A12 Chelmsford to A120 widening scheme

TR010060

7.2 Transport Assessment

Appendix G: Junction Modelling Technical Notes – Local Road Junctions

APFP Regulation 5(2)(q)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Volume 7

August 2022

Infrastructure Planning

Planning Act 2008

A12 Chelmsford to A120 widening scheme

Development Consent Order 202[]

7.2 TRANSPORT ASSESSMENT

APPENDIX G: JUNCTION MODELLING TECHNICAL NOTES – LOCAL ROAD JUNCTIONS

Regulation Reference	Regulation 5(2)(q)
Planning Inspectorate Scheme Reference	TR010060
Application Document Reference	TR010060/APP/7.2
Author	A12 Project Team, National Highways

Version	**Date**	**Status of Version**
Rev 1	August 2022	DCO Application

CONTENTS

G.1. Maldon Rd / B1137 The Street: Junction Model Technical Note

G.1.1. Introduction

Overview

The purpose of this technical note is to describe the modelling assessment which has been undertaken for the B1137 The Street/Maldon Road junction as part of the A12 Chelmsford to A120 widening project.

Junction Location

The B1137 The Street/Maldon Road junction is located in Hatfield Peverel in Chelmsford. It is sited adjacent to the existing junction 20b on the A12 and provides access to/from the A12 from Hatfield Peverel in the west and from Maldon in the south.

The junction consists of a priority controlled mini roundabout layout, with three approach arms: Maldon Road, The B1137 The Street EB (in the west) and The Street WB (in the east). The junction layout will not be altered as part of the A12 scheme. However, the changes to the A12 junctions, particularly junction 21 which will be located close to the B1137 The Street/Maldon Road junction, will result in changes to traffic volumes through the junction. Therefore, the B1137 The Street/Maldon Road junction has been assessed to identify the likely impact the A12 scheme will have on the junction operation.

G.1.2. Modelled Scenarios

B1137 The Street/Maldon Road junction has been assessed using the industry standard Vissim software. The traffic scenarios listed below have been modelled. AM refers to the modelled hour of 07:30-08:30, IP refers to the average inter-peak hour (10:00-16:00hrs) and PM refers to the modelled hour of 17:00-18:00:

- Current operation 2019 – AM, PM
- Future operation with construction traffic 2025 (construction phase) – AM, IP, PM
- Future operation without scheme 2027 & 2042 – AM, PM
- Future operation with scheme 2027 & 2042 (operational phase) – AM, PM

Vissim Model Extents

The extents of the Vissim model are shown in Plate G 1.1. Details of the entry arms into the junction are described in Table G 1-1.

Plate G 1-1: B1137 The Street/Maldon Road Junction Vissim Model Extents

Table G 1-1: Description of B1137 The Street/Maldon Road Junction

Junction	Control Type	Entry Arms	Junction Description
B1137 The Street / Maldon Road	Priority control	Maldon Road NB	Existing junction layout; mini roundabout
		B1137 The Street EB (in the West)	
		The Street WB (in the East)	

The Street WB connects to the existing A12 SB off-slip. The model network also includes Wellington Bridge (B1137) to the north which crosses over the A12 mainline carriageway and connects to the existing A12 NB on-slip at the existing junction 20b with the A12. With the A12 scheme in place, the new junction 21 would move traffic approaching the B1137 The Street/Maldon Road junction from The Street WB to Wellington Bridge.

G.1.3. Key Assumptions & Input Parameters

The Vissim models have been developed based upon the modelling approach set out in Appendix E of the Transport Assessment. In addition, specific assumptions and parameters associated with the B1137 The Street/Maldon Road junction have also been included in the models and these are discussed below.

Current Operation Calibration and Validation

A base model representing the current layout and current operation of the B1137 The Street/Maldon Road junction has been developed for the AM and PM peaks representing a base year of 2019. The model was calibrated and validated against observed traffic flows and journey time data and achieved the calibration and validation criteria outlined in TAG. The base model, therefore, reliably replicates the observed behaviour of traffic at the junction and as such was considered suitable for testing of the future 2025, 2027 and 2042 without and with scheme traffic scenarios.

Further details of the base model calibration and validation can be found in Annex A.

Public Transport

Bus stops, routes and associated bus stopping times have been input for bus services 71, 73, 75, 505 and 676. Nine bus stops have been added to the network and these are located on the B1137 The Street, Maldon Road and The Street WB (in the east).

The bus routes have been included in all of the modelled scenarios for the AM, IP and PM peak models and are identifiable by the orange route marker in Plate G 1-2 to Plate G 1-3.

Plate G 1-2: Eastbound and Westbound Bus Route for Services 71 & 676

Plate G 1-3: Westbound Bus Route for Service 71

Plate G 1-4: Eastbound and Westbound Bus Route for Services 73, 75 & 505

G.1.4. Traffic Data

Construction Traffic

The future operation with construction traffic 2025 scenario has been developed to assess the impact of construction traffic on network operation at the B1137 The Street/Maldon Road junction. The peak year of construction is 2025 and the traffic flows for this scenario are a combination of the forecast background traffic levels for 2025 and the anticipated volume of construction vehicles.

To generate the 2025 background traffic flows, negative growth factors were applied to the 2027 without scheme traffic demand which are shown in Table G 1-2.

Table G 1-2: 2027 to 2025 Negative Growth Factors

Vehicle Type	Factor	Source
Car/LGV	0.985	Estimated from TEMPro 7.2 for Essex County for average weekday
HGV	0.988	Estimated from RTF 2018, July for trunk A category road type and for Eastern England region

Chapter 6 in the DCO Transport Assessment provides further details of how the levels of construction traffic has been derived. For the extents of the B1137 The Street/Maldon Road junction model, the Total and HGV without scheme and construction vehicles that are anticipated to pass directly through the junction are shown in Table G 1-3.

Table G 1-3: 2025 Construction Traffic

Scenario	AM		PM		IP	
	Total	HGV	Total	HGV	Total	HGV
Without Scheme 2025	1,931	78	1,936	16	1,395	57
Construction Traffic 2025	433	4	85	7	19	19

Future Operation with and Without Scheme

A strategic traffic model has been developed for the appraisal of the A12 scheme using industry standard SATURN software, further details of this can be found in the ComMA report. The AM, IP and PM peak traffic outputs from the SATURN model have been used as the vehicle inputs for the Vissim modelling. These can be found in full in Annex B.

A cordon of the strategic model was made which matched the Vissim model network. Flows were then extracted from the strategic model. The Total and HGV flows from the cordon SATURN models are shown below in Table G 1-4.

Table G 1-4: Total Cordoned Flow from SATURN Model (Vehicles)

Scenario	AM		PM	
	Total	HGV	Total	HGV
Current Operation 2019	1,838	94	1,883	32
Without Scheme 2027	1,964	79	1,972	17
Without Scheme 2042	2,183	84	2,133	18
With Scheme 2027	1,954	54	2,043	16
With Scheme 2042	2,149	61	2,297	15

G.1.5. Junction Modelling Outputs

Vissim Error & Warning Messages

Ten model simulation runs were carried out for each modelled scenario. The outputs Vissim demonstrated that there were no warnings or errors during the simulation runs for any of the modelled scenarios.

Vissim Model Outputs

The Vissim outputs presented include a Level of Service (LOS) category for each junction approach arm as well as for the junction as a whole. LOS is based upon average vehicle delay and can be used as a guide for how well the junction operates. Table G 1-5 shows the bands used in the LOS calculation.

Table G 1-5: Level of Service Categories

LOS	Signalised Junction Delay (s/veh)	Priority Junction Delay (s/veh)	Description of Traffic Operation
A	≤10 sec	≤10 sec	Highly stable, free-flow condition with little or no congestion.
B	10–20 sec	10–15 sec	Stable, free-flow condition with little congestion.
C	20–35 sec	15–25 sec	Stable flow condition, with moderate congestion.
D	35–55 sec	25–35 sec	Less stable Approaching unstable condition with increasing congestion.
E	55–80 sec	35–50 sec	Unstable flow condition, volume at or slightly over capacity, considerable delays.
F	>80 sec	>50 sec	Forced flow condition, volumes exceed capacity; long delays with stop-and-go traffic.

Vehicle delay is presented in seconds and queue length results have also been collected from the models in five-minute intervals. The results presented for each model show the average queue length for the peak hour models, as well as the average of the maximum queue length output.

Current Operation (2019)

The LOS, delay, and queue length Vissim results for the current operation 2019 scenario are presented in Table G 1-6.

Table G 1-6: Vissim Outputs 2019 Current Operation

Time Period	Entry arm	LOS	Vehicles	Vehicle Delay (s)	Average Queue (m)	Average Maximum Queue (m)
AM	Maldon Road NB	D	604	35	37	115
	B1137 The Street EB (West)	C	618	17	10	81
	The Street WB (East)	C	629	17	19	88
	Total	**C**	**1851**	**23**	**-**	**-**
PM	Maldon Road NB	C	595	22	15	83
	B1137 The Street EB (West)	D	839	33	53	178
	The Street WB (East)	B	451	12	8	51
	Total	**C**	**1885**	**25**	**-**	**-**

The model results show that the junction operates with a LOS C in both the AM and PM peak periods. There is queueing on Maldon Road NB in the AM peak and on B1137 The Street EB in the PM peak. This is as expected from the base model and reflects the longer observed journey times seen on these routes during the 2019 base model calibration.

For the current operation scenario, Plates G 1-4 and 1-5 below illustrate the average queue lengths on each junction approach for the AM and PM peaks respectively. The average queue lengths are identifiable by the red blocks and the queue length distance is also reported (m).

Plate G 1-4: 2019 AM Peak Current Operation Average Queue Lengths

Plate G 1-5: 2019 PM Peak Current Operation Average Queue Lengths

The results show that the junction experiences some level of traffic queuing in the current year of operation (2019) in both the AM and PM peaks. The longest average queue in the AM peak can be found on the Maldon Road approach (37m), which equates to an approximate traffic queue of 7 vehicles. The longest average queue in the PM peak can be found on the B1137 The Street EB (West) approach (53m), which equates to an approximate traffic queue of 9 vehicles.

Future Operation with Construction (2025)

The LOS, delay, and queue length Vissim results for the future operation with construction 2025 scenario are presented in Table G 1-7.

Table G 1-7: Vissim Outputs 2025 Future Operation with Construction

Time Period	Entry arm	LOS	Vehicles	Vehicle Delay (s)	Average Queue (m)	Average Maximum Queue (m)
AM	Maldon Road NB	E	710	43	64	156
	B1137 The Street EB (West)	C	667	21	18	106
	The Street WB (East)	D	602	32	58	176
	Total	**D**	**1978**	**32**	**-**	**-**
IP	Maldon Road NB	C	435	16	6	52
	B1137 The Street EB (West)	B	562	15	6	60
	The Street WB (East)	A	381	8	3	35
	Total	**B**	**1378**	**13**	**-**	**-**
PM	Maldon Road NB	C	580	23	16	85
	B1137 The Street EB (West)	E	845	36	63	188
	The Street WB (East)	C	550	17	16	74
	Total	**D**	**1975**	**27**	**-**	**-**

The model results show that the junction operates with a LOS D in both the AM and PM peak periods, and with a LOS B in the IP period.

For the AM peak, there is additional traffic queueing on The Street WB (East) approach, which is a result of the additional 433 construction vehicles anticipated to use this road. However, most of these vehicles do not travel through the B1137 The Street/Maldon Road junction and instead turn right onto Wellington Bridge to access the construction compound. The level of traffic queuing shown in the results is not anticipated to block back enough to interfere with the operation of the A12 mainline carriageway.

As can be seen in the next section of this report, for the PM peak, the modelled LOS is similar to that of the 2027 without scheme scenario results, and any additional traffic queuing or delays is a result of increased background traffic rather than the 85 additional construction vehicles which can be anticipated to travel through the B1137 The Street/Maldon Road junction.

For the future operation with construction traffic scenario, Plates G 1-6 and 1-7 below illustrate the average queue lengths on each junction approach for the AM and PM peaks respectively.

Plate G 1-6: 2025 AM Peak Future Operation with Construction Average Queue Lengths

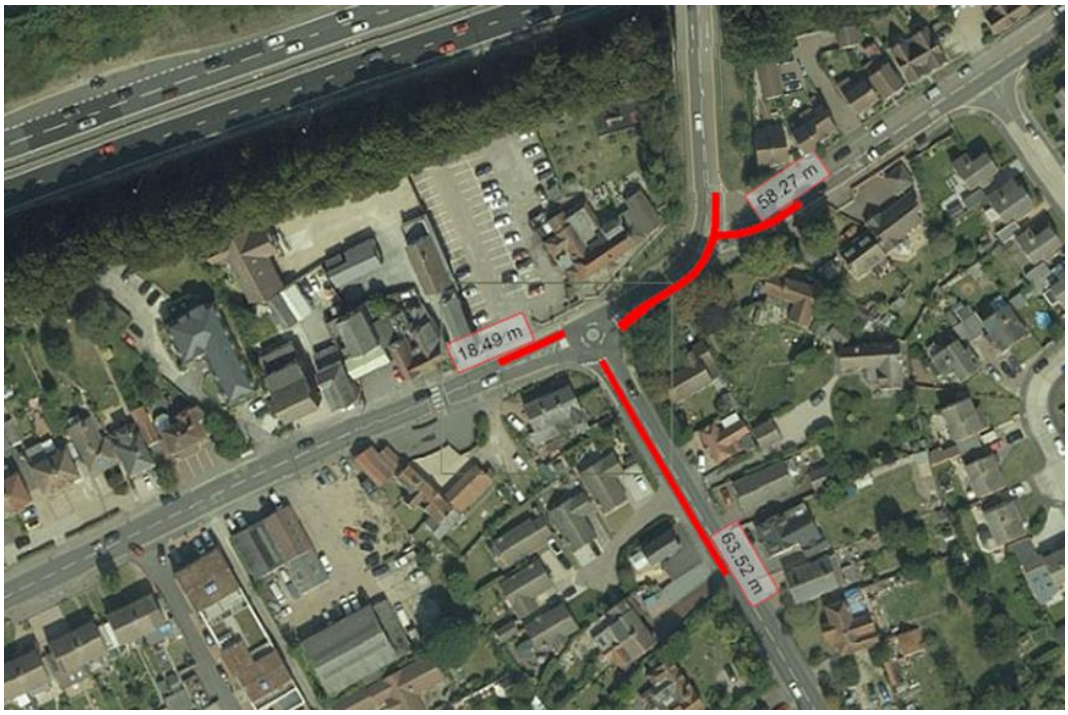


Plate G 1-7: 2025 PM Peak Future Operation with Construction Average Queue Lengths

The results show that the junction experiences some level of traffic queuing in the future operation with construction traffic scenario (2025) in both the AM and PM peaks. The longest average queue in the AM peak can be found on the Maldon Road approach (64m), which equates to an approximate traffic queue of 11 vehicles. The longest average queue in the PM peak can be found on the B1137 The Street EB (West) approach (62m), which equates to an approximate traffic queue of 11 vehicles.

Future Operation without Scheme (2027, 2042)

The LOS, delay, and queue length Vissim results for the future operation without scheme for 2027 and 2042 are presented in Tables G 1-8 and 1-9 respectively.

Table G 1-8: Vissim Outputs 2027 Future Operation without Scheme

Time Period	Entry arm	LOS	Vehicles	Vehicle Delay (s)	Average Queue (m)	Average Maximum Queue (m)
AM	Maldon Road NB	E	686	36	45	134
	B1137 The Street EB (West)	C	667	20	16	100
	The Street WB (East)	B	606	12	10	67
	Total	**C**	**1959**	**23**	**-**	**-**
PM	Maldon Road NB	C	589	23	16	86
	B1137 The Street EB (West)	E	851	37	66	195
	The Street WB (East)	C	512	15	12	60
	Total	**D**	**1951**	**27**	**-**	**-**

Table G 1-9: Vissim Outputs 2042 Future Operation without Scheme

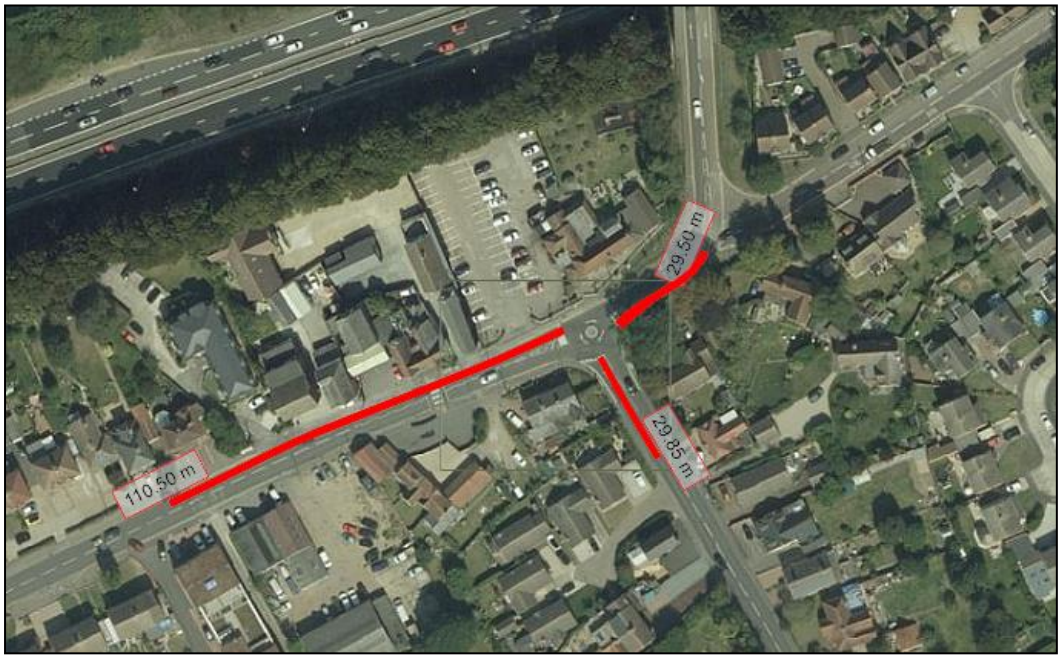
Time Period	Entry arm	LOS	Vehicles	Vehicle Delay (s)	Average Queue (m)	Average Maximum Queue (m)
AM	Maldon Road NB	E	749	49	84	184
	B1137 The Street EB (West)	D	794	27	34	140
	The Street WB (East)	C	631	15	15	79
	Total	**D**	**2173**	**31**	**-**	**-**
PM	Maldon Road NB	D	634	30	30	106
	B1137 The Street EB (West)	E	885	46	111	254
	The Street WB (East)	C	600	24	30	96
	Total	**D**	**2118**	**35**	**-**	**-**

The model results show that the junction operates with a LOS C for the 2027 and 2042 AM peak and with a LOS D for the 2027 and 2042 PM peak. The increase in vehicle delays and traffic queueing, compared to the current operation (2019) is caused by the higher volumes of traffic forecast to use this junction in future years.

For the 2042 future operation without scheme scenario, Plates G 1-8 and 1-9 below illustrate the average queue lengths on each junction approach for the AM and PM peaks respectively.

Plate G 1-8: 2042 AM Peak Future Operation without Scheme Average Queue Lengths

Plate G 1-9: 2042 PM Peak Future Operation without Scheme Average Queue Lengths



The results show that the junction experiences traffic queuing in the future operation without scheme in both the AM and PM peaks. The longest average queue in the AM peak can be found on the Maldon Road approach (84m), which equates to an approximate traffic queue of 15 vehicles. The longest average queue in the PM peak can be found on the B1137 The Street EB (West) approach (111m), which equates to an approximate traffic queue of 19 vehicles.

Future Operation with Scheme (2027, 2042)

The LOS, delay, and queue length Vissim results for the future operation with scheme for 2027 and 2042 are presented in Tables G 1-10 and 1-11 respectively.

Table G 1-10: Vissim Outputs 2027 Future Operation with Scheme

Time Period	Entry arm	LOS	Vehicles	Vehicle Delay (s)	Average Queue (m)	Average Maximum Queue (m)
AM	Maldon Road NB	E	804	38	62	169
	B1137 The Street EB (West)	D	441	27	20	77
	The Street WB (East)	A	701	8	5	52
	Total	**C**	**1945**	**25**	**-**	**-**
PM	Maldon Road NB	D	699	25	24	109
	B1137 The Street EB (West)	C	424	22	13	66
	The Street WB (East)	B	905	12	14	88
	Total	**C**	**2028**	**18**	**-**	**-**

Table G 1-11: Vissim Outputs 2042 Future Operation with Scheme

Time Period	Entry arm	LOS	Vehicles	Vehicle Delay (s)	Average Queue (m)	Average Maximum Queue (m)
AM	Maldon Road NB	E	832	49	101	215
	B1137 The Street EB (West)	E	512	43	45	112
	The Street WB (East)	A	803	10	9	69
	Total	**D**	**2147**	**33**	**-**	**-**
PM	Maldon Road NB	D	736	29	34	124
	B1137 The Street EB (West)	E	565	37	40	115
	The Street WB (East)	B	981	14	21	113
	Total	**C**	**2282**	**25**	**-**	**-**

The model results show that the junction operates with a LOS C in the 2027 AM peak and with a LOS D in the 2042 AM peak. The junction operates with a LOS C in the 2027 and 2042 PM peaks.

There is an increase in the traffic queue lengths during the AM peak on the Maldon Road approach to the junction. The average queue on this approach in 2042 is 101m compared to 84m in the future operation without scheme scenario. This is the result of an increase in traffic using Maldon Road with the A12 scheme in place.

The PM peak models show a reduction in the traffic queue lengths and vehicle delay for the B1137 The Street EB (West). In 2042, the average queue length on this approach is 40m, which is a significantly shorter queue length than that modelled in the without scheme scenario where the average queue length is 111m on this junction approach.

The improved operation in the PM peak is due to a traffic pattern change at the B1137 The Street/Maldon Road junction. In the without scheme scenario, traffic travelling towards Maldon would leave the A12 at junction 20b, travel through Hatfield Peverel and turn right into Maldon Road at the junction to travel south towards Maldon. In the with scheme scenario, the same traffic approaches from the new junction 21 and travels on The Street WB (East) junction approach and turns left into

Maldon Road towards Maldon. Even though higher volumes of traffic use the B1137 The Street/Maldon Road junction during the PM peak in the with scheme scenario, there is an improvement in traffic queues and vehicle delays at the junction as a result of changes to traffic movements and in routes taken through the junction.

For the 2042 future operation with scheme scenario, Plates G 1-10 and 1-11 below illustrate the average queue lengths on each junction approach for the AM and PM peaks respectively.

Plate G 1-10: 2042 AM Peak Future Operation with Scheme Average Queue Lengths

Plate G 1-11: 2042 PM Peak Future Operation with Scheme Average Queue Lengths

The results show that the junction experiences traffic queuing in the future operation with scheme scenarios during the AM and PM peaks. The longest average queue in the AM peak can be found on the Maldon Road approach (101m), which equates to an approximate traffic queue of 18 vehicles. The longest average queue in the PM peak can be found on the B1137 The Street EB (West) approach (40m), which equates to an approximate traffic queue of 7 vehicles.

G.1.6. Summary

The Vissim modelling results demonstrate that the B1137 The Street/Maldon Road junction currently experiences some level of traffic queuing and vehicle delay in the current year of operation (2019), when the junction operates with a LOS C in the AM and PM peaks. The longest queues are seen on Maldon Road (NB) in the AM peak and B1137 The Street (EB) in the PM peak.

The with construction traffic 2025 model results in the junction operating with a LOS D in the AM and PM peaks. There may be additional queues on The Street WB (East) during the AM peak due to the construction vehicles using this road to access the construction compound via Wellington Bridge.

For the future operation forecast years of 2027 and 2042, the modelling results demonstrate an increase in traffic queuing and vehicle delay for both the without scheme and with scheme scenarios for both 2027 and 2042. This is to be expected as traffic demand increases in the future years.

It is anticipated that traffic queueing on Maldon Road in the AM peak will be greater in the with scheme scenario, resulting from an increase in traffic levels brought about by the A12 scheme.

It is anticipated that queueing on The Street EB (West) would be reduced in the PM peak in the with scheme scenario. This is due to a change in the traffic patterns, with traffic expected to use the new junction 21 and approach the B1137 The Street/Maldon Road junction from the east, turning left into Maldon Road.

A summary of the LOS and vehicle delay results for the modelled scenarios at B1137 The Street/Maldon Road junction is provided in Table G 1-12.

Table G 1-12: LOS and Vehicle Delay Summary

Scenario	AM		PM		IP	
	LOS	Veh Delay (sec)	LOS	Veh Delay (sec)	LOS	Veh Delay (sec)
Current Operation 2019	C	23	C	25	B	12
With Construction 2025	D	32	D	27	B	13
Without Scheme 2027	C	23	D	27		
With Scheme 2027	C	25	C	18		
Without Scheme 2042	D	31	D	35		
With Scheme 2042	D	33	C	25		

G.1.7. Annex A B1137 The Street/Maldon Road Base Model Validation Report

G.1.7.1. Introduction

A 2019 base year Vissim micro-simulation model has been developed for the junction of B1019 Maldon Road and B1137 The Street in Hatfield Peverel. It will be used to assess the possible impact the A12 scheme may have on the junction in the forecast years.

Purpose of Report

The purpose of this technical note is to document the development of the base year Vissim traffic model for AM, PM, and Inter Peak time periods. The report details the calibration and validation of the model against observed datasets including traffic counts and journey time data.

Report structure

The remainder of the report is structured into the following sections:

- Section G.1.7.2 – Model Development: This section describes the various parameters and assumptions used in the development of the model network.
- Section G.1.7.3 – Traffic Demand: This section outlines the survey count data used within the model development process.
- Section G.1.7.4 – Journey Time Data: This section outlines the journey time data and routes used for the validation process
- Section G.1.7.5 and G.1.7.6 – Count Calibration: This section explains the base model calibration process.
- Section G.1.7.7 – Journey Time Validation: This section sets out the validation criteria employed and presents comparisons between modelled and observed data.
- Section G.1.7.8 – Summary: This section includes a summary of the base model development undertaken and a recommendation regarding whether the model is suitable for its intended purpose.

G.1.7.2. Model Development

Software Specification

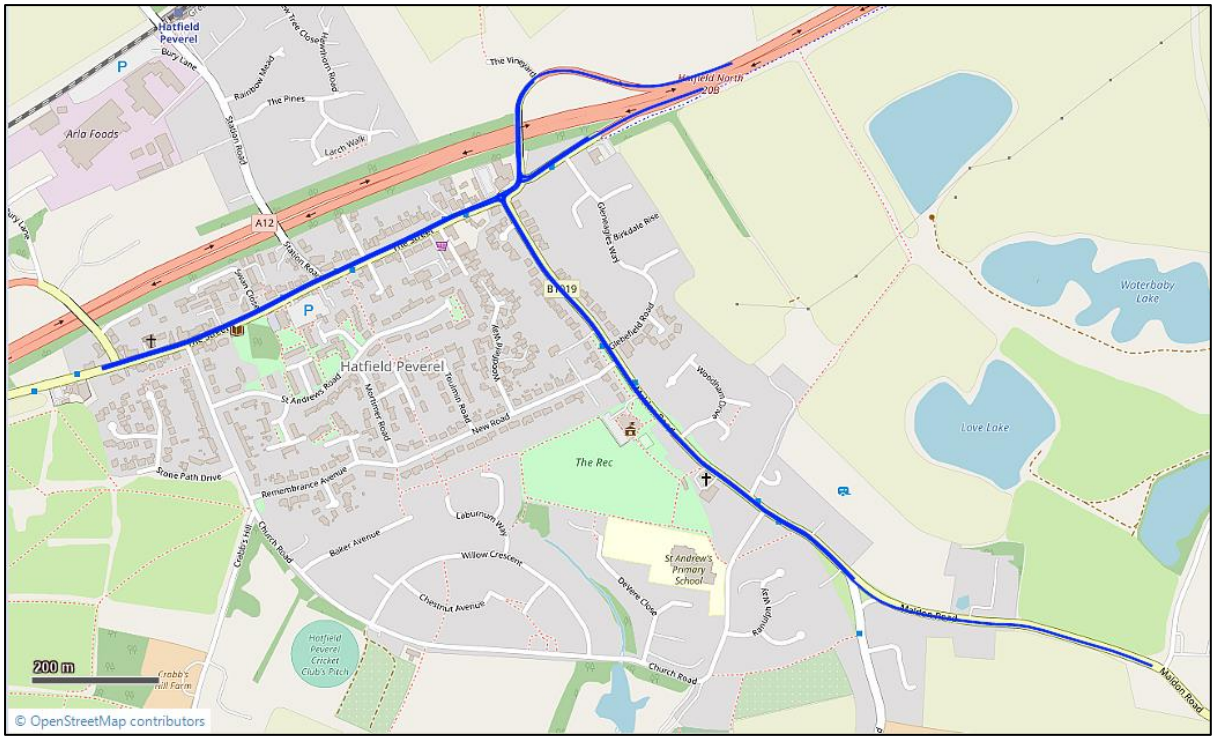
The base model has been developed in Vissim 2020-08

Model Extent

The Vissim model covers the area identified in Plate G 1-12. The base model includes:

- B1137 The Street (West)
- B1019 Maldon Road
- B1137 The Street (East)
- B1137 Wellington Bridge

Plate G 1-12: Network Extent



It should be noted that other roads joining onto either Maldon Road or The Street have not been included within the model extents as the focus of the assessment is solely the operation of the mini roundabout at the junction of Maldon Road and The Street. The traffic demand used in the base model is from observed traffic counts at the junction and the future year traffic demand is from the SATURN model, therefore, the Vissim models capture all traffic demand at the junction.

Model Periods

The peak hours modelled match those which are modelled in the strategic Saturn model, and are as follows:

- AM peak – 07:30 to 08:30
- IP (average hour) – 10:00 to 16:00
- PM peak – 17:00 to 18:00

The model has the validated periods as shown above and also includes a 15-minute 'warm-up' period, used to populate the network with traffic prior to the evaluation periods. It was considered that a 'cool-down' period would not be required for this study.

User Classes

The Maldon Road / The Street Vissim model includes two vehicle types:

- Car
- HGV

Signal Timings

The junction of Maldon Road and The Street in Hatfield Peverel is a mini roundabout. No signals have been included within the model.

Model Assignment

Static route assignment was used in the base model for all movements. There is no route choice for the movements through the model network.

Public Transport

Bus routes and associated bus stopping times have been input for bus services 71, 73, 505 and 676. Nine bus stops have been added to the network.

Site Observations

No site observations have been carried out. This should be regarded as a weakness to the modelling.

Desired Speed Distributions

Desired speed distributions have been created based on Department for Transport (DfT) data - Table SPE0111: Free flow vehicle speeds by road type and vehicle type in Great Britain. The speed distributions within this model are based on 2019 data.

Driving Behaviour Types

Within the model just one driving behaviour type has been used for all links - "Urban (motorized)". The Vissim default parameter values have been maintained for this driving behaviour type.

G.1.7.3. Traffic Demand

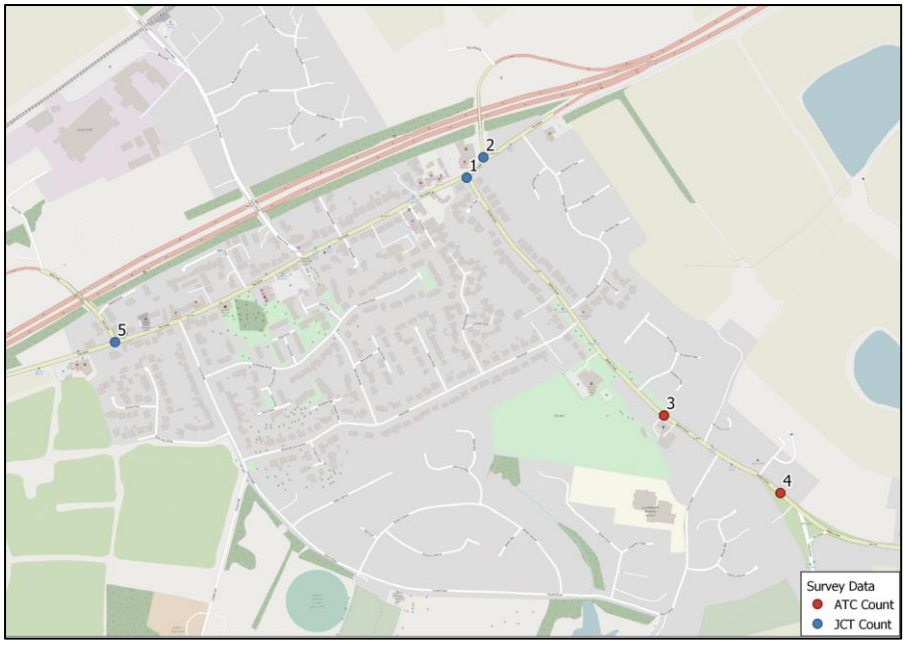
Traffic Survey Data

It was not possible to collect new traffic count data as part of this study. The traffic count data available is shown in Table G 1-13 and graphically in Plate G 1-13.

Table G 1-13: Traffic count data available

Site number	Location	Count Type	Date of survey
1	Maldon Road / The Street	JCT	7th Feb 2017
2	The Street / Wellington Bridge	JCT	10th May 2016
3	Maldon Road	ATC	7th Feb 2017 - 13th Feb 2017
4	Maldon Road	ATC	20th June 2016 - 14th July 2016
5	The Street / Bury Lane	JCT	10th May 2016

Plate G 1-13: Location of traffic count data



For this model, the traffic flows will be based on the data from site 1, which is a 1-day Manual Classified Turning Count (MCTC) undertaken on Tuesday 7th February 2017.

Counts 3, 4 and 5 were considered to be too far away from the junction, particularly as side roads within Hatfield Peverel have not been included in the model. Volumes of traffic between count site 1 and 2 were compared, and given they are one day turning counts from different dates, they were broadly similar.

Traffic Survey Classification

Below, Table G 1-14 shows how data from the MCTC survey was classified:

Table G 1-14: Survey data vehicle classification

MCTC classification	Vissim Vehicle Type
Cars	Car
LGV 1	
LGV2	
MGV	HGV
HGV 1	
HGV 2	
PSV (bus / coach)	
Motorbike	Not included
Cyclist	Not included

Factoring count data to 2019

The MCTC survey was undertaken in 2017, in order to be able to validate the model against 2019 journey time data the survey data was factored using RTF18 growth factors. This follows the same methodology adopted by the strategic modelling for A12 project. Factors suitable for 'minor road' were applied; to convert from 2017 to 2019 the following factors were used:

- Car 1.021
- HGV 0.992

G.1.7.4. Journey Time and Queue Data

Journey Time Data

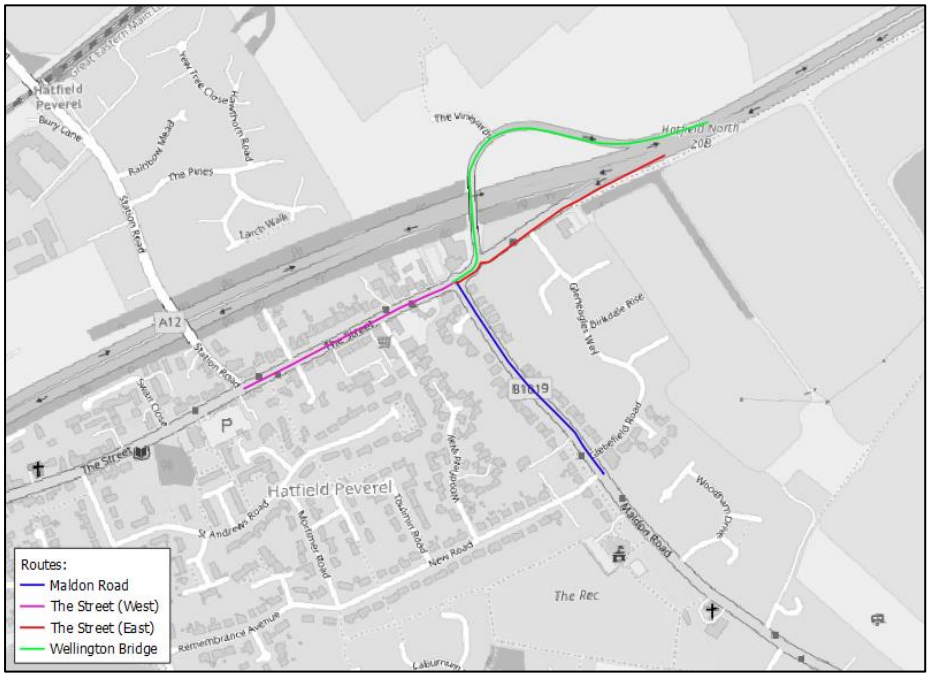
The journey time data used for model validation is from the 2019 TrafficMaster database. This dataset was used to validate the representation of journey times and delays in the model along key routes. The TrafficMaster database contains journey time and speed information obtained from journeys made by vehicles fitted with TrafficMaster GPS tracking devices (SmartNav) and is available by date in 15-minute intervals and by vehicle type. The datasets are then mapped to the Ordnance Survey Integrated Transport Network (ITN) to provide speed and travel time information on a link by link basis.

Six journey time routes have been defined in the Vissim Model. Route descriptions are presented in Table G 1-15, and the location of the routes is presented in Plate G 1-14.

Table G 1-15: Journey time route description

Route no.	Description	Route length
1	Maldon Road NB	320
2	Maldon Road SB	320
3	The Street (West) EB	311
4	The Street (West) WB	311
5	The Street (East) WB	323
6	Wellington Bridge EB	506

Plate G 1-14: Journey Time Routes



The data was processed in SQL to provide AM, IP, and PM journey times for an average weekday in the neutral months of 2019. The data was cleaned to avoid all bank and school holidays, the final dataset was then based on an average weekday. The day to day variability was also monitored on each link by using the recorded mean and standard deviation travel times for each ITN link for all vehicles, and any daily outliers with standard deviations greater than 2 from the mean were removed from the data set.

Queue Data

No queue data was available. The validation of the model will rely solely on the journey time data.

G.1.7.5. Count Calibration and Validation

Criteria

TAG contains two sets of measures to assess link flow validation, as follows:

The absolute and percentage differences between modelled flows and counts.

The GEH statistic, which is a form of the Chi-squared statistic that incorporates both relative and absolute errors, and is defined as follows:

$$GEH = \sqrt{\frac{(M-O)2}{(M+O)/2}}$$

Where M is the modelled flow and O is the observed flow.

These two measures are broadly consistent and link flows that meet either criterion should be regarded as satisfactory.

The acceptability guidelines as outlined in TAG Unit M3.1 are shown in Table G 1-16 below.

Table G 1-16: Link Flow and Turning Movement Validation Criteria and Acceptability Guidelines

	Criteria and Measure	Acceptability Guideline	
Flow Criteria			
1	Observed flow < 700vph	Modelled flow within +/- 100vph	> 85% of links
	Observed flow 700 to 2700vph	Modelled flow within +/- 15%	
	Observed flow > 2700vph	Modelled flow within +/- 400vph	
GEH Criteria			
2	GEH statistic for individual links < 5		> 85% of links

G.1.7.6. Calibration Results

As the Vissim model has no allowance for route choice all counts are effectively used as calibration counts and there is no independent validation count dataset, instead journey times are used as the validation dataset.

Turning flows have been calibrated in each modelled time period. A summary of the calibration achieved by the models based on an average of 10 simulation seed runs can be seen in Tables G 1-17 to 1-19 below.

Table G 1-17: AM Peak Turning Flows (vehicles)

From	To	Observed (vehs)	Modelled (vehs)	Difference (vehs)	GEH	Pass / Fail
The Street (West)	Maldon Road	377	379	2	0.1	Pass
The Street (West)	Wellington Bridge	231	239	8	0.5	Pass
Maldon Road	The Street (West)	453	454	1	0.1	Pass
Maldon Road	Wellington Bridge	151	151	0	0.0	Pass
The Street (East)	The Street (West)	440	438	-2	0.1	Pass
The Street (East)	Maldon Road	186	188	2	0.2	Pass
All Movements		1838	1850	12		

Table G 1-18: IP Peak Turning Flows (vehicles)

From	To	Observed (vehs)	Modelled (vehs)	Difference (vehs)	GEH	Pass / Fail
The Street (West)	Maldon Road	314	319	5	0.3	Pass
The Street (West)	Wellington Bridge	170	172	2	0.2	Pass
Maldon Road	The Street (West)	314	309	-5	0.3	Pass
Maldon Road	Wellington Bridge	153	156	3	0.2	Pass
The Street (East)	The Street (West)	164	165	1	0.1	Pass
The Street (East)	Maldon Road	149	150	1	0.1	Pass
All Movements		1265	1265	1270		

Table G 1-19: PM Peak Turning Flows (vehicles)

From	To	Observed (vehs)	Modelled (vehs)	Difference (vehs)	GEH	▪ ass / Fail
The Street (West)	Maldon Road	480	479	-1	0.0	Pass
The Street (West)	Wellington Bridge	355	360	5	0.3	Pass
Maldon Road	The Street (West)	392	388	-4	0.2	Pass
Maldon Road	Wellington Bridge	203	207	4	0.3	Pass
The Street (East)	The Street (West)	281	283	2	0.1	Pass
The Street (East)	Maldon Road	172	168	-4	0.3	Pass
All Movements		1883	1885	2		

G.1.7.7. Journey Time Validation

Journey time routes located on the key roads within the modelled road network were coded into the model, with the model validated to journey times on the routes identified in Section G.1.7.4.

Acceptability guidelines set out in TAG recommend that average modelled travel times should be within 15% of the corresponding observed values (or within one minute if 15% of the observed value is less than a minute) in at least 85% of cases. The observed mean journey time for each route has been used to validate against and is deemed to be sufficient to meet the requirements set out in the guidance.

Results were collected from the models for 10 simulation seed runs, and an average across vehicle categories was taken to give an average journey time for each route. The results can be seen in Tables G 1-20 to Table 1-22.

Table G 1-20: AM Journey Time Validation

Ref.	Name	Observed (seconds)	Modelled (seconds)	Difference (seconds)	% Difference	Pass / Fail
1	Maldon Road NB	61	56	-4	-7%	Pass
2	Maldon Road SB	29	27	-2	-5%	Pass
3	The Street (West) EB	39	41	1	4%	Pass
4	The Street (West) WB	40	32	-7	-19%	Fail
5	The Street (East) WB	35	36	1	4%	Pass
6	Wellington Bridge EB	36	34	-2	-6%	Pass

Table G 1-21: IP Journey Time Validation

Ref.	Name	Observed (seconds)	Modelled (seconds)	Difference (seconds)	% Difference	Pass / Fail
1	Maldon Road NB	35	36	1	1%	Pass
2	Maldon Road SB	28	27	-1	-4%	Pass
3	The Street (West) EB	36	38	2	5%	Pass
4	The Street (West) WB	33	31	-2	-5%	Pass
5	The Street (East) WB	30	29	-2	-6%	Pass
6	Wellington Bridge EB	36	34	-2	-6%	Pass

Table G 1-22: PM Journey Time Validation

Ref.	Name	Observed (seconds)	Modelled (seconds)	Difference (seconds)	% Difference	Pass / Fail
1	Maldon Road NB	39	43	4	11%	Pass
2	Maldon Road SB	28	27	-1	-3%	Pass
3	The Street (West) EB	49	53	4	8%	Pass
4	The Street (West) WB	36	31	-5	-14%	Pass
5	The Street (East) WB	38	33	-5	-13%	Pass
6	Wellington Bridge EB	36	34	-2	-5%	Pass

One journey time route in the AM time period does not meet TAG criteria, all other routes do pass the criteria.

The journey time route which does not pass in the AM peak, “The Street (West) WB”, validates traffic travelling away from the Maldon Road / The Street junction and towards the junction of The Street / Station Road. The modelled journey time for this route is too quick in all three time periods; this is because the model does not contain the junction of The Street / Station road which would add delay to this journey time route. For the purpose of this study, which is to assess the operation of the Maldon Road and The Street junction, it is not of concern that this one route does not meet TAG criteria.

G.1.7.8. Summary

This report details the calibration and validation of the Vissim base model for Maldon Road / The Street in Hatfield Peverel.

Vissim modelling has been undertaken to replicate the observed behaviour of traffic for AM, PM, and Inter Peak time periods. The calibration and validation results achieved by the model show that they offer a consistent and reliable approximation of observed baseline conditions.

Journey time comparisons also show a good match with observed data.

The Vissim base model as described is considered suitable for testing forecast year with scheme and without scheme flows.

G.1.8. Annex B

Traffic Flows in vehicles per hour used in the Vissim assessments. Current operation 2019:

AM Peak - Car

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	362	0	216	**579**
Maldon Road (South)	433	0	0	140	**573**
The St (East)	417	176	0	0	**592**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**849**	**538**	**0**	**356**	**1744**

AM Peak - HGV

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	15	0	15	**30**
Maldon Road (South)	20	0	0	11	**31**
The St (East)	24	10	0	0	**34**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**44**	**25**	**0**	**26**	**94**

IP Peak - Car

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	301	0	158	**458**
Maldon Road (South)	303	0	0	141	**443**
The St (East)	153	132	0	0	**285**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**455**	**433**	**0**	**299**	**1187**

IP Peak - HGV

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	14	0	12	**26**
Maldon Road (South)	12	0	0	12	**24**
The St (East)	11	17	0	0	**28**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**23**	**31**	**0**	**24**	**78**

PM Peak - Car

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	476	0	351	**827**
Maldon Road (South)	385	0	0	197	**582**
The St (East)	272	171	0	0	**442**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**657**	**646**	**0**	**548**	**1851**

PM Peak - HGV

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	4	0	4	**8**
Maldon Road (South)	7	0	0	6	**13**
The St (East)	9	2	0	0	**11**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**16**	**6**	**0**	**10**	**32**

Traffic Flows in vehicles per hour from the strategic SATURN model used in the Vissim assessments. Future operation with construction traffic 2025:

AM Peak - Car

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	310	3	300	**613**
Maldon Road (South)	498	0	1	154	**654**
The St (East)	350	222	0	14	**586**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**848**	**532**	**4**	**468**	**1853**

AM Peak - HGV

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	9	0	26	**36**
Maldon Road (South)	12	0	0	7	**19**
The St (East)	17	5	0	2	**23**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**29**	**14**	**0**	**35**	**78**

AM Peak – Car Construction

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	0	0	0	**0**
Maldon Road (South)	0	0	0	37	**37**
The St (East)	0	0	0	352	**352**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**0**	**0**	**0**	**389**	**389**

AM Peak - Minibus Construction

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	0	0	9	**9**
Maldon Road (South)	0	0	0	0	**0**
The St (East)	9	0	0	23	**32**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**9**	**0**	**0**	**32**	**40**

AM Peak - HGV Construction

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	0	0	0	**0**
Maldon Road (South)	0	0	0	0	**0**
The St (East)	0	0	0	4	**4**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**0**	**0**	**0**	**4**	**4**

IP Peak - Car

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	327	7	197	**531**
Maldon Road (South)	299	0	4	117	**421**
The St (East)	213	150	0	24	**386**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**512**	**477**	**11**	**338**	**1338**

IP Peak - HGV

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	8	0	14	**22**
Maldon Road (South)	9	0	0	6	**15**
The St (East)	16	5	0	0	**21**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**25**	**13**	**0**	**20**	**57**

IP Peak – Car Construction

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	0	0	0	**0**
Maldon Road (South)	0	0	0	0	**0**
The St (East)	0	0	0	0	**0**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**0**	**0**	**0**	**0**	**0**

IP Peak - Minibus Construction

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	0	0	0	**0**
Maldon Road (South)	0	0	0	0	**0**
The St (East)	0	0	0	0	**0**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**0**	**0**	**0**	**0**	**0**

IP Peak - HGV Construction

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	0	0	0	**0**
Maldon Road (South)	0	0	0	0	**0**
The St (East)	0	0	0	19	**19**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**0**	**0**	**0**	**19**	**19**

PM Peak - Car

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	511	13	304	**828**
Maldon Road (South)	345	0	4	224	**573**
The St (East)	306	197	0	14	**518**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**651**	**709**	**18**	**542**	**1920**

PM Peak - HGV

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	3	0	4	**7**
Maldon Road (South)	4	0	0	2	**6**
The St (East)	2	1	0	0	**3**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**5**	**5**	**0**	**6**	**16**

PM Peak – Car Construction

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	0	0	0	**0**
Maldon Road (South)	0	0	0	0	**0**
The St (East)	0	37	0	0	**37**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**0**	**37**	**0**	**0**	**37**

PM Peak - Minibus Construction

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	0	0	9	**9**
Maldon Road (South)	0	0	0	0	**0**
The St (East)	9	0	0	23	**32**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**9**	**0**	**0**	**32**	**40**

PM Peak - HGV Construction

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	0	0	0	**0**
Maldon Road (South)	0	0	0	0	**0**
The St (East)	0	0	0	7	**7**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**0**	**0**	**0**	**7**	**7**

Traffic Flows in vehicles per hour from the strategic SATURN model used in the Vissim assessments. Future operation without scheme 2027:

AM Peak - Car

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	315	3	304	**622**
Maldon Road (South)	506	0	1	156	**664**
The St (East)	355	225	0	14	**595**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**861**	**541**	**5**	**475**	**1881**

AM Peak - HGV

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	9	0	27	**36**
Maldon Road (South)	12	0	0	7	**19**
The St (East)	17	5	0	2	**24**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**29**	**14**	**0**	**36**	**79**

PM Peak - Car

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	519	14	308	**841**
Maldon Road (South)	350	0	4	228	**582**
The St (East)	311	200	0	15	**526**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**661**	**719**	**18**	**550**	**1949**

PM Peak - HGV

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	3	0	4	**8**
Maldon Road (South)	4	0	0	2	**6**
The St (East)	2	1	0	0	**3**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**6**	**5**	**0**	**6**	**17**

Traffic Flows in vehicles per hour from the strategic SATURN model used in the Vissim assessments. Future operation without scheme 2042:

AM Peak - Car

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	339	3	403	**746**
Maldon Road (South)	572	0	1	151	**725**
The St (East)	362	244	0	18	**625**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**935**	**584**	**5**	**573**	**2096**

AM Peak - HGV

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	10	0	27	**37**
Maldon Road (South)	13	0	0	10	**23**
The St (East)	17	5	0	2	**24**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**30**	**15**	**0**	**39**	**84**

PM Peak - Car

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	534	13	333	**880**
Maldon Road (South)	379	0	4	243	**626**
The St (East)	387	212	0	4	**603**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**766**	**746**	**18**	**579**	**2109**

PM Peak - HGV

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	4	0	4	**7**
Maldon Road (South)	4	0	0	3	**7**
The St (East)	2	2	0	0	**4**
B1137 Wellington Bridge (North)	0	0	0	0	**0**
Total	**6**	**5**	**0**	**6**	**18**

Traffic Flows in vehicles per hour from the strategic SATURN model used in the Vissim assessments. Future operation with scheme 2027:

AM Peak - Car

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	133	1	278	**412**
Maldon Road (South)	144	0	1	648	**793**
The St (East)	2	5	0	18	**25**
B1137 Wellington Bridge (North)	269	395	6	0	**670**
Total	**415**	**532**	**8**	**944**	**1900**

AM Peak - HGV

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	2	0	18	**20**
Maldon Road (South)	1	0	0	7	**8**
The St (East)	0	0	0	0	**0**
B1137 Wellington Bridge (North)	17	9	0	0	**26**
Total	**18**	**11**	**0**	**25**	**54**

PM Peak - Car

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	134	1	275	**411**
Maldon Road (South)	143	0	4	544	**691**
The St (East)	1	3	0	9	**13**
B1137 Wellington Bridge (North)	238	655	19	0	**911**
Total	**382**	**792**	**24**	**828**	**2027**

PM Peak - HGV

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	3	0	4	**7**
Maldon Road (South)	3	0	0	3	**6**
The St (East)	0	0	0	0	**0**
B1137 Wellington Bridge (North)	2	2	0	0	**3**
Total	**5**	**5**	**0**	**7**	**16**

Traffic Flows in vehicles per hour from the strategic SATURN model used in the Vissim assessments. Future operation with scheme 2042:

AM Peak - Car

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	100	2	379	**480**
Maldon Road (South)	149	0	1	670	**820**
The St (East)	2	5	0	18	**25**
B1137 Wellington Bridge (North)	290	467	5	0	**763**
Total	**442**	**572**	**8**	**1067**	**2089**

AM Peak - HGV

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	0	0	20	**20**
Maldon Road (South)	1	0	0	8	**9**
The St (East)	0	0	0	0	**0**
B1137 Wellington Bridge (North)	19	12	0	0	**32**
Total	**20**	**13**	**0**	**28**	**61**

PM Peak - Car

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	136	2	417	**555**
Maldon Road (South)	150	0	4	575	**730**
The St (East)	2	3	0	9	**13**
B1137 Wellington Bridge (North)	282	684	18	0	**985**
Total	**434**	**823**	**24**	**1002**	**2282**

PM Peak - HGV

Origin / Destination	The St (West)	Maldon Road (South)	The St (East)	B1137 Wellington Bridge (North)	Total
The St (West)	0	0	0	4	**5**
Maldon Road (South)	4	0	0	3	**7**
The St (East)	0	0	0	0	**0**
B1137 Wellington Bridge (North)	2	2	0	0	**4**
Total	**6**	**2**	**0**	**7**	**15**

G.2. B1023 Inworth Rd / B1024 Feering Hill aka "Gore Pit" (near Kelvedon): Junction Model Technical Note

G.2.1. Introduction

Overview

The purpose of this technical note is to describe the modelling assessments which have been undertaken at B1024 Feering Hill and B1023 Inworth Road/Rye Mill Lane staggered junction (also known as “Gore pit” junction) as part of the A12 Chelmsford to A120 widening project.

The junction is currently a staggered crossroads, located north east of Kelvedon. The B1024 forms the major road of this junction with a north-east (Feering Hill arm) /south-west (and London Road arm) orientation and joins the A12 further north east of the junction. B1023 Inworth Road and Rye Mill Lane form the two minor roads at this junction to the south east and north west respectively.

Modelling scenarios

The Gore Pit junction has been assessed using the PICADY module within the industry standard junction modelling software Junctions 9. The following traffic scenarios have been considered for both the AM (07:30-08:30) and PM (17:00 – 18:00) peak hours, all with the existing junction arrangement:

- Current operation scenario (2019).
- Future operation without the proposed scheme in place (2027).
- Future operation with the proposed scheme in place (2027).
- Future operation without the proposed scheme in place (2042)
- Future operation with the proposed scheme in place (2042).

G.2.2. Model description

Junction location

The location of the Gore Pit junction is shown in Plate G 2-1, north east of Kelvedon.

The majority of the traffic passing through this junction consists of traffic to / from the A12 further north east, together with a significant amount of traffic to / from Tiptree and beyond via Inworth Road.

Plate G 2-1: B1023 Inworth Road/B1024 Feering Hill staggered T-junction (Source: Open Street Map)

Key assumptions and input parameters

The PICADY model required several geometric parameters to be measured for the calculation of theoretical capacity. Junction geometric measurements were taken at the junction from AutoCAD drawings in accordance with the PICADY user guide.

Traffic volume has been input as vehicles with a 2.5 PCU factor for Heavy Goods Vehicles used.

Traffic data

A bespoke traffic model has been developed for the appraisal of the proposed scheme using industry standard SATURN software, for which further details can be found in the Combined Modelling and Appraisal report. The outputs from the strategic model formed the basis for the inputs into the junction modelling.

Existing traffic flows are similar for both the AM and PM peak hours. Flows are significantly lower on Rye Mill Lane. With the proposed scheme in place, there is a mixture of increases and decreases in flows at various turning movements, but overall there is a net decrease in total junction inflows. All the traffic flows for all the scenarios, along with HGV proportions, are provided in Annex A.

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G.2.3. Junction modelling results

Current operation (2019)

A key statistic produced by PICADY is the RFC (Reference Flow to Capacity). A value of 0.85 is desirable for all arms of new junctions and indicates that the junction is likely statistically to be under-capacity. In assessing an existing junction, for values below 0.85 a junction is considered to be under-capacity, for values between 0.85 and 1.00 a junction is considered to be approaching capacity, whereas for values above 1.00 a junction is considered to be over-capacity.

The results of the junction modelling for current operations are presented in Table G 2-1.

Table G 2-1 Results for Inworth Rd/Feering Hill Rd PICADY model for Current Operation (2019)

	AM					PM				
Movements	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
Inworth Rd to Feering Hill (W)	F	196	305.47	18	1.15	F	83	163.74	4	0.96
Inworth Rd to Rye Mill Ln and London Rd	F	287	284.96	27	1.14	F	222	117.98	8	0.94
From London Rd	A	498	8.03	0	0.07	A	661	7.21	0	0.04
Rye Mill Ln to London Rd	B	31	10.5	0	0.09	B	67	13.23	0	0.21
Rye Mill Ln to Inworth Rd and Feering Hill	C	58	18.19	0	0.24	D	115	27.88	1	0.5
From Feering Hill	A	469	8.39	0	0.26	B	552	11.85	1	0.44

The results show that the junction is currently over capacity on the Inworth Road arm in the weekday AM peak hour, and very close to capacity in the PM peak hour, with queues of up to 27 vehicles and delays of approximately 5 minutes. All other arms operate satisfactorily, with minimal queues and delays.

Future operation with construction (2025)

The future operation with construction (2025) has not been considered because there is unlikely to be significant volumes of construction traffic travelling through Kelvedon.

Future operation without scheme in place (2027, 2042)

The results of the junction modelling for future operations without the proposed scheme in place are presented in Table G 2-2 for 2027 and Table G 2-3 for 2042 respectively.

Table G 2-2 Results for Inworth Rd/Feering Hill Rd PICADY model for Future operation without scheme (2027)

	AM					PM				
Movements	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
Inworth Rd to Feering Hill (W)	F	211	850.41	45	1.45	F	124	695.09	24	1.45
Inworth Rd to Rye Mill Ln and London Rd	F	336	838.19	73	1.46	F	289	667.28	55	1.44
From London Rd	A	570	9.36	0	0.09	A	763	8.08	0	0.05
Rye Mill Ln to London Rd	B	31	12.87	0	0.11	D	71	31.56	1	0.41
Rye Mill Ln to Inworth Rd and Feering Hill	D	60	27.84	1	0.34	F	133	70.14	3	0.77
From Feering Hill	A	585	9.6	1	0.34	B	585	13.99	1	0.51

The results show that, without the proposed scheme in place, the junction operation has worsened by 2027 in both the weekday AM and PM peak hours, with queues of up to 70 vehicles and delays of up to 14 minutes on the B1024 Inworth Road arm.

Table G 2-3 Results for Inworth Rd/Feering Hill Rd PICADY model for Future operation without scheme (2042)

	AM					PM				
Movements	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
Inworth Rd to Feering Hill (W)	F	210	1416.73	68	1.73	F	103	1293.49	30	1.71
Inworth Rd to Rye Mill Ln and London Rd	F	366	1402.94	122	1.74	F	308	1173.99	90	1.76
From London Rd	B	643	10.84	0	0.1	A	829	8.75	0	0.06
Rye Mill Ln to London Rd	C	36	18.05	0	0.17	F	84	244.79	6	1.13
Rye Mill Ln to Inworth Rd and Feering Hill	F	67	51.89	1	0.53	F	146	217.4	10	1.1
From Feering Hill	B	639	10.26	1	0.36	C	625	15.8	1	0.56

The results show that, without the proposed scheme in place, the junction operation has worsened still further by 2042 in both the weekday AM and PM peak hours, with the Rye Mill Lane arm over-capacity in the weekday PM peak hour as well as the B1024 Inworth Road for both the weekday AM and PM peak hours. Forecast queues have increased to approximately 120 vehicles and there are delays of up to 24 minutes on the B1024 Inworth Road arm.

Future operation with scheme in place (2027, 2042)

The results of the junction modelling for future operations with the proposed scheme in place are presented in Table G 2-4 for the year 2027 and Table G 2-5 for 2042 respectively.

Table G 2-4 Results for Inworth Rd/Feering Hill Rd PICADY model for Future operation with scheme (2027)

	AM					PM				
Movements	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
Inworth Rd to Feering Hill (W)	E	178	39.07	2	0.69	F	237	333.01	21	1.18
Inworth Rd to Rye Mill Ln and London Rd	F	241	61.11	4	0.83	F	253	316.45	28	1.17
From London Rd	A	477	7.1	0	0.06	A	516	7.52	0	0.04
Rye Mill Ln to London Rd	A	29	9.82	0	0.08	C	65	17.03	0	0.25
Rye Mill Ln to Inworth Rd and Feering Hill	C	62	16.48	0	0.24	E	139	36.03	2	0.61
From Feering Hill	A	469	8.53	0	0.28	B	498	10.23	1	0.38

The results show that, with the proposed scheme in place, Inworth Road operates satisfactorily in the 2027 weekday AM peak hour. In the 2027 weekday PM peak hour, whilst it continues to operate over-capacity, a comparison with Table G 3-2 above shows that the performance improves with the proposed scheme in place compared to that without the proposed scheme in place.

Table G 2-5 Results for Inworth Rd/Feering Hill Rd PICADY model for Future operation with scheme (2042)

	AM					PM				
Movements	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
Inworth Rd to Feering Hill (W)	F	196	277.74	17	1.12	F	168	794.65	34	1.42
Inworth Rd to Rye Mill Ln and London Rd	F	291	255.94	24	1.12	F	354	773.71	70	1.44
From London Rd	A	538	7.84	0	0.06	A	625	8.13	0	0.05
Rye Mill Ln to London Rd	B	33	11.17	0	0.1	F	70	85.9	2	0.7
Rye Mill Ln to Inworth Rd and Feering Hill	C	69	21.61	1	0.31	F	160	101.23	4	0.89
From Feering Hill	A	521	8.94	0	0.29	B	480	11.53	1	0.41

The results show that, with the proposed scheme in place, the junction operation has worsened by 2042 in both the weekday AM and PM peak hours. However, a comparison with Table G 3-3 above shows that the performance improves with the proposed scheme in place compared to that without the proposed scheme in place.

G.2.4. Summary

A summary of the results for the Inworth Rd/Feering Hill Rd PICADY model are presented below in Table G 2-6.

Table G 2-6: Results for the Inworth Rd/Feering Hill Rd PICADY assessment

Junction	Software (key statistic used)	Current operation		Future operation, with scheme 2027		Future operation, with scheme 2042		Future operation, without scheme 2027		Future operation, without scheme 2042	
		Weekday 0730-0830	Weekday 1700-1800	Weekday 0730-0830	Weekday 1700-1800	Weekday 0730-0830	Weekday 1700-1800	Weekday 0730-0830	Weekday 1700-1800	Weekday 0730-0830	Weekday 1700-1800
B1023 Inworth Rd / B1024 Feering Hill aka "Gore Pit" (near Kelvedon)	PICADY (RFC)	1.15	0.96	0.83	1.18	1.12	1.44	1.46	1.45	1.74	1.76

The following can be summarised form the results:

- The junction is currently over-capacity during the weekday AM peak hour and very close to capacity in the PM peak hour.
- In 2027 without the proposed scheme in place, the junction is over-capacity during both the weekday AM and peak hours.
- In 2042 without the proposed scheme in place, the junction operation worsens still further, with both side roads overcapacity and with extensive queues and delays.
- In 2027 with the proposed scheme in place, the junction operation is improved compared to the situation without the proposed scheme in place.
- In 2042 with the proposed scheme in place, the junction operation is improved compared to the situation without the proposed scheme in place.

G.2.5. Annex A

Traffic Flows – Current Operation (2019)

AM Peak

Origin / Destination	London Rd	Inworth Rd	B1024 Feering Hill	Rye Mill Ln	Total
London Rd	0	193	273	32	498
Inworth Rd	266	0	196	21	483
B1024 Feering Hill	237	136	0	96	469
Rye Mill Ln	31	12	46	0	89
Total	534	341	515	149	1539

PM Peak

Origin / Destination	London Rd	Inworth Rd	B1024 Feering Hill	Rye Mill Ln	Total
London Rd	0	302	339	20	661
Inworth Rd	214	0	83	8	305
B1024 Feering Hill	300	205	0	47	552
Rye Mill Ln	67	47	68	0	182
Total	581	554	490	75	1700

Traffic Flows – Without Scheme Operation (2027)

AM Peak

Origin / Destination	London Rd	Inworth Rd	B1024 Feering Hill	Rye Mill Ln	Total
London Rd	0	219	318	33	570
Inworth Rd	308	0	211	28	547
B1024 Feering Hill	311	171	0	103	585
Rye Mill Ln	31	15	45	0	91
Total	650	405	574	164	1793

PM Peak

Origin / Destination	London Rd	Inworth Rd	B1024 Feering Hill	Rye Mill Ln	Total
London Rd	0	340	402	21	763
Inworth Rd	278	0	124	11	413
B1024 Feering Hill	320	218	0	47	585
Rye Mill Ln	71	59	74	0	204
Total	669	617	600	79	1965

Traffic Flows – With Scheme Operation (2027)

AM Peak

Origin / Destination	London Rd	Inworth Rd	B1024 Feering Hill	Rye Mill Ln	Total
London Rd	0	287	160	30	477
Inworth Rd	152	0	178	89	419
B1024 Feering Hill	275	150	0	44	469
Rye Mill Ln	29	46	16	0	91
Total	456	483	354	163	1456

PM Peak

Origin / Destination	London Rd	Inworth Rd	B1024 Feering Hill	Rye Mill Ln	Total
London Rd	1	240	259	17	516
Inworth Rd	237	0	206	47	490
B1024 Feering Hill	291	189	0	18	498
Rye Mill Ln	65	114	25	0	204
Total	593	543	490	82	1709

Traffic Flows – Without Scheme Operation (2042)

AM Peak

Origin / Destination	London Rd	Inworth Rd	B1024 Feering Hill	Rye Mill Ln	Total
London Rd	0	235	373	35	643
Inworth Rd	336	0	210	30	576
B1024 Feering Hill	347	174	0	118	639
Rye Mill Ln	36	18	49	0	103
Total	719	427	632	183	1961

PM Peak

Origin / Destination	London Rd	Inworth Rd	B1024 Feering Hill	Rye Mill Ln	Total
London Rd	0	326	481	22	829
Inworth Rd	296	0	103	12	411
B1024 Feering Hill	349	226	0	50	625
Rye Mill Ln	84	65	81	0	230
Total	729	617	665	84	2095

Traffic Flows – With Scheme Operation (2042)

AM Peak

Origin / Destination	London Rd	Inworth Rd	B1024 Feering Hill	Rye Mill Ln	Total
London Rd	0	349	162	27	538
Inworth Rd	180	0	196	111	487
B1024 Feering Hill	323	148	0	50	521
Rye Mill Ln	33	51	18	0	102
Total	536	548	376	188	1648

PM Peak

Origin / Destination	London Rd	Inworth Rd	B1024 Feering Hill	Rye Mill Ln	Total
London Rd	1	270	336	19	626
Inworth Rd	303	0	168	51	522
B1024 Feering Hill	272	187	0	21	480
Rye Mill Ln	70	130	30	0	230
Total	646	587	534	91	1858

HGV Proportions – Current Operations (2019)

AM Peak

Origin / Destination	London Rd	Inworth Rd	B1024 Feering Hill	Rye Mill Ln	Average
London Rd	0%	2%	3%	6%	3%
Inworth Rd	3%	0%	0%	0%	1%
B1024 Feering Hill	2%	1%	0%	4%	2%
Rye Mill Ln	3%	0%	2%	0%	1%
Average	2%	1%	1%	3%	-

PM Peak

Origin / Destination	London Rd	Inworth Rd	B1024 Feering Hill	Rye Mill Ln	Average
London Rd	0%	0%	1%	5%	2%
Inworth Rd	1%	0%	0%	0%	0%
B1024 Feering Hill	0%	0%	0%	4%	1%
Rye Mill Ln	0%	0%	1%	0%	0%
Average	0%	0%	1%	2%	-

HGV Proportions – Without Scheme Operations (2027)

AM Peak

Origin / Destination	London Rd	Inworth Rd	B1024 Feering Hill	Rye Mill Ln	Average
London Rd	0%	2%	2%	6%	3%
Inworth Rd	2%	0%	0%	0%	1%
B1024 Feering Hill	1%	1%	0%	4%	2%
Rye Mill Ln	3%	0%	4%	0%	2%
Average	2%	1%	2%	3%	-

PM Peak

Origin / Destination	London Rd	Inworth Rd	B1024 Feering Hill	Rye Mill Ln	Average
London Rd	0%	0%	1%	5%	2%
Inworth Rd	1%	0%	0%	0%	0%
B1024 Feering Hill	0%	0%	0%	4%	1%
Rye Mill Ln	0%	0%	1%	0%	0%
Average	0%	0%	1%	2%	-

HGV Proportions – With Scheme Operations (2027)

AM Peak

Origin / Destination	London Rd	Inworth Rd	B1024 Feering Hill	Rye Mill Ln	Average
London Rd	0%	0%	4%	3%	2%
Inworth Rd	0%	0%	1%	0%	0%
B1024 Feering Hill	1%	1%	0%	9%	3%
Rye Mill Ln	3%	2%	0%	0%	1%
Average	1%	1%	1%	3%	-

PM Peak

Origin / Destination	London Rd	Inworth Rd	B1024 Feering Hill	Rye Mill Ln	Average
London Rd	0%	0%	1%	6%	2%
Inworth Rd	0%	0%	0%	0%	0%
B1024 Feering Hill	0%	0%	0%	11%	3%
Rye Mill Ln	0%	1%	4%	0%	1%
Average	0%	0%	1%	4%	-

HGV Proportions – Without Scheme Operations (2042)

AM Peak

Origin / Destination	London Rd	Inworth Rd	B1024 Feering Hill	Rye Mill Ln	Average
London Rd	0%	1%	2%	6%	2%
Inworth Rd	3%	0%	0%	0%	1%
B1024 Feering Hill	1%	1%	0%	3%	1%
Rye Mill Ln	3%	0%	4%	0%	2%
Average	2%	0%	2%	2%	-

PM Peak

Origin / Destination	London Rd	Inworth Rd	B1024 Feering Hill	Rye Mill Ln	Average
London Rd	0%	0%	1%	5%	1%
Inworth Rd	1%	0%	0%	0%	0%
B1024 Feering Hill	0%	0%	0%	4%	1%
Rye Mill Ln	0%	0%	1%	0%	0%
Average	0%	0%	0%	2%	-

HGV Proportions – With Scheme Operations (2042)

AM Peak

Origin / Destination	London Rd	Inworth Rd	B1024 Feering Hill	Rye Mill Ln	Average
London Rd	0%	0%	4%	4%	2%
Inworth Rd	1%	0%	1%	3%	1%
B1024 Feering Hill	1%	1%	0%	2%	1%
Rye Mill Ln	3%	4%	0%	0%	2%
Average	1%	1%	1%	2%	-

PM Peak

Origin / Destination	London Rd	Inworth Rd	B1024 Feering Hill	Rye Mill Ln	Average
London Rd	0%	0%	1%	5%	2%
Inworth Rd	0%	0%	0%	0%	0%
B1024 Feering Hill	0%	0%	0%	10%	3%
Rye Mill Ln	0%	1%	3%	0%	1%
Average	0%	0%	1%	4%	-

G.3. B1024 Station Rd / B1024 High St (Kelvedon): Junction Model Technical Note

G.3.1. Introduction

Overview

The purpose of this technical note is to describe the modelling assessments which have been undertaken at B1024 Station Road/B1024 High Street crossroads priority junction as part of the A12 Chelmsford to A120 widening project.

The junction is currently a crossroads junction located in Kelvedon. The B1024 High Street and B1024 Feering Hill form the major road through Kelvedon with north-east and southwest orientations respectively. The B1024 Station Road, which provides access to / from Coggeshall, and Swan Street form the minor arms at this junction to the north west and south east respectively.

The layout at this junction is proposed to become a three-arm mini roundabout in the future years as part of a proposed development.

Modelling scenarios

The junction has been assessed using the PICADY and ARCADY modules within the industry standard junction modelling software Junctions 9. The following traffic scenarios have been considered for both the AM (07:30-08:30) and PM (17:00 – 18:00) peak hours:

- Current operation scenario (2019) for the existing junction arrangement.
- Future operation without the proposed scheme in place (2027) for the future junction arrangement.
- Future operation with the proposed scheme in place (2027) for the future junction arrangement.
- Future operation without the proposed scheme in place (2042) for the future junction arrangement
- Future operation with the proposed scheme in place (2042) for the future junction arrangement.

G.3.2. Model description

Junction location

The location of the junction is shown in Plate G 3-1. The junction is located in Kelvedon with B1024 High Street (south-west major arm) running through Kelvedon town and Feering Hill (north-east major arm) connecting with Feering. Access to Coggeshall is provided through B1024 Station Road (north minor arm) and local connectivity to adjoining land uses in Kelvedon is provided through Swan Street (south minor arm).

In the future, the layout at this junction is proposed to become a three-arm mini roundabout as part of a proposed development, consisting of B1024 High Street (south-west arm); Feering Hill (north-east arm); and B1024 Station Road (north arm). The existing fourth arm (Swan Street) will be diverted to connect to Feering Hill at a new priority junction immediately north-east of the proposed mini-roundabout. The proposed layout is shown in Plate G 3-2.

Plate G 3-1: B1024 Station Road/B1024 High Street crossroads junction (Source: Open Street Map)

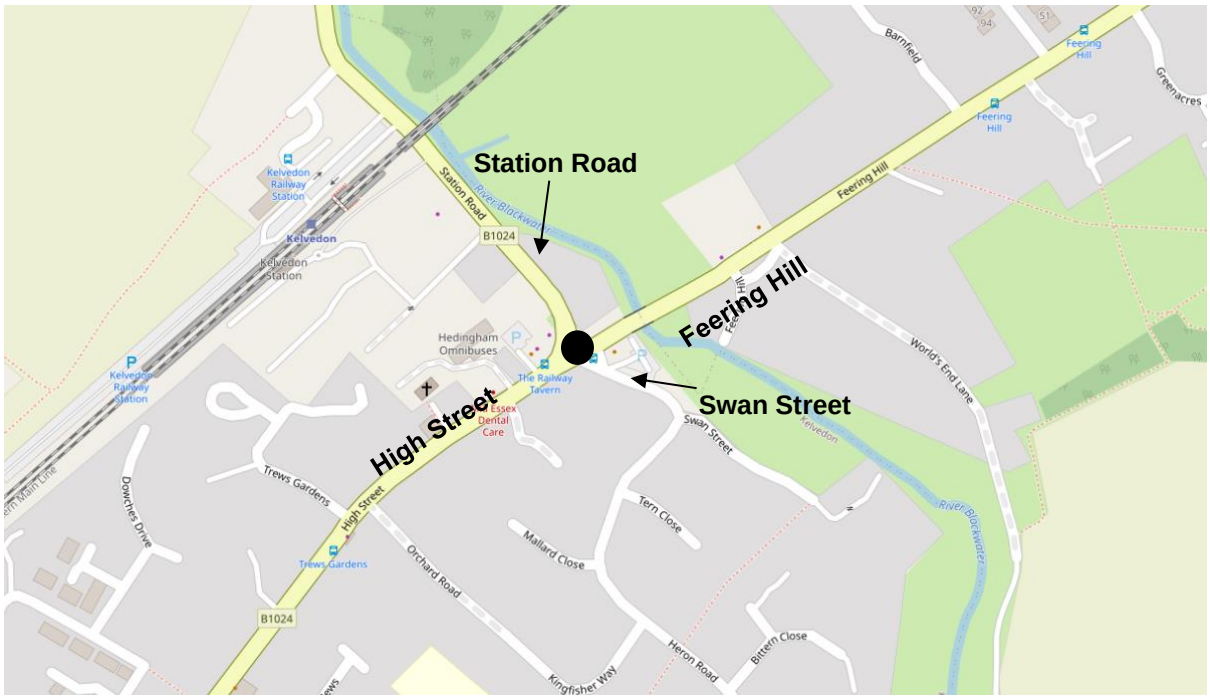
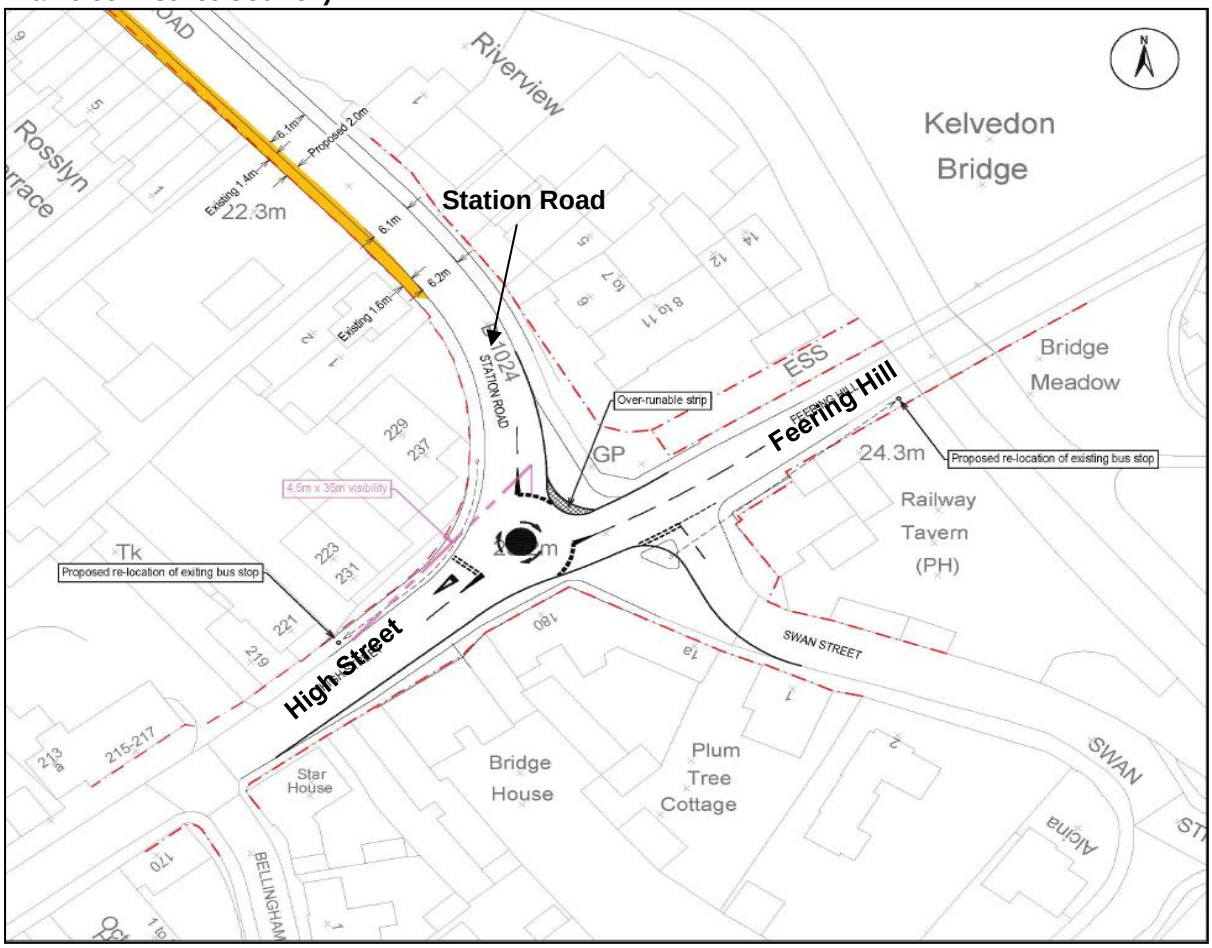


Plate G 3-2: Proposed B1024 Station Road/B1024 High Street mini-roundabout (Source: Braintree District Council)



Key assumptions and input parameters

The PICADY and ARCADY models required several geometric parameters to be measured for the calculation of theoretical capacity. Junction geometric measurements were taken at the junction from AutoCAD drawings in accordance with the PICADY/ARCADY user guides.

Traffic volume has been input as vehicles with a 2.5 PCU factor for Heavy Goods Vehicles.

Traffic data

A bespoke traffic model has been developed for the appraisal of the proposed scheme using industry standard SATURN software, for which further details can be found in the Combined Modelling and Appraisal report. The outputs from the strategic model formed the basis for the inputs into the junction modelling.

Currently, the highest traffic flows are on the B1024 High Street / Feering Hill, but traffic flows on B1024 Station Road are also quite high, with flows on Swan Street very low. With the A12 scheme in place, traffic flows on the B1024 High Street / Feering Hill are forecast to reduce. There would also be a small reduction in flows on the B1024 Station Road. All the traffic flows for all the scenarios, along with HGV proportions, are provided in Annex A.

G.3.3. Junction modelling results

Current operation (2019)

A key statistic produced by PICADY and ARCADY is the RFC (Reference Flow to Capacity). A value of 0.85 is desirable for all arms of new junctions and indicates that the junction is likely statistically to be under-capacity. In assessing an existing junction, for values below 0.85 a junction is considered to be under-capacity, for values between 0.85 and 1.00 a junction is considered to be approaching capacity, whereas for values above 1.00 a junction is considered to be over-capacity.

The results of the junction modelling for current operations 2019 are presented in Table G 3-1.

Table G 3-1: Results for B1024 Station Road/B1024 High Street PICADY model for Current Operation (2019)

	AM					PM				
Movements	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
Swan Street to High Street and Station Road	A	24, 3	8.62	0	0.06	A	16, 3	8.94	0	0.05
Swan Street to Feering Hill and Station Road	C	29, 3	17.74	0	0.14	C	26, 3	16.54	0	0.12
From Feering Hill	A	556	9.01	2	0.5	A	504	6.35	1	0.3
Station Road to Feering Hill and Swan Street	C	89, 2	18.14	1	0.34	B	136, 2	11.45	1	0.32
Station Road to High Street and Swan Street	E	172, 2	41.24	2	0.69	C	98, 2	21.93	1	0.4
From Station Road	A	436	5.07	0	0.04	A	592	4.31	0	0.09

The results show that this junction currently operates satisfactorily during both the weekday AM and PM peak hours, with minimal queues and delays generally of 20 seconds or less.

Future operation with construction (2025)

The future operation with construction (2025) has not been considered because there is unlikely to be significant volumes of construction traffic travelling through Kelvedon.

Future operation without scheme in place (2027, 2042)

The results of the junction modelling for future operations without scheme in place are presented in Table G 3-2 for the year 2027 and Table G 3-3 for the year 2042.

Table G 3-2: Results for B1024 Station Road/B1024 High Street ARCADY model for Future operation without scheme (2027)

	AM					PM				
Arm	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
Feering Hill	E	629	46.59	9	0.91	C	601	23.02	4	0.81
High Street	B	526	11.43	2	0.65	B	655	14.73	3	0.75
Station Road	B	338	13.67	1	0.59	B	287	11.16	1	0.49

The results show that the junction is approaching capacity in 2027 without the proposed scheme in place during the weekday AM peak hour, but operates satisfactorily in the weekday PM peak hour. However, queues are less than 10 vehicles and delays are approximately 45 seconds or less.

Table G 3-3: Results for B1024 Station Road/B1024 High Street ARCADY model for Future operation without scheme (2042)

	AM					PM				
Arm	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
Feering Hill	F	687	101.86	22	1.01	E	673	49.74	10	0.93
High Street	B	593	14.53	3	0.73	C	723	21.77	5	0.83
Station Road	C	376	17.42	2	0.67	B	318	13.46	1	0.57

The results show that the junction is over-capacity in 2042 without the proposed scheme in place during the weekday AM peak hour and is approaching capacity in the PM peak hour. Queues are generally less than 10 vehicles and delays are less than 2 minutes.

Future operation with scheme in place (2027, 2042)

The results of the junction modelling for future operations with the proposed scheme in place are presented in Table G 3-4 for the year 2027 and in Table G 3-5 for the year 2042.

Table G 3-4: Results for B1024 Station Road/B1024 High Street ARCADY model for Future operation with scheme (2027)

	AM					PM				
Arm	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
Feering Hill	B	401	11.37	1	0.58	B	491	13.36	2	0.67
High Street	A	428	8.2	1	0.52	B	586	11.15	2	0.67
Station Road	B	319	10.03	1	0.49	A	277	9.57	1	0.45

The results show that the junction operates satisfactorily in 2027 with the proposed scheme in place during both the weekday AM and PM peak hours, with minimal queues and delays of less than 15 seconds. A comparison with Table G 3-2 above shows that the performance improves with the proposed scheme in place compared to that without the proposed scheme in place.

Table G 3-5: Results for B1024 Station Road/B1024 High Street ARCADY model for Future operation with scheme (2042)

	AM					PM				
Arm	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
Feering Hill	B	428	13.4	2	0.64	C	539	17.27	3	0.74
High Street	A	494	9.63	2	0.59	B	637	13.92	3	0.73
Station Road	B	359	12.13	1	0.57	A	290	9.59	1	0.46

The results show that this junction operates satisfactorily in 2042 with the proposed scheme in place during both the weekday AM and PM peak hours, with minimal queues and delays of less than 20 seconds. A comparison with Table G 3-3 above shows that the performance improves with the proposed scheme in place compared to that without the proposed scheme in place.

G.3.4. Summary

A summary of the results for the B1024 Station Road/B1024 High Street ARCADY assessment are shown in Table G 3-6.

Table G 3-6: Results for B1024 Station Road/B1024 High Street ARCADY assessment

Junction	Software (key statistic used)	Current operation		Future operation, with scheme 2027		Future operation, with scheme 2042		Future operation, without scheme 2027		Future operation, without scheme 2042	
		Weekday 0730-0830	Weekday 1700-1800	Weekday 0730-0830	Weekday 1700-1800	Weekday 0730-0830	Weekday 1700-1800	Weekday 0730-0830	Weekday 1700-1800	Weekday 0730-0830	Weekday 1700-1800
B1024 Station Rd / B1024 High St (Kelvedon)	PICADY (RFC)	0.69	0.40	0.58	0.67	0.64	0.74	0.91	0.81	1.01	0.93

The following can be summaried from the results:

- The junction currently operates satisfactorily during the weekday AM and PM peak hours.
- In 2027 without the proposed scheme in place, the junction is approaching capacity during the weekday AM peak hour but operates satisfactorily during the weekday PM peak hour.
- In 2042 without the proposed scheme in place, the junction is over-capacity during the weekday AM peak hour and is approaching capacity during the weekday PM peak hour.
- In 2027 with the proposed scheme in place, the junction operates satisfactorily during both the weekday AM and PM peak hours.
- In 2042 with the proposed scheme in place, the junction operates satisfactorily during both the weekday AM and PM peak hours.

G.3.5. Annex A

Traffic Flows – Current Operation (2019)

AM Peak

Origin / Destination	Feering Hill	Swan Street	High Street	Station Road	Total
Feering Hill	0	8	365	183	556
Swan Street	29	0	24	3	56
High Street	330	10	0	96	436
Station Road	89	2	172	0	263
Total	448	20	561	282	1311

PM Peak

Origin / Destination	Feering Hill	Swan Street	High Street	Station Road	Total
Feering Hill	0	33	371	100	504
Swan Street	26	0	16	3	45
High Street	385	26	0	181	592
Station Road	136	2	98	0	236
Total	547	61	485	284	1377

Traffic Flows – Without Scheme Operation (2027)

AM Peak

Origin / Destination	Feering Hill	High Street	Station Rd	Total
Feering Hill	0	410	219	629
High Street	404	0	122	526
Station Rd	139	199	0	338
Total	543	609	341	1493

PM Peak

Origin / Destination	Feering Hill	High Street	Station Rd	Total
Feering Hill	0	455	146	601
High Street	413	0	242	655
Station Rd	158	129	0	287
Total	571	584	388	1543

Traffic Flows – With Scheme Operation (2027)

AM Peak

Origin / Destination	Feering Hill	High Street	Station Rd	Total
Feering Hill	0	214	187	401
High Street	291	0	137	428
Station Rd	128	191	0	319
Total	419	405	324	1148

PM Peak

Origin / Destination	Feering Hill	High Street	Station Rd	Total
Feering Hill	0	349	142	491
High Street	350	0	236	586
Station Rd	139	138	0	277
Total	489	487	378	1354

Traffic Flows – Without Scheme Operation (2042)

AM Peak

Origin / Destination	Feering Hill	High Street	Station Rd	Total
Feering Hill	0	465	222	687
High Street	434	0	159	593
Station Rd	161	215	0	376
Total	595	680	381	1656

PM Peak

Origin / Destination	Feering Hill	High Street	Station Rd	Total
Feering Hill	0	516	157	673
High Street	444	0	279	723
Station Rd	164	154	0	318
Total	608	670	436	1714

Traffic Flows – With Scheme Operation (2042)

AM Peak

Origin / Destination	Feering Hill	High Street	Station Rd	Total
Feering Hill	0	238	190	428
High Street	331	0	163	494
Station Rd	138	221	0	359
Total	469	459	353	1281

PM Peak

Origin / Destination	Feering Hill	High Street	Station Rd	Total
Feering Hill	0	383	156	539
High Street	330	0	307	637
Station Rd	139	151	0	290
Total	469	534	463	1466

HGV Proportions – Current Operations (2019)

AM Peak

Origin / Destination	Feering Hill	Swan Street	High Street	Station Road	Average
Feering Hill	0%	0%	2%	1%	1%
Swan Street	0%	0%	0%	0%	0%
High Street	2%	10%	0%	2%	4%
Station Road	1%	0%	1%	0%	0%
Average	1%	3%	1%	1%	-

PM Peak

Origin / Destination	Feering Hill	Swan Street	High Street	Station Road	Average
Feering Hill	0%	0%	1%	0%	0%
Swan Street	0%	0%	0%	0%	0%
High Street	1%	0%	0%	0%	0%
Station Road	0%	0%	1%	0%	0%
Average	0%	0%	1%	0%	-

HGV Proportions – Without Scheme Operations (2027)

AM Peak

Origin / Destination	Feering Hill	High Street	Station Rd	Average
Feering Hill	0%	2%	1%	1%
High Street	2%	0%	2%	1%
Station Rd	1%	1%	0%	0%
Average	1%	1%	1%	-

PM Peak

Origin / Destination	Feering Hill	High Street	Station Rd	Average
Feering Hill	0%	1%	0%	0%
High Street	1%	0%	0%	0%
Station Rd	0%	1%	0%	0%
Average	0%	1%	0%	-

HGV Proportions – With Scheme Operations (2027)

AM Peak

Origin / Destination	Feering Hill	High Street	Station Rd	Average
Feering Hill	0%	3%	1%	1%
High Street	3%	0%	1%	1%
Station Rd	1%	1%	0%	0%
Average	1%	1%	1%	-

PM Peak

Origin / Destination	Feering Hill	High Street	Station Rd	Average
Feering Hill	0%	1%	0%	0%
High Street	1%	0%	0%	0%
Station Rd	0%	1%	0%	0%
Average	0%	1%	0%	-

HGV Proportions – Without Scheme Operations (2042)

AM Peak

Origin / Destination	Feering Hill	High Street	Station Rd	Average
Feering Hill	0%	2%	1%	1%
High Street	2%	0%	1%	1%
Station Rd	1%	0%	0%	0%
Average	1%	1%	1%	-

PM Peak

Origin / Destination	Feering Hill	High Street	Station Rd	Average
Feering Hill	0%	1%	0%	0%
High Street	1%	0%	0%	0%
Station Rd	0%	1%	0%	0%
Average	0%	1%	0%	-

HGV Proportions – With Scheme Operations (2042)

AM Peak

Origin / Destination	Feering Hill	High Street	Station Rd	Average
Feering Hill	0%	3%	1%	1%
High Street	2%	0%	1%	1%
Station Rd	1%	0%	0%	0%
Average	1%	1%	1%	-

PM Peak

Origin / Destination	Feering Hill	High Street	Station Rd	Average
Feering Hill	0%	1%	0%	0%
High Street	1%	0%	0%	0%
Station Rd	0%	1%	0%	0%
Average	0%	1%	0%	-

G.4. B1023 Kelvedon Rd / B1022 Maldon Rd (Tiptree): Junction Model Technical Note

G.4.1. Introduction

Overview

The purpose of this technical note is to describe the modelling assessments which have been undertaken at the B1023 Kelvedon Road / B1022 Maldon Road junction as part of the A12 Chelmsford to A120 widening project.

The junction is currently a double mini-roundabout located in Tiptree. The junction layout is slightly staggered, with the B1022 Maldon Road running in a north-east/south-west orientation, intersecting with the B1023 Church Road / Kelvedon Road which runs in a south-east/north-west orientation. The two mini-roundabouts are offset by approximately 30 metres.

Modelling scenarios

The junction has been assessed using the ARCADY module within the industry standard junction modelling software Junctions 9. The following traffic scenarios have been considered for both the AM (07:30-08:30) and PM (17:00 – 18:00) peak hours, all with the existing junction arrangement:

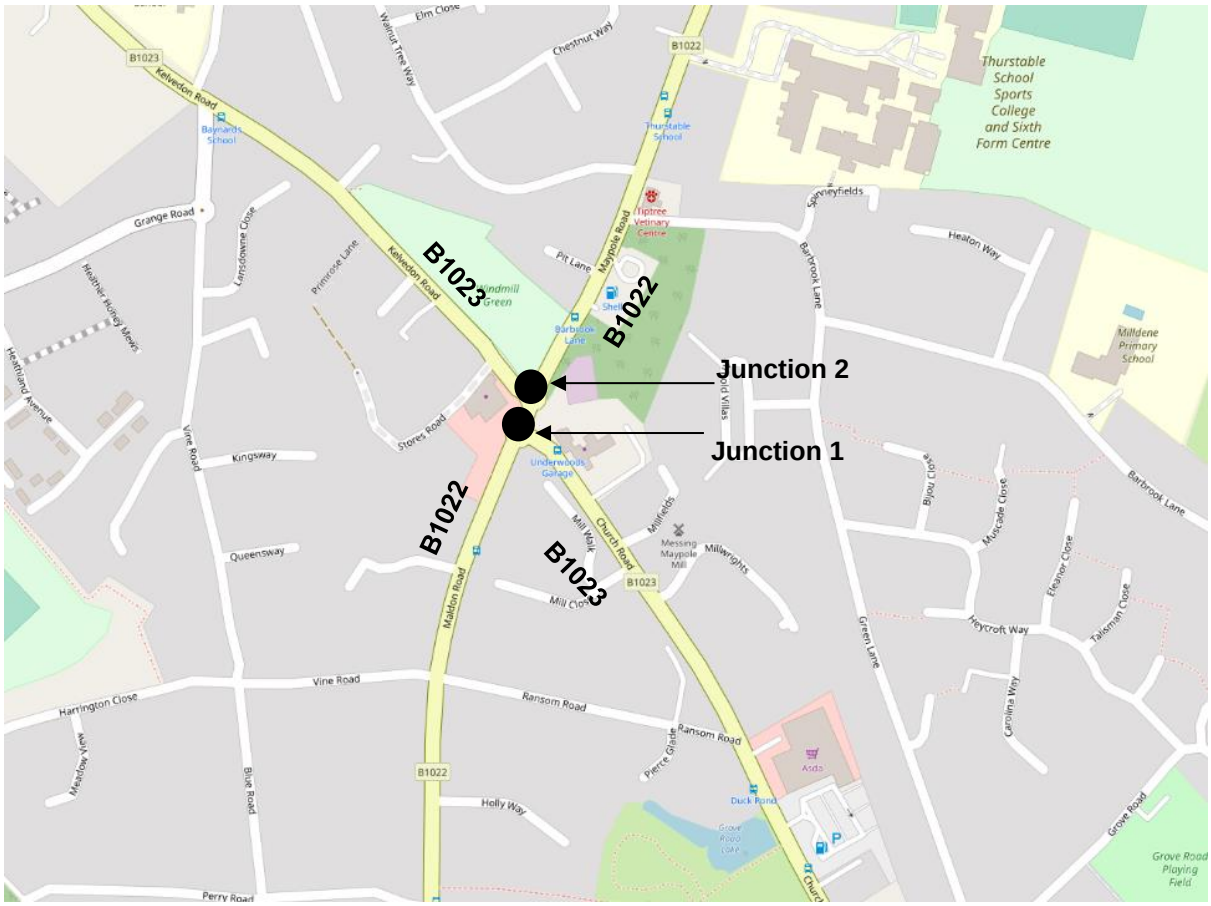
- Current operation scenario (2019).
- Future operation without the proposed scheme in place (2027).
- Future operation with the proposed scheme in place (2027).
- Future operation without the proposed scheme in place (2042).
- Future operation with the proposed scheme in place (2042).

G.4.2. Model description

Junction location

The location of the junction is shown in Plate G 4-1. The B1022 Maldon Road forms the south-west approach for Junction 1 and north-east approach for Junction 2. The B1023 Church Road forms the south-east approach for Junction 1 and the B1023 Kelvedon Road forms the north-west approach for Junction 2. The B1023 has the highest flows at this double mini roundabout junction.

Plate G 4-1: B1023 / B1022 double mini roundabout (Source: Open Street Map)



Key assumptions and input parameters

The ARCADY model required several geometric parameters to be measured for the calculation of theoretical capacity. Given the close proximity of the two mini-roundabouts, the junction was initially modelled in a lane simulation mode with linked junctions. However, due to known limitations with the ARCADY software for modelling double mini roundabouts, it was not possible for the junction model to reflect observed journey times.

Therefore, other options of assessing the pair of junctions as a standard or oval roundabout were considered. Junction geometric parameters were measured at the junction from AutoCAD drawings in accordance with the ARCADY user guide. In comparison with observed journey times, the roundabout with an oval central island was considered to be a better fit than the other options considered.

Traffic volumes have been input as vehicles with a 2.5 PCU factor for Heavy Goods Vehicles.

Traffic data

A bespoke traffic model has been developed for the appraisal of the proposed scheme using industry standard SATURN software, for which further details can be found in the Combined Modelling and Appraisal report. The outputs from the strategic model formed the basis for the inputs into the junction modelling.

However, for this junction, local surveyed flows were available in the form of a historic turning count at this junction. To improve the robustness of the turning flows at this junction, where the surveyed turning flows were significantly greater than those from the SATURN model, such flows were uplifted using TEMPRO / RTF growth rates to derive 2027 and 2042 flows without the A12 scheme in place. The changes in turning flows resulting from the A12 scheme, as forecast by the SATURN model, were then applied to derive the 2027 and 2042 flows with the proposed scheme in place.

Making best use of the SATURN and local surveyed flows has improved the robustness of the flows at this junction. The resultant traffic flows under each scenario along with their HGV proportions are shown in Annex A.

G.4.3. Junction modelling results

Current operation (2019)

Observed 2019 journey times were available for both the B1022 and B1023 from data collected for use in calibrating the SATURN traffic model. A comparison of the modelled journey times against the observed journey times are shown in Table G 4-1.

The on-field geometric parameters were used to compare the actual intercept values with the empirically calculated values by the ARCADY model. It was determined during the junction calibration exercise that the B1022 Maldon Road north-east arm, the B1023 Church Road arm and the B1023 Kelvedon Road arm required small intercept corrections of 50pcu/hr; 75pcu/hr; and 375pcu/hr respectively. These intercept corrections were also applied to future models.

From Table G 4-1 it can be seen that the B1023 Church Road arm is under-estimating queues and delays, whilst the B1023 Kelvedon Road and B1022 Maldon Road (south-west) arm is over-estimating them.

Table G 4-1: Observed and Modelled Journey time results for Current Operations (2019)

		AM			PM		
Arm	**Distance (m)**	**AM Observed Journey time (s)**	**AM Modelled Journey time (s)**	**Absolute Difference (s)**	**PM Observed Journey time (s)**	**PM Modelled Journey time (s)**	**Absolute Difference (s)**
B1022 (NE arm) Maldon Road to B1022 (SW arm) Maldon Road	402	53	56	+3	60	55	-5
B1022 (SW arm) Maldon Road to B1022 (NE arm) Maldon Road	402	46	67	+21	52	70	+18
B1023 (SE arm) Church Road to B1023 (NW arm) Kelvedon Road	537	66	50	-16	89	49	-40
B1023 (NW arm) Kelvedon Road to B1023 (SE arm) Church Road	537	49	79	+30	48	82	+34

A key statistic produced by ARCADY is the RFC (Reference Flow to Capacity). A value of 0.85 is desirable for all arms of new junctions and indicates that the junction is likely statistically to be under-capacity. In assessing an existing junction, for values below 0.85 a junction is considered to be under-capacity, for values between 0.85 and 1.00 a junction is considered to be approaching capacity, whereas for values above 1.00 a junction is considered to be over-capacity.

The results of the junction modelling for current operations 2019 are presented in Table G 4-2.

Table G 4-2: Results for Tiptree double mini roundabout ARCADY model for Current Operation (2019)

	AM					PM				
Arm	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
B1022 (NE arm) Maldon Road	C	511	15.29	2	0.70	B	344	13.01	1	0.58
B1023 (SE arm) Church Road	A	462	4.51	1	0.38	A	364	3.71	0	0.29
B1022 (SW arm) Maldon Road	B	507	10.71	2	0.62	C	720	18.24	4	0.80
B1023 (NW arm) Kelvedon Road	A	367	4.58	1	0.33	A	636	9.74	2	0.65

The results show that the junction currently operates satisfactorily during both the weekday AM and PM peak hours, with queues of less than 5 vehicles and delays of 20 seconds or less.

Future operation with construction (2025)

The future operation with construction (2025) has not been considered because there is unlikely to be significant volumes of construction traffic travelling through Tiptree.

Future operation without scheme in place (2027, 2042)

The results of the junction modelling for future operations without the proposed scheme in place are presented in Table G 4-3 for the year 2027 and in Table G 4-4 for the year 2042.

Table G 4-3: Results for Tiptree double mini roundabout ARCADY model without the proposed scheme in place (2027)

	AM					PM				
Arm	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
B1022 (NE arm) Maldon Road	C	506	17.40	3	0.72	C	374	16.89	2	0.66
B1023 (SE arm) Church Road	A	475	4.67	1	0.40	A	412	4.16	1	0.34
B1022 (SW arm) Maldon Road	B	584	14.44	3	0.72	E	828	48.30	12	0.94
B1023 (NW arm) Kelvedon Road	A	437	5.21	1	0.40	B	699	13.17	3	0.74

The results show that the junction operates satisfactorily in 2027 without the proposed scheme in place during the AM peak hour, but is close to capacity in the weekday PM peak hour. Queues are 12 vehicles or less and delays are 50 seconds or less.

Table G 4-4 Results for Tiptree double mini roundabout ARCADY model without the proposed scheme in place (2042)

	AM					PM				
Arm	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
B1022 (NE arm) Maldon Road	C	528	21.71	3	0.78	C	405	20.18	2	0.71
B1023 (SE arm) Church Road	A	501	4.95	1	0.42	A	450	4.46	1	0.38
B1022 (SW arm) Maldon Road	C	627	19.46	4	0.79	F	897	118.28	34	1.04
B1023 (NW arm) Kelvedon Road	A	477	5.79	1	0.45	C	710	15.53	3	0.77

The results show that the junction continues to operate satisfactorily in 2042 without the proposed scheme in place during the AM peak hours of traffic but is slightly over-capacity in the weekday PM peak hours. Queues are 35 vehicles or less and delays are 2 minutes or less.

Future operation with scheme in place (2027, 2042)

The results of the junction modelling for future operations with the proposed scheme in place are presented in Table G 4-5 for the year 2027 and in Table G 4-6 for the year 2042.

Table G 4-5 Results for Tiptree double mini roundabout ARCADY model with the proposed scheme in place (2027)

	AM					PM				
Arm	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
B1022 (NE arm) Maldon Road	C	422	15.10	2	0.66	C	314	15.25	1	0.59
B1023 (SE arm) Church Road	A	599	5.38	1	0.49	A	485	4.36	1	0.39
B1022 (SW arm) Maldon Road	B	507	12.32	2	0.65	E	782	42.78	10	0.93
B1023 (NW arm) Kelvedon Road	A	543	5.84	1	0.48	B	731	13.32	3	0.75

The results show that the junction operates satisfactorily in 2027 with the proposed scheme in place in the weekday AM peak hour and is close to capacity in the weekday PM peak hour. Queues are 10 vehicles or less and delays are 0.75 minutes or less. In comparison with Table G 4-3 above, it can be seen that the junction operation is similar to that without the proposed scheme in place.

Table G 4-6 Results for Tiptree double mini roundabout ARCADY model with the proposed scheme in place (2042)

	AM					PM				
Arm	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
B1022 (NE arm) Maldon Road	C	430	16.56	2	0.68	C	302	15.18	1	0.58
B1023 (SE arm) Church Road	A	658	5.92	1	0.54	A	516	4.53	1	0.42
B1022 (SW arm) Maldon Road	B	501	13.37	2	0.67	F	856	112.05	31	1.03
B1023 (NW arm) Kelvedon Road	A	579	6.50	1	0.53	C	749	16.66	4	0.79

The results show that the junction continues to operate satisfactorily in 2042 with the proposed scheme in place during the AM peak hour, but is slightly over-capacity in the weekday PM peak hour. Queues are 30 vehicles or less and delays are 2 minutes or less. In comparison with Table G 4-4 above, it can be seen that the junction operation is similar to that without the proposed scheme in place.

G.4.4. Summary

Table G 4-7 shows a summary of the results for the B1023 / B1022 double mini roundabout junction assessment.

Table G 4-7: Results for Tiptree double mini roundabout ARCADY model

Junction	Software (key statistic used)	Current operation		Future operation, with scheme 2027		Future operation, with scheme 2042		Future operation, without scheme 2027		Future operation, without scheme 2042	
		Weekday 0730-0830	Weekday 1700-1800	Weekday 0730-0830	Weekday 1700-1800	Weekday 0730-0830	Weekday 1700-1800	Weekday 0730-0830	Weekday 1700-1800	Weekday 0730-0830	Weekday 1700-1800
B1023 Kelvedon Rd / B1022 Maldon Rd (Tiptree)	ARCADY (RFC)	0.70	0.80	0.66	0.93	0.68	1.03	0.72	0.94	0.79	1.04

The results show that:

- The junction currently operates satisfactorily during both the weekday AM and PM peak hours.
- In 2027 without the proposed scheme in place, the junction operates satisfactorily during the weekday AM peak hour but is close to capacity in the weekday PM peak hour.
- In 2042 without the proposed scheme in place, the junction operates satisfactorily during the weekday AM peak hour but is over-capacity in the weekday PM peak hour.
- In 2027 with the proposed scheme in place, the junction operates satisfactorily during the weekday AM peak hour but is close to capacity in the weekday PM peak hour. This is the same as the situation without the proposed scheme in place.
- In 2042 with the proposed scheme in place, the junction operates satisfactorily during the weekday AM peak hour but is over-capacity in the weekday PM peak hour. This is the same as the situation without the proposed scheme in place.

G.4.5. Annex A

Traffic Flows – Current Operation (2019)

AM Peak

Origin / Destination	B1022 (NE arm) Maldon Road	B1023 (SE arm) Church Road	B1022 (SW arm) Maldon Road	B1023 (NW arm) Kelvedon Road	Total
B1022 (NE arm) Maldon Road	0	144	306	61	511
B1023 (SE arm) Church Road	152	0	43	267	462
B1022 (SW arm) Maldon Road	291	67	0	149	507
B1023 (NW arm) Kelvedon Road	92	169	106	0	367
Total	535	379	455	477	1847

PM Peak

Origin / Destination	B1022 (NE arm) Maldon Road	B1023 (SE arm) Church Road	B1022 (SW arm) Maldon Road	B1023 (NW arm) Kelvedon Road	Total
B1022 (NE arm) Maldon Road	0	119	205	20	344
B1023 (SE arm) Church Road	179	0	56	129	364
B1022 (SW arm) Maldon Road	460	133	0	127	720
B1023 (NW arm) Kelvedon Road	146	303	187	0	636
Total	785	555	448	276	2064

Traffic Flows – Without Scheme Operation (2027)

AM Peak

Origin / Destination	B1022 (NE arm) Maldon Road	B1023 (SE arm) Church Road	B1022 (SW arm) Maldon Road	B1023 (NW arm) Kelvedon Road	Total
B1022 (NE arm) Maldon Road	0	154	293	59	506
B1023 (SE arm) Church Road	163	0	47	265	475
B1022 (SW arm) Maldon Road	313	72	0	199	584
B1023 (NW arm) Kelvedon Road	99	197	141	0	437
Total	575	423	481	523	2001

PM Peak

Origin / Destination	B1022 (NE arm) Maldon Road	B1023 (SE arm) Church Road	B1022 (SW arm) Maldon Road	B1023 (NW arm) Kelvedon Road	Total
B1022 (NE arm) Maldon Road	0	128	233	13	374
B1023 (SE arm) Church Road	192	0	60	160	412
B1022 (SW arm) Maldon Road	495	142	0	191	828
B1023 (NW arm) Kelvedon Road	157	302	240	0	699
Total	844	573	533	364	2313

Traffic Flows – With Scheme Operation (2027)

AM Peak

Origin / Destination	B1022 (NE arm) Maldon Road	B1023 (SE arm) Church Road	B1022 (SW arm) Maldon Road	B1023 (NW arm) Kelvedon Road	Total
B1022 (NE arm) Maldon Road	0	143	274	5	422
B1023 (SE arm) Church Road	117	0	47	435	599
B1022 (SW arm) Maldon Road	265	72	0	170	507
B1023 (NW arm) Kelvedon Road	87	280	176	0	543
Total	469	495	497	610	2070

PM Peak

Origin / Destination	B1022 (NE arm) Maldon Road	B1023 (SE arm) Church Road	B1022 (SW arm) Maldon Road	B1023 (NW arm) Kelvedon Road	Total
B1022 (NE arm) Maldon Road	0	107	204	3	314
B1023 (SE arm) Church Road	186	0	60	239	485
B1022 (SW arm) Maldon Road	439	142	0	201	782
B1023 (NW arm) Kelvedon Road	107	400	224	0	731
Total	732	650	488	443	2312

Traffic Flows – Without Scheme Operation (2042)

AM Peak

Origin / Destination	B1022 (NE arm) Maldon Road	B1023 (SE arm) Church Road	B1022 (SW arm) Maldon Road	B1023 (NW arm) Kelvedon Road	Total
B1022 (NE arm) Maldon Road	0	170	286	72	528
B1023 (SE arm) Church Road	180	0	51	270	501
B1022 (SW arm) Maldon Road	346	79	0	202	627
B1023 (NW arm) Kelvedon Road	109	209	159	0	477
Total	635	458	496	544	2133

PM Peak

Origin / Destination	B1022 (NE arm) Maldon Road	B1023 (SE arm) Church Road	B1022 (SW arm) Maldon Road	B1023 (NW arm) Kelvedon Road	Total
B1022 (NE arm) Maldon Road	0	142	250	13	405
B1023 (SE arm) Church Road	213	0	66	171	450
B1022 (SW arm) Maldon Road	546	157	0	194	898
B1023 (NW arm) Kelvedon Road	173	292	245	0	710
Total	932	591	561	378	2462

Traffic Flows – With Scheme Operation (2042)

AM Peak

Origin / Destination	B1022 (NE arm) Maldon Road	B1023 (SE arm) Church Road	B1022 (SW arm) Maldon Road	B1023 (NW arm) Kelvedon Road	Total
B1022 (NE arm) Maldon Road	0	158	270	2	430
B1023 (SE arm) Church Road	177	0	51	430	658
B1022 (SW arm) Maldon Road	253	79	0	169	501
B1023 (NW arm) Kelvedon Road	106	300	173	0	579
Total	536	537	494	601	2168

PM Peak

Origin / Destination	B1022 (NE arm) Maldon Road	B1023 (SE arm) Church Road	B1022 (SW arm) Maldon Road	B1023 (NW arm) Kelvedon Road	Total
B1022 (NE arm) Maldon Road	0	99	193	10	302
B1023 (SE arm) Church Road	206	0	66	244	516
B1022 (SW arm) Maldon Road	497	157	0	202	857
B1023 (NW arm) Kelvedon Road	112	415	222	0	749
Total	815	671	481	456	2423

HGV Proportions – Current Operations (2019)

AM Peak

Origin / Destination	B1022 (NE arm) Maldon Road	B1023 (SE arm) Church Road	B1022 (SW arm) Maldon Road	B1023 (NW arm) Kelvedon Road	Total
B1022 (NE arm) Maldon Road	0%	3%	2%	3%	2%
B1023 (SE arm) Church Road	1%	0%	5%	2%	2%
B1022 (SW arm) Maldon Road	0%	4%	0%	2%	1%
B1023 (NW arm) Kelvedon Road	2%	2%	1%	0%	2%
Total	1%	3%	2%	2%	2%

PM Peak

Origin / Destination	B1022 (NE arm) Maldon Road	B1023 (SE arm) Church Road	B1022 (SW arm) Maldon Road	B1023 (NW arm) Kelvedon Road	Total
B1022 (NE arm) Maldon Road	0%	0%	1%	5%	1%
B1023 (SE arm) Church Road	0%	0%	0%	1%	0%
B1022 (SW arm) Maldon Road	0%	0%	0%	2%	1%
B1023 (NW arm) Kelvedon Road	0%	0%	0%	0%	0%
Total	0%	0%	0%	1%	0%

HGV Proportions – Without Scheme Operations (2027)

AM Peak

Origin / Destination	B1022 (NE arm) Maldon Road	B1023 (SE arm) Church Road	B1022 (SW arm) Maldon Road	B1023 (NW arm) Kelvedon Road	Total
B1022 (NE arm) Maldon Road	0%	3%	2%	2%	2%
B1023 (SE arm) Church Road	1%	0%	4%	2%	1%
B1022 (SW arm) Maldon Road	0%	4%	0%	2%	1%
B1023 (NW arm) Kelvedon Road	2%	2%	1%	0%	1%
Total	1%	2%	2%	2%	2%

PM Peak

Origin / Destination	B1022 (NE arm) Maldon Road	B1023 (SE arm) Church Road	B1022 (SW arm) Maldon Road	B1023 (NW arm) Kelvedon Road	Total
B1022 (NE arm) Maldon Road	0%	0%	1%	8%	1%
B1023 (SE arm) Church Road	0%	0%	0%	1%	0%
B1022 (SW arm) Maldon Road	0%	0%	0%	1%	0%
B1023 (NW arm) Kelvedon Road	0%	0%	0%	0%	0%
Total	0%	0%	0%	1%	0%

HGV Proportions – With Scheme Operations (2027)

AM Peak

Origin / Destination	B1022 (NE arm) Maldon Road	B1023 (SE arm) Church Road	B1022 (SW arm) Maldon Road	B1023 (NW arm) Kelvedon Road	Total
B1022 (NE arm) Maldon Road	0%	3%	1%	0%	1%
B1023 (SE arm) Church Road	1%	0%	4%	1%	2%
B1022 (SW arm) Maldon Road	0%	4%	0%	2%	1%
B1023 (NW arm) Kelvedon Road	2%	3%	3%	0%	3%
Total	1%	3%	2%	1%	2%

PM Peak

Origin / Destination	B1022 (NE arm) Maldon Road	B1023 (SE arm) Church Road	B1022 (SW arm) Maldon Road	B1023 (NW arm) Kelvedon Road	Total
B1022 (NE arm) Maldon Road	0%	0%	0%	33%	1%
B1023 (SE arm) Church Road	0%	0%	0%	0%	0%
B1022 (SW arm) Maldon Road	0%	0%	0%	1%	1%
B1023 (NW arm) Kelvedon Road	0%	0%	0%	0%	0%
Total	0%	0%	0%	1%	0%

HGV Proportions – Without Scheme Operations (2042)

AM Peak

Origin / Destination	B1022 (NE arm) Maldon Road	B1023 (SE arm) Church Road	B1022 (SW arm) Maldon Road	B1023 (NW arm) Kelvedon Road	Total
B1022 (NE arm) Maldon Road	0%	2%	2%	1%	2%
B1023 (SE arm) Church Road	1%	0%	4%	2%	2%
B1022 (SW arm) Maldon Road	0%	4%	0%	1%	1%
B1023 (NW arm) Kelvedon Road	2%	1%	1%	0%	1%
Total	1%	2%	2%	2%	1%

PM Peak

Origin / Destination	B1022 (NE arm) Maldon Road	B1023 (SE arm) Church Road	B1022 (SW arm) Maldon Road	B1023 (NW arm) Kelvedon Road	Total
B1022 (NE arm) Maldon Road	0%	0%	1%	8%	1%
B1023 (SE arm) Church Road	0%	0%	0%	1%	0%
B1022 (SW arm) Maldon Road	0%	0%	0%	1%	0%
B1023 (NW arm) Kelvedon Road	0%	0%	0%	0%	0%
Total	0%	0%	0%	1%	0%

HGV Proportions – With Scheme Operations (2042)

AM Peak

Origin / Destination	B1022 (NE arm) Maldon Road	B1023 (SE arm) Church Road	B1022 (SW arm) Maldon Road	B1023 (NW arm) Kelvedon Road	Total
B1022 (NE arm) Maldon Road	0%	3%	1%	0%	1%
B1023 (SE arm) Church Road	1%	0%	4%	2%	2%
B1022 (SW arm) Maldon Road	0%	4%	0%	2%	2%
B1023 (NW arm) Kelvedon Road	2%	2%	3%	0%	2%
Total	1%	3%	2%	2%	2%

PM Peak

Origin / Destination	B1022 (NE arm) Maldon Road	B1023 (SE arm) Church Road	B1022 (SW arm) Maldon Road	B1023 (NW arm) Kelvedon Road	Total
B1022 (NE arm) Maldon Road	0%	0%	1%	10%	1%
B1023 (SE arm) Church Road	0%	0%	0%	1%	0%
B1022 (SW arm) Maldon Road	0%	0%	0%	1%	0%
B1023 (NW arm) Kelvedon Road	0%	0%	0%	0%	0%
Total	0%	0%	0%	1%	0%

G.5. B1408 London Rd / School Rd (Copford): Junction Model Technical Note

G.5.1. Introduction

Overview

The purpose of this technical note is to describe the modelling assessments which have been undertaken at the B1408 London Road/School Road priority junction as part of the A12 Chelmsford to A120 widening project.

The B1408 London Road / School Road junction is currently a priority junction, located in Copford, to the west of Colchester. The B1408 London Road is the major road with an east west orientation and School Road forms the minor arm.

Modelling scenarios

The junction has been assessed using the PICADY module within the industry standard junction modelling software Junctions 9. The following traffic scenarios have been considered for both the AM (07:30-08:30) and PM (17:00 – 18:00) peak hours, all with the existing junction arrangement:

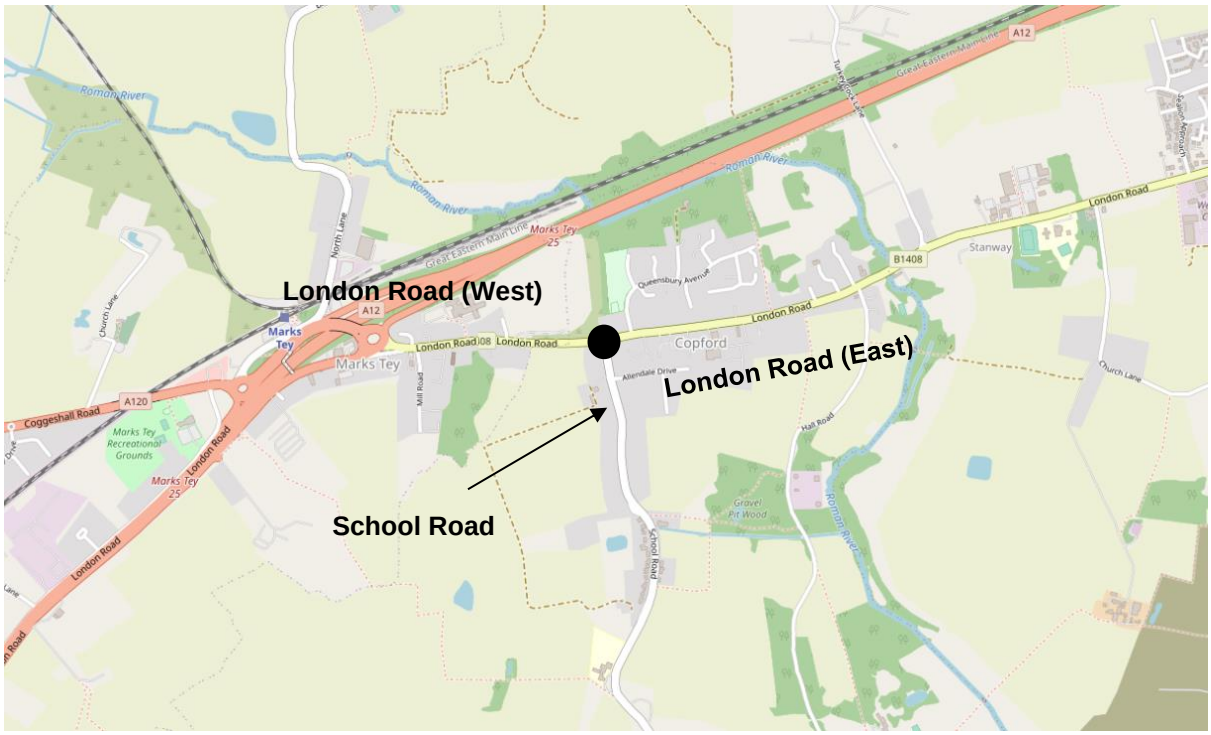
- Current operation scenario (2019).
- Future operation without the proposed scheme in place (2027).
- Future operation with the proposed scheme in place (2027).
- Future operation without the proposed scheme in place (2042).
- Future operation with the proposed scheme in place (2042).

G.5.2. Model description

Junction location

The location of the junction is shown in Plate G 5-1. The junction is located in Copford with the B1408 London Road running east-west from A12 Junction 25 to Colchester. School Road forms the minor arm and runs north-south providing access to small communities to the south, such as Copford Green.

Plate G 5-1: B1408 London Road/School Road priority junction (Source: Open Street Map)



Key assumptions and input parameters

The PICADY model required several geometric parameters to be measured for the calculation of theoretical capacity. Junction geometric measurements were taken at the junction from AutoCAD drawings in accordance with the PICADY user guide.

Traffic volume has been input as vehicles with a 2.5 PCU factor for Heavy Goods Vehicles.

Traffic data

A bespoke traffic model has been developed for the appraisal of the proposed scheme using industry standard SATURN software, for which further details can be found in the Combined Modelling and Appraisal report. The outputs from the strategic model formed the basis for the inputs into the junction modelling.

The current A12 / Easthorpe Road junction will be closed once the new scheme is in place, with small increases in traffic of approximately 50 vehicles or less in the peak hours predicted on School Road as a consequence.

Traffic flows are modest on the B1408 London Road major road, with only small flows on the School Road minor arm during both the weekday AM and PM peak hours for all scenarios. All the traffic flows for all the scenarios, along with HGV proportions, are provided in Annex A.

G.5.3. Junction modelling results

Current operation (2019)

A key statistic produced by PICADY is the RFC (Reference Flow to Capacity). A value of 0.85 is desirable for all arms of new junctions and indicates that the junction is likely statistically to be under-capacity. In assessing an existing junction, for values below 0.85 a junction is considered to be under-capacity, for values between 0.85 and 1.00 a junction is considered to be approaching capacity, whereas for values above 1.00 a junction is considered to be over-capacity.

The results of the junction modelling for current operation are presented in Table G 5-1.

Table G 5-1: Results for B1408 London Road/School Road PICADY model for Current Operation (2019)

	AM					PM				
Movements	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
School Road to London Road (West)	A	102	7.26	0	0.18	A	97	6.98	0	0.17
School Road to London Road (East)	A	61	9.81	0	0.15	A	52	9.76	0	0.13
From London Road (West)	A	284	6.85	0	0.14	A	360	7.13	0	0.21

The results show that the junction currently operates satisfactorily, with no queues and delays of less than 10 seconds during both the weekday AM and PM peak hours.

Future operation with construction (2025)

The future operation with construction (2025) has not been considered because there is unlikely to be significant volumes of construction traffic travelling through Boreham.

Future operation without scheme in place (2027, 2042)

The results of the junction modelling for future operations without the proposed scheme in place are presented in Table G 5-2 for the year 2027 and Table G 5-3 for the year 2042.

Table G 5-2: Results for B1408 London Road/School Road PICADY model for Future operation without scheme (2027)

	AM					PM				
Movements	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
School Road to London Road (West)	A	107	7.84	0	0.2	A	109	7.52	0	0.2
School Road to London Road (East)	B	71	10.88	0	0.19	B	65	10.87	0	0.18
From London Road (West)	A	336	7.32	0	0.16	A	412	7.56	0	0.23

The results show that the junction operates satisfactorily in 2027 without the proposed scheme in place during both the weekday AM and PM peak hours, with no queues and delays of approximately 10 seconds.

Table G 5-3: Results for B1408 London Road/School Road PICADY model for Future operation without scheme (2042)

	AM					PM				
Movements	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
School Road to London Road (West)	A	105	8.57	0	0.22	A	106	8.1	0	0.21
School Road to London Road (East)	C	111	15.98	1	0.35	B	84	12.82	0	0.25
From London Road (West)	A	401	8.13	0	0.2	A	485	8.24	0	0.27

The results show that the junction operates satisfactorily in 2042 without the proposed scheme in place during both the weekday AM and PM peak hours, with no queues and delays of approximately 15 seconds or less.

Future operation with scheme in place (2027, 2042)

The results of the junction modelling for future operations with the proposed scheme in place are presented in Table G 5-4 for the year 2027 and in Table G 5-5 for the year 2042.

Table G 5-4: Results for B1408 London Road/School Road PICADY model for Future operation with scheme (2027)

	AM					PM				
Movements	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
School Road to London Road (West)	A	161	9.57	1	0.32	A	121	7.9	0	0.23
School Road to London Road (East)	B	69	12.99	0	0.22	B	54	12.26	0	0.17
From London Road (West)	A	424	7.63	0	0.15	A	537	7.9	0	0.26

The results show that the junction operates satisfactorily in 2027 with the proposed scheme in place in both the weekday AM and PM peak hours, with no queues and delays of less than 15 seconds.

Table G 5-5: Results for B1408 London Road/School Road PICADY model for Future operation with scheme (2042)

	AM					PM				
Movements	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
School Road to London Road (West)	B	176	12.05	1	0.39	A	133	9.18	0	0.27
School Road to London Road (East)	C	84	17.72	0	0.31	C	74	15.67	0	0.26
From London Road (West)	A	498	8.39	0	0.19	A	621	8.69	0	0.29

The results show that the junction operates satisfactorily in 2042 with the proposed scheme in place during both the weekday AM and PM peak hours, with no queues and delays of less than 20 seconds.

G.5.4. Summary

The junction operates satisfactorily, both currently and in the future, both with and without the proposed scheme in place.

G.5.5. Annex A

Traffic Flows – Current Operation (2019)

AM Peak

Origin / Destination	London Rd (East)	School Rd	London Rd (West)	Total
London Rd (East)	0	19	204	223
School Rd	61	0	102	163
London Rd (West)	209	75	0	284
Total	270	94	306	670

PM Peak

Origin / Destination	London Rd (East)	School Rd	London Rd (West)	Total
London Rd (East)	0	20	143	163
School Rd	52	0	97	149
London Rd (West)	238	122	0	360
Total	290	142	240	672

Traffic Flows – Without Scheme Operation (2027)

AM Peak

Origin / Destination	London Rd (East)	School Rd	London Rd (West)	Total
London Rd (East)	0	29	247	276
School Rd	71	0	107	178
London Rd (West)	249	87	0	336
Total	320	116	354	790

PM Peak

Origin / Destination	London Rd (East)	School Rd	London Rd (West)	Total
London Rd (East)	0	30	182	212
School Rd	65	0	109	174
London Rd (West)	285	127	0	412
Total	350	157	291	798

Traffic Flows – With Scheme Operation (2027)

AM Peak

Origin / Destination	London Rd (East)	School Rd	London Rd (West)	Total
London Rd (East)	0	25	328	353
School Rd	69	0	161	230
London Rd (West)	347	77	0	424
Total	416	102	489	1007

PM Peak

Origin / Destination	London Rd (East)	School Rd	London Rd (West)	Total
London Rd (East)	0	23	237	260
School Rd	54	0	121	175
London Rd (West)	395	142	0	537
Total	449	165	358	972

Traffic Flows – Without Scheme Operation (2042)

AM Peak

Origin / Destination	London Rd (East)	School Rd	London Rd (West)	Total
London Rd (East)	0	47	352	399
School Rd	111	0	105	216
London Rd (West)	301	100	0	401
Total	412	147	457	1016

PM Peak

Origin / Destination	London Rd (East)	School Rd	London Rd (West)	Total
London Rd (East)	0	50	235	285
School Rd	84	0	106	190
London Rd (West)	339	146	0	485
Total	423	196	341	960

Traffic Flows – With Scheme Operation (2042)

AM Peak

Origin / Destination	London Rd (East)	School Rd	London Rd (West)	Total
London Rd (East)	0	33	456	489
School Rd	84	0	176	260
London Rd (West)	409	89	0	498
Total	493	122	632	1247

PM Peak

Origin / Destination	London Rd (East)	School Rd	London Rd (West)	Total
London Rd (East)	0	41	323	364
School Rd	74	0	133	207
London Rd (West)	473	148	0	621
Total	547	189	456	1192

HGV Proportions – Current Operations (2019)

AM Peak

Origin / Destination	London Rd (East)	School Rd	London Rd (West)	Average
London Rd (East)	0%	0%	1%	0%
School Rd	0%	0%	0%	0%
London Rd (West)	3%	1%	0%	1%
Average	1%	0%	0%	-

PM Peak

Origin / Destination	London Rd (East)	School Rd	London Rd (West)	Average
London Rd (East)	0%	0%	1%	0%
School Rd	0%	0%	1%	0%
London Rd (West)	1%	0%	0%	0%
Average	0%	0%	1%	-

HGV Proportions – Without Scheme Operations (2027)

AM Peak

Origin / Destination	London Rd (East)	School Rd	London Rd (West)	Average
London Rd (East)	0%	0%	1%	0%
School Rd	0%	0%	1%	0%
London Rd (West)	3%	2%	0%	2%
Average	1%	1%	1%	-

PM Peak

Origin / Destination	London Rd (East)	School Rd	London Rd (West)	Average
London Rd (East)	0%	0%	2%	1%
School Rd	0%	0%	1%	0%
London Rd (West)	1%	1%	0%	1%
Average	0%	0%	1%	-

HGV Proportions – With Scheme Operations (2027)

AM Peak

Origin / Destination	London Rd (East)	School Rd	London Rd (West)	Average
London Rd (East)	0%	0%	2%	1%
School Rd	0%	0%	1%	0%
London Rd (West)	1%	3%	0%	1%
Average	0%	1%	1%	-

PM Peak

Origin / Destination	London Rd (East)	School Rd	London Rd (West)	Average
London Rd (East)	0%	0%	3%	1%
School Rd	0%	0%	1%	0%
London Rd (West)	1%	0%	0%	0%
Average	0%	0%	1%	-

HGV Proportions – Without Scheme Operations (2042)

AM Peak

Origin / Destination	London Rd (East)	School Rd	London Rd (West)	Average
London Rd (East)	0%	0%	1%	0%
School Rd	0%	0%	0%	0%
London Rd (West)	3%	2%	0%	2%
Average	1%	1%	0%	-

PM Peak

Origin / Destination	London Rd (East)	School Rd	London Rd (West)	Average
London Rd (East)	0%	0%	2%	1%
School Rd	0%	0%	1%	0%
London Rd (West)	1%	1%	0%	0%
Average	0%	0%	1%	-

HGV Proportions – With Scheme Operations (2042)

AM Peak

Origin / Destination	London Rd (East)	School Rd	London Rd (West)	Average
London Rd (East)	0%	0%	1%	0%
School Rd	0%	0%	1%	0%
London Rd (West)	1%	2%	0%	1%
Average	0%	1%	1%	-

PM Peak

Origin / Destination	London Rd (East)	School Rd	London Rd (West)	Average
London Rd (East)	0%	0%	2%	1%
School Rd	0%	0%	1%	0%
London Rd (West)	1%	1%	0%	0%
Average	0%	0%	1%	-

G.6. B1137 Main Road / Church Road (Boreham): Junction Model Technical Note

G.6.1. Introduction

Overview

The purpose of this technical note is to describe the modelling assessments which have been undertaken at B1137 Main Road/Church Road priority junction as part of the A12 Chelmsford to A120 widening project.

The B1137 Main Road / Church Road junction is a priority junction, located in Boreham. The B1137 Main Road is the major road with an east-west orientation and Church Road is the minor arm.

Modelling scenarios

The junction has been assessed using the PICADY module within the industry standard junction modelling software Junctions 9. The following traffic scenarios have been considered for both the AM (07:30-08:30) and PM (17:00 – 18:00) peak hours, all with the existing junction arrangement:

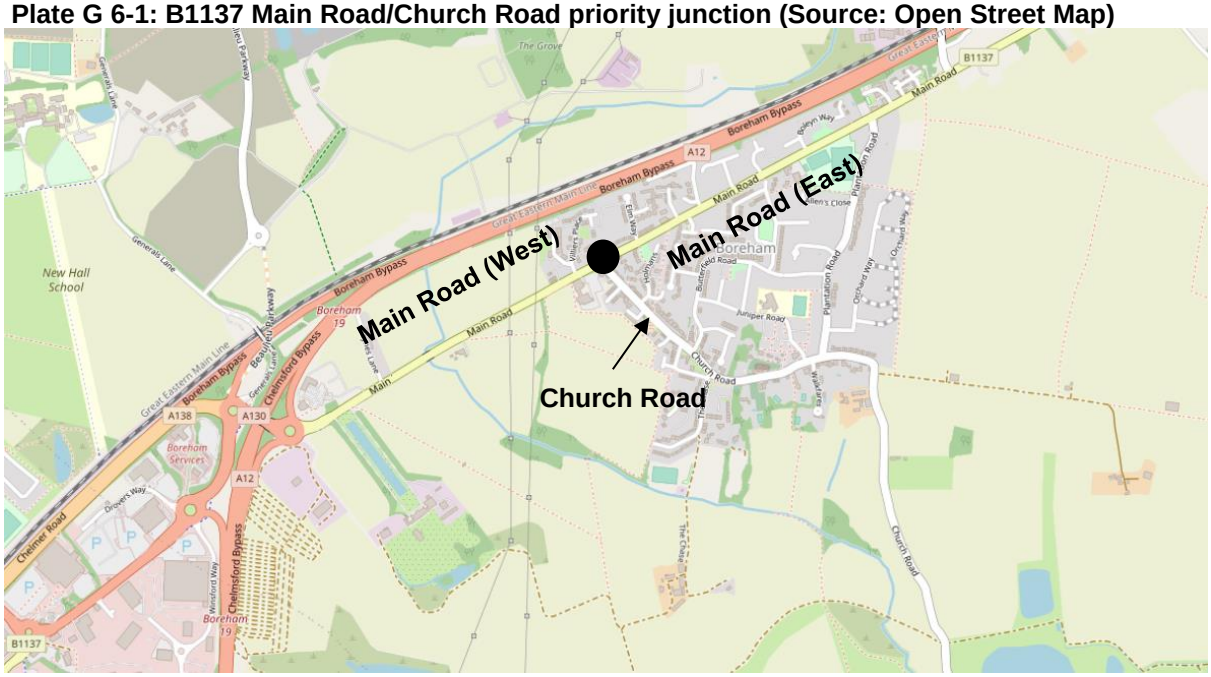
- Current operation scenario (2019).
- Future operation without the proposed scheme in place (2027).
- Future operation with the proposed scheme in place (2027).
- Future operation without the proposed scheme in place (2042).
- Future operation with the proposed scheme in place (2042).

G.6.2. Model description

Junction location

The location of the junction is shown in Plate G 6-1. The junction is located in Boreham with the B1137 Main Road running east-west through Boreham connecting the A12 Junction 19 to Hatfield Peverel. Church Road forms the minor arm and, along with Plantation Road, provides access to residential areas of Boreham.

Plate G 6-1: B1137 Main Road/Church Road priority junction (Source: Open Street Map)



Key assumptions and input parameters

The PICADY model required several geometric parameters to be measured for the calculation of theoretical capacity. Junction geometric measurements were taken at the junction from AutoCAD drawings in accordance with the PICADY user guide.

Traffic volume has been input as vehicles with a 2.5 PCU factor for Heavy Goods Vehicles.

Traffic data

A bespoke traffic model has been developed for the appraisal of the proposed scheme using industry standard SATURN software, for which further details can be found in the Combined Modelling and Appraisal report. The outputs from the strategic model formed the basis for the inputs into the junction modelling.

However, for this junction, local surveyed flows were available in the form of a historic turning count at this junction from a Transport Assessment report for a housing development east of Plantation Road, which is currently being built out. To improve the robustness of the turning flows at this junction, where 2019 base + development turning flows were significantly greater than those from the SATURN model, such flows were uplifted using TEMPRO/RTF growth rates to derive 2027 and 2042 flows without the A12 scheme in place. The changes in turning flows resulting from the A12 scheme, as forecast by the SATURN model, were then applied to derive the 2027 and 2042 flows with the proposed scheme in place.

Making best use of the SATURN and local surveyed flows has improved the robustness of the flows at this junction. The resultant traffic flows under each scenario along with their HGV proportions are shown in Annex A.

G.6.3. Junction modelling results

Current operation (2019)

A key statistic produced by PICADY is the RFC (Reference Flow to Capacity). A value of 0.85 is desirable for all arms of new junctions and indicates that the junction is likely statistically to be under-capacity. In assessing an existing junction, for values below 0.85 a junction is considered to be under-capacity, for values between 0.85 and 1.00 a junction is considered to be approaching capacity, whereas for values above 1.00 a junction is considered to be over-capacity.

The results of the junction modelling for current operations in 2019 are presented in Table G 6-1.

Table G 6-1: Results for B1137 Main Road/Church Road PICADY model for Current Operation (2019)

	AM					PM				
Movements	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
From Church Road	B	167	12.73	1	0.39	B	130	11.26	0	0.31
From Main Road (West)	A	432	7.35	0	0.19	A	495	7.87	0	0.24

The results show that the junction currently operates satisfactorily, with no queues and delays of approximately 10 seconds, during both the weekday AM and PM peak hours.

Future operation with construction (2025)

The future operation with construction (2025) has not been considered because there is unlikely to be significant volumes of construction traffic travelling through Boreham.

Future operation without scheme in place (2027, 2042)

The results of the junction modelling for future operations without the proposed scheme in place are presented in Table G 6-2 for the year 2027 and Table G 6-3 for the year 2042.

Table G 6-2: Results for B1137 Main Road/Church Road PICADY model for Future Operation without scheme (2027)

	AM					PM				
Movements	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
From Church Road	B	180	14.04	1	0.44	B	140	12.22	1	0.34
From Main Road (West)	A	463	7.60	0	0.21	A	532	8.23	0	0.26

The results show that the junction operates satisfactorily in 2027 without the proposed scheme in place during both the weekday AM and PM peak hours, with minimal queues and delays of less than 15 seconds.

Table G 6-3: Results for B1137 Main Road/Church Road PICADY model for Future Operation without scheme (2042)

	AM					PM				
Movements	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
From Church Road	C	198	16.47	1	0.5	B	154	13.86	1	0.4
From Main Road (West)	A	511	8.03	0	0.24	A	587	8.82	0	0.3

The results show the junction operates satisfactorily in 2042 without the proposed scheme in place during both the weekday AM and PM peak hours, with minimal queues and delays of approximately 15 seconds or less.

Future operation with scheme in place (2027, 2042)

The results of the junction modelling for future operations with the proposed scheme in place are presented in Table G 6-4 for the year 2027 and in Table G 6-5 for the year 2042.

Table G 6-4: Results for B1137 Main Road/Church Road PICADY model for Future Operation with scheme (2027)

	AM					PM				
Movements	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
From Church Road	C	175	18.29	1	0.5	B	138	13.07	1	0.36
From Main Road (West)	A	484	8.93	0	0.25	A	289	9.81	1	0.33

The results show that the junction operates satisfactorily in 2027 with the proposed scheme in place in both the weekday AM and PM peak hours, with minimal queues and delays of less than 20 seconds.

Table G 6-5: Results for B1137 Main Road/Church Road PICADY model for Future Operation with scheme (2042)

	AM					PM				
Movements	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
From Church Road	B	164	13.79	1	0.41	C	172	16.28	1	0.46
From Main Road (West)	A	481	9.17	1	0.27	A	242	9.99	1	0.34

The results show that the junction operates satisfactorily in 2042 with the proposed scheme in place during both the weekday AM and PM peak hours, with minimal queues and delays of less than 20 seconds.

G.6.4. Summary

The junction operates satisfactorily currently and in 2027 and 2042, both with and without the proposed scheme in place.

G.6.5. Annex A

Traffic Flows – Current Operation (2019)

AM Peak

Origin / Destination	Main Rd (East)	Church Rd	Main Rd (West)	Total
Main Rd (East)	0	30	342	372
Church Rd	49	0	118	167
Main Rd (West)	326	106	0	432
Total	375	136	460	971

PM Peak

Origin / Destination	Main Rd (East)	Church Rd	Main Rd (West)	Total
Main Rd (East)	0	53	377	430
Church Rd	34	0	96	130
Main Rd (West)	364	131	0	495
Total	398	184	473	1055

Traffic Flows – Without Scheme Operation (2027)

AM Peak

Origin / Destination	Main Rd (East)	Church Rd	Main Rd (West)	Total
Main Rd (East)	0	32	367	399
Church Rd	53	0	127	180
Main Rd (West)	350	113	0	463
Total	403	145	494	1042

PM Peak

Origin / Destination	Main Rd (East)	Church Rd	Main Rd (West)	Total
Main Rd (East)	0	56	404	460
Church Rd	37	0	103	140
Main Rd (West)	391	141	0	532
Total	428	197	507	1132

Traffic Flows – With Scheme Operation (2027)

AM Peak

Origin / Destination	Main Rd (East)	Church Rd	Main Rd (West)	Total
Main Rd (East)	0	32	569	601
Church Rd	53	0	122	175
Main Rd (West)	362	122	0	484
Total	415	154	691	1260

PM Peak

Origin / Destination	Main Rd (East)	Church Rd	Main Rd (West)	Total
Main Rd (East)	0	56	540	596
Church Rd	37	0	101	138
Main Rd (West)	123	166	0	289
Total	160	222	641	1023

Traffic Flows – Without Scheme Operation (2042)

AM Peak

Origin / Destination	Main Rd (East)	Church Rd	Main Rd (West)	Total
Main Rd (East)	0	35	405	440
Church Rd	58	0	140	198
Main Rd (West)	386	125	0	511
Total	444	160	545	1149

PM Peak

Origin / Destination	Main Rd (East)	Church Rd	Main Rd (West)	Total
Main Rd (East)	0	62	446	508
Church Rd	40	0	114	154
Main Rd (West)	432	155	0	587
Total	472	217	560	1249

Traffic Flows – With Scheme Operation (2042)

AM Peak

Origin / Destination	Main Rd (East)	Church Rd	Main Rd (West)	Total
Main Rd (East)	0	30	581	611
Church Rd	20	0	144	164
Main Rd (West)	352	129	0	481
Total	372	159	725	1256

PM Peak

Origin / Destination	Main Rd (East)	Church Rd	Main Rd (West)	Total
Main Rd (East)	0	45	564	609
Church Rd	57	0	115	172
Main Rd (West)	74	168	0	242
Total	131	213	679	1023

HGV Proportions – Current Operations (2019)

AM Peak

Origin / Destination	Main Rd (East)	Church Rd	Main Rd (West)	Average
Main Rd (East)	0%	0%	3%	1%
Church Rd	2%	0%	1%	1%
Main Rd (West)	2%	1%	0%	1%
Average	1%	0%	1%	-

PM Peak

Origin / Destination	Main Rd (East)	Church Rd	Main Rd (West)	Average
Main Rd (East)	0%	0%	1%	0%
Church Rd	0%	0%	1%	0%
Main Rd (West)	1%	0%	0%	0%
Average	0%	0%	1%	-

HGV Proportions – Without Scheme Operations (2027)

AM Peak

Origin / Destination	Main Rd (East)	Church Rd	Main Rd (West)	Average
Main Rd (East)	0%	0%	3%	1%
Church Rd	2%	0%	1%	1%
Main Rd (West)	2%	1%	0%	1%
Average	1%	0%	1%	-

PM Peak

Origin / Destination	Main Rd (East)	Church Rd	Main Rd (West)	Average
Main Rd (East)	0%	0%	1%	0%
Church Rd	0%	0%	1%	0%
Main Rd (West)	1%	0%	0%	0%
Average	0%	0%	1%	-

HGV Proportions – With Scheme Operations (2027)

AM Peak

Origin / Destination	Main Rd (East)	Church Rd	Main Rd (West)	Average
Main Rd (East)	0%	0%	2%	1%
Church Rd	2%	0%	1%	1%
Main Rd (West)	2%	1%	0%	1%
Average	1%	0%	1%	-

PM Peak

Origin / Destination	Main Rd (East)	Church Rd	Main Rd (West)	Average
Main Rd (East)	0%	0%	1%	0%
Church Rd	0%	0%	1%	0%
Main Rd (West)	3%	0%	0%	1%
Average	1%	0%	1%	-

HGV Proportions – Without Scheme Operations (2042)

AM Peak

Origin / Destination	Main Rd (East)	Church Rd	Main Rd (West)	Average
Main Rd (East)	0%	0%	3%	1%
Church Rd	2%	0%	1%	1%
Main Rd (West)	2%	1%	0%	1%
Average	1%	0%	1%	-

PM Peak

Origin / Destination	Main Rd (East)	Church Rd	Main Rd (West)	Average
Main Rd (East)	0%	0%	1%	0%
Church Rd	0%	0%	1%	0%
Main Rd (West)	1%	0%	0%	0%
Average	0%	0%	1%	-

HGV Proportions – With Scheme Operations (2042)

AM Peak

Origin / Destination	Main Rd (East)	Church Rd	Main Rd (West)	Average
Main Rd (East)	0%	0%	2%	1%
Church Rd	5%	0%	1%	2%
Main Rd (West)	2%	1%	0%	1%
Average	2%	0%	1%	-

PM Peak

Origin / Destination	Main Rd (East)	Church Rd	Main Rd (West)	Average
Main Rd (East)	0%	0%	1%	0%
Church Rd	0%	0%	1%	0%
Main Rd (West)	6%	0%	0%	2%
Average	2%	0%	1%	-

G.7. B1137 Main Road / Plantation Road (Boreham) : Junction Model Technical Note

G.7.1. Introduction

Overview

The purpose of this technical note is to describe the modelling assessments which have been undertaken at B1137 Main Road/Plantation Road priority junction as part of the A12 Chelmsford to A120 widening project.

The B1137 Main Road / Plantation Road junction is a priority junction, located in Boreham. The B1137 Main Road is the major road with an east-west orientation and Plantation Road is the minor arm.

Modelling scenarios

The junction has been assessed using the PICADY module within the industry standard junction modelling software Junctions 9. The following traffic scenarios have been considered for both the AM (07:30 – 08:30) and PM (17:00 – 18:00) peak hours, all with the existing junction arrangement:

- Current operation scenario (2019).
- Future operation without the proposed scheme in place (2027).
- Future operation with the proposed scheme in place (2027).
- Future operation without the proposed scheme in place (2042).
- Future operation with the proposed scheme in place (2042).

G.7.2. Model description

Junction location

The location of the junction is shown in Plate G 7-1. The junction is located in Boreham with the B1137 Main Road running east-west through Boreham connecting the A12 Junction 19 to Hatfield Peverel. Plantation Road forms the minor arm and, along with Church Road, provides access to residential areas of Boreham.

Plate G 7-1: B1408 London Road/School Road T-junction (Source: Open Street Map)

Key assumptions and input parameters

The PICADY model required several geometric parameters to be measured for the calculation of theoretical capacity. Junction geometric measurements were taken at the junction from AutoCAD drawings in accordance with the PICADY user guide.

Traffic volume has been input as vehicles with a 2.5 PCU factor for Heavy Goods Vehicles.

Traffic data

A bespoke traffic model has been developed for the appraisal of the proposed scheme using industry standard SATURN software, for which further details can be found in the Combined Modelling and Appraisal report. The outputs from the strategic model formed the basis for the inputs into the junction modelling.

However, for this junction, local surveyed flows were available in the form of a historic turning count at this junction from a Transport Assessment report for a housing development east of Plantation Road, which is currently being built out. To improve the robustness of the turning flows at this junction, where 2019 base + development turning flows were significantly greater than those from the SATURN model, such flows were uplifted using TEMPRO/RTF growth rates to derive 2027 and 2042 flows without the A12 scheme in place. The changes in turning flows resulting from the A12 scheme, as forecast by the SATURN model, were then applied to derive the 2027 and 2042 flows with the proposed scheme in place.

Making best use of the SATURN and local surveyed flows has improved the robustness of the flows at this junction. The resultant traffic flows under each scenario along with their HGV proportions are shown in Annex A.

G.7.3. Junction modelling results

Current operation (2019)

A key statistic produced by PICADY is the RFC (Reference Flow to Capacity). A value of 0.85 is desirable for all arms of new junctions and indicates that the junction is likely statistically to be under-capacity. In assessing an existing junction, for values below 0.85 a junction is considered to be under-capacity, for values between 0.85 and 1.00 a junction is considered to be approaching capacity, whereas for values above 1.00 a junction is considered to be over-capacity.

The results of the junction modelling for current operation are presented in Table G 7-1.

Table G 7-1: Results for B1137 Main Road/Plantation Road PICADY model for Current Operation (2019)

	AM					PM				
Movements	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
From Plantation Rd	C	151	16.12	1	0.43	C	158	17.68	1	0.46
From Main Rd (West)	A	340	4.76	0	0.06	A	395	4.71	0	0.08

The results show that the junction currently operates satisfactorily, with no queues and delays of less than 20 seconds, during both the AM and PM peak hours.

Future operation with construction (2025)

The future operation with construction (2025) has not been considered because there is unlikely to be significant volumes of construction traffic travelling through Boreham.

Future operation without scheme in place (2027, 2042)

The results of the junction modelling for future operations without the proposed scheme in place are presented in Table G 7-2 for the year 2027 and in Table G 7-3 for the year 2042.

Table G 7-2: Results for B1137 Main Road/Plantation Road PICADY model for Future operation without scheme (2027)

	AM					PM				
Movements	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
From Plantation Rd	C	162	18.09	1	0.47	C	172	20.33	1	0.51
From Main Rd (West)	A	364	4.74	0	0.06	A	424	4.69	0	0.09

The results show that the junction operates satisfactorily in 2027 without the proposed scheme in place during both the weekday AM and PM peak hours, with minimal queues and delays of approximately 20 seconds or less.

Table G 7-3: Results for B1137 Main Road/Plantation Road PICADY model for Future operation without scheme (2042)

	AM					PM				
Movements	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
From Plantation Rd	C	178	22.18	1	0.55	D	189	26.14	2	0.60
From Main Rd (West)	A	402	4.72	0	0.07	A	469	4.67	0	0.11

The results show that the junction operates satisfactorily in 2042 without the proposed scheme in place during both the weekday AM and PM peak hours, with minimal queues and delays of less than 0.5 minutes.

Future operation with scheme in place (2027, 2042)

The results of the junction modelling for future operations with the proposed scheme in place are presented in Table G 7-4 for the year 2027 and in Table G 7-5 for the year 2042.

Table G 7-4: Results for B1137 Main Road/Plantation Road PICADY model for Future operation with scheme (2027)

	AM					PM				
Movements	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
From Plantation Rd	E	203	41.26	2	0.72	D	203	26.0	2	0.62
From Main Rd (West)	A	378	5.02	0	0.07	A	157	6.4	0	0.08

The results show that the junction operates satisfactorily in 2027 with the proposed scheme in place in both the AM and PM peak hours, with minimal queues and delays of approximately 40 seconds or less.

Table G 7-5: Results for B1137 Main Road/Plantation Road PICADY model for Future operation with scheme (2042)

	AM					PM				
Movements	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
From Plantation Rd	F	272	131.10	10	0.98	D	225	32.99	2	0.70
From Main Rd (West)	A	331	5.40	0	0.08	A	128	7.05	0	0.09

The results show that the junction is close to its capacity in 2042 with the proposed scheme in place during the AM peak hour, but the queues are only approximately 10 vehicles and delays are approximately 2 minutes. The junction operates satisfactorily in the PM peak hour, with queues of 2 vehicles and delays of approximately 0.5 minutes.

G.7.4. Summary

A summary of the results of the B1137 Main Road/Plantation Road PICADY assessment are presented in Table G 7-6:

Table G 7-6: Results for the B1137 Main Road/Plantation Road PICADY assessment

Junction	Software (key statistic used)	Current operation		Future operation, with scheme 2027		Future operation, with scheme 2042		Future operation, without scheme 2027		Future operation, without scheme 2042	
		Weekday 0730-0830	Weekday 1700-1800	Weekday 0730-0830	Weekday 1700-1800	Weekday 0730-0830	Weekday 1700-1800	Weekday 0730-0830	Weekday 1700-1800	Weekday 0730-0830	Weekday 1700-1800
B1137 Main Road / Plantation Road (Boreham)	PICADY (RFC)	0.43	0.46	0.72	0.62	0.98	0.70	0.47	0.51	0.55	0.60

The junction operates satisfactorily currently and in 2027 and 2042 without the proposed scheme in place. With the proposed scheme in place, the junction operates satisfactorily in 2027 and is close to its capacity in 2042 but for the AM peak hour only (operates satisfactorily in the PM peak hour).

G.7.5. Annex A

Traffic Flows – Current Operation (2019)

AM Peak

Origin / Destination	Main Rd (East)	Plantation Rd	Main Rd (West)	Total
Main Rd (East)	0	93	343	436
Plantation Rd	122	0	29	151
Main Rd (West)	316	24	0	340
Total	438	117	372	927

PM Peak

Origin / Destination	Main Rd (East)	Plantation Rd	Main Rd (West)	Total
Main Rd (East)	0	119	360	479
Plantation Rd	120	0	38	158
Main Rd (West)	363	32	0	395
Total	483	151	398	1032

Traffic Flows – Without Scheme Operation (2027)

AM Peak

Origin / Destination	Main Rd (East)	Plantation Rd	Main Rd (West)	Total
Main Rd (East)	0	100	368	468
Plantation Rd	131	0	31	162
Main Rd (West)	339	25	0	364
Total	470	125	399	994

PM Peak

Origin / Destination	Main Rd (East)	Plantation Rd	Main Rd (West)	Total
Main Rd (East)	0	127	387	514
Plantation Rd	129	0	41	170
Main Rd (West)	390	34	0	424
Total	519	161	428	1108

Traffic Flows – With Scheme Operation (2027)

AM Peak

Origin / Destination	Main Rd (East)	Plantation Rd	Main Rd (West)	Total
Main Rd (East)	0	134	571	705
Plantation Rd	172	0	31	203
Main Rd (West)	353	25	0	378
Total	525	159	602	1286

PM Peak

Origin / Destination	Main Rd (East)	Plantation Rd	Main Rd (West)	Total
Main Rd (East)	0	130	523	653
Plantation Rd	162	0	41	203
Main Rd (West)	123	34	0	157
Total	285	164	564	1013

Traffic Flows – Without Scheme Operation (2042)

AM Peak

Origin / Destination	Main Rd (East)	Plantation Rd	Main Rd (West)	Total
Main Rd (East)	0	111	406	517
Plantation Rd	144	0	34	178
Main Rd (West)	374	28	0	402
Total	518	139	440	1097

PM Peak

Origin / Destination	Main Rd (East)	Plantation Rd	Main Rd (West)	Total
Main Rd (East)	0	141	427	568
Plantation Rd	142	0	45	187
Main Rd (West)	431	38	0	469
Total	573	179	472	1224

Traffic Flows – With Scheme Operation (2042)

AM Peak

Origin / Destination	Main Rd (East)	Plantation Rd	Main Rd (West)	Total
Main Rd (East)	0	168	577	745
Plantation Rd	238	0	34	272
Main Rd (West)	303	28	0	331
Total	541	196	611	1348

PM Peak

Origin / Destination	Main Rd (East)	Plantation Rd	Main Rd (West)	Total
Main Rd (East)	0	202	527	729
Plantation Rd	180	0	45	225
Main Rd (West)	90	38	0	128
Total	270	240	572	1082

HGV Proportions – Current Operations (2019)

AM Peak

Origin / Destination	Main Rd (East)	Plantation Rd	Main Rd (West)	Average
Main Rd (East)	0%	0%	3%	1%
Plantation Rd	0%	0%	0%	0%
Main Rd (West)	2%	0%	0%	1%
Average	1%	0%	1%	-

PM Peak

Origin / Destination	Main Rd (East)	Plantation Rd	Main Rd (West)	Average
Main Rd (East)	0%	1%	1%	1%
Plantation Rd	1%	0%	0%	0%
Main Rd (West)	1%	0%	0%	0%
Average	1%	0%	0%	-

HGV Proportions – Without Scheme Operations (2027)

AM Peak

Origin / Destination	Main Rd (East)	Plantation Rd	Main Rd (West)	Average
Main Rd (East)	0%	0%	3%	1%
Plantation Rd	0%	0%	0%	0%
Main Rd (West)	2%	0%	0%	1%
Average	1%	0%	1%	-

PM Peak

Origin / Destination	Main Rd (East)	Plantation Rd	Main Rd (West)	Average
Main Rd (East)	0%	1%	1%	1%
Plantation Rd	1%	0%	0%	0%
Main Rd (West)	1%	0%	0%	0%
Average	1%	0%	0%	-

HGV Proportions – With Scheme Operations (2027)

AM Peak

Origin / Destination	Main Rd (East)	Plantation Rd	Main Rd (West)	Average
Main Rd (East)	0%	0%	2%	1%
Plantation Rd	0%	0%	0%	0%
Main Rd (West)	2%	0%	0%	1%
Average	1%	0%	1%	-

PM Peak

Origin / Destination	Main Rd (East)	Plantation Rd	Main Rd (West)	Average
Main Rd (East)	0%	1%	1%	1%
Plantation Rd	1%	0%	0%	0%
Main Rd (West)	3%	0%	0%	1%
Average	1%	0%	0%	-

HGV Proportions – Without Scheme Operations (2042)

AM Peak

Origin / Destination	Main Rd (East)	Plantation Rd	Main Rd (West)	Average
Main Rd (East)	0%	0%	3%	1%
Plantation Rd	0%	0%	0%	0%
Main Rd (West)	2%	0%	0%	1%
Average	1%	0%	1%	-

PM Peak

Origin / Destination	Main Rd (East)	Plantation Rd	Main Rd (West)	Average
Main Rd (East)	0%	1%	1%	1%
Plantation Rd	1%	0%	0%	0%
Main Rd (West)	1%	0%	0%	0%
Average	1%	0%	0%	-

HGV Proportions – With Scheme Operations (2042)

AM Peak

Origin / Destination	Main Rd (East)	Plantation Rd	Main Rd (West)	Average
Main Rd (East)	0%	0%	2%	1%
Plantation Rd	0%	0%	0%	0%
Main Rd (West)	3%	0%	0%	1%
Average	1%	0%	1%	-

PM Peak

Origin / Destination	Main Rd (East)	Plantation Rd	Main Rd (West)	Average
Main Rd (East)	0%	1%	1%	1%
Plantation Rd	1%	0%	0%	0%
Main Rd (West)	5%	0%	0%	2%
Average	2%	0%	0%	-

G.8. B1137 Main Road / Waltham Road (Boreham): Junction Model Technical Note

G.8.1. Introduction

Overview

The purpose of this technical note is to describe the modelling assessments which have been undertaken at B1137 Main Road/Waltham Road priority junction as part of the A12 Chelmsford to A120 widening project.

The B1137 Main Road / Waltham Road junction is currently a priority junction, located in Boreham. Main Road is the major road with an east west orientation and Waltham Road forms the minor arm.

Modelling scenarios

The junction has been assessed using the PICADY module within the industry standard junction modelling software Junctions 9. The following traffic scenarios have been considered for both the AM (07:30-08:30) and PM (17:00 – 18:00) peak hours, all with the existing junction arrangement:

- Current operation scenario (2019).
- Future operation without the proposed scheme in place (2027).
- Future operation with the proposed scheme in place (2027).
- Future operation without the proposed scheme in place (2042).
- Future operation with the proposed scheme in place (2042).

G.8.2. Model description

Junction location

The location of the junction is shown in Plate G 8-1. The junction is located in Boreham with the B1137 Main Road (West) passing through Boreham to the A12 Junction 19 and the B1137 Main Road (East) leading to Hatfield Peverel. Waltham Road heads north towards Braintree.

Plate G 8-1: B1408 London Road/School Road priority junction (Source: Open Street Map)

Key assumptions and input parameters

The PICADY model required several geometric parameters to be measured for the calculation of theoretical capacity. Junction geometric measurements were taken at the junction from AutoCAD drawings in accordance with the PICADY user guide.

Traffic volume has been input as vehicles with a 2.5 PCU factor for Heavy Goods Vehicles.

Traffic data

A bespoke traffic model has been developed for the appraisal of the proposed scheme using industry standard SATURN software, for which further details can be found in the Combined Modelling and Appraisal report. The outputs from the strategic model formed the basis for the inputs into the junction modelling.

Existing traffic flows show that there is a significant volume of traffic travelling from Waltham Road through Boreham to access J19 (and vice versa) in both the weekday AM and PM peak hours. In 2027 without the proposed scheme in place, the single carriageway Chelmsford North Eastern Bypass (CNEB) will have opened and this greatly reduces the volumes of traffic making the above movements. Once the A12 scheme is open, traffic flows increase on the B1137 through Boreham and through this junction because the A12 J20a on-slip and off-slips at Hatfield Peverel are closed and some of that traffic is forecast to travel from J19 to Hatfield Peverel through Boreham instead. However, by 2042, without the proposed scheme in place, traffic flows have increased significantly again from Waltham Road to J19 (and vice versa), but decrease with the A12 scheme in place. All the traffic flows for all the scenarios, along with HGV proportions, are provided in Annex A.

G.8.3. Junction modelling results

Current operation (2019)

A key statistic produced by PICADY is the RFC (Reference Flow to Capacity). A value of 0.85 is desirable for all arms of new junctions and indicates that the junction is likely statistically to be under-capacity. In assessing an existing junction, for values below 0.85 a junction is considered to be under-capacity, for values between 0.85 and 1.00 a junction is considered to be approaching capacity, whereas for values above 1.00 a junction is considered to be over-capacity.

The results of the junction modelling for current operations are presented in Table G 3-1.

Table G 8-1: Results for B1137 Main Road/Waltham Road PICADY model for Current Operation (2019)

	AM					PM				
Movements	Max LOS	Average Demand (PCU/hr)	Max. Delay (s)	Max Queue (PCU)	Max RFC	Max LOS	Average Demand (PCU/hr)	Max. Delay (s)	Max Queue (PCU)	Max RFC
Waltham Rd to Main Rd (E)	F	128	1005.87	32	1.44	F	200	281.74	17	1.12
Waltham Rd to Main Rd (W)	F	436	967.97	105	1.47	F	291	261.39	24	1.13
From Main Rd (E)	C	419	15.22	2	0.64	A	303	9.51	1	0.39

The results show that the junction is currently significantly over capacity on the Waltham Road arm in the weekday AM and PM peak hours, with queues of approximately 100 vehicles and delays of

approximately 17 minutes in the weekday AM peak hour (lower in the PM peak hour). All other arms operate satisfactorily, with minimal queues and delays.

Future operation with construction (2025)

The future operation with construction (2025) has not been considered because there is unlikely to be significant volumes of construction traffic travelling through Boreham.

Future operation without scheme in place (2027, 2042)

The results of the junction modelling for future operations without the proposed scheme in place are presented in Table G 8-2 for the year 2027 and Table G 8-3 for the year 2042.

Table G 8-2: Results for B1137 Main Road/Waltham Road PICADY model for Future operation without scheme (2027)

	AM					PM				
Movements	Max LOS	Average Demand (PCU/hr)	Max. Delay (s)	Max Queue (PCU)	Max RFC	Max LOS	Average Demand (PCU/hr)	Max. Delay (s)	Max Queue (PCU)	Max RFC
Waltham Rd to Main Rd (E)	B	164	14.43	1	0.42	B	233	12.61	1	0.47
Waltham Rd to Main Rd (W)	D	166	31.77	2	0.62	C	25	16.37	0	0.11
From Main Rd (E)	C	496	20.12	3	0.74	B	357	10.95	1	0.48

The results show that in 2027 without the proposed scheme in place the junction operates satisfactorily in both the weekday AM and PM peak hours, with minimal queues and delays of approximately 0.5 minutes.

Table G 8-3: Results for B1137 Main Road/Waltham Road PICADY model for Future operation without scheme (2042)

	AM					PM				
Movements	Max LOS	Average Demand (PCU/hr)	Max. Delay (s)	Max Queue (PCU)	Max RFC	Max LOS	Average Demand (PCU/hr)	Max. Delay (s)	Max Queue (PCU)	Max RFC
Waltham Rd to Main Rd (E)	F	303	1631.88	112	1.87	F	425	1331.31	130	1.8
Waltham Rd to Main Rd (W)	F	344	1629.25	126	1.87	F	149	1361.35	46	1.77
From Main Rd (E)	F	579	76.8	14	0.96	F	543	188.42	33	1.08

The results show that in 2042 without the proposed scheme in place, the junction is significantly over-capacity in both the weekday AM and PM peak hours, with queues of up to 130 vehicles and delays of approximately 27 minutes.

Future operation with scheme in place (2027, 2042)

The results of the junction modelling for future operations with the proposed scheme in place are presented in Table G 8-4 for the year 2027 and Table G 8-5 for the year 2042.

Table G 8-4: Results for B1137 Main Road/Waltham Road PICADY model for Future operation with scheme (2027)

	AM					PM				
Movements	Max LOS	Average Demand (PCU/hr)	Max. Delay (s)	Max Queue (PCU)	Max RFC	Max LOS	Average Demand (PCU/hr)	Max. Delay (s)	Max Queue (PCU)	Max RFC
Waltham Rd to Main Rd (E)	B	117	12.13	1	0.3	B	232	10.03	1	0.42
Waltham Rd to Main Rd (W)	D	151	29.65	1	0.58	B	22	13.06	0	0.08
From Main Rd (E)	C	673	15.58	4	0.73	A	471	7.48	1	0.4

The results show that the junction operates satisfactorily in 2027 in both the weekday AM and PM peak hours. A comparison with Table G 8-2 above shows that the performance improves significantly with the proposed scheme in place compared to that without the proposed scheme in place.

Table G 8-5: Results for B1137 Main Road/Waltham Road PICADY model for Future operation with scheme (2042)

	AM					PM				
Movements	Max LOS	Average Demand (PCU/hr)	Max. Delay (s)	Max Queue (PCU)	Max RFC	Max LOS	Average Demand (PCU/hr)	Max. Delay (s)	Max Queue (PCU)	Max RFC
Waltham Rd to Main Rd (E)	F	248	1282.83	77	1.69	F	433	252.91	36	1.16
Waltham Rd to Main Rd (W)	F	338	1275.39	102	1.7	F	117	326.09	11	1.11
From Main Rd (E)	E	722	45.52	12	0.91	C	641	24.05	5	0.81

The results show that in 2042 with the proposed scheme in place, the junction is significantly over-capacity in both the weekday AM and PM peak hours, with queues of up to 100 vehicles and delays of over 20 minutes. However, a comparison with Table G 8-3 above shows that the performance improves with the proposed scheme in place compared to that without the proposed scheme in place.

G.8.4. Summary

A summary of the reeults for the B1137 Main Road / Waltham Road junction is presented below in Table G 8-6.

Table G 8-6: Results of the B1137 Main Road / Waltham Road junction PICADY assessment

Junction	Software (key statistic used)	Current operation (Existing layout, 2019 flows)		Future operation, with (Proposed layout, DS flows)		Future operation, with (Proposed layout, DS flows)		Future operation, without (Proposed layout, DM flows)		Future operation, without (Proposed layout, DM flows)	
		Weekday 0730-0830	Weekday 1700-1800	Weekday 0730-0830	Weekday 1700-1800	Weekday 0730-0830	Weekday 1700-1800	Weekday 0730-0830	Weekday 1700-1800	Weekday 0730-0830	Weekday 1700-1800
B1137 Main Road / Waltham Road (Boreham)	PICADY (RFC)	1.47	1.13	0.73	0.42	1.70	1.16	0.74	0.48	1.87	1.80

The results can be summarised as follows:

- The junction is currently over-capacity during both the weekday AM and PM peak hours.
- In 2027 without the proposed scheme in place, the junction operates satisfactorily during both the weekday AM and PM peak hours.
- In 2042 without the proposed scheme in place, the junction is significantly over-capacity during both the weekday AM and PM peak hours.
- In 2027 with the proposed scheme in place, the junction operates satisfactorily during both the weekday AM and PM peak hours of traffic and its operation is improved compared to the situation without the proposed scheme in place.
- In 2042 with the proposed scheme in place, the junction operation is improved compared to the situation without the proposed scheme in place. Nevertheless, the junction is significantly over-capacity during both the weekday AM and PM peak hours.

G.8.5. Annex A

Traffic Flows – Current Operation (2019)

AM Peak

Origin / Destination	Main Rd (West)	Waltham Rd	Main Rd (East)	Total
Main Rd (West)	0	150	139	289
Waltham Rd	436	0	128	564
Main Rd (East)	97	322	0	419
Total	533	472	267	1272

PM Peak

Origin / Destination	Main Rd (West)	Waltham Rd	Main Rd (East)	Total
Main Rd (West)	0	262	416	678
Waltham Rd	291	0	200	491
Main Rd (East)	142	161	0	303
Total	433	423	616	1472

Traffic Flows – Without Scheme Operation (2027)

AM Peak

Origin / Destination	Main Rd (West)	Waltham Rd	Main Rd (East)	Total
Main Rd (West)	0	46	196	242
Waltham Rd	166	0	164	330
Main Rd (East)	124	372	0	496
Total	290	418	360	1068

PM Peak

Origin / Destination	Main Rd (West)	Waltham Rd	Main Rd (East)	Total
Main Rd (West)	0	88	551	639
Waltham Rd	25	0	233	258
Main Rd (East)	152	205	0	357
Total	177	293	784	1254

Traffic Flows – With Scheme Operation (2027)

AM Peak

Origin / Destination	Main Rd (West)	Waltham Rd	Main Rd (East)	Total
Main Rd (West)	0	47	241	288
Waltham Rd	151	0	117	268
Main Rd (East)	384	289	0	673
Total	535	336	358	1229

PM Peak

Origin / Destination	Main Rd (West)	Waltham Rd	Main Rd (East)	Total
Main Rd (West)	0	63	343	406
Waltham Rd	22	0	232	254
Main Rd (East)	296	175	0	471
Total	318	238	575	1131

Traffic Flows – Without Scheme Operation (2042)

AM Peak

Origin / Destination	Main Rd (West)	Waltham Rd	Main Rd (East)	Total
Main Rd (West)	0	127	332	459
Waltham Rd	344	0	303	647
Main Rd (East)	157	422	0	579
Total	501	549	635	1685

PM Peak

Origin / Destination	Main Rd (West)	Waltham Rd	Main Rd (East)	Total
Main Rd (West)	0	278	607	885
Waltham Rd	149	0	425	574
Main Rd (East)	137	406	0	543
Total	286	684	1032	2002

Traffic Flows – With Scheme Operation (2042)

AM Peak

Origin / Destination	Main Rd (West)	Waltham Rd	Main Rd (East)	Total
Main Rd (West)	0	200	272	472
Waltham Rd	338	0	248	586
Main Rd (East)	401	321	0	722
Total	739	521	520	1780

PM Peak

Origin / Destination	Main Rd (West)	Waltham Rd	Main Rd (East)	Total
Main Rd (West)	0	236	347	583
Waltham Rd	117	0	433	550
Main Rd (East)	333	308	0	641
Total	450	544	780	1774

HGV Proportions – Current Operations (2019)

AM Peak

Origin / Destination	Main Rd (West)	Waltham Rd	Main Rd (East)	Average
Main Rd (West)	0%	4%	3%	2%
Waltham Rd	3%	0%	5%	3%
Main Rd (East)	4%	4%	0%	3%
Average	2%	3%	3%	-

PM Peak

Origin / Destination	Main Rd (West)	Waltham Rd	Main Rd (East)	Average
Main Rd (West)	0%	2%	1%	1%
Waltham Rd	0%	0%	1%	0%
Main Rd (East)	1%	1%	0%	1%
Average	0%	1%	1%	-

HGV Proportions – Without Scheme Operations (2027)

AM Peak

Origin / Destination	Main Rd (West)	Waltham Rd	Main Rd (East)	Average
Main Rd (West)	0%	0%	8%	3%
Waltham Rd	1%	0%	4%	2%
Main Rd (East)	3%	4%	0%	2%
Average	1%	1%	4%	-

PM Peak

Origin / Destination	Main Rd (West)	Waltham Rd	Main Rd (East)	Average
Main Rd (West)	0%	0%	1%	0%
Waltham Rd	0%	0%	0%	0%
Main Rd (East)	1%	1%	0%	1%
Average	0%	0%	0%	-

HGV Proportions – With Scheme Operations (2027)

AM Peak

Origin / Destination	Main Rd (West)	Waltham Rd	Main Rd (East)	Average
Main Rd (West)	0%	0%	3%	1%
Waltham Rd	1%	0%	5%	2%
Main Rd (East)	3%	5%	0%	3%
Average	1%	2%	3%	-

PM Peak

Origin / Destination	Main Rd (West)	Waltham Rd	Main Rd (East)	Average
Main Rd (West)	0%	0%	1%	0%
Waltham Rd	0%	0%	0%	0%
Main Rd (East)	1%	1%	0%	1%
Average	0%	0%	0%	-

HGV Proportions – Without Scheme Operations (2042)

AM Peak

Origin / Destination	Main Rd (West)	Waltham Rd	Main Rd (East)	Average
Main Rd (West)	0%	0%	5%	2%
Waltham Rd	1%	0%	2%	1%
Main Rd (East)	3%	4%	0%	2%
Average	1%	1%	2%	-

PM Peak

Origin / Destination	Main Rd (West)	Waltham Rd	Main Rd (East)	Average
Main Rd (West)	0%	0%	1%	0%
Waltham Rd	0%	0%	0%	0%
Main Rd (East)	1%	0%	0%	0%
Average	0%	0%	0%	-

HGV Proportions – With Scheme Operations (2042)

AM Peak

Origin / Destination	Main Rd (West)	Waltham Rd	Main Rd (East)	Average
Main Rd (West)	0%	0%	3%	1%
Waltham Rd	1%	0%	3%	1%
Main Rd (East)	4%	5%	0%	3%
Average	2%	2%	2%	-

PM Peak

Origin / Destination	Main Rd (West)	Waltham Rd	Main Rd (East)	Average
Main Rd (West)	0%	0%	1%	0%
Waltham Rd	0%	0%	0%	0%
Main Rd (East)	2%	1%	0%	1%
Average	1%	0%	0%	-

G.9. Rivenhall End West roundabout: Junction Model Technical Note

G.9.1. Introduction

Overview

The purpose of this technical note is to describe the modelling assessments which have been undertaken for the proposed Rivenhall End West roundabout as part of the A12 Chelmsford to A120 widening project.

Modelling scenarios

The proposed roundabout has been assessed using the ARCADY module within the industry standard junction modelling software Junctions 9.

The following traffic scenarios have been considered for both the AM (07:30-08:30) and PM (17:00 – 18:00) peak hours:

- Future operation with scheme scenario (2027, 2042) for the proposed junction arrangement.

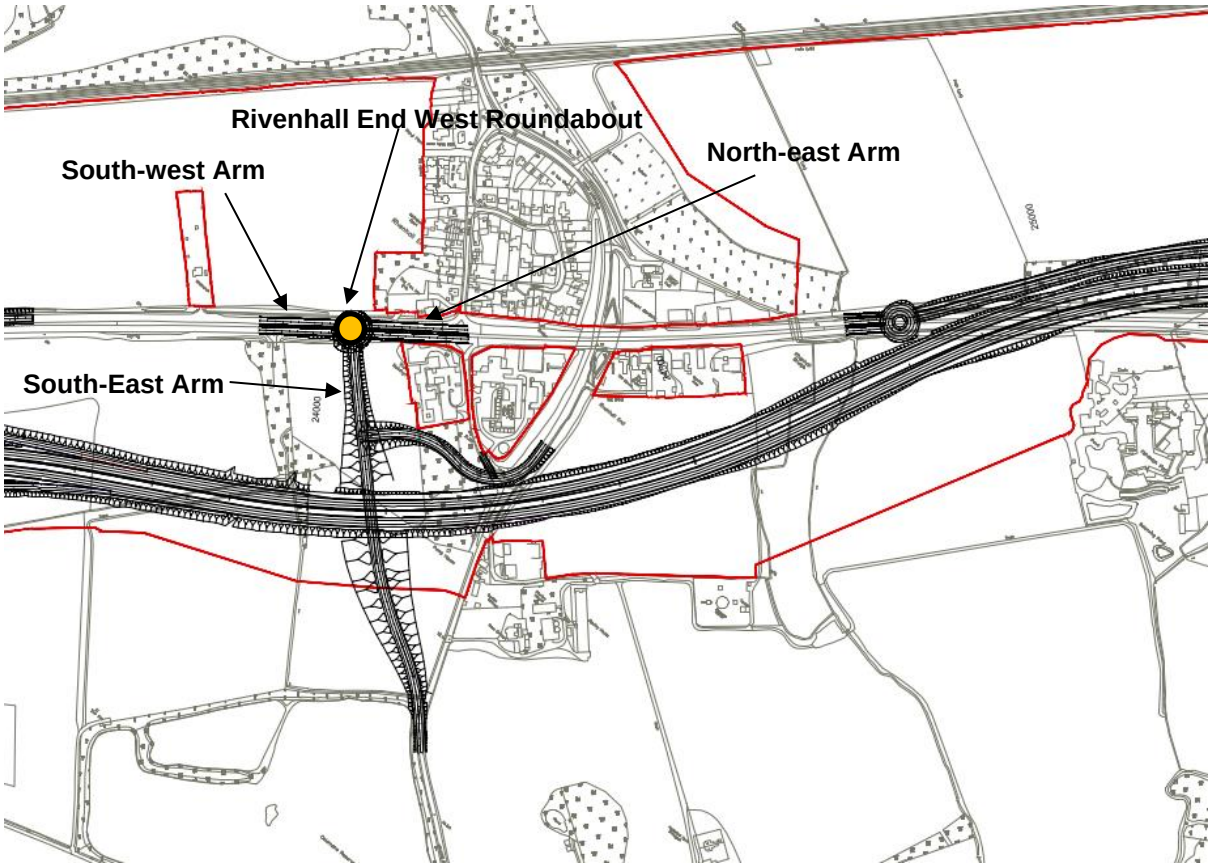
The 2019 Current scenario, 2025 Construction scenario and future scenarios without the proposed scheme in place (2027, 2042) have not been considered because the junction does not exist in those scenarios.

G.9.2. Model description

Junction location

The proposed location of the Rivenhall End West roundabout junction is shown in Plate G 9-1 Located immediately to the west of Rivenhall End, the junction is a 3-arm roundabout on what will become the former A12, between junction 22 to the south-west and Kelvedon to the north-east, with a realigned Braxted Road towards Great Braxted as the minor arm.

Plate G 9-1: Rivenhall End West roundabout (Source: CAD drawing)



Key assumptions and input parameters

The ARCADY model required several geometric parameters to be measured for the calculation of theoretical capacity. Junction geometric measurements were taken at the junction from AutoCAD drawings and measured in accordance with the ARCADY user guide.

Traffic volume has been input as vehicles with a 2.5 PCU factor for Heavy Goods Vehicles used.

Traffic data

A bespoke traffic model has been developed for the appraisal of the proposed scheme using industry standard SATURN software, for which further details can be found in the Combined Modelling and Appraisal report. The outputs from the strategic model formed the basis for the inputs into the junction modelling, using the Origin-Destination Table G function which synthesizes a peak within the peak hour. The with scheme (2027, 2042) traffic flows, along with HGV proportions are shown in Annex A.

G.9.3. Junction modelling results

Current operation (2019)

The current operation (2019) has not been considered because the junction does not exist in 2019.

Future operation with construction (2025)

The future operation with construction (2025) has not been considered because the junction would not exist.

Future operation without scheme in place (2027, 2042)

The future operation without the proposed scheme in place (2027, 2042) has not been considered because junction would not exist.

Future operation with scheme in place (2027, 2042)

The results of the junction modelling for the future operations with the proposed scheme in place are presented in Table G 9-1 for the year 2027 and in Table G 9-2 for the year 2042.

Table G 9-1: Results for Rivenhall End West roundabout model for Future operation with scheme (2027)

	2027 AM					2027 PM				
Arm	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
North-east arm	A	332	2.10	0	0.18	A	185	2.19	0	0.11
South-east arm	A	724	5.78	1	0.56	A	442	3.50	1	0.32
South-west arm	A	671	2.02	0	0.29	A	1081	2.59	1	0.46

Table G 9-2: Results for Rivenhall End West roundabout model for Future operation with scheme (2042)

	2042 AM					2042 PM				
Arm	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
North-east arm	A	353	2.28	0	0.20	A	197	2.24	0	0.12
South-east arm	A	751	6.25	1	0.59	A	495	3.75	1	0.36
South-west arm	A	823	2.21	1	0.36	A	1143	2.73	1	0.49

A key statistic produced by ARCADY is the RFC (Reference Flow to Capacity). A value of 0.85 is desirable for all arms of new junctions and indicates that the junction is likely statistically to be under-capacity. In assessing an existing junction, for values below 0.85 a junction is considered to be under-capacity, for values between 0.85 and 1.00 a junction is considered to be approaching capacity, whereas for values above 1.00 a junction is considered to be over-capacity.

The results show that the junction is under-capacity in both future scenarios with the proposed scheme in place (2027 and 2042) during the weekday AM and PM peak hours, with queues of 1 vehicle or less and delays of less than 10 seconds.

G.9.4. Summary

The results show that the junction operates satisfactorily with the proposed scheme in place in 2027 and 2042.

G.9.5. Annex A

Traffic Flows – With Scheme (2027)

AM Peak

Origin / Destination	North-east arm	South-east arm	South-west arm	Total
North-east arm	0	31	301	332
South-east arm	27	0	697	724
South-west arm	200	471	0	671
Total	227	502	998	1727

PM Peak

Origin / Destination	North-east arm	South-east arm	South-west arm	Total
North-east arm	0	15	170	185
South-east arm	20	0	422	442
South-west arm	338	743	0	1081
Total	358	758	592	1708

Traffic Flows – With Scheme (2042)

AM Peak

Origin / Destination	North-east arm	South-east arm	South-west arm	Total
North-east arm	0	26	327	353
South-east arm	27	0	724	751
South-west arm	224	599	0	823
Total	251	625	1051	1927

PM Peak

Origin / Destination	North-east arm	South-east arm	South-west arm	Total
North-east arm	0	11	186	197
South-east arm	22	0	473	495
South-west arm	372	771	0	1143
Total	394	782	659	1835

HGV Proportions – With Scheme (2027)

AM Peak

Origin / Destination	North-east arm	South-east arm	South-west arm	Average
North-east arm	0%	1%	1%	1%
South-east arm	6%	0%	2%	3%
South-west arm	6%	2%	0%	3%
Average	4%	1%	1%	-

PM Peak

Origin / Destination	North-east arm	South-east arm	South-west arm	Average
North-east arm	0%	4%	1%	2%
South-east arm	7%	0%	1%	3%
South-west arm	1%	1%	0%	1%
Average	3%	2%	1%	-

HGV Proportions – With Scheme (2042)

AM Peak

Origin / Destination	North-east arm	South-east arm	South-west arm	Average
North-east arm	0%	1%	1%	1%
South-east arm	6%	0%	2%	3%
South-west arm	4%	2%	0%	2%
Average	3%	1%	1%	-

PM Peak

Origin / Destination	North-east arm	South-east arm	South-west arm	Average
North-east arm	0%	5%	1%	2%
South-east arm	8%	0%	1%	3%
South-west arm	1%	1%	0%	1%
Average	3%	2%	1%	-

G.10. Rivenhall End East roundabout: Junction Model Technical Note

G.11.1. Introduction

Overview

The purpose of this technical note is to describe the modelling assessments which have been undertaken for the proposed Rivenhall End East roundabout as part of the A12 Chelmsford to A120 widening project.

Modelling scenarios

The proposed roundabout has been assessed using the ARCADY module within the industry standard junction modelling software Junctions 9.

The following traffic scenarios have been considered for both the AM (07:30-08:30) and PM (17:00 – 18:00) peak hours:

- Future operation with scheme scenario (2027, 2042) for the proposed junction arrangement.

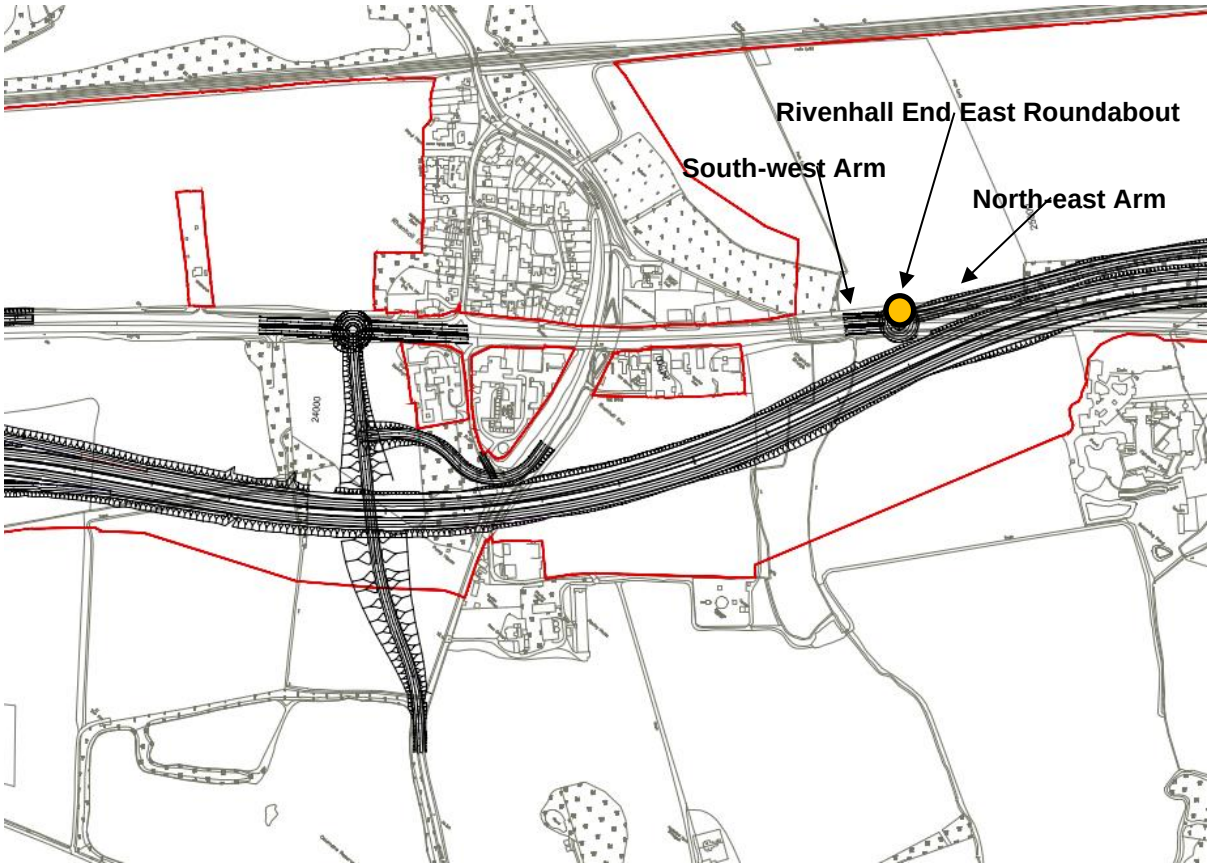
The 2019 Current scenario, 2025 Construction scenario and future scenarios without scheme in place (2027, 2042) have not been considered because the junction does not exist in those scenarios.

G.11.2. Model description

Junction location

The proposed location of the Rivenhall End East roundabout junction is shown in Plate G 10-1. Located to the north-east of Rivenhall End, the junction is a 2-arm roundabout on what will become the former old A12, between junction 22 to the south-west and Kelvedon to the north-east.

Plate G 10-1: Rivenhall End East roundabout (Source: CAD drawing)



Key assumptions and input parameters

The ARCADY model required several geometric parameters to be measured for the calculation of theoretical capacity. Junction geometric measurements were taken at the junction from AutoCAD drawings and measured in accordance with the ARCADY user guide.

Traffic volume has been input as vehicles with a 2.5 PCU factor for Heavy Goods Vehicles used.

Traffic data

A bespoke traffic model has been developed for the appraisal of the proposed scheme using industry standard SATURN software, for which further details can be found in the Combined Modelling and Appraisal report. The outputs from the strategic model formed the basis for the inputs into the junction modelling, using the Origin-Destination Table G function which synthesizes a peak within the peak hour. The with scheme (2027, 2042) traffic flows, along with HGV proportions are shown in Annex A.

G.11.3. Junction modelling results

Current operation (2019)

The current operation (2019) has not been considered because the junction does not exist in 2019.

Future operation with construction (2025)

The future operation with construction (2025) has not been considered because the junction would not exist.

Future operation without scheme in place (2027, 2042)

The future operation without the proposed scheme in place (2027, 2042) has not been considered because junction would not exist.

Future operation with scheme in place (2027, 2042)

The results of the junction modelling for the future operations with the proposed scheme in place are presented in Table G 10-1 for the year 2027 and in Table G 10-2 for the year 2042.

Table G 10-1: Results for Rivenhall End East roundabout model for Future operation with scheme (2027)

	2027 AM					2027 PM				
Arm	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
North-east arm	A	332	4.30	0	0.30	A	185	3.65	0	0.17
South-west arm	A	227	1.72	0	0.11	A	358	1.74	0	0.16

Table G 10-2: Results for Rivenhall End East roundabout model for Future operation with scheme (2042)

	2042 AM					2042 PM				
Arm	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**	**Max LOS**	**Average Demand (PCU/hr)**	**Max. Delay (s)**	**Max Queue (PCU)**	**Max RFC**
North-east arm	A	354	4.43	1	0.32	A	197	3.70	0	0.18
South-west arm	A	251	1.70	0	0.12	A	394	1.78	0	0.18

A key statistic produced by ARCADY is the RFC (Reference Flow to Capacity). A value of 0.85 is desirable for all arms of new junctions and indicates that the junction is likely statistically to be under-capacity. In assessing an existing junction, for values below 0.85 a junction is considered to be under-capacity, for values between 0.85 and 1.00 a junction is considered to be approaching capacity, whereas for values above 1.00 a junction is considered to be over-capacity.

The results show that the junction is under-capacity in both future scenarios with the proposed scheme in place (2027 and 2042) during the weekday AM and PM peak hours, with minimal queues and delays of less than 5 seconds.

G.11.4. Summary

The results show that the junction operates satisfactorily with the proposed scheme in place in 2027 and 2042.

G.11.5. Annex A

Traffic Flows – With Scheme (2027)

AM Peak

Origin / Destination	North-east arm	South-west arm	Total
North-east arm	0	332	332
South-west arm	227	0	227
Total	227	332	559

PM Peak

Origin / Destination	North-east arm	South-west arm	Total
North-east arm	0	185	185
South-west arm	358	0	358
Total	358	185	543

Traffic Flows – With Scheme (2042)

AM Peak

Origin / Destination	North-east arm	South-west arm	Total
North-east arm	0	354	354
South-west arm	251	0	251
Total	251	354	605

PM Peak

Origin / Destination	North-east arm	South-west arm	Total
North-east arm	0	197	197
South-west arm	394	0	394
Total	394	197	591

HGV Proportions – With Scheme (2027)

AM Peak

Origin / Destination	North-east arm	South-west arm	Average
North-east arm	0%	1%	1%
South-west arm	6%	0%	3%
Average	3%	1%	-

PM Peak

Origin / Destination	North-east arm	South-west arm	Average
North-east arm	0%	2%	1%
South-west arm	1%	0%	1%
Average	1%	1%	-

HGV Proportions – With Scheme (2042)

AM Peak

Origin / Destination	North-east arm	South-west arm	Average
North-east arm	0%	1%	1%
South-west arm	4%	0%	2%
Average	2%	1%	-

PM Peak

Origin / Destination	North-east arm	South-west arm	Average
North-east arm	0%	2%	1%
South-west arm	1%	0%	1%
Average	1%	1%	-

G.12. Rivenhall End Henry Dixon Road: Junction Model Technical Note

G.12.1. Introduction

Overview

The purpose of this technical note is to describe the modelling assessments which have been undertaken for the proposed Henry Dixon Road signalised junction as part of the A12 Chelmsford to A120 widening project.

Modelling scenarios

The proposed signalised junction has been assessed using the industry standard signalised junction modelling software LINSIG.

The following traffic scenarios have been considered for both the AM (07:30-08:30) and PM (17:00 – 18:00) peak hours:

- Future operation with scheme scenario (2027, 2042) for the proposed junction arrangement.

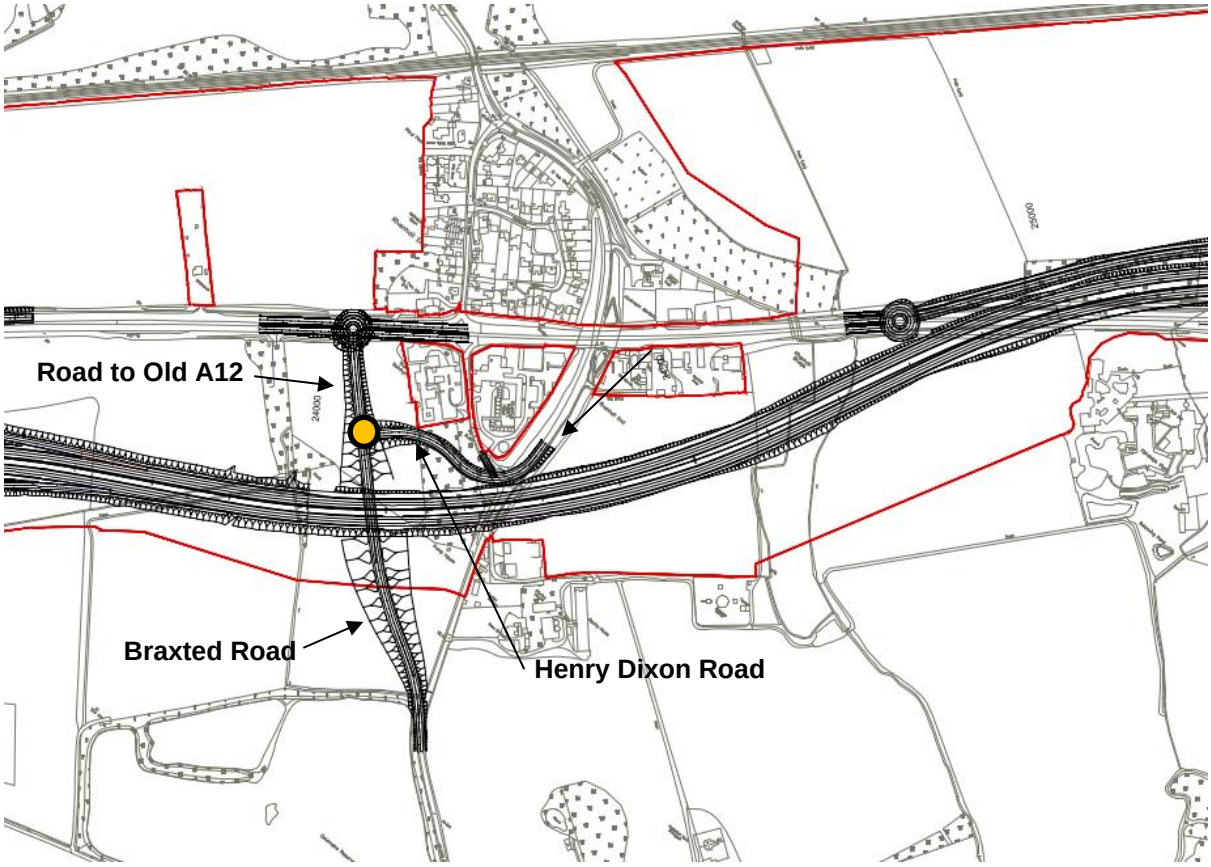
The 2019 Current scenario, 2025 Construction scenario and future scenarios without the proposed scheme in place (2027, 2042) have not been considered because the junction does not exist in those scenarios.

G.12.2. Model description

Junction location

The location of the proposed Henry Dixon Road signalised junction is shown in Plate G 11-1. Located immediately to the south-west of Rivenhall End, the junction is a 3-arm signalised junction on the realigned Braxted Road, with Henry Dixon Road as the minor arm.

Plate G 11-1: Henry Dixon Road Junction (Source: CAD drawing)



Key assumptions and input parameters

The LINSIG model required several geometric parameters to be measured for the calculation of theoretical capacity. Junction geometric measurements were taken at the junction from AutoCAD drawings and measured in accordance with the LINSIG user guide. The stage sequencing and signal times for this junction were based on those within the strategic SATURN model.

Traffic volume has been input as PCUs with a 2.5 PCU factor for Heavy Goods Vehicles used.

Traffic data

A bespoke traffic model has been developed for the appraisal of the proposed scheme using industry standard SATURN software, for which further details can be found in the Combined Modelling and Appraisal report. The outputs from the strategic model formed the basis for the inputs into the junction modelling. All the traffic flows for the 2027 and 2042 future scenarios with the proposed scheme in place are shown in Annex A.

G.12.3. Junction modelling results

Current Operation (2019)

The current operation (2019) scenario has not been modelled because the junction does not exist in 2019.

Future operation with construction (2025)

The future operation with construction (2025) scenario has not been modelled because the junction would not exist.

Future operation without scheme in place (2027, 2042)

The future operation without scheme (2027, 2042) scenario has not been modelled because the junction would not exist.

Future operation with scheme in place (2027, 2042)

The results of the future operation with the proposed scheme in place for 2027 are presented in Table G 11-1 for the year and in Table G 11-2 for the year 2042.

A key statistic produced by LINSIG is the PRC (Practical Reserve Capacity). A positive value indicates that the junction is likely to be under-capacity, whilst a negative value indicates that the junction is likely to be over-capacity.

Table G 11-1: Results for Henry Dixon Road junction LINSIG model for Future operation with scheme (2027)

		AM		PM		
Arm	**DoS (%)**	**MMQ (PCU)**	**Avg PCU delay (sec)**	**DoS (%)**	**MMQ (PCU)**	**Avg PCU delay (sec)**
Old A12	65.8%	11	26.6	67.8%	18	21.1
Henry Dixon Road	68.8%	9	26.5	68.4%	8	45.1
Braxted Road	69.2%	10	31.4	64.8%	11	34.6

Practical Reserve Capacity (PRC)	30%	31.7%

The results show that in 2027 with the proposed scheme in place, the junction is performing below capacity in both the weekday AM and PM peak hours, with queues of less than 20 vehicles and delays of 0.75 minutes or less.

Table G 11-2: Results for Henry Dixon Road junction LINSIG model for Future operation with scheme (2042)

		AM		PM		
Arm	**DoS (%)**	**MMQ (PCU)**	**Avg PCU delay (sec)**	**DoS (%)**	**MMQ (PCU)**	**Avg PCU delay (sec)**
Old A12	83%	15	30.6	72%	13	17.3
Henry Dixon Road	84.9%	11	35.4	81.6%	8	42.6
Braxted Road	83.8%	10	39.2	81.4%	7	37.7
Practical Reserve Capacity (PRC)	6%			10.3%		

The results show that in 2042 with the proposed scheme in place, the junction is approaching capacity in both the weekday AM and PM peak hours, with queues of 15 vehicles or less and delays of 0.75 minutes or less.

G.12.4. Summary

The results show that the junction operates satisfactorily with the proposed scheme in place in both 2027, but is approaching capacity in 2042, although queues and delays are not significant.

G.12.5. Annex A

Traffic Flows – With Scheme (2027)

AM Peak

Origin / Destination	Old A12	Henry Dixon Road	Braxted Road	Total
Old A12	0	336	182	518
Henry Dixon Road	393	0	132	525
Braxted Road	350	140	0	490
Total	743	476	314	1533

PM Peak

Origin / Destination	Old A12	Henry Dixon Road	Braxted Road	Total
Old A12	0	363	403	766
Henry Dixon Road	250	0	149	399
Braxted Road	202	177	0	379
Total	452	540	552	1544

Traffic Flows – With Scheme (2042)

AM Peak

Origin / Destination	Old A12	Henry Dixon Road	Braxted Road	Total
Old A12	0	463	180	643
Henry Dixon Road	438	0	169	607
Braxted Road	334	151	0	485
Total	772	614	349	1735

PM Peak

Origin / Destination	Old A12	Henry Dixon Road	Braxted Road	Total
Old A12	0	366	427	793
Henry Dixon Road	288	0	197	485
Braxted Road	217	230	0	447
Total	505	596	624	1725

G.13. Eastways (Witham): Junction Model Technical Note

G.13.1. Introduction

Overview

The purpose of this technical note is to describe the modelling assessments which have been undertaken at Eastways (near J22) as part of the A12 Chelmsford to A120 widening project.

This junction is currently a 4-arm signalised junction, located north east of Witham. The B1389 Colchester Road forms two major arms of this junction with a north-east/south-west orientation and forms the A12 northbound merge further north of the junction. Eastways; another arm of the junction, provides access to / from an industrial estate located to the west of Colchester Road; whilst Coleman's Bridge is the other arm, primarily serving as the A12 southbound off-slip.

Modelling scenarios

Eastways (near J22) has been assessed using the industry standard signalised junction modelling software LINSIG. The following traffic scenarios have been considered:

- Current operation scenario (2019) for the existing junction arrangement.
- Construction scenario (2025, the peak year of construction) for the existing junction arrangement.
- Future operation without the proposed scheme in place (2027) with the existing junction arrangement.
- Future operation without the proposed scheme in place (2042) with the existing junction arrangement.

Assessments for the future situation with the proposed scheme in place have been modelled using VISSIM and are discussed in separate technical notes included within the Transport Assessment report.

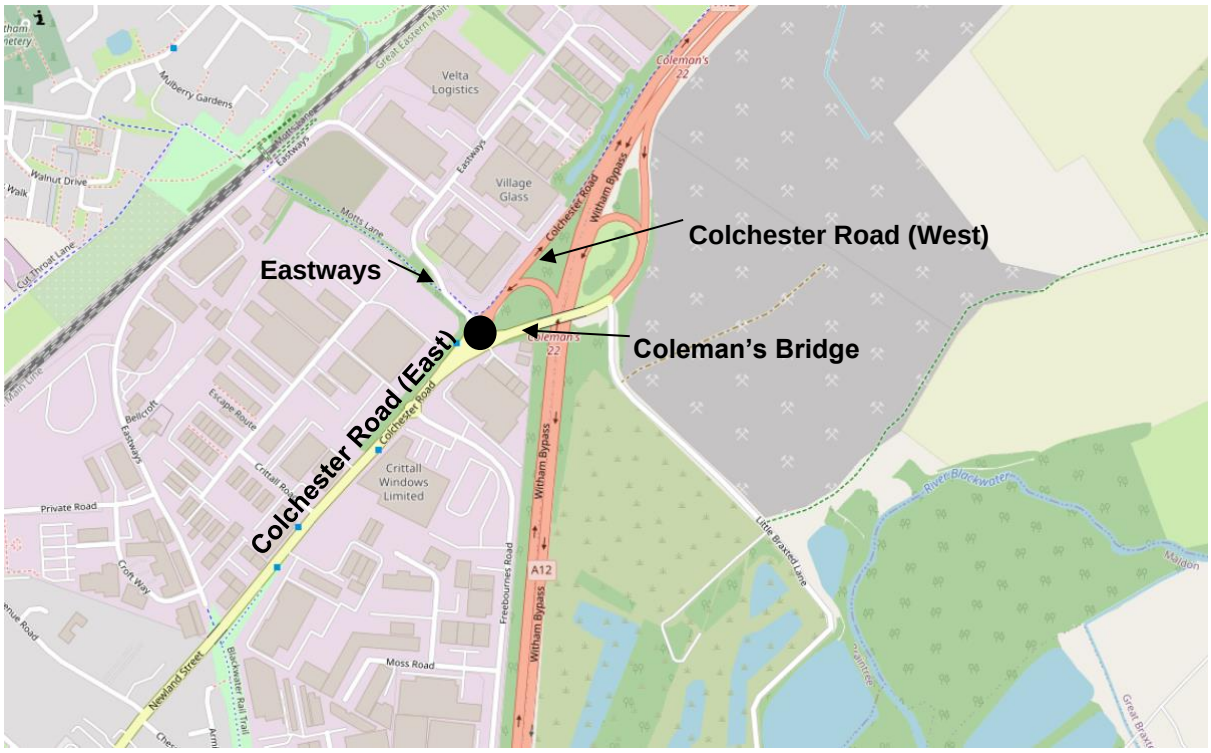
G.13.2. Model description

Junction location

The location of Eastways (near J22) is shown in Plate G 12-1, north east of Witham.

The majority of the traffic passing through this junction consist of traffic to / from the A12 slip roads. There is a significant volume of traffic to the industrial estate in the weekday AM peak hour and a significant volume of traffic leaving in the weekday PM peak hour. Traffic going towards Witham is high in AM peak hour, with a reverse directional demand in the PM peak hour.

Plate G 12-1: Eastways (near J22) (Source: Open Street Map)



Key assumptions and input parameters

The LINSIG model required several geometric parameters to be measured for the calculation of theoretical capacity. Junction geometric measurements were taken at the junction from AutoCAD drawings and measured in accordance with the LINSIG user guide. The stage sequencing and signal times for this junction were based on those within the strategic SATURN model.

The cycle lengths and signal timings were adjusted slightly for 2027 and 2042 with the proposed scheme in place in order to better cater for the traffic patterns and demand. Different cycle times were used for weekday AM and PM peak hours of traffic for 2027 (AM – 120 seconds and PM – 65 seconds) and 2042 (AM – 90 seconds and PM – 70 seconds). Also, an additional stage was included in the weekday AM peak hour to service the traffic turning right from Eastways to Colchester Road. The signal timings were then optimized to obtain an efficient level of performance at the junction.

Traffic flows and HGV percentages have been extracted from the base year and future years SATURN models.

Traffic volume has been input as PCUs with a 2.5 PCU factor for Heavy Goods Vehicles used.

Traffic data

A bespoke traffic model has been developed for the appraisal of the proposed scheme using industry standard SATURN software, for which further details can be found in the Combined Modelling and Appraisal report. The outputs from the strategic model formed the basis for the inputs into the junction modelling.

The SATURN Base Year (2019) model was developed along with forecast years (2027 and 2042). Traffic Flows and HGV composition for all scenarios were extracted from the SATURN strategic model. To derive the 2025 construction flows, the 2027 without scheme SATURN model flows were adjusted to 2025 by applying relevant car and Heavy Goods Vehicles growth factors to derive the 2025 without scheme flows, and construction flows were then added on top. All the traffic flows for all the scenarios are provided in Annex A.

G.13.3. Junction modelling results

Current Operation (2019)

A key statistic produced by LINSIG is the PRC (Practical Reserve Capacity). A positive value indicates that the junction is likely to be under-capacity, whilst a negative value indicates that the junction is likely to be over-capacity.

The results of the junction modelling are presented in Table G 12-1.

Table G 12-1: Results for A12 Junction 22 (Eastways) LINSIG model for Current Operation (2019)

	AM			PM		
Arm	**DoS (%)**	**MMQ (PCU)**	**Avg PCU delay (sec)**	**DoS (%)**	**MMQ (PCU)**	**Avg PCU delay (sec)**
Colchester Road (East)	80.2	8	51.3	59.5	3	57.7
Coleman's Bridge	81.7	17	32.7	56.6	8	28.3
Colchester Road (West)	42	4	28.6	97.6	20	88.9
Eastways	73.9	5	72	94.7	19	74.4
Practical Reserve Capacity (PRC)	10.2%			-8.4%		

The results show that in 2019 the current operation of the junction is slightly under-capacity in the weekday AM peak hour but slightly over-capacity in the PM peak hour, but with queues of less than 20 vehicles and delays of 1 to 1.5 minutes.

Future operation with construction (2025)

The results of the junction modelling are presented in Table G 12-2 below.

Table G 12-2: Results for A12 Junction 22 (Eastways) LINSIG model for Future operation with construction (2025)

	AM			IP			PM		
Arm	**DoS (%)**	**MMQ (PCU)**	**Avg PCU delay (sec)**	**DoS (%)**	**MMQ (PCU)**	**Avg PCU delay (sec)**	**DoS (%)**	**MMQ (PCU)**	**Avg PCU delay (sec)**
Colchester Road (East)	100.9	17	136.5	61.6	4.0	50.2	24.9	1	46.3
Coleman's Bridge	104.9	59	140.1	61.7	8.2	30.2	84.9	15	44.7
Colchester Road (West)	106.6	27	208.8	60.2	5.4	39.1	115.9	54	330.1
Eastways	100.7	13	174.5	59.1	7.1	38.9	115.5	75	304.7
Practical Reserve Capacity (PRC)	-18.4%			45.8%			-28.8%		

The results show that in 2025 with construction traffic, the junction is over-capacity during the weekday AM and PM peak hours, with queues of nearly 60 vehicles (AM) and 75 vehicles (PM) and delays of approximately 3 minutes (AM) and 5.5 minutes (PM). In the weekday IP peak, the junction is under-capacity with small queues and delays.

Future operation without scheme in place (2027, 2042)

The results of the future operation without the proposed scheme in place for 2027 are presented in Table G 12-3 and for 2042 are presented in Table G 12-4.

Table G 12-3: Results for A12 Junction 22 (Eastways) LINSIG model for Future operation without scheme (2027)

	AM			PM		
Arm	**DoS (%)**	**MMQ (PCU)**	**Avg PCU delay (sec)**	**DoS (%)**	**MMQ (PCU)**	**Avg PCU delay (sec)**
Colchester Road (East)	85.2	8	59.9	68.6	4	62.5
Coleman's Bridge	88.5	21	37.6	70.7	11	35.2
Colchester Road (West)	62	7	35.9	120.2	65	382.4
Eastways	82.8	7	77.2	117.1	81	326.3
Practical Reserve Capacity (PRC)	1.7%			-33.5%		

The results show that in 2027 without the proposed scheme in place, the junction is approaching capacity during the weekday AM peak hour and is significantly over-capacity in the PM peak hour, with queues of approximately 20 vehicles (AM) and 80 vehicles (PM) and delays of approximately 1 minute (AM) and 6.5 minutes (PM).

Table G 12-4: Results for A12 Junction 22 (Eastways) LINSIG model for Future operation without scheme (2042)

	AM			PM		
Arm	**DoS (%)**	**MMQ (PCU)**	**Avg PCU delay (sec)**	**DoS (%)**	**MMQ (PCU)**	**Avg PCU delay (sec)**
Colchester Road (East)	87.3	9	61.4	78.8	5	72.8
Coleman's Bridge	89.9	22	40.9	77.1	12	39.2
Colchester Road (West)	64.8	7	35.1	128.6	81	486.3
Eastways	90.5	9	97.9	124.3	110	421.4
Practical Reserve Capacity (PRC)	-0.6%			-42.9%		

The results show that in 2042 without the proposed scheme in place, the junction is slightly over-capacity during the weekday AM peak hour and is significantly over-capacity in the PM peak hour, with queues of approximately 20 vehicles (AM) and 110 vehicles (PM) and delays of approximately 1.5 minutes (AM) and 8 minutes (PM).

Future operation with scheme in place (2027, 2042)

Assessments for the future situation with the proposed scheme in place have been modelled using LINSIG and are discussed in separate technical notes included within the Transport Assessment report.

The results of the future operation with the proposed scheme in place for 2027 are presented in Table G 12-5 and for 2042 are presented in Table G 12-6.

Table G 12-5: Results for A12 Junction 22 (Eastways) LINSIG model for Future operation with scheme (2027)

	AM			PM		
Arm	**DoS (%)**	**MMQ (PCU)**	**Avg PCU delay (sec)**	**DoS (%)**	**MMQ (PCU)**	**Avg PCU delay (sec)**
Colchester Road (East)	70.8	8	7.5	73.9	9	24.8
Screwfix	8.7	1	50.9	3.2	0	10.6
Colchester Road (West)	51.8	6	10.7	101.1	34	85.9
Eastways	75.0	8	71.9	86.0	9	21.9

Practical Reserve Capacity (PRC)	20.0%	-12.4%

The results show that in 2027 with the proposed scheme in place, the junction is under capacity during the weekday AM peak hour and is slightly over-capacity in the PM peak hour, with queues of approximately 8 vehicles (AM) and 35 vehicles (PM) and delays of approximately 1.5 minutes or less in both the weekday AM and PM peak hours of traffic. A comparison with Table G 12-3 above shows that the performance improves significantly with the proposed scheme in place compared to that without the proposed scheme in place.

Table G12-6: Results for A12 Junction 22 (Eastways) LINSIG model for Future operation with scheme (2042)

	AM			PM		
Arm	**DoS (%)**	**MMQ (PCU)**	**Avg PCU delay (sec)**	**DoS (%)**	**MMQ (PCU)**	**Avg PCU delay (sec)**
Colchester Road (East)	76.3	8	35.6	86.8	13	39.4
Screwfix	7.9	1	37.8	3.0	0	9.8
Colchester Road (West)	64.5	8	16.8	110.2	80	214.8
Eastways	74.3	7	54.9	88.0	11	23.2
Practical Reserve Capacity (PRC)	17.5%			-22.4%		

The results show that in 2042 with the proposed scheme in place, the junction is under capacity during the weekday AM peak hour and is significantly over-capacity in the PM peak hour, with queues of 10 vehicles or less (AM) and 80 vehicles (PM) and delays of approximately 1 minute in (AM) and 3.5 minutes (PM). A comparison with Tabe G 12-4 above shows that the performance improves significantly with the proposed scheme in place compared to that without the proposed scheme in place

G.13.4. Summary

A summary of the results of the Eastways LinSig assessment are summarised below in Table G 12-7.

Table G 12-7: Results for Eastways LinSig assessment

Junction	Software (key statistic used)	Current operation		Construction phase			Future operation, with scheme 2027		Future operation, with scheme 2042		Future operation, without scheme 2027		Future operation, without scheme 2042	
		Weekday 0730-0830	Weekday 1700-1800	Weekday 0700-0800	Weekday Ave 1000-1600	Weekday 1700-1800	Weekday 0730-0830	Weekday 1700-1800	Weekday 0730-0830	Weekday 1700-1800	Weekday 0730-0830	Weekday 1700-1800	Weekday 0730-0830	Weekday 1700-1800
Eastways (near J22)	LINSIG (PRC)	10.2%	-8.4%	-18.4%	45.8%	-28.8%	20.0%	-12.4%	17.5%	-22.4%	1.7%	-33.5%	-0.6%	-42.9%

The following can be summarised from the results:

- The junction currently operates satisfactorily during the weekday AM peak hour but is over-capacity in the PM peak hour.
- Under the 2025 construction scenario, the junction is over capacity during both the weekday AM and PM peak hours but operates satisfactorily during the IP.
- In 2027 without the proposed scheme in place, the junction is approaching capacity during the weekday AM peak hour and is over capacity during the PM peak hour.
- In 2042 without the proposed scheme in place, the junction is over-capacity, and the performance worsens still, in the weekday AM and PM peak hours.
- In 2027 with the proposed scheme in place, the junction operation is improved compared to the situation without the proposed scheme in place. The junction is under capacity during the weekday AM peak hour but is slightly over capacity during the PM peak hour.
- In 2042 with the proposed scheme in place, the junction operation is improved compared to the situation without the proposed scheme in place. The junction is just over capacity during the weekday AM peak hour and is over capacity during the PM peak hour.

G.13.5. Annex A

Traffic Flows – Current Operation (2019)

AM Peak

Origin / Destination	Colchester Rd (East)	Coleman's Bridge	Colchester Rd (West)	Eastways	Total
Colchester Rd (East)	0	0	237	169	406
Coleman's Bridge	0	0	637	144	781
Colchester Rd (West)	351	73	0	65	489
Eastways	67	62	20	0	149
Total	418	135	894	378	1825

PM Peak

Origin / Destination	Colchester Rd (East)	Coleman's Bridge	Colchester Rd (West)	Eastways	Total
Colchester Rd (East)	0	0	105	35	140
Coleman's Bridge	0	0	379	59	438
Colchester Rd (West)	747	223	0	24	994
Eastways	212	271	47	0	530
Total	959	494	531	118	2102

Traffic Flows – Without Scheme + Construction (2025)

AM Peak

Origin / Destination	Colchester Rd (East)	Coleman's Bridge	Colchester Rd (West)	Eastways	Total
Colchester Rd (East)	0	8	212	207	427
Coleman's Bridge	169	0	683	194	1046
Colchester Rd (West)	474	95	0	138	707
Eastways	86	85	32	0	203
Total	729	188	927	539	2383

IP Peak

Origin / Destination	Colchester Rd (East)	Coleman's Bridge	Colchester Rd (West)	Eastways	Total
Colchester Rd (East)	0	18	117	97	232
Coleman's Bridge	43	0	363	84	490
Colchester Rd (West)	362	108	0	63	533
Eastways	111	110	70	0	291
Total	516	236	550	244	1546

PM Peak

Origin / Destination	Colchester Rd (East)	Coleman's Bridge	Colchester Rd (West)	Eastways	Total
Colchester Rd (East)	0	17	13	43	73
Coleman's Bridge	38	0	491	68	597
Colchester Rd (West)	746	183	0	33	962
Eastways	294	368	88	0	750
Total	1078	568	592	144	2382

Traffic Flows – With Scheme (2027)

AM Peak

Origin / Destination	Colchester Rd (East)	Coleman's Bridge	Colchester Rd (West)	Eastways	Total
Colchester Rd (East)	0	21	1029	388	1438
Screwfix	10	0	12	3	25
Colchester Rd (West)	664	14	0	148	826
Eastways	154	0	49	1	204
Total	828	35	1090	540	2493

PM Peak

Origin / Destination	Colchester Rd (East)	Coleman's Bridge	Colchester Rd (West)	Eastways	Total
Colchester Rd (East)	0	10	678	113	801
Screwfix	19	0	11	0	30
Colchester Rd (West)	1158	12	0	42	1212
Eastways	647	0	113	0	760
Total	1824	22	802	155	2803

Traffic Flows – With Scheme (2042)

AM Peak

Origin / Destination	Colchester Rd (East)	Coleman's Bridge	Colchester Rd (West)	Eastways	Total
Colchester Rd (East)	0	21	1039	424	1484
Screwfix	10	0	12	3	25
Colchester Rd (West)	760	14	0	149	923
Eastways	177	0	46	1	223
Total	947	35	1097	577	2655

PM Peak

Origin / Destination	Colchester Rd (East)	Coleman's Bridge	Colchester Rd (West)	Eastways	Total
Colchester Rd (East)	0	10	741	128	879
Screwfix	19	0	11	0	30
Colchester Rd (West)	1172	12	0	43	1228
Eastways	716	0	119	0	836
Total	1908	22	871	172	2972

Traffic Flows – Without Scheme (2027)

AM Peak

Origin / Destination	Colchester Rd (East)	Coleman's Bridge	Colchester Rd (West)	Eastways	Total
Colchester Rd (East)	0	0	214	207	421
Coleman's Bridge	0	0	690	182	872
Colchester Rd (West)	403	95	0	141	639
Eastways	87	85	32	0	204
Total	490	180	936	530	2136

PM Peak

Origin / Destination	Colchester Rd (East)	Coleman's Bridge	Colchester Rd (West)	Eastways	Total
Colchester Rd (East)	0	7	114	44	165
Coleman's Bridge	0	0	421	68	489
Colchester Rd (West)	761	187	0	34	982
Eastways	297	374	89	0	760
Total	1058	568	624	146	2396

Traffic Flows – Without Scheme (2042)

AM Peak

Origin / Destination	Colchester Rd (East)	Coleman's Bridge	Colchester Rd (West)	Eastways	Total
Colchester Rd (East)	0	0	220	229	449
Coleman's Bridge	0	0	675	189	864
Colchester Rd (West)	420	133	0	147	700
Eastways	84	93	46	0	223
Total	504	226	941	565	2236

PM Peak

Origin / Destination	Colchester Rd (East)	Coleman's Bridge	Colchester Rd (West)	Eastways	Total
Colchester Rd (East)	0	23	116	50	189
Coleman's Bridge	0	0	444	74	518
Colchester Rd (West)	783	184	0	36	1003
Eastways	333	417	85	0	835
Total	1116	624	645	160	2545