Appendix C – Traffic Modelling Report

Alfriston VISSIM Model: Base Model Development and Scheme Testing

Prepared for

East Sussex County Council

October 2017

1 The Square
Temple Quay
Bristol
BS1 6DG

Document History

Client Name:

This document has been issued and amended as follows:

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Contents

Introduction

1.1 Overview

CH2M has been commissioned by East Sussex County Council (ESCC) to develop a series of micro-simulation traffic models of Alfriston High Street.

The models will be used to test the impacts of proposed signalisation along the High Street including the introduction of one-way shuttle working.

1.2 Report Purpose

This report provides a summary of the development and testing of 2017 Base and proposed Scheme models.

Model Specification

2.1 Software

The models have been developed using PTV VISSIM version 9.00 service pack 04.

2.2 Model Extents

The models encompass the stretch of High Street between The Tye and Sloe Lane, inclusive of the following modelled junctions:

- High Street / Weavers Lane;
- High Street / Star Lane;
- High Street / River Lane; and
- High Street / West Street / North Street.

The full extents of the model can be seen in **Figure** .

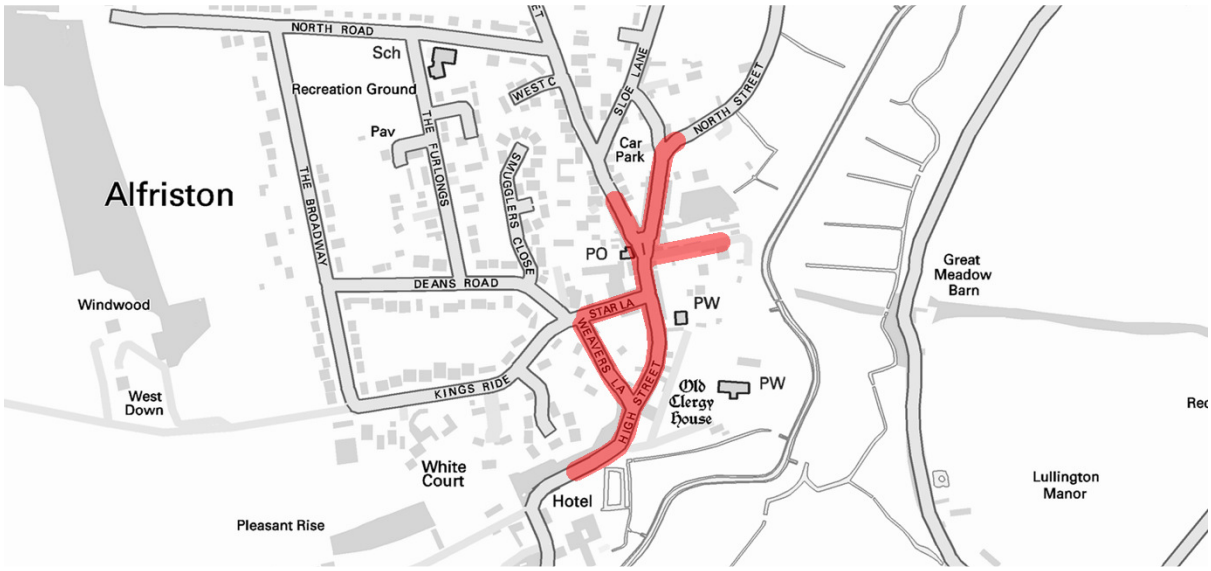

Figure 1: VISSIM Model Extents

2.3 Model Durations

Traffic flow data provided by ESCC was analysed to establish the peak periods for modelling. This led to the development of the following two 2-hours models, inclusive of 'warm-up' periods:

- Weekday Evening Peak between 16:00 and 18:00; and
- Weekend Peak between 12:00 and 14:00.

A breakdown of observed traffic flows during the Weekday and Weekend periods can be seen in **Figure 2** and **Figure 3**.

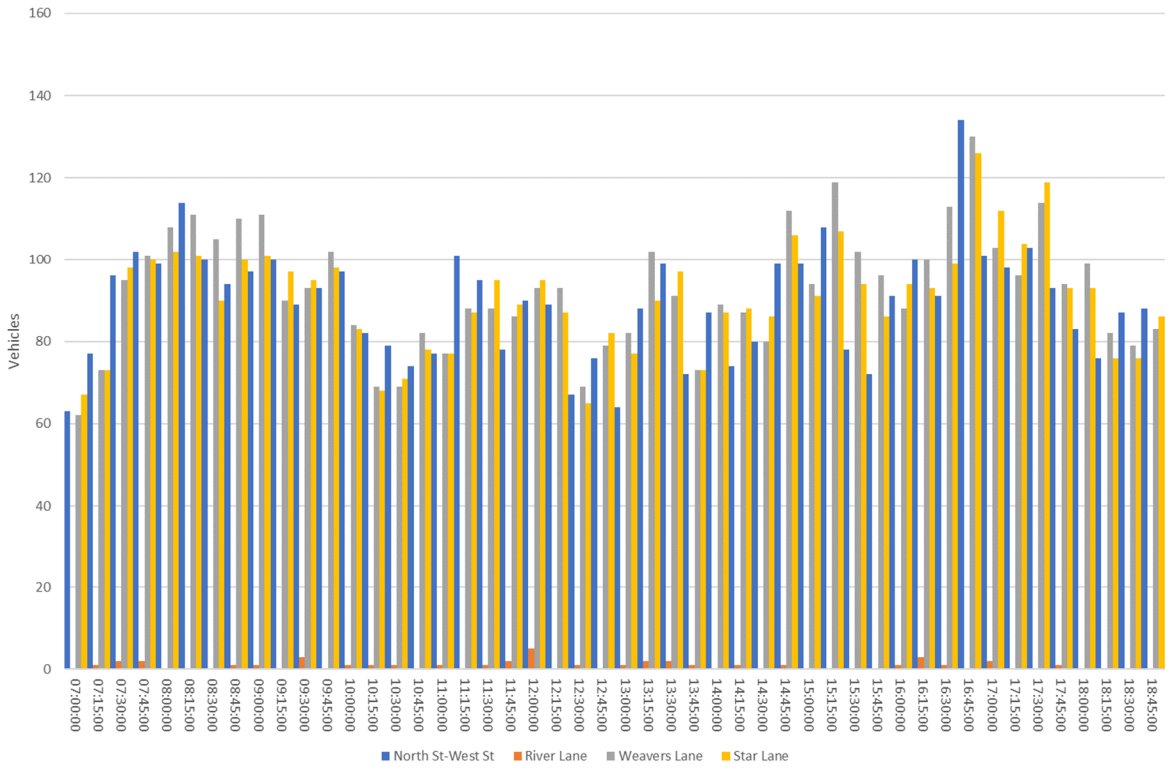

Figure 2: Weekday Evening Peak Flow Summary

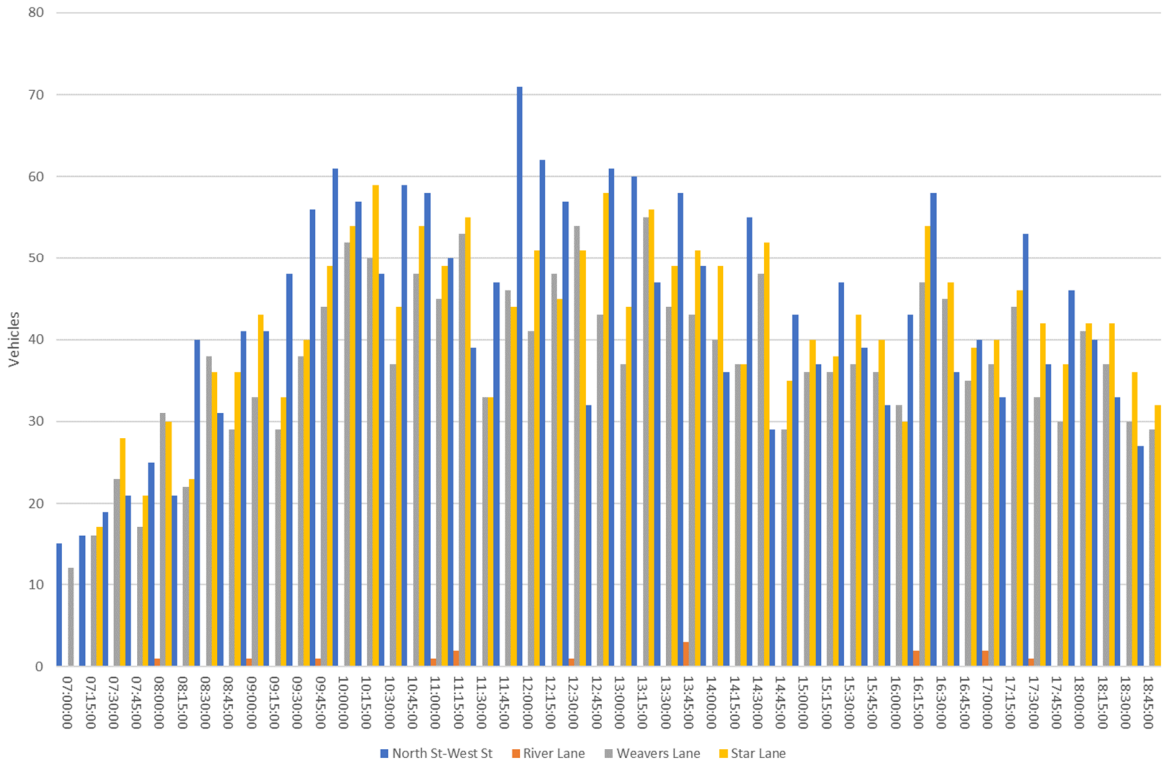

Figure 3: Weekend Peak Flow Summary

2.4 Model Assignment

Static traffic assignment utilising vehicle inputs and routing decisions based on observed turning proportions at individual junctions has been used.

In the case of Market Square, a 'partial' route has been used to allow northbound traffic to pass to the east of the island if no southbound traffic is detected. Otherwise, vehicles are routed via the western side.

2.5 Network

2.5.1 Highway Layout

CAD drawings of the study area were provided by East Sussex Highways and used as the basis for coding the road network within the models. Aerial and streetview imagery as well as manual observations of the corridor in operation were used to refine the network and overall functionality of the models.

2.5.2 Junctions

The modelled area includes only give-way junctions. To replicate their operation, a combination of priority rules and conflict areas have been used. Default values for headway and gap acceptance times were used as a starting point and then adjusted accordingly during the calibration of the models.

2.5.3 Public Transport Stops

The location of bus stops along the corridor was identified from aerial and streetview imagery. The only bus stop existing within the modelled area is located within Market Square.

2.6 Driver Behaviour

A record of manual observations taken at various points along the High Street corridor was provided by ESCC. This was reviewed by CH2M in conjunction with video, aerial and streetview imagery and used to influence driver behaviour within the models as accurately as possible.

Based on the information available, instances of drivers 'mounting' the kerb to allow two-way operation along the section of High Street between Weavers Lane and Star Lane is a common occurrence. Sadly, with the software unable to model this type of unorthodox behaviour, a number of proxies have had to be implemented. This includes the use of dynamic 5mph speed reductions and priority rules along the High Street, the section of North Street between Market Square and Sloe Lane and along Star Lane. Whilst the workarounds are acknowledged as being somewhat limited, they do allow for a degree of 'friction' to be replicated within the models in the appropriate areas.

Northbound parking outside of the Star Inn has also been simulated within the Base models through the use of dynamic parking spaces and partial routes to enable overtaking on the southbound carriageway providing suitable gaps in the traffic.

Model Calibration

3.1 Traffic Flow Inputs

3.1.1 Traffic Flow Input Data

3.1.1.1 Manual Classified Counts

Manual classified traffic count (MCC) data collected on Thursday the 13th of July 2017 and Saturday the 5th of August 2017 at the following junctions has been used to develop the Weekday Evening Peak and Weekend Peak models:

- High Street / Weavers Lane;
- High Street / Star Lane;
- High Street / River Lane; and
- High Street / West Street / North Street.

3.1.1.2 Vehicle Inputs

The MCC data was aggregated by vehicle type to form traffic flow inputs for the following vehicle classes:

- Cars;
- LGVs; and
- HGVs.

Input flows were assigned within the models in 15-minute intervals to account for the variance in traffic across the modelled periods. Since the MCC data was recorded in 15-minute intervals, no additional manipulations were required to derive the flow profiles.

3.1.2 Public Transport

Bus services operating within the modelled area were identified using information available on the official ESCC website[1]. Corresponding model entry times have been coded as per the online timetables.

3.2 Goodness of Fit

3.2.1 Overview

2017 Weekday Evening and Weekend Base models have been calibrated to ensure they pass the correct traffic flows with the GEH statistic adopted as the main indicator of the 'goodness of fit' between modelled and observed flows. In keeping with recommendations set out in the Design Manual for Roads and Bridges (DMRB), GEH values of less than 5 have been targeted.

A summary of the fit achieved by the Weekday Evening Peak model, based on the average of 10 simulation seed runs, can be seen in **Table 1**.

[1] https://www.eastsussex.gov.uk/roadsandtransport/public/buses/routes/

Period	Counts	GEH<5		Max GEH	Max Difference
16:00 - 17:00	22	22	100%	3.44	46
17:00 - 18:00	22	22	100%	3.13	34

Table 1: Model Calibration Results – Weekday Evening Peak

Based on the results presented, the Weekday model can be shown to display an acceptable level of fit against the corresponding observed data in both of the modelled hours.

A summary of the fit achieved by the Weekend Peak model can be seen in **Table** .

Period	Counts	GEH<5		Max GEH	Max Difference
12:00 - 13:00	22	22	100%	4.72	67
13:00 - 14:00	22	22	100%	1.99	27

Table 2: Model Calibration Results – Weekend Peak

Based on the results presented, the Weekend model also shows an acceptable level of fit against the corresponding observed data in both of the modelled hours.

Proposed Scheme Testing

4.1 Scheme Overview

The proposed scheme includes the signalisation of the High Street corridor between Weavers Lane and Market Square. The proposed four stage method-of-control can be seen in **Figure** .

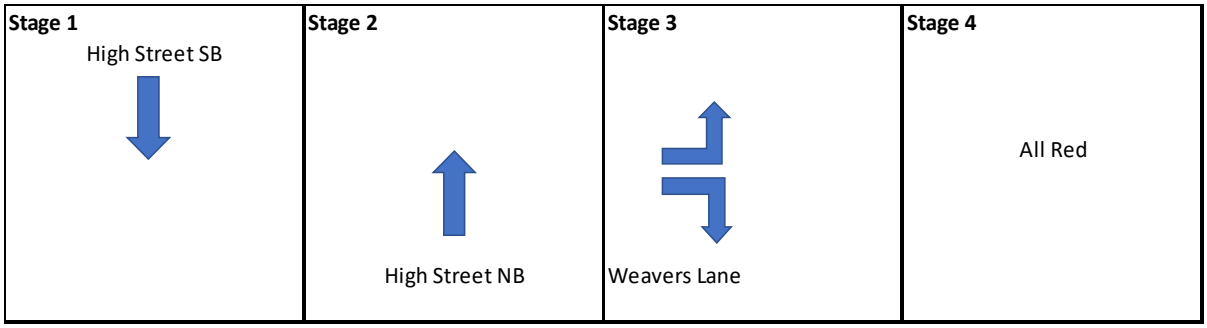

Figure 4: Proposed Method-of-Control

The proposed scheme changes also includes:

- The downgrading of the High Street / Star Lane junction to allow for westbound traffic movements only. Due to kerb realignment as part of the accommodation of the northbound traffic signals, LGV and HGV will be unable to left-turn into Star Lane. Within the models, all affected vehicles have been assumed to enter/exit the network on Weavers Lane.

- The removal of parking within 50m either side of the new High Street southbound stop line located to the north of Star Lane.

4.2 Scheme Impacts

4.2.1 Network Performance Indicators

The performance of the proposed scheme has been appraised on the basis of average-maximum queue lengths and journey times along the High Street corridor.

4.2.2 Weekday Evening Peak

4.2.2.1 Queue Lengths

Table provides an indication of 'average maximum' queue lengths during the Weekday Evening Peak period. The values shown represent the average of the single largest queues recorded at any point during each of the 5 simulation runs.

Approach	Average Maximum (metres)
High Street Northbound	71
Weavers Lane	25
High Street Southbound	141

Table 3: Queue Lengths (m) - Weekday Evening Peak

In addition to the 'average-maximum' queue lengths shown in **Table 3**, 'average-absolute' queue lengths broken down into 60-second intervals can be seen in **Figures 5 to 7** for the High Street

northbound, southbound and Weavers Lane stop lines. Queue profiles have been produced for a single seed run, namely the worst performing seed across the 10 runs undertaken.

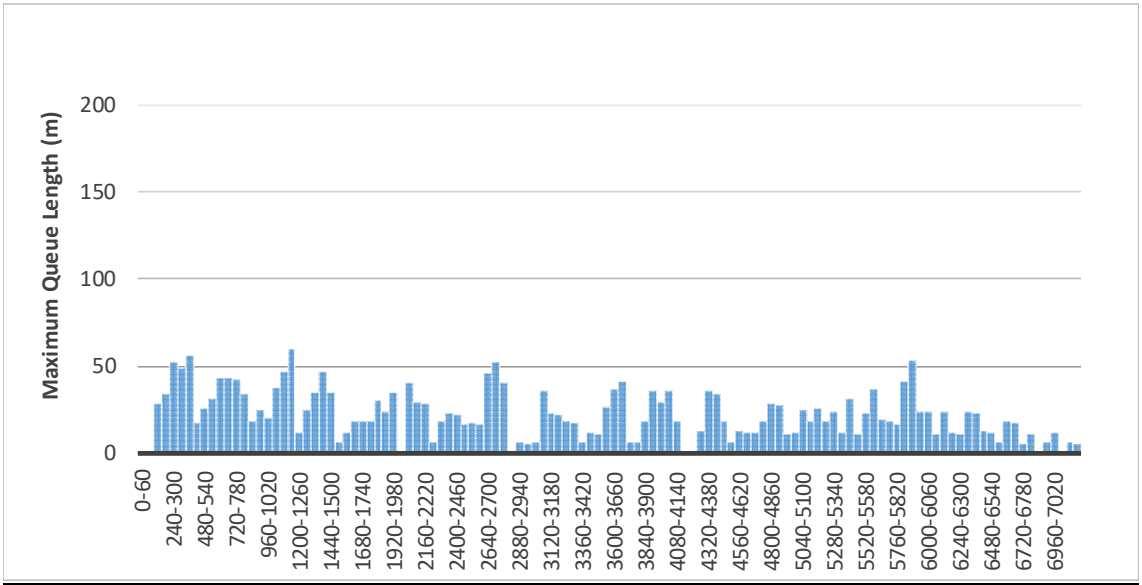

Figure 5: Weekday Evening Peak Queue Profile: High Street Northbound

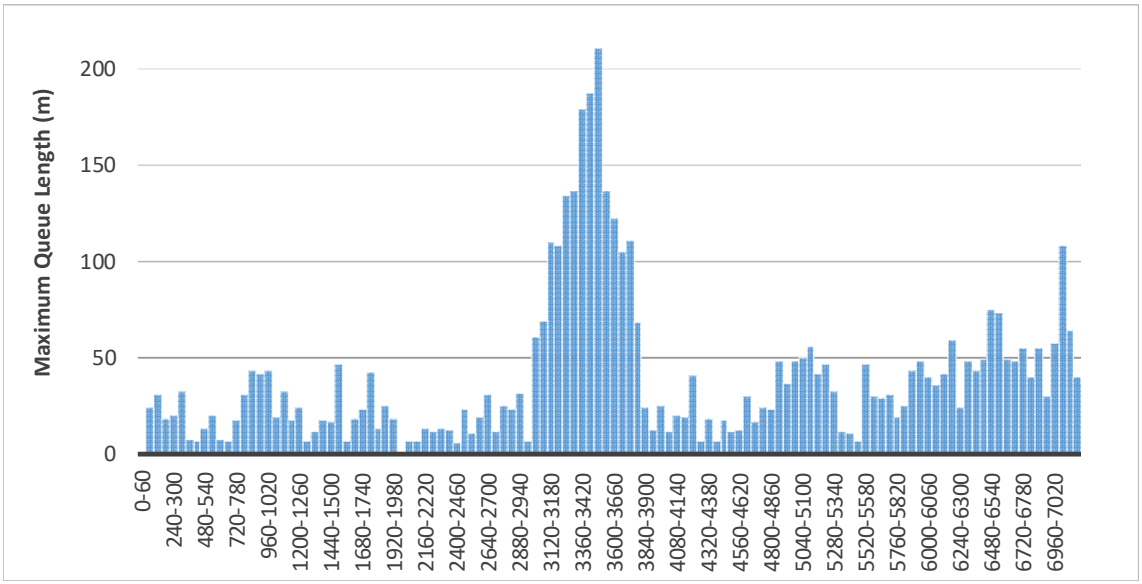

Figure 6: Weekday Evening Peak Queue Profile: High Street Southbound

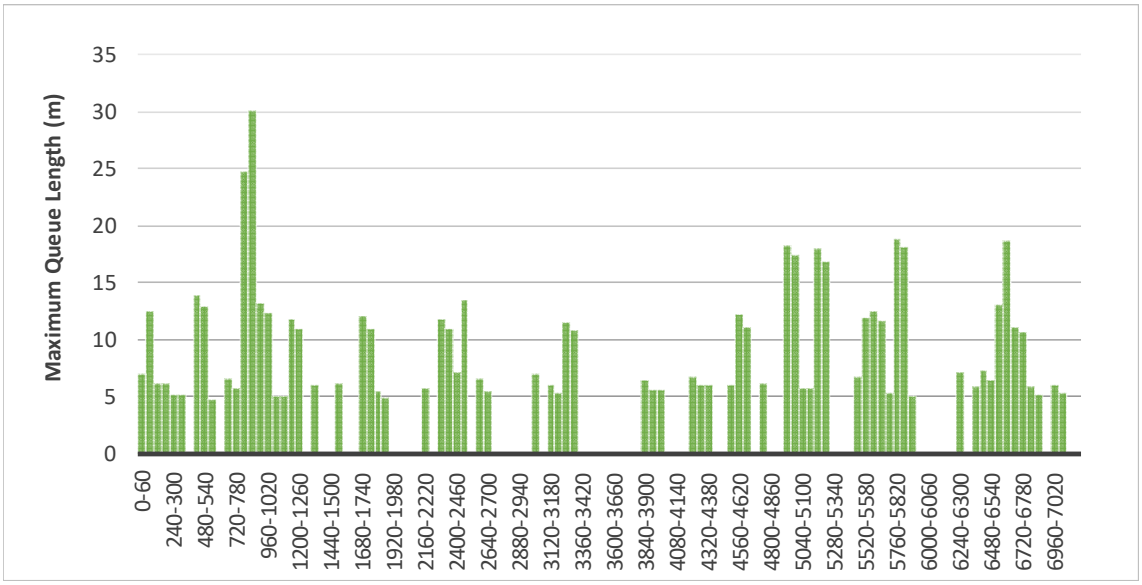

Figure 7: Weekday Evening Peak Queue Profile: Weavers Lane

4.2.2.2 Journey Times

A comparison of journey times along the High Street corridor in the Base and Proposed Scheme models can be seen in

.

Hour	Route Number	Route Name	Base Model - Travel Time (seconds)	Scheme - Travel Time (seconds)	Difference
16:00 - 18:00	1	High Street Northbound	134	126	-9
	2	High Street Southbound	96	127	31

Table 4: Network Journey Times (s) - Weekday Evening Peak

4.2.3 Weekend Peak

4.2.3.1 Queue Lengths

Table 5 provides an indication of 'average maximum' queue lengths during the Weekend Peak period. The values shown represent the average of the single largest queues recorded at any point during each of the 10 simulation runs.

Approach	Average Maximum (metres)
High Street Northbound	82
Weavers Lane	33
High Street Southbound	146

Table 5: Queue Lengths (m) - Saturday Peak

In addition to the 'average-maximum' queue lengths shown in **Table 5**, 'average-absolute' queue lengths broken down into 60-second intervals can be seen in **Figures 8 to 10** for the High Street northbound, southbound and Weavers Lane stop lines. Queue profiles have been produced for a single seed run, namely the worst performing across the 10 runs undertaken.

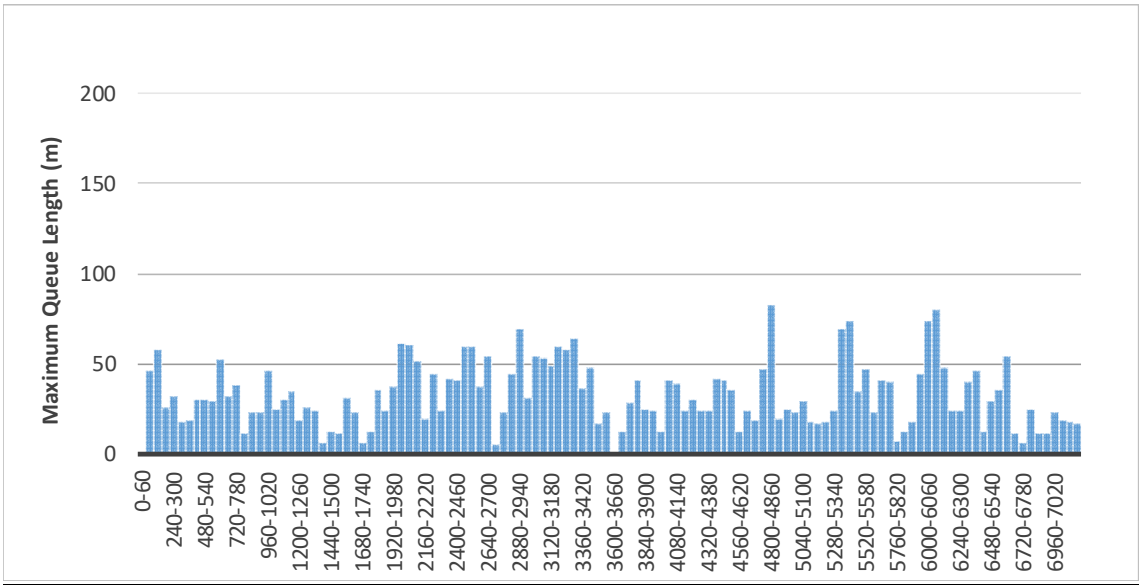

Figure 8: Saturday Queue Profile: High Street Northbound

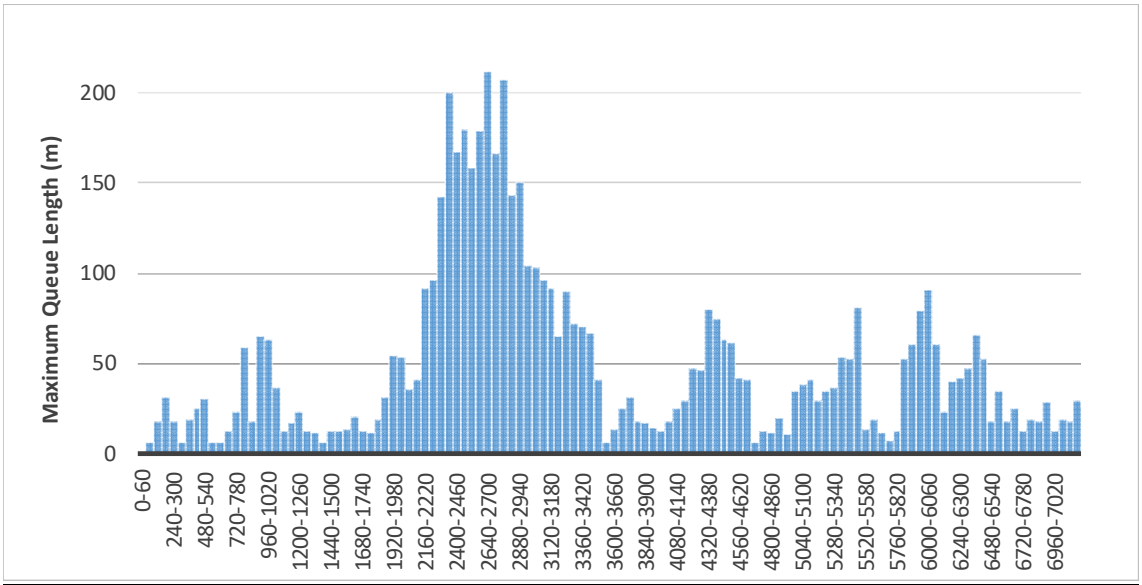

Figure 9: Saturday Queue Profile: High Street Southbound

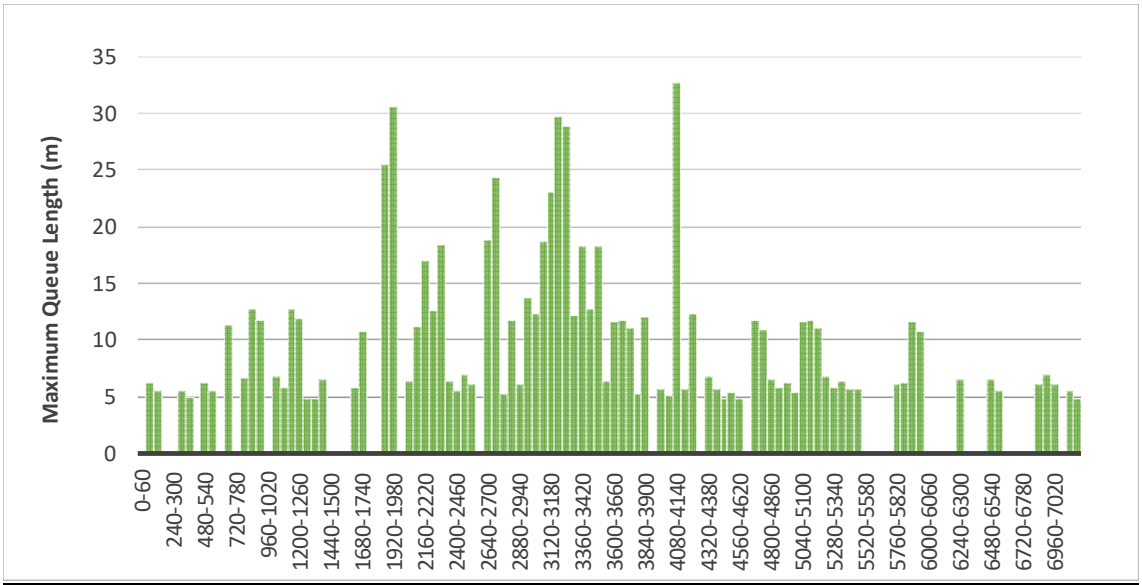

Figure 10: Saturday Queue Profile: Weavers Lane

4.2.3.2 Journey Times

A comparison of journey times along the High Street corridor in the Base and Proposed Scheme models can be seen in **Table 6**.

Hour	Route Number	Route Name	Base Model - Travel Time (seconds)	Scheme - Travel Time (seconds)	Difference
12:00 - 14:00	1	High Street Northbound	145	133	-12
	2	High Street Southbound	97	137	40

Table 6: Network Journey Times (s) - Weekend Peak

Model Summary

5.1 Overview

This report has been produced by CH2M to provide a summary of the development and testing of Base and proposed Scheme VISSIM models for Alfriston High Street corridor.

5.2 Model Calibration

2017 Base models have been developed for Weekday Evening and Weekend Peak periods. As expected, both models can be shown to display a good fit against the corresponding observed traffic flow data.

Due to the nature and layout of the High Street, unorthodox driver behaviours such as 'mounting' of the kerb to enable two-way operation is a common occurrence. Sadly, with the software unable to model this type of unconventional behaviour directly, a number of proxies have had to be implemented. This includes the use of dynamic 5mph speed reductions and priority rules along the High Street, the section of North Street between Market Square and Sloe Lane and along Star Lane. Whilst these workarounds are acknowledged as being somewhat limited, they do allow for a degree of 'friction' to be replicated within the models in the appropriate areas.

Taking all factors into account, it is CH2M's opinion that the models developed offer as realistic a representation of actual network operation as is possible.

5.3 Scheme Performance

The performance of the proposed scheme has been appraised on the basis of maximum queue lengths and journey times along the High Street corridor.

Based on the results presented, the introduction of traffic signal control and shuttle working along the section of High Street between Weavers Lane and Market Square can be shown to have a minimal impact on average network journey times. This equates to a negligible reduction in northbound times and an increase of circa 30 seconds in evening peak and 40 seconds in weekend peak in southbound direction.

When considering the extents of queueing on approach to the High Street, 'average-maximum' queue lengths in the region of approximately 140m in a northbound direction and 100m in a southbound direction are predicted. In the case of the latter, the 'absolute-maximum' queue length recorded on this approach was circa 200m; something which may prove 'undesirable' given the significance of Market Square as a focal point for the town.

When considering the removal of parking within 50m of the new High Street southbound stop line, modelling would suggest this to be necessary. Without it, the model can be shown to gridlock after a short period of time due to the limited stacking capacity available.