer to Table 8.10).

12.11 A combined monetised noise impact of £0.29 million, a local air quality impact of £0.013 million and monetised carbon benefit of £0.87 million have been calculated by the VIA East Midlands and AECOM (December 2020).

12.12 The Core growth forecast results, were (all costs in 2010 market prices discounted to a 2010 present value year):

- PVB £51.4M
- PVC £19.2M
- NPV £32.1M
- BCR 2.67

12.13 For the Core growth forecast, the TUBA appraisals produced an overall NPV of £32.1 million (refer to Table 8.15) in 2010 market prices discounted to a 2010 present value year. This NPV included accident benefits, carbon benefits, construction delay disbenefits and indirect tax impacts. The BCR is 2.67, which the DfT would categorise as High value for money.

12.14 In addition to an assessment of the Core growth forecast, and in line with TAG advice, uncertainty in the forecasting process was considered through the preparation of two alternative growth forecasts referred to as Low and High alternative growth scenarios.

12.15 For the High growth forecast, the TUBA appraisals produced an overall NPV of £110.1 million (refer to Table 8.16) in 2010 market prices discounted to a 2010 present value year. This NPV included accident benefits, carbon benefits, construction delay disbenefits and indirect tax impacts. The BCR is 6.73, which the DfT would categorise as Very High value for money.

12.16 For the Low growth forecast, the TUBA appraisals produced an overall NPV of £-24.6 million (refer to Table 8.17) in 2010 market prices discounted to a 2010 present value year. This NPV included accident benefits, carbon benefits, construction delay disbenefits and indirect tax impacts. The BCR is negative, which the DfT would categorise as Very Poor value for money.

12.17 Sensitivity testing has been undertaken to review the impact of the July 2020 Office for Budget Responsibility (OBR) forecasts by using the DfT's TUBA software (Version 1.9.14) and applying the economic parameters file 'Economics_TAG_db1_14_0.txt' which is consistent with TAG Data Book v1.14 July 2020. Under an OBR forecast scenario the PVB and BCR would reduce slightly in all scenarios.

12.18 In accordance with DfT Value for Money Guidance, the benefits associated with Induced Assessment (Land Value Uplift, Transport External Costs and Land Amenity Value) were excluded from the initial analysis of monetised costs and benefits.

12.19 The Scheme is estimated to deliver £5.336m additional induced Investment benefits (Table 10.3).

12.20 For the Core growth forecast, including Induced Investment impacts, the appraisals produced an overall NPV of 37.5 million (refer to Table 11.1) in 2010 market prices discounted to a 2010 present value year. This NPV included accident benefits, carbon benefits, construction delay disbenefits, indirect tax impacts, land value uplift, Transport External Costs and Land Amenity Value.

12.21 The Core growth forecast results, with induced investment, were (all costs in 2010 market prices discounted to a 2010 present value year):

- PVB £56.7M
- PVC £19.2M
- NPV £37.5M
- BCR 2.95

12.22 With the inclusion of Induced Investment, the Scheme's economic appraisals, using the High alternative growth and Low alternative growth forecasts resulted in positive BCR values of 7.01 and 0.00 respectively (Table 11.2 and Table 11.3).

12.23 In transport economy terms, the combined package of improvements would provide high value for money under a Core and High growth scenario.