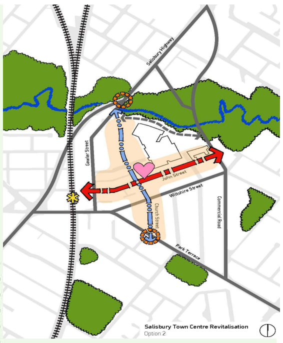

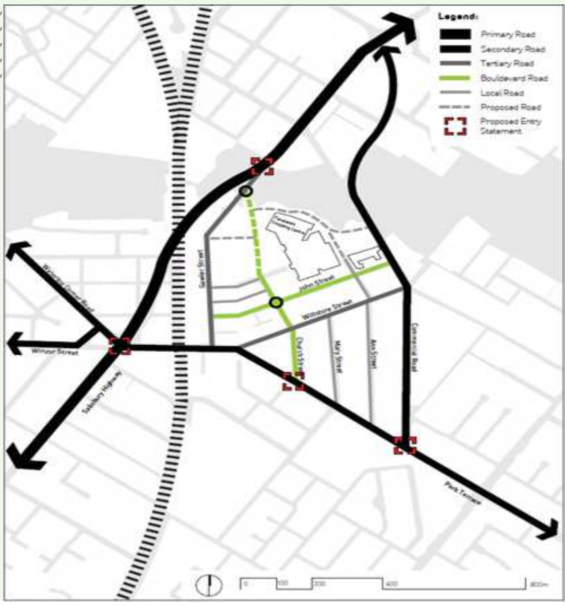

Salisbury Town Centre Revitalisation

Transport Assessment Report

Prepared for: City of Salisbury
Date: 28 June 2012

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Calibration Report
Salisbury Town Centre
City of Salisbury

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Contents

1. Executive Summary

This report outlines the development, calibration, and validation of the Aimsun Salisbury Town Centre model built on behalf of the City of Salisbury (CoS) by Aurecon.

The modelling centres on the delivery of a network analysis modelling methodology at an appropriate level to analyse the performance and connectivity issues and to test proposed actions associated with the local road network within the study area.

Stage 1 of this process was the development of a fully calibrated/ validated base Aimsun model reflecting existing traffic conditions. The subsequent stages assess the future probable schemes and associated traffic generation/ growth associated with the Salisbury Town Centre.

The base Aimsun model has been developed reflecting traffic conditions in the morning period, 07:00-09:30 and evening period, 15:00-18:00, replicating observed traffic conditions for year 2011.

The road network was constructed and calibrated utilising the Aimsun microscopic traffic simulation software. Detailed coding of lane and junction descriptions were developed using aerial photographs of the region, on-street measurements and knowledge of the network operation. During the calibration process, model parameters have been adjusted, to improve model operation. All model form changes that deviate from default are described in this report.

The first stage of the model build was to ascertain the traffic movements through the study area. These were derived from the higher tier MASTEM modelling with a cordoned matrix extract reflecting the Aimsun study area. Development of the matrices utilised traffic count data to derive appropriate matrices for both the morning and evening periods.

The second stage involved comparisons of observed and the modelled data comparing the following statistics:

- Turn counts
- Link counts
- Screenline counts

Lastly the validation process centred on the following elements:

- Journey time analysis
- Queue length assessment

The analysis concludes the Aimsun Salisbury Town Centre model is appropriately calibrated/ validated reflecting existing conditions for both peak periods. With this it is considered that the model is a suitable tool to analyse the performance and connectivity issues and to test the proposed actions associated with the local road network within the study area.

2. Introduction

This report sets out the traffic modelling associated with the Salisbury Town Centre and surrounding area. This report focuses on the aspects of the model development, operation, and adherence to good practice and summarises the results of the model calibration/ validation.

2.1 Background

The City of Salisbury (CoS) appointed Aurecon to undertake the traffic/transport modelling for the revitalisation of the Salisbury Town Centre. The transport modelling involved the following:

- MASTEM modelling of the impacts of providing the Saints Road Extension
- Aimsun microscopic modelling of the existing conditions and the modelling of options and recommended scheme in the vicinity of the Town Centre area.

The initial stage of the modelling centres on the development of a base model with which all schemes will be assessed. The model has been developed to reflect both the morning and evening peak periods and with dynamic route capability to reflect the vehicle route choice and their reaction to the prevailing traffic conditions. This provides an additional level of confidence regarding the Salisbury operation in calibration and more importantly option testing.

2.2 Purpose

Microscopic simulation models have been developed of the Salisbury Town Centre area and calibrated to existing network and traffic conditions. The calibrated model of the existing situation can then be used to assess future changes within the model and traffic impacts of various transport concepts. These assessments provide valuable information that can be used as input to decisions regarding the future of the Salisbury area. The foundation for this assessment is the creation of an agreed base case model.

3. Model Form

3.1 Aimsun

The model suite used for this commission was Aimsun. Aimsun represents traffic flows within a network, by simulating individual vehicles and their interactions with other vehicles and the surrounding road environment. As with real traffic conditions, these interactions can vary for each model run, resulting in unique results.

The Aimsun version used is version 6.1.3. All option testing should be undertaken using the same version of the software.

To obtain statistically meaningful results the average network performance is taken from multiple simulation runs. Previous experience indicates that ten model runs are sufficient to obtain stable results for a network of this size, nature and purpose.

3.2 Base Model Network

The base model network, as shown in Figure 1, is primarily the area enclosed by Salisbury Highway to the west, Commercial Road to the north and Park Terrace to the south. All roads considered major within this area have been integrated in the model. Driveways and roads carrying what is considered low traffic volumes which do not significantly influence traffic flow within the model have not been included.

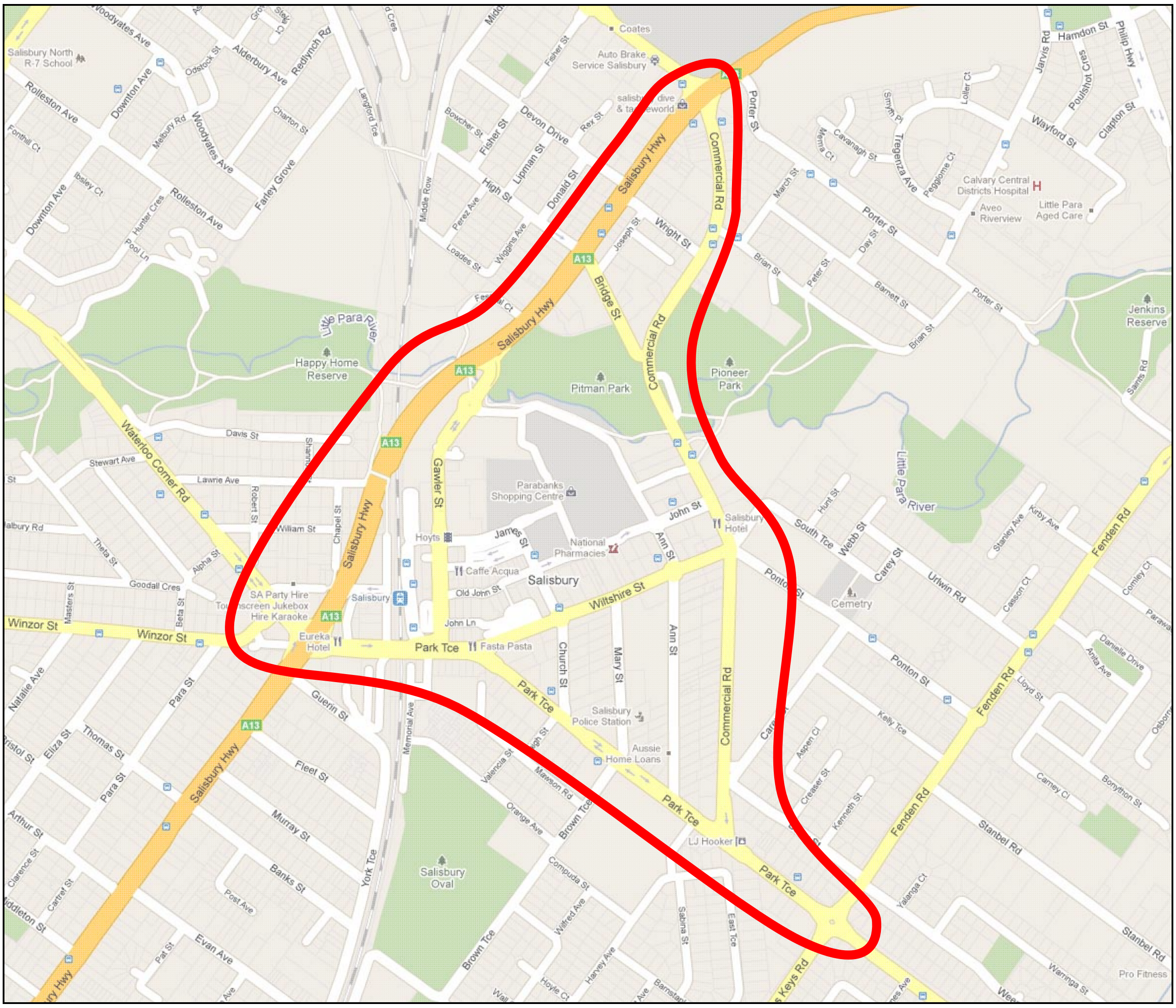

Figure 1 - Study area

The base model was compiled using available digital aerial photography, with site visits to confirm the accuracy and operation of the modelled network. Based on the supplied data, the model was constructed to a 1:1 scale, ensuring correct vehicle operation and accurate reaction to the road geometry and other vehicles.

3.3 Model Periods

The Aimsun model has been developed for a morning and evening traffic periods:

- Morning period (AM) – 07:00 to 09:30
- Evening period (PM) – 15:00 to 18:00

The following peak hours have been calculated for each of the above model periods, based on observed survey data.

- Morning peak hour – 08:15 to 09:15
- Evening peak hour – 16:15 to 17:15

Model duration of greater than two hours ensures the shoulders to the peaks of the background traffic and development traffic are adequately modelled. This allows the model to adequately accommodate peak hour spreading which could result with future growth within the study area. Due to these reasons and the late morning peak hour, an additional 30 minute cool down has been added to the morning model.

3.4 Site Visits

Site visits were undertaken by Aurecon staff on the 3rd, 4th and 5th of May 2011 to confirm the model form and ensure realistic vehicle behaviour is replicated within the model.

4. Traffic Data Collection

4.1 Survey Data

Peak period count data was collected by HDS, in addition to supplement this count data was received from both CoS and DTEI to supplement. The following section summarises the traffic data collection process undertaken.

Turn count data was provided for the key intersections throughout the Salisbury area. Given the count data is from different months/ different weeks/ different days there is likely to be some disparity between intersections in addition to the expected human errors that comes with count data.

4.1.1 Turn Count Data

In total 19 intersections were surveyed, recording turn counts by vehicle type in fifteen minute intervals. These counts consisted of both full and partial turning count data. Full count refers to all movements that is both turns and through movements collected for all approaches to the intersection. Partial counts refer to the collection of turns only.

Those intersections counted are listed below and presented in Figure 2.

Full turning counts (all movements):

- Park Terrace / Mary Terrace / Brown Terrace
- Wiltshire Street / Church Street
- Wiltshire Street / Ann Street
- Church Street / John Street / Old John Street
- Ann Street / John Street / Old John Street
- Gawler Street / James Street
- Gawler Street / Shopping Centre Access
- Commercial Road / Wiltshire Street / Ponton Street

Partial turning counts (turns only):

- Bridge Street at Commercial Road
- Bridge Street at Salisbury Highway
- Brian Street at Commercial Road
- Wright Street at Commercial Road
- Church Street at Park Terrace
- Ann Street at Park Terrace
- Carey Street at Commercial Road
- John Street at Commercial Road
- Shopping Centre Access (Barnacle Bills) at Commercial Road
- Church Street at James Street
- Old John Street at Gawler Street

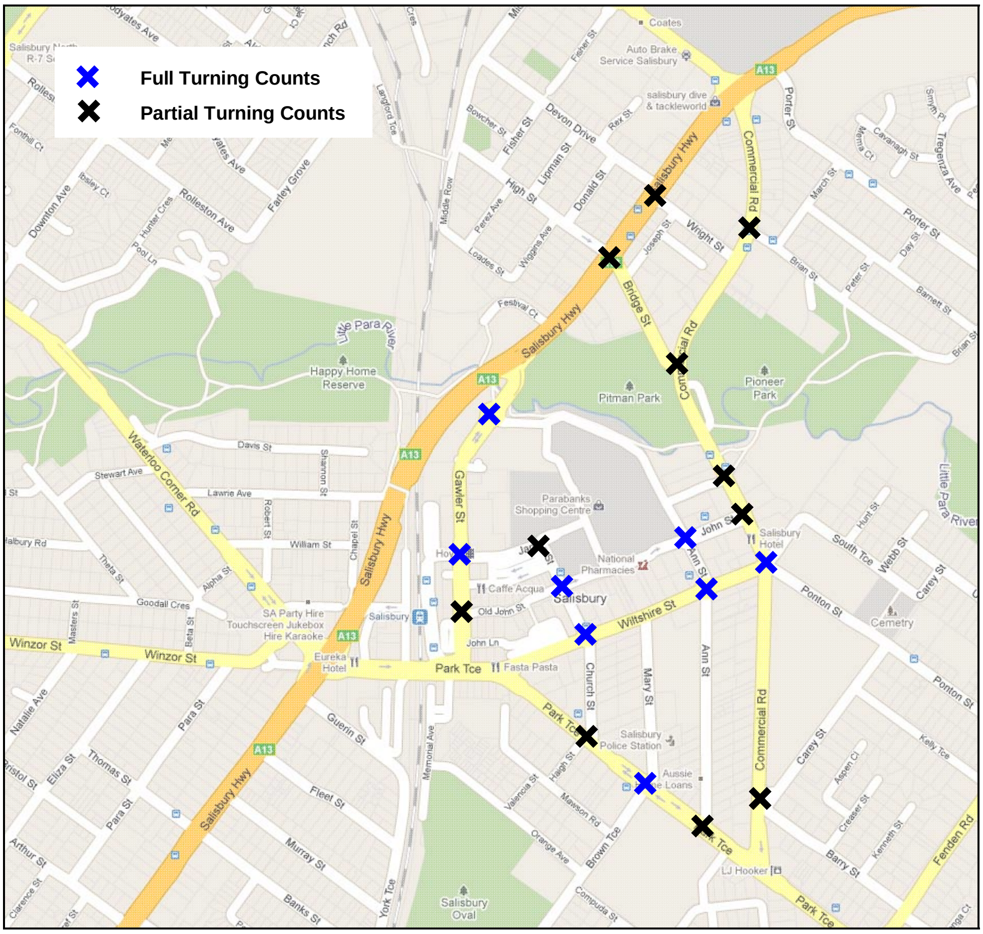

Figure 2 - Turn count survey locations

4.1.2 Loop Count Information

Loop count information in the form of tube counts, were collected at 8 locations on the 4th and 5th of May 2011. The location of these counts centred on the access points to the Salisbury Mall in addition to locations where a comparison between turn count data could be undertaken.

The location of the loop count collection points is presented in Figure 3 below.

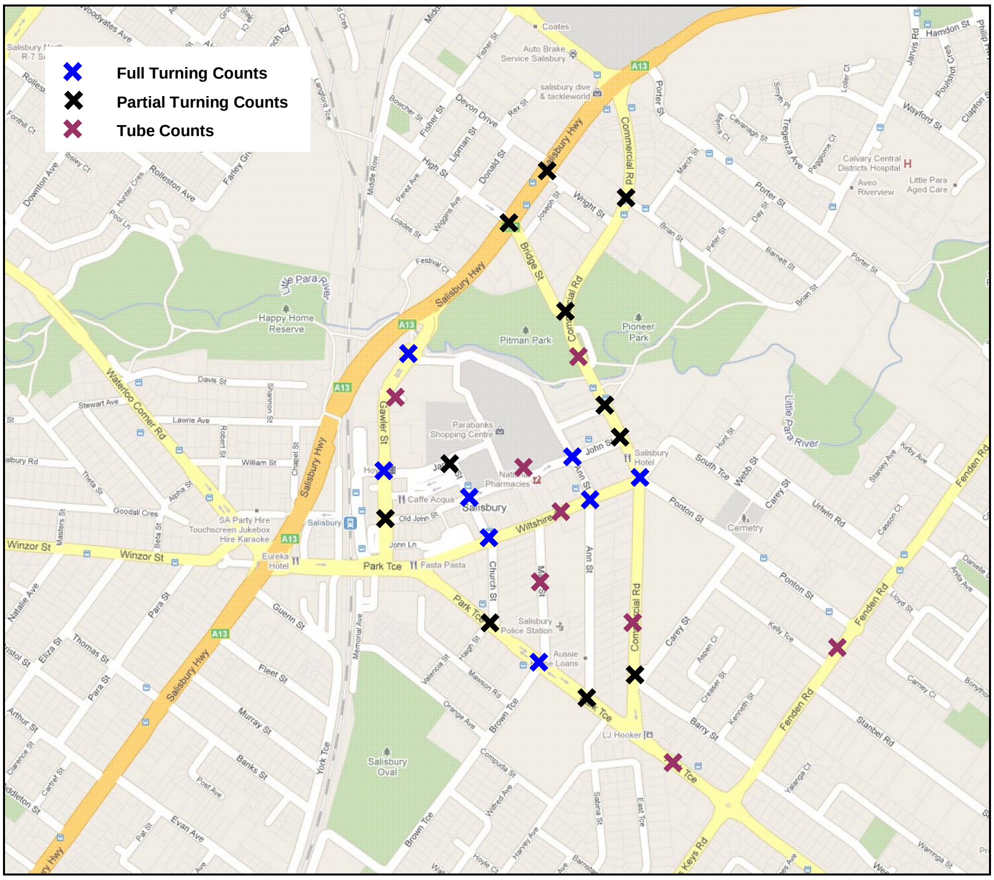

Figure 3 - Tube count survey locations

4.1.3 Additional Survey Data

Historic traffic survey data was provided by DTEI ranging from year 2008 to 2010. Given the age of this data factoring was required to align these counts with the latest counts. This was undertaken using SCATS "VS" volume count data and intersections listed in Section 4.1.1 and Section 4.1.2 which are situated adjacent to the intersections provided by DTEI. These additional data sets are listed in Table 1 below with their respective survey dates.

Intersection	Survey Date
Park Terrace/ Commercial Road	28 May 2008
Park Terrace/ Fenden Road	29 April 2008
Park Terrace/ Gawler Street	26 October 2008
Park Terrace/ Wiltshire Street	14 May 2008
Salisbury Highway/ Commercial Road	9 November 2010
Salisbury Highway/ Gawler Street	15 May 2008
Salisbury Highway/ Park Terrace/ Waterloo Corner Road	28 October 2010
Waterloo Corner Road/ Winzor Street	13 March 2003
Wiltshire Street/ Mary Street	2 April 2009

Table 1 – Historical survey data

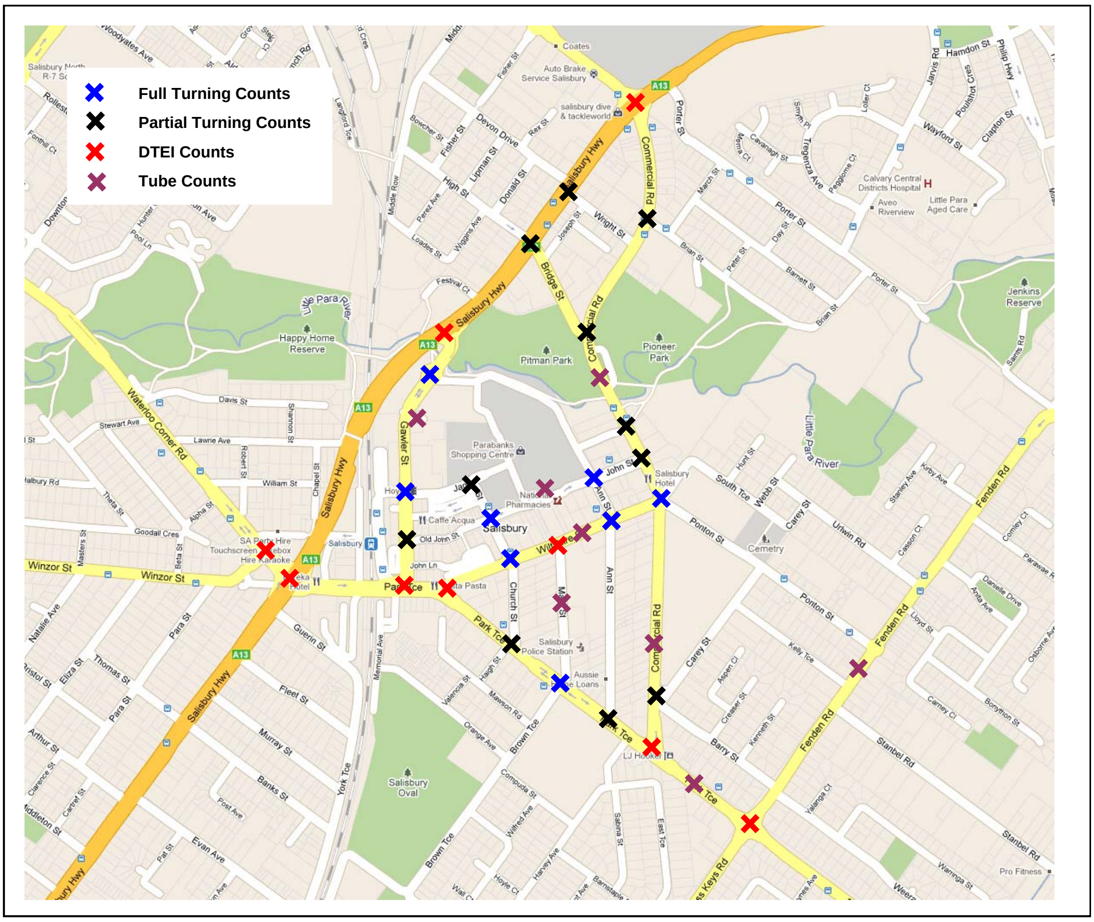

Figure 4 - Turn count survey locations

4.1.4 Journey Time Data

To form part of the validation process travel time surveys have been undertaken through the modelled area. In total four routes were selected with travel times being recorded for each modelled period, in each direction of travel.

The four routes selected are as follows.

- **Route 1:** Salisbury Highway – Park Terrace to John Rice Avenue
- **Route 2:** Park Terrace – Salisbury Highway to Fenden Road
- **Route 3:** Commercial Road – Park Terrace to Salisbury Highway
- **Route 4:** Gawler Street – Park Terrace to Salisbury Highway

The travel time surveys were undertaken on the 5th of May 2011 and were traversed repeatedly for the following time periods:

- Morning period – 07:00 to 09:30
- Evening period – 15:00 to 18:00

The routes surveyed are shown in the Figure 5 below.

Figure 5 – Journey time route

4.1.5 Traffic Signal Data

SCATS traffic data was collected from the 2nd to the 6th of May 2011. In total data for 7 signalised intersections and 3 pedestrian crossings was obtained. The data was supplied via VS, SM, and IDM files in addition to the LX and database files. This data enabled the fixed signal timings to be derived for each of the modelled periods. In addition traffic signal offsets, pedestrian activations, rail crossing operations, and lane induced loop volumes was also calculated for input to the models.

The signalised intersections and pedestrian crossings are listed below.

- Salisbury Highway / Park Terrace, TCS 200
- Salisbury Highway / Gawler Street, TCS 321
- Salisbury Highway / Commercial Road, TCS 244
- Park Terrace / Rail Crossing, TCS 470
- Park Terrace Bus Station Exit, TCS 470
- Park Terrace / Gawler Street, TCS 470
- Park Terrace / Wiltshire Street, TCS 525

- Park Terrace / Mary Street, TCS 468
- Commercial Rd/ Wiltshire Street, TCS457
- Park Terrace Pedestrian Crossing, PC 322
- Commercial Road Pedestrian Crossing between Bridge St and John St, PC 241
- Commercial Road Pedestrian Crossing between Wiltshire St and Carey Street, PC 235

4.1.6 Public Transport Information

All bus route data entered into the base models was obtained from the Adelaide Metro website and consisted of routes, schedules, and stop locations. Train scheduling was obtained from Adelaide Metro Northern Train timetable.

Further details regarding the bus and train information provided and included in the models are detailed in Section 5.5 of this report.

5. Traffic Demand and Assignment

5.1 Zone Structure

There is a degree of interdependence between the definitions of the study area/ zoning system and the network, such that one should not define one with out reference to the other.

The foremost component in defining the zoning structure for the microsimulation model was the existing zone structure utilised with the higher tier MASTEM model. Disaggregation of these MATSEM zones has been undertaken where considered applicable.

Disaggregation of the MASTEM zones was based on the main areas of trip generation through Salisbury.

In total 27 zones have been applied to the model. The zone layout is shown in Figure 6.

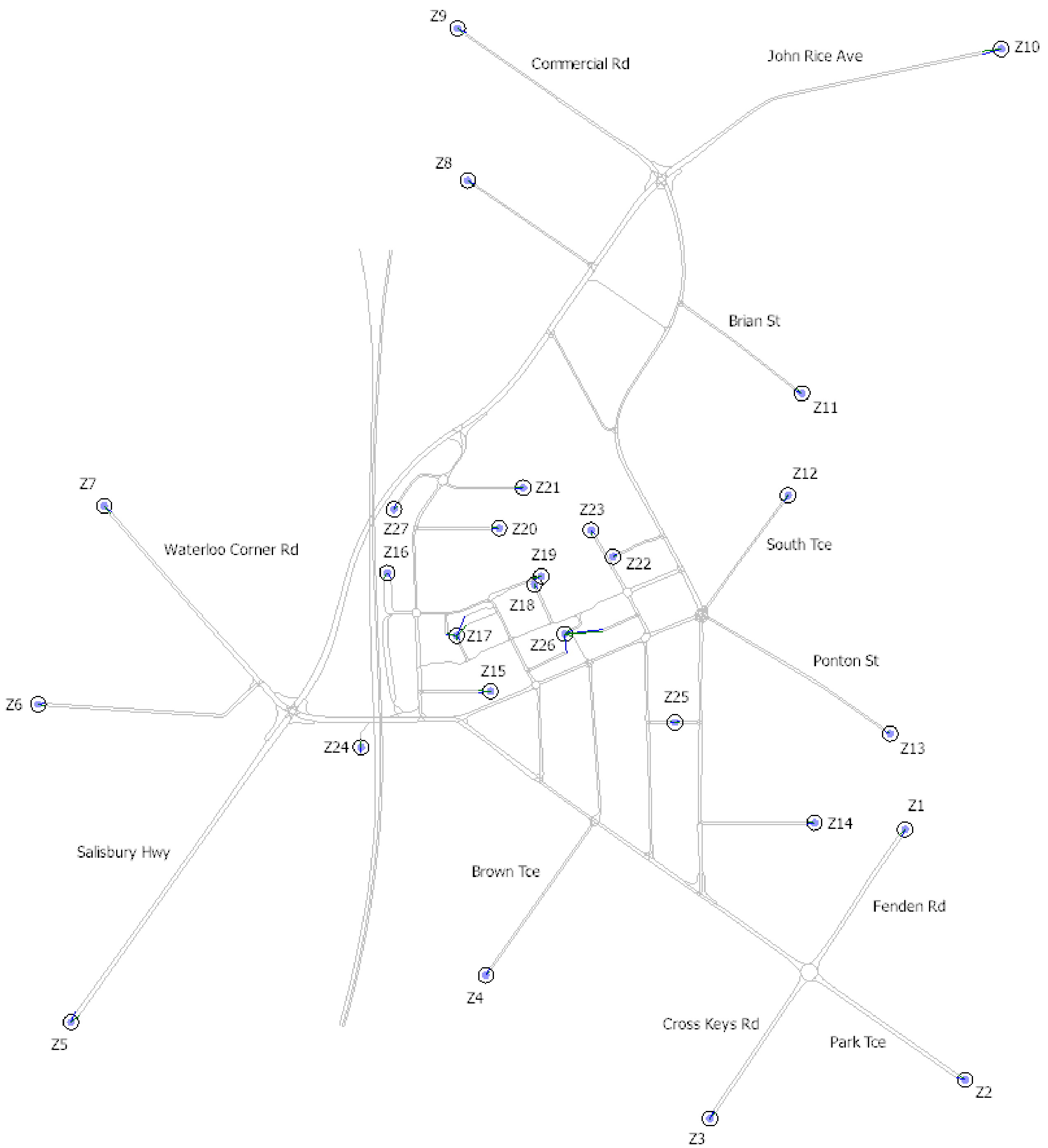

Figure 6 - Network zone configuration

5.2 Demand Matrices Development

In total 4 vehicle demand matrices have been assigned to the network. These represent cars, lights goods vehicles (LGVs), medium goods vehicles (MGVs), and heavy goods vehicles (HGVs). These both use the MASTEM prior matrix as a base.

5.2.1 MASTEM Demand Matrices

MASTEM cordon matrices were extracted from the 2011 MASTEM model. These matrices are considered coarse in the Salisbury model area with a total of 9 zones covering the model area. It was noted that no internal zones are defined for both the Salisbury Town and the Parabanks Shopping Centres which are considered large trip generators. This is not surprising given the extent of the MASTEM model area.

With this, the MASTEM matrices were under went a calibration process to better reflect the traffic generators within the model area.

5.2.2 Aimsun Matrix Development

The methodology for the creation of the demand matrix development is detailed below.

1. Cordon origin/ destination (O/D) demand matrices for both car and truck were extracted from the 2011 MASTEM model as hourly traffic volumes. These were manipulated to reflect the AIMSUN proposed zone structure. Disaggregation was also undertaken to reflect the areas within the AIMSUN model where no zones were available in the MASTEM model.

2. The peak hour matrices were adjusted to collected survey data using the Furness method. Trip end totals for each Aimsun zone were formed from external link survey data, internal link survey data, and other filler zones representing car parks with values based on their survey differences, surrounding land use, and number of individual car parks.

3. As part of the calibration process the matrices were manually adjusted to refine distributions created by the MASTEM zone disaggregation. A seed matrix was established to enable any shortcomings of the MASTEM model to be adjusted; this is adjusting the initial cell to cell trip numbers to influence the final matrix. The Furness method of matrix updating was then undertaken again with an iterative process to derive matrices that resulted in the best match when running the model and analysing the statistics.

Comparison of the Morning and Evening prior matrices is shown below and shows the only significant change from the final matrices compared to the prior matrices from the MASTEM model is for zone 5 (Salisbury Highway), zone 7 (Waterloo Corner Rd), and zone 10 (John Rice Avenue). The MASTEM outputs showed a large flow towards the Adelaide CBD in the morning period and low volumes heading toward the Adelaide CBD in the evening period. However survey data showed that a tidal flow was not so apparent and if anything traffic had destinations involving the industrial areas to the north of Salisbury the morning period.

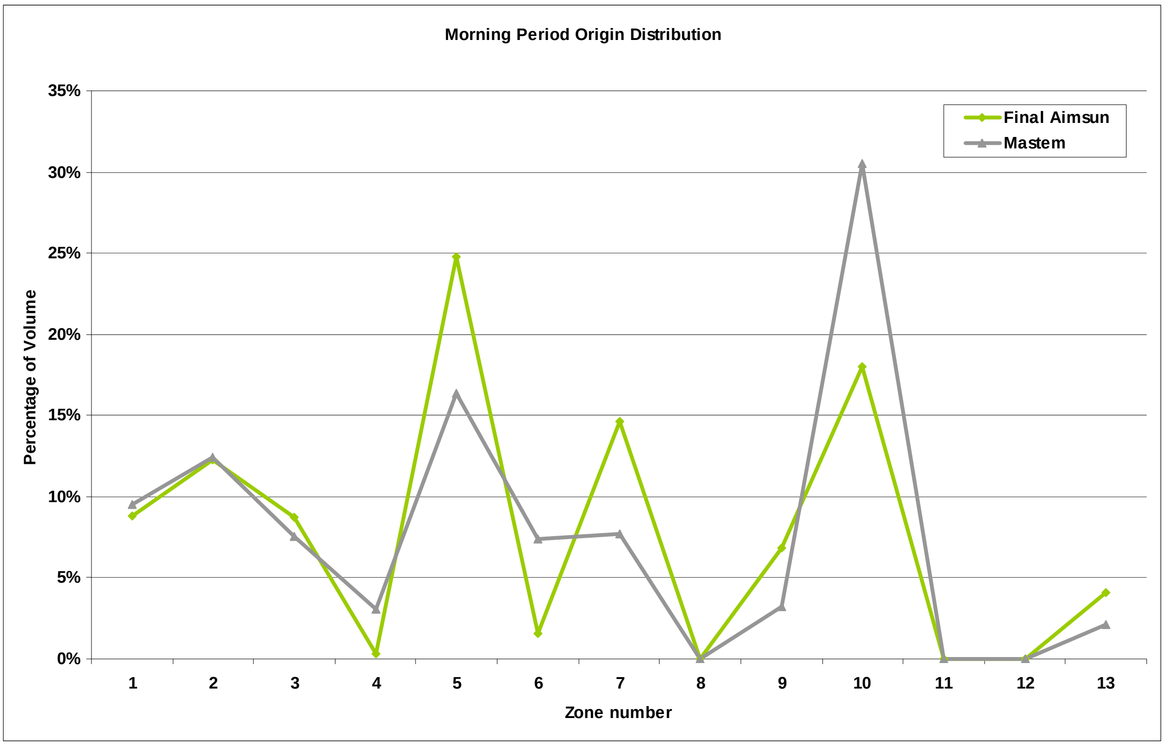

Figure 7 – Morning period origin distribution comparison

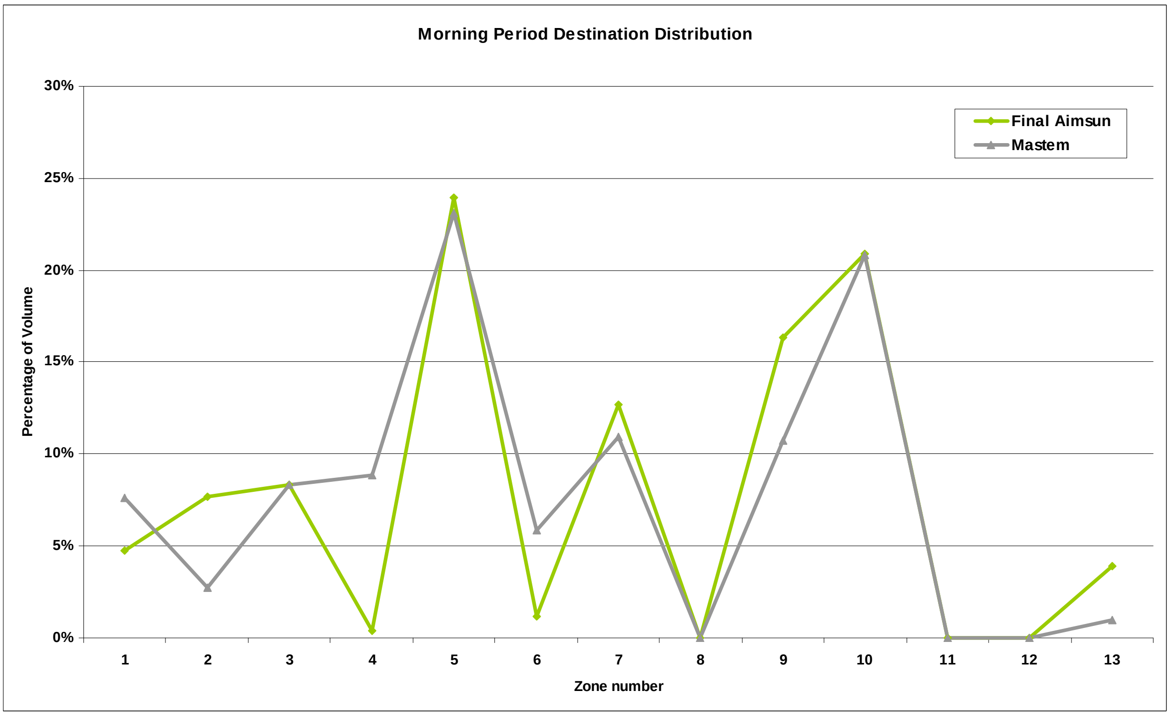

Figure 8 – Morning period destination distribution comparison

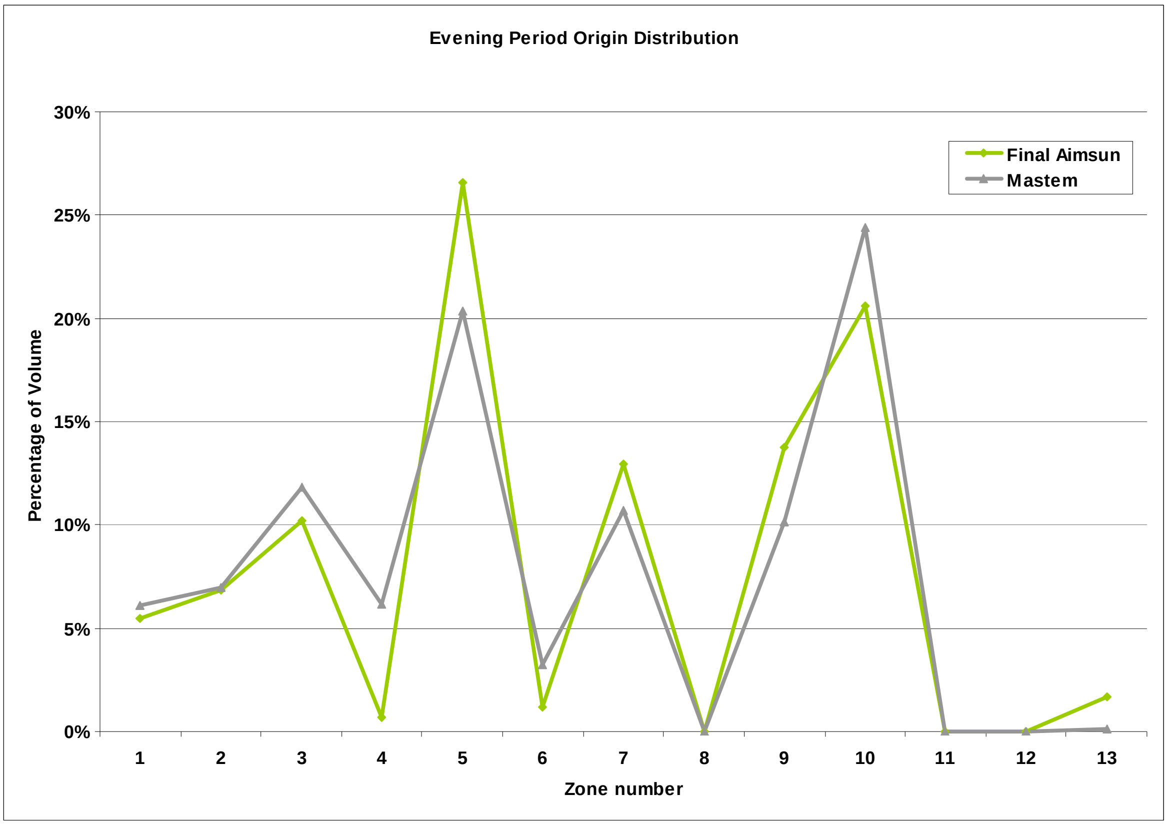

Figure 9 – Evening period origin distribution comparison

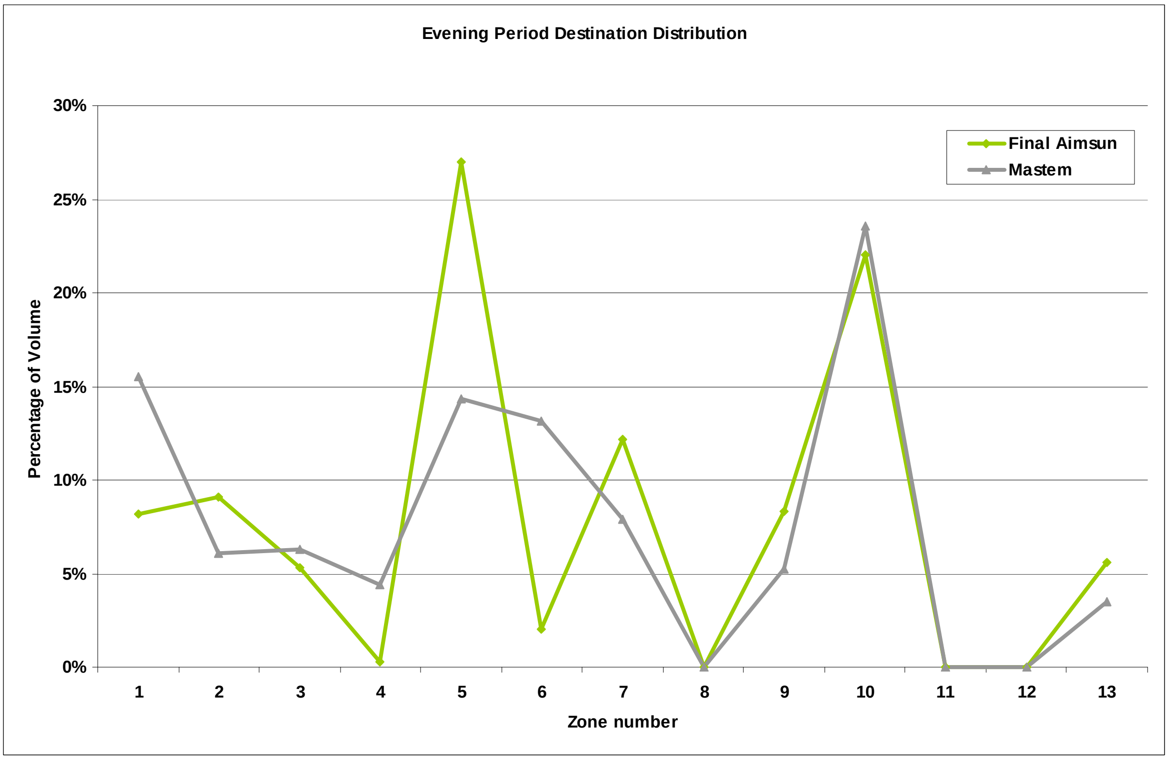

Figure 10 – Evening period destination distribution comparison

5.3 Traffic Demand Profiles

Demand profiles have been applied to dispense traffic demands in defined time intervals over the model periods. Global release profiles have been developed for car and goods vehicles (GV). These profiles were developed based on the May 2011 survey data which was collated in 15 minute intervals.

The demand release profiles, labelled as traffic flow factors, are displayed in Table 2 and Table 1 and are a percentage of the peak hour matrices.

AM	Cars %	GV %
07:00	14.4	16.7
07:15	18.9	22.7
07:30	17.1	24.9
07:45	21.0	23.7
08:00	21.2	26.4
08:15	25.1	24.6
08:30	25.5	19.9
08:45	27.0	23.6
09:00	22.4	32.0
09:15	19.2	35.7

Table 2 - AM demand profiles

PM	Cars %	GV %
15:00	25.4	43.3
15:15	25.6	41.9
15:30	23.3	51.6
15:45	24.3	35.8
16:00	24.6	42.1
16:15	25.2	26.3
16:30	24.6	26.3
16:45	24.3	16.9
17:00	25.9	30.5
17:15	25.5	13.7
17:30	22.3	9.4
17:45	21.3	5.4

Table 3 - PM demand profiles

The split of LGVs, MGVs, and HGVs was been based on survey data and is calculated as 80.3%, 18.2%, and 1.5% respectively, for both periods. LGV vehicles are represented by the “Truck DTEI” vehicle type, MGV by “Truck &Semi DTEI”, and HGV by “B-Double - DTEI”.

5.4 Vehicle Characteristics

The DTEI AIMSUN templates, stated in the DTEI Aimsun Model Development Manual, 28 August 2010, have been used to form vehicle types and kinematics. One deviation from this relates to the addition of two train types that are variations of the DTEI train with the differences solely relating to length.

Name	Mean	Deviation	Min	Max	Units
Length	4.6	0.45	3.35	5.35	meters
Width	1.75	0	1.75	1.75	meters
Max Desired Speed	110	10	80	120	km/h
Max Acceleration	2.7	0.2	2.2	3.5	m/s2
Normal Deceleration	3.5	0.2	3	4	m/s2
Max Deceleration	6	0.5	5	7	m/s2
Speed Acceptance	0.958	0.088	0.75	1.12	
Min Distance Veh	1.85	0.8	0.5	3.2	meters
Give Way Time	15	5	5	30	Secs
Guidance Acceptance	100	0	100	100	%
Sensitivity Factor	1	0	1	1	
Minimum Headway	1.1	0.2	0.5	2	Secs

Table 4 - Vehicle standard file (from Aimsun)

5.5 Public Transport

5.5.1 Bus Routes

All bus routes in operation in the study area have been included in the model. Route and schedule information was obtained from the Adelaide Metro website and is listed in Appendix F.

5.5.2 Bus Stops

In total 28 bus stops have been applied to the model, including 8 at the Salisbury Interchange. This has been replicated using information from site visits and from the aerials within the model.

5.5.3 Bus Stop Dwell Times

Without wide scale surveys bus stop dwell are difficult to ascertain. Given this data was not readily available an estimated bus stop dwell time of 30 seconds was applied within the town centre with 20 seconds dwell time applied to the outer suburbs bus stops. These dwell times include the physical stop time at the bus stop. The bus entry and exit delay is assumed to be reflected in the model.

5.5.4 Trains

Train schedules, stops, and dwell times for the two stops at the Salisbury Station were collected from a combination of the Adelaide Metro website, site visits, and aerials. To supplement this data SCATS outputs from May 5th 2011 was used to determine the freight train movements.

The signalised barrier controlled rail crossing on Park Terrace is replicated in the model by way of an actuated control plan with loops on the tracks. When a scheduled train activates the loops, the signals on Park Terrace (TCS 470) switch to amber, then red, stopping the Park Terrace traffic. As the train leaves the station it activates a second loop which allows the signals on Park Terrace to return to normal operation. The green time of the main phase of TCS 470 is extended to maintain the coordination to those signals at adjacent to the rail crossing, i.e.: those at Salisbury Highway and Wiltshire Street. This was undertaken as it reflects the operation of the signals on street which was determined with through assessment of the LX file for the area.

Queue detection loops also exist on-street on either side of the rail crossing in both directions and operate by changing specific signals at the Gawler Street/ Park Terrace intersection, the Salisbury Highway/ Park Terrace intersection, and the rail crossing to red when a queue is detected to be encroaching towards or from the rail crossing. This stops the queue increasing in length any further so that there is no possibility of any queue overlapping the rail tracks or spilling back through the Gawler Street/ Park Terrace and Salisbury Highway/ Park Terrace intersections. This queue detection function has been replicated in the model by implementing a *traffic management strategy* so that when a queue extends towards the rail crossing or adjacent intersections, traffic is stopped at specific locations, depending on where the queue has been detected. The relationships between the locations of the queue detection and the operation of the signals are given below.

Detected Queue Location	Signal Operation
Eastbound before the rail crossing	Waterloo Corner Rd through movement and Salisbury Highway South right turn movement change to red at the Salisbury Highway/ Waterloo Corner Rd intersection
Eastbound immediately after the rail crossing	Rail crossing eastbound changes to red
Westbound before the rail crossing	Gawler Street approach and Park Terrace westbound through movement change to red at the Park Terrace/ Gawler Street intersection
Westbound immediately after the rail crossing	Rail crossing westbound changes to red

Through sensitivity testing this method also operates satisfactorily with increased traffic volumes as may possibly be the case with future model years.

5.6 Pedestrians

Whilst individual pedestrian movements have not been modelled within the base model, the effect of pedestrian movements on traffic signals and timings has been taken into account. This has been done by firstly including all signalised and zebra pedestrian crossings. Timings for these crossings are either based from the collected signal data or have been approximated from on-site observations.

Secondly, the arrow protected pedestrian movements at signalised intersections cause delay to turning vehicles on-street. These have been replicated in the model by keeping each turning movement red for the first 10 seconds of their particular signal phase.

6. Traffic Assignment Calibration Process

6.1 Stochastic Assignment

Stochastic route choice uses dynamic travel time information, both past and current points of time in the simulation, to determine the routing for each vehicle. Thus, vehicles react to the prevailing traffic conditions, selecting the optimal route prior to loading onto the network and in some cases, dynamically changing this route to a lower cost route if available. The total cost of each route is represented by a travel time value with the routes with the lowest travel times for an OD pair being preferable.

Stochastic route choice is not considered ideal to represent non-recurrent situations (i.e. traffic incidents, unusual rerouting or deviations), as it tends to create the 'optimal' solution with drivers assumed to have perfect knowledge of the network and prevailing conditions. With this, modelled drivers would react to congestion finding other an alternative optimal route based on lowest cost to destination. It is considered that this underestimates the realistic congestion situation as observed in Salisbury, this in general is drivers are aware of congestion levels within peak periods about the Salisbury Town Centre with the majority unlikely to choice an alternative route but rather stick to the main streets.

The initial assignment of traffic through the network utilised the "Fixed using travel times collected under free-flow conditions" routes stochastic assignment tool within Aimsun as previously discussed with 100% of the traffic demand assigned to the network.

Visual observations of the model operating revealed two roads, Bridge Street and Wright Street, were the optimal route for many OD pairs. With the cost to destination influenced by section attractiveness, the default attractiveness values of these two roads, allocated by their capacities, was reduced to enable routing that was more accurate to what was seen on street.

6.2 Dynamic Route Choice

Upon achieving good calibration with the stochastic assignment, the initial path assignment file was collected as an *.apa* file and then loaded with each model run. The percentage of stochastic assignment was then reduced to what is considered to be realistic for a model of this size; this is 50% of traffic through the network follow the stochastic assignment with the remainder being dynamic.

The settings used with the modelling are listed below.

Parameter	Value
Route Choice	
Cycle	0:02:30
Number of Intervals	3
Attractiveness Waiting	3
User Defined Cost Weight	0
Use of O/D Routes and Path Assignment Results	
Car and LGV following O/D Routes	0%
Car and LGV following Path Assignment Results	50%
MGV and HGV following O/D Routes	0%
MGV and HGV following Path Assignment Results	50%
Route Choice Model	
Route Choice Model	C-Logit
Dynamic	Enabled
Initial K-SPs	3
Max Number to Keep	6
Max Number of Paths	3
Parameters	
Scale	24
Beta	0.15
Gamma	1

Table 5 - Traffic Assignment Parameters

7. Model Coding

Through the calibration process adjustments have been made to the modelling parameters to ensure the model replicates the existing observed traffic conditions.

7.1 Behaviour

DTEI default values have been retained.

7.2 Configuration

Global arrivals release style

The release style of uniform has been used.

Simulation Step

The time step value of 0.45 seconds is used in the models.

Mean Reaction Time

The mean reaction time of each driver, in seconds, is associated with the lag in time between a change in speed of the preceding vehicle and the following vehicles reaction to the change. The value of 0.9 seconds is utilised in this model with a reaction time at stop of 1.25 seconds.

7.3 Distance zones

The default node zone distance has been used for most sections; however some have been modified to better replicate the lane changing behaviour on street.

7.4 Road types

In total 5 road types have been used in the model. The road types generally reflect the speed, capacities, and distance zones of the roads within the network.

7.5 Turn speeds

Some turning speeds have been reduced to 20 km/h at priority intersections and left slip lanes as the default turn speeds appeared unrealistic for a give-way movement.

7.6 Version

The model has been developed in version 6.1.3 R9501 of Aimsun. This was the latest current version at the time of model development.

8. Model Calibration

8.1 Calibration/ Validation criteria

Model calibration/ validation is necessary to ensure that a model accurately represents an existing traffic situation and can be used with confidence to test alternatives. Model calibration for this model has been based on the following:

- **Vehicle Behaviour:** Undertaking a visual check to confirm the observed on-street vehicle behaviour is consistent with that observed in the model
- **Turn Counts:** Comparing observed and modelled turning movements for general traffic over the modelled peak hour periods
- **Link Counts:** Comparing observed and modelled link counts for general traffic over the modelled peak hour periods
- **Screenlines:** Comparing observed and modelled total link counts for general traffic across defined boundary lines over the modelled peak hour periods
- **Journey Times:** Comparing observed and modelled journey travel times for general traffic over the modelled peak hour periods
- **Queue Lengths:** Undertaking a visual check to confirm the modelled queue operation is consistent with those observed on site

The sets of criteria, recommended by different sources, have been referenced to assess the acceptability of the level of calibration achieved in the model. These are presented in full in the following table are sourced from the DTEI Aimsun Model Development Manual dated 28 August 2010.

Type	Criterion Source	Criteria and Measures (Observed vs. Modelled)	Calibration Target
Model Stability	Aurecon	The overall network statistics such as mean flow, density, mean speed, mean travel time, mean delay, total travel distance and total travel time.	The coefficient of variation (CoV) within 5%
Turn Counts and Link Flows	UK Dept of Transport	Within 100 vph for flows <700 vph	>85% of cases
		Within 15% for 700 vph < flows < 2700 vph	>85% of cases
		Within 400 vph for flows > 2700 vph	>85% of cases
		Sum of all flows	Within 5%
		GEH statistics <5 for individual flows	>85% of cases
		GEH statistics for sum of all flows	<4
Turn Counts and Link Flows	NZTA EEM	R2 value modelled vs observed values	>0.85
		Percentage RMSE	<30%
Screenlines	NZTA EEM	R2 value modelled vs observed values	>0.85
Journey Time	DMRB	Travel times not greater than 6 minutes, within 1 minute	>85% of cases
		Travel times greater than 6 minutes, within 15%	>85% of cases

Table 6 – Calibration criteria

All data listed in Section 4.1.1 was used to calibrate the model with the addition of historical 2010 data at Salisbury Highway/ Park Terrace and Salisbury Highway/ Commercial Road. Calibration of the model using all data available including all historical data is presented in Appendix D and Appendix E.

Detailed comparisons between observed and modelled calibration statistics are presented in the following sections for the peak hours. Statistics for the full periods, including the shoulders periods, is presented in Appendix A, Appendix B, and Appendix C.

8.2 Model Stability

The coefficient of variation (COV) has been used to assess the variability between each run on the network statistics. The COV is a measure of the variation between model runs. Typically 5% is considered a good level of correlation. The coefficient of variance is calculated by divided the mean by the standard deviation as follows:

$$COV = \frac{SD}{\mu} \times 100$$

Where: SD = Standard Deviation

μ = Mean

Log Run	Average Travel Time (s)	Total Distance (km)	Total Number of Vehicles	Mean Speed (kph)
Mean	121	21,042	18,585	34
Std Dev	1	123	63	0
Min	119	20,893	18,465	34
Max	123	21,239	18,678	34
Range	4	347	213	0
CoV	**0.90%**	**0.59%**	**0.34%**	**0.39%**

Table 7 – Morning period, network statistics (10 runs)

Log Run	Average Travel Time (s)	Total Distance (km)	Total Number of Vehicles	Mean Speed (kph)
Mean	130	28,802	25,685	31
Std Dev	2	176	66	0
Min	127	28,499	25,572	31
Max	131	29,013	25,821	32
Range	4	515	249	1
CoV	**1.27%**	**0.61%**	**0.26%**	**0.90%**

Table 8 – Evening period, network statistics (10 runs)

The general network statistics for both periods predict a CoV of less than 3%. Overall it is considered that the model is stable however it was found that approximately one in every three the model would become blocked by a bus within Aimsun either unable to complete a movement around a small roundabout or unable to exit a bus stop correctly. These blocked runs were removed from the analysis. Average unreleased and lost vehicle numbers for the peak hour periods are given below.

Period	Unreleased vehicles	Vehicles lost
Morning	2	32
Evening	4	11

Table 9 – Unreleased and lost vehicle numbers

8.3 Turn count calibration

The following sections make comparisons between observed and modelled turn counts for each peak hour period, by organising the observed counts into volume ranges. This allows the data to be assessed with more emphasis placed on the higher volume movements. The comparison includes averaged modelled results from all ten runs. Graphical comparisons are also presented for each period.

8.3.1 Morning Peak Hour Turn Count Comparisons

The following table presents the results achieved comparing observed and modelled count data for each individual link with a survey target during the morning peak hour period. The links have been organised into ranges by their observed count.

Criteria and Measures	Calibration Acceptance Targets	Result	Number meeting criteria	Total number of counts
Within 100 vph, for Flows <700 vph	>85% of cases	99%	149	150
Within 15%, for 700 vph< Flows <2700 vph	>85% of cases	100%	4	4
Sum of All Flows	Within 5%	2%		
GEH < 5 for Individual Flows	>85% of cases	82%		
GEH for Sum of All Flows	GEH<4	2.8		
R2 value for modelled versus observed flows	>0.85	0.9736		
% RMSE	<30%	25%		

Table 10 - Morning peak hour observed versus modelled turn counts

The number of individual turning movements with GEH values less than 5 is below the 85% criteria at 82% however all of these turning movements with a GEH greater than 5 are counts that are less than 700 vph. Also the table illustrates that virtually all of the modelled turning counts are within 15% or 100 vph of the observed volume at 99%.

The following graph presents a plot of observed counts against modelled counts for the morning peak period.

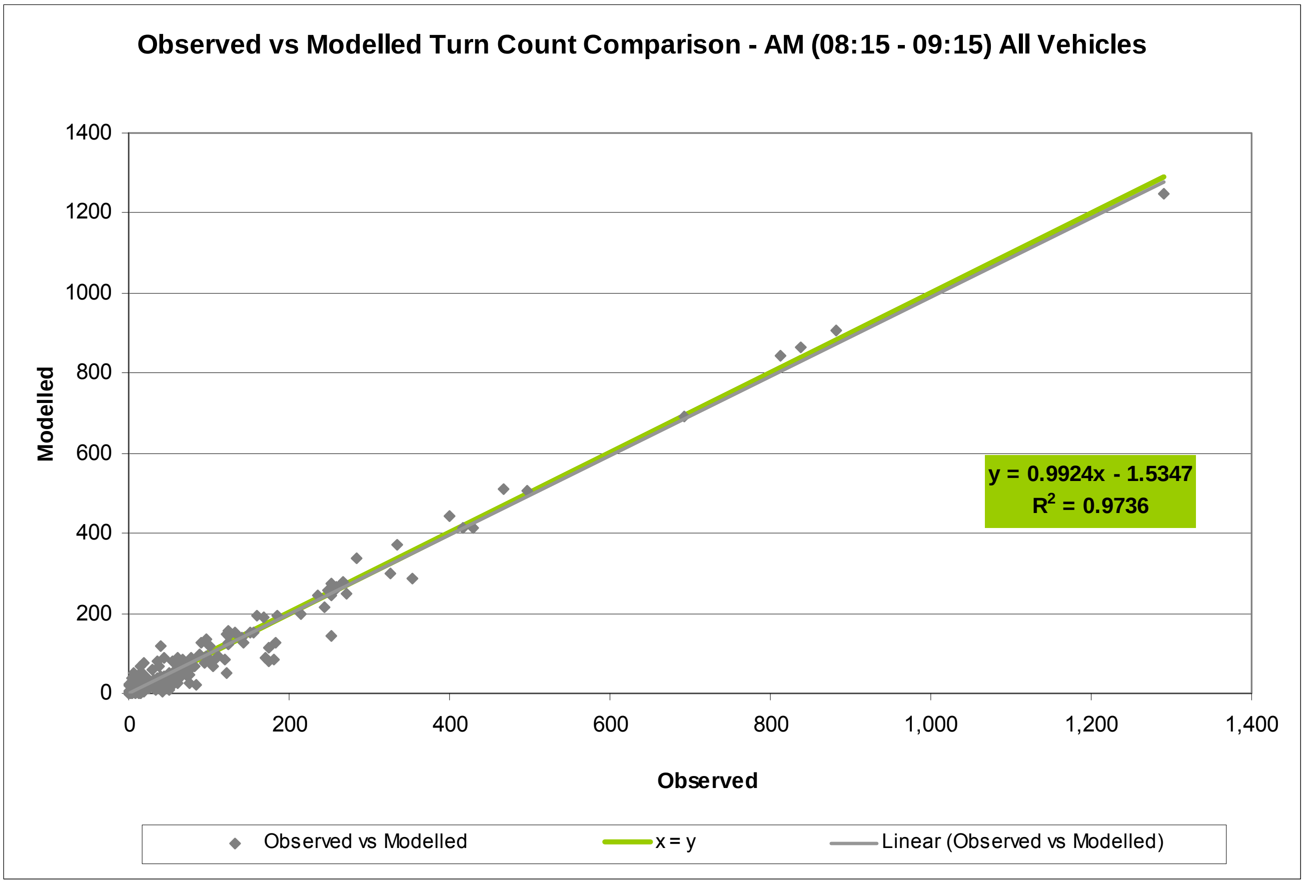

Figure 11 – Morning peak hour observed versus modelled turn counts

The graph illustrates a strong correlation between observed and modelled counts, reinforced by the R^2 value of 0.9736.

8.3.2 Evening Peak Hour Turn Count Comparisons

The following table presents the results achieved comparing observed and modelled count data for each individual turn with a survey target during the Evening peak hour period. The turns have been organised into ranges by their observed count.

Criteria and Measures	Calibration Acceptance Targets	Result	Number meeting criteria	Total number of counts
Within 100 vph, for Flows <700 vph	>85% of cases	97%	146	150
Within 15%, for 700 vph< Flows <2700 vph	>85% of cases	100%	4	4
Sum of All Flows	Within 5%	1%		
GEH < 5 for Individual Flows	>85% of cases	82%		
GEH for Sum of All Flows	GEH<4	1.1		
R2 value for modelled versus observed flows	>0.85	0.9731		
% RMSE	<30%	26%		

Table 11 – Evening peak hour observed versus modelled turn counts

The number of individual turning movements with GEH values less than 5 is below the 85% criteria at 82% however, as with the morning period, all of these turning movements with a GEH greater than 5 are counts that are less than 700 vph. Also the table illustrates that virtually all of the modelled turning counts are within 15% or 100 vph of the observed volume at 97%.

The following graph shows a plot of observed counts against modelled counts for the evening peak hour period.

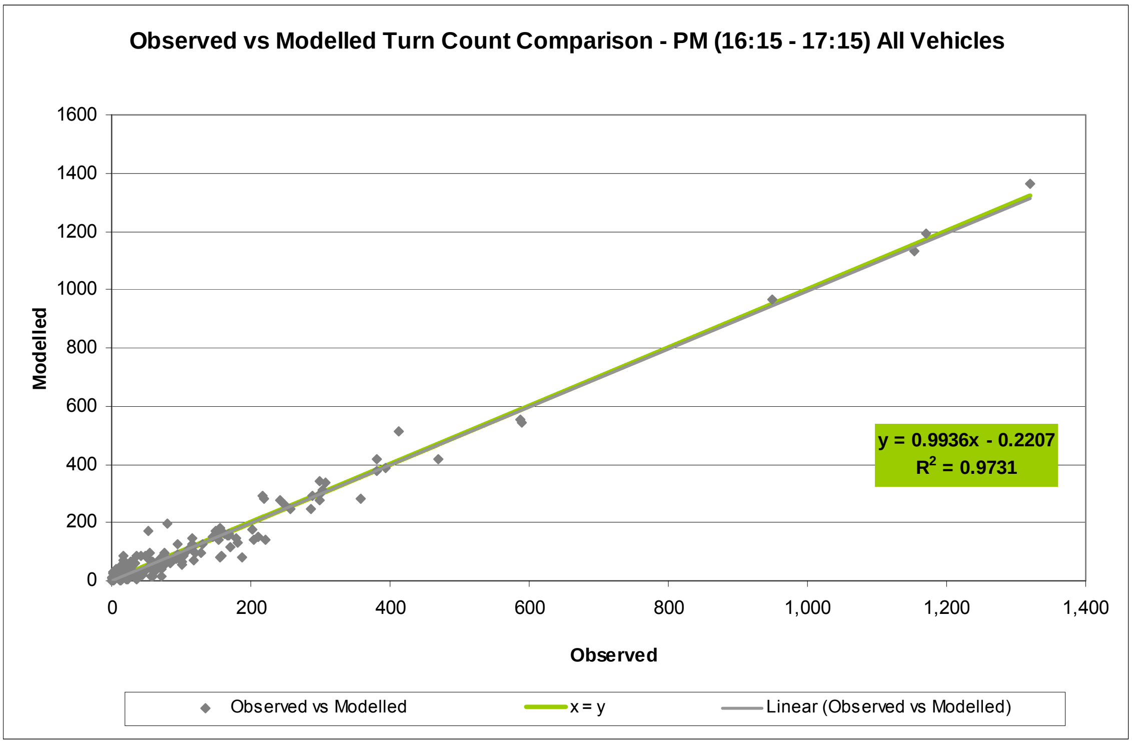

Figure 12 – Evening peak hour observed versus modelled turn counts

The graph illustrates a strong correlation between observed and modelled counts, reinforced by the R^2 value of 0.9731.

8.4 Link Count Calibration

Link counts have been compared based on approach and exit link flows at intersections. That is, the link counts are comprised from the same set of data used for turn count comparisons.

The following sections compare the observed and modelled link counts for each peak hour period, by organising the observed counts into volume ranges. This allows the data to be assessed with more emphasis placed on the higher volume movements. The comparison includes averaged modelled results from all ten runs. Graphical comparisons are also presented for each period.

The link count calibration for the full three hour periods is shown in Appendix B.

8.4.1 Morning Peak Hour Link Count Comparisons

The following table presents the results achieved from comparing observed and modelled count data for each individual link with a survey target during the Morning peak hour period. The links have been organised into ranges by their observed count.

Criteria and Measures	Calibration Acceptance Targets	Result	Number meeting criteria	Total number of counts
Within 100 vph, for Flows <700 vph	>85% of cases	93%	80	86
Within 15%, for 700 vph< Flows <2700 vph	>85% of cases	100%	15	15
Sum of All Flows	Within 5%	2%		
GEH < 5 for Individual Flows	>85% of cases	85%		
GEH for Sum of All Flows	GEH<4	3.7		
R2 value for modelled versus observed flows	>0.85	0.9853		
% RMSE	<30%	14%		

Table 12 – Morning peak hour observed versus modelled link counts

The table illustrates that the majority of the modelled link counts are within 15% or 100 vph of the observed volume and all other criteria has been met.

The following graph presents a plot of observed counts against modelled counts for the morning peak period.

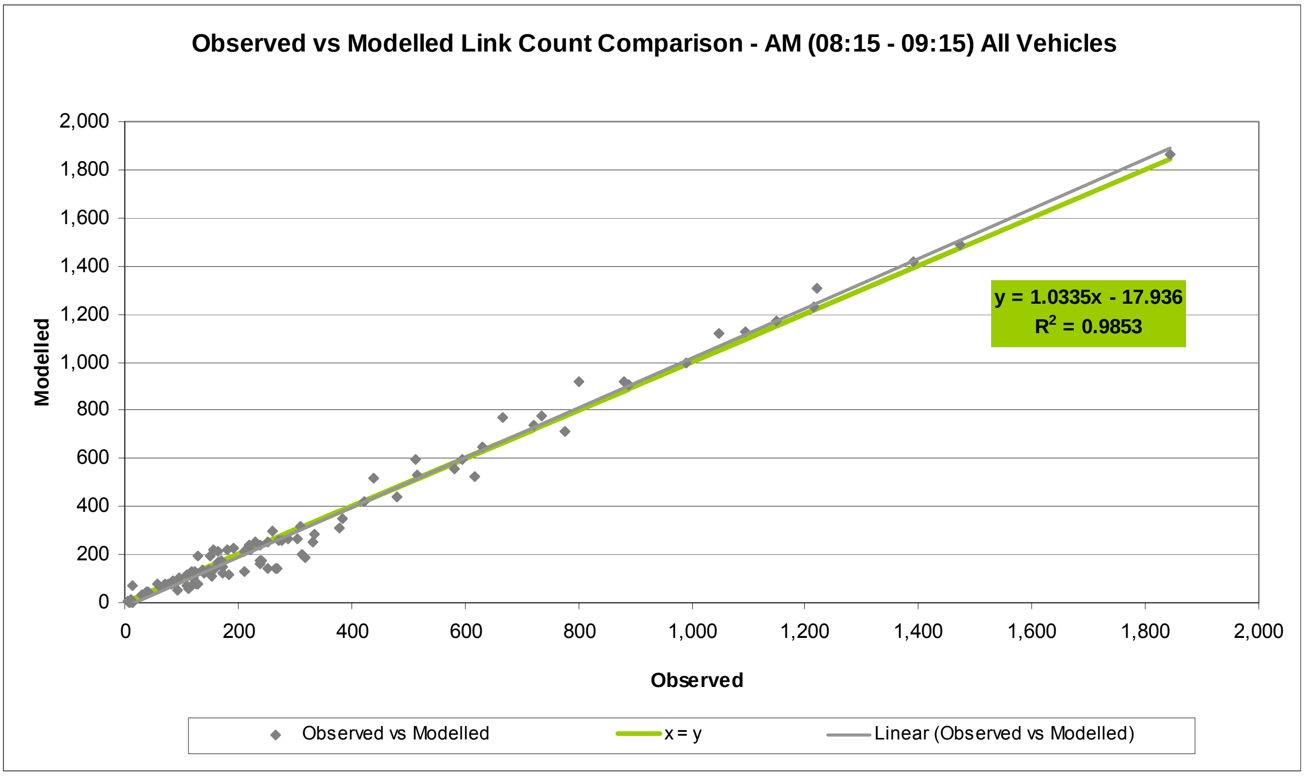

Figure 13 – Morning peak hour observed versus modelled link counts

The graph illustrates a good correlation between observed and modelled counts, reinforced by the R^2 value of 0.9853.

8.4.2 Evening Peak Hour Link Count Comparisons

The following table presents the results achieved comparing the observed and modelled count data for each individual link with a survey target during the Evening peak hour period. The links have been organised into ranges by their observed count.

Criteria and Measures	Calibration Acceptance Targets	Result	Number meeting criteria	Total number of counts
Within 100 vph, for Flows <700 vph	>85% of cases	94%	82	87
Within 15%, for 700 vph< Flows <2700 vph	>85% of cases	93%	13	14
Sum of All Flows	Within 5%	1%		
GEH < 5 for Individual Flows	>85% of cases	88%		
GEH for Sum of All Flows	GEH<4	1.8		
R2 value for modelled versus observed flows	>0.85	0.9868		
% RMSE	<30%	13%		

Table 13 – Evening Peak Hour Observed Versus Modelled Link Counts

The table illustrates that the majority of the modelled link counts are within 15% or 100 vph of the observed volume. It also shows that the sum of all links is within acceptable limits as is the GEH limits.

The following graph shows a plot of observed counts against modelled counts for the Evening peak period.

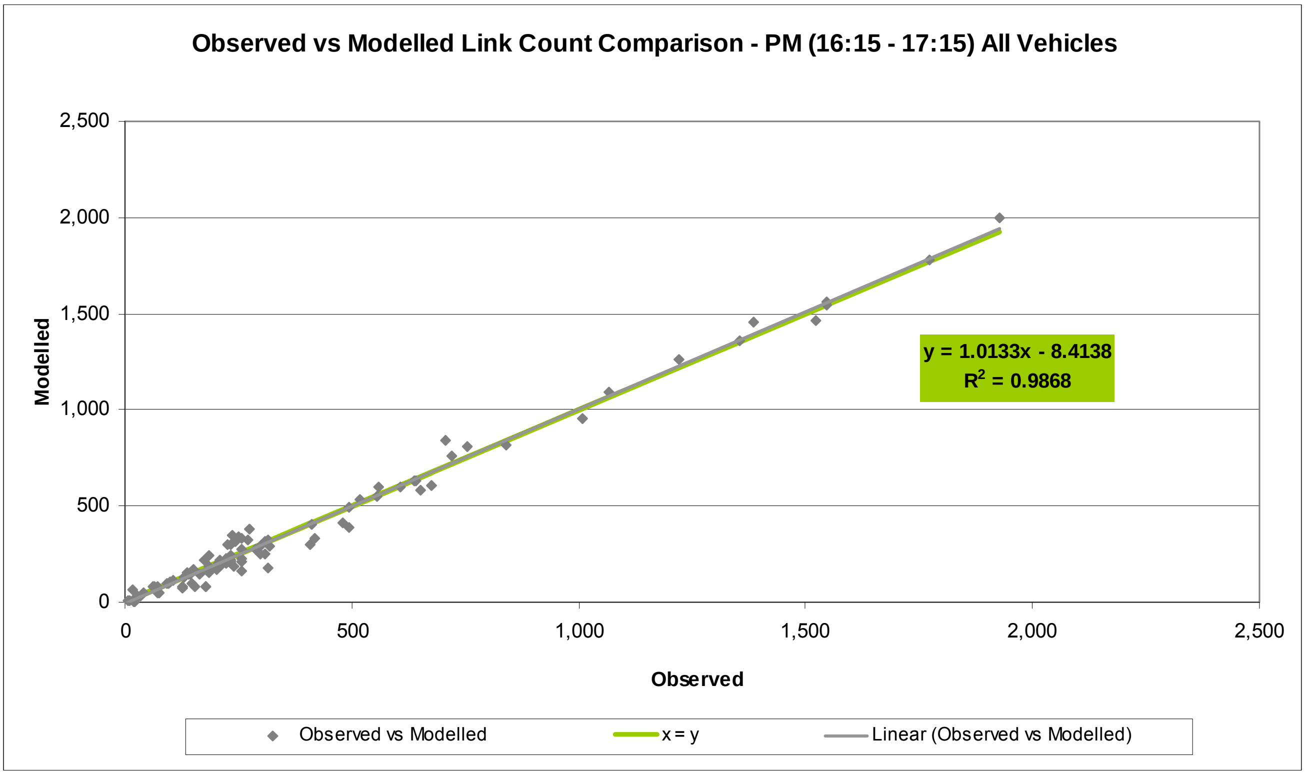

Figure 14 – Evening peak hour observed versus modelled link counts

The graph illustrates a strong correlation between observed and modelled counts, reinforced by the R^2 value of 0.9868.

8.5 Screenline Calibration

Screenline locations for the calibration process have been undertaken at the following locations. For the purpose of the screenline evaluations, the historical data at the intersection of Fenden Road and Park Terrace has been used.

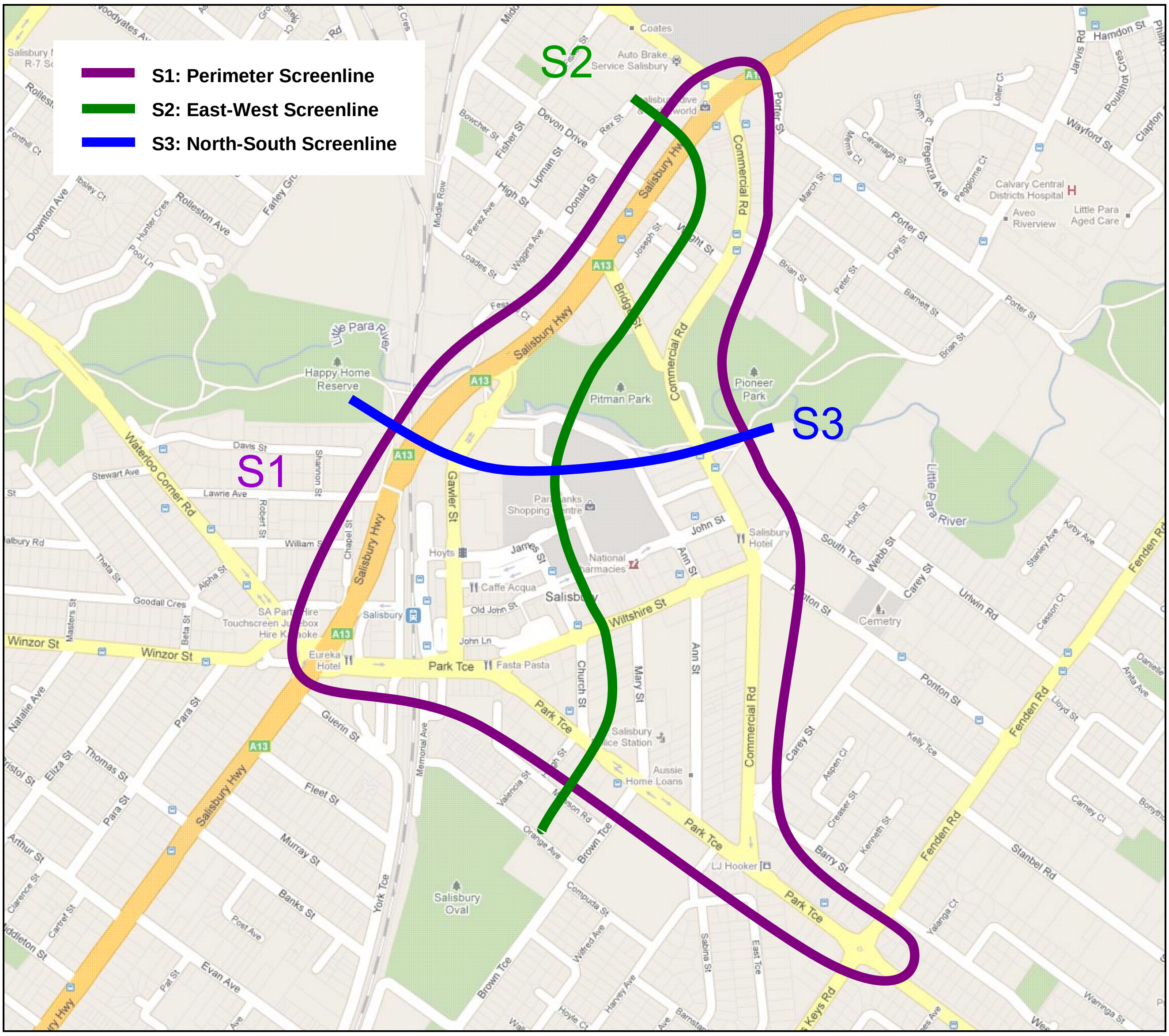

Figure 15 – Screenline locations

Comparison of the observed and modelled screenline totals are shown below in Table 14 for the morning peak hour. According to the DTEI Aimsun Model Development Manual the criteria for screenlines is an R2 value greater than 0.85 must be obtained.

Screenline	Observed	Modelled	Diff	% Diff	GEH
S1 Perimeter Inbound	7,859	7,977	118	1.5%	1.3
S1 Perimeter Outbound	6,409	6,630	221	3.4%	2.7
S2 East-West Eastbound	2,231	2,271	40	1.8%	0.8
S2 East-West Westbound	2,229	2,281	52	2.3%	1.1
S3 North-South Northbound	2,369	2,333	-36	-1.5%	0.7
S3 North-South Southbound	2,049	1,968	-81	-3.9%	1.8
Sum of all screenlines	**23,146**	**23,460**	**314**	**1.4%**	**2.1**
R2 value	**0.9951**				

Table 14 – Morning peak hour screenline comparisons

All screenlines for the morning period have a % difference less than 5% and all GEH values less than 3. Also the R2 value is greater than 0.85 and meets the set criteria.

Comparison of the observed and modelled screenline totals are shown below in Table 15 for the evening peak hour.

Screenline	Observed	Modelled	Diff	% Diff	GEH
S1 Perimeter Inbound	7,360	7,464	104	1.4%	1.2
S1 Perimeter Outbound	8,006	8,048	42	0.5%	0.5
S2 East-West Eastbound	2,502	2,596	94	3.8%	1.9
S2 East-West Westbound	2,380	2,342	-38	-1.6%	0.8
S3 North-South Northbound	2,384	2,223	-161	-6.8%	3.4
S3 North-South Southbound	2,663	2,421	-242	-9.1%	4.8
Sum of all screenlines	**25,295**	**25,093**	**-202**	**-0.8%**	**1.3**
R2 value	**0.9925**				

Table 15 – Evening peak hour screenline comparisons

All screenlines for the evening period have a percentage difference less than 10% and the R2 value is greater than 0.85 so meets the set criteria.

8.6 Journey Time Calibration

Journey time comparisons have been undertaken for the entire peak modelled hours for the routes described earlier in this report in Section 4.1.4. The comparison includes the average of the average model results from all ten runs.

It is also worth noting that the modelled journey times comprise of numerous vehicle runs over the period specified however the observed journey times comprise of a few runs undertaken sometime during this period. This should be taken into consideration when reviewing the results below.

The specified criteria state the journey times should be 1 minute if less than 6 minutes in travel, otherwise within 15%. Refer Figure 5 for route details.

8.6.1 Morning Peak Hour Travel Time Comparisons

The observed and modelled journey times in minutes are presented in the following table with difference and percentages for the AM peak hour period.

Route Name	Observed			Modelled	Diff	% Diff
	Minimum	Average	Maximum	Average		
R1 – Salisbury Highway Northbound	2:48	3:00	3:09	2:12	-0:48	-26%
R1 – Salisbury Highway Southbound	2:20	2:24	2:31	1:58	-0:26	-18%
R2 – Park Terrace Eastbound	1:57	2:10	2:34	2:20	0:10	8%
R2 – Park Terrace Westbound	3:45	4:06	4:17	3:22	-0:44	-18%
R3 – Commercial Road Northbound	2:08	3:29	4:52	3:52	0:24	11%
R3 – Commercial Road Southbound	2:15	2:25	2:32	2:23	-0:02	-1%
R4 – Gawler Street Northbound	1:09	1:17	1:26	2:25	1:08	88%
R4 – Gawler Street Southbound	2:00	2:18	2:52	2:08	-0:10	-7%

Table 16 – Morning peak hour journey time comparison

The table illustrates a good correlation between observed and modelled journey times with all routes having a difference that is less than 1 minute with the exception of R4 - Gawler Street Northbound which shows a 1:08 minutes difference when compared to observed data. This is considered to be a reflection of the queuing on Gawler Street at Salisbury Highway where the model over predicts this when compared to on-street observations.

8.6.2 Evening Hour Travel Time Comparisons

The observed and modelled journey times in minutes are presented in the following table with difference and percentages for the PM peak hour period.

Route Name	Observed			Modelled	Diff	% Diff
	Minimum	Average	Maximum	Average		
R1 – Salisbury Highway Northbound	2:25	2:49	3:13	2:39	-0:10	-6%
R1 – Salisbury Highway Southbound	-	2:20	-	1:59	-0:21	-15%
R2 – Park Terrace Eastbound	1:59	2:01	2:02	2:01	0:00	0%
R2 – Park Terrace Westbound	3:10	3:26	3:42	3:28	0:02	1%
R3 – Commercial Road Northbound	-	3:26	-	3:21	-0:05	-2%
R3 – Commercial Road Southbound	2:21	2:41	3:01	2:14	-0:27	-17%
R4 – Gawler Street Northbound	-	1:20	-	2:35	1:15	94%
R4 – Gawler Street Southbound	-	2:20	-	2:54	0:34	25%

Table 17 – Evening peak hour journey time comparison

The majority of the modelled evening journey time routes are within the 15% or 1 minute criteria when compared against observed data. As was noted with the morning period, R4 - Gawler Street Northbound is showing a journey time greater than 1 minute when comparing modelled and observed. This is reflective of larger than observed queues on Gawler Street Northbound. It is noted that the observed data only consists of one journey time observation during the peak.

8.7 Queue Length Calibration

Queues were observed visually within Aimsun over numerous model runs. In addition, comparisons have been made between observed and modelled queue length data.

Queuing is an inherently unstable phenomenon which can vary greatly from day to day. Queue measurements can be very subjective as the definition of what vehicles count as “queued” can differ between observers and between modelling packages.

Not withstanding the issues relating to queue variability, queue comparisons are still valuable and have been made between observed and modelled queue length data to ensure queue patterns are appropriately represented in the model.

Queuing was observed on-street in both peak periods on Park Terrace eastbound and westbound between Salisbury Highway and Wiltshire Street. This is predominantly due to the operation of the rail crossing barrier and the effect on the rail crossing traffic signals. The traffic queues on Park Terrace are considered to be replicated in the model to a suitable level. In addition, queues were observed to form on the south approach to the Salisbury Highway / Park terrace intersection in the evening; this is reflected in the model.

As pointed out with the journey time comparison, the area at the northern end of Gawler Street with its intersection with Salisbury Highway exhibits increased delay in the model when compared to observations. In addition queuing in the evening period on the western approach to the John Street/ Commercial Road intersection in the model is greater than observed. It is thought that these areas of unexpected modelled queuing are caused by the lack of micro-routing in the model in those areas. The routing factors such as the

Attractiveness Weight have been adjusted to reflect the global routing replicating model wide routing however the queue build-up at these intersection is a result of the inability of traffic to react to queues on a very micro level. To adjust this, global routing would require altering which would be at the expense of the wider model. It was considered that this queuing was acceptable, but would be noted with any option testing undertaken.

8.8 Calibration Results Summary

The calibration summary below, recommended by different sources, has been referenced to assess the acceptability of the level of calibration achieved in the model. Queue calibration has also been undertaken, however this is not referenced in the criteria. However, in summary the comparisons showed observed queues are appropriately replicated by Aimsun and are representative of actual vehicle operation during each peak hour period.

Type	Criteria and Measures (Observed vs Modelled)	Calibration Target	AM	PM
Model Stability	The overall network statistics such as mean flow, density, mean speed, mean travel time, mean delay, total travel distance and total travel time.	The coefficient of variation (CoV) within 5%	0.90%	1.27%
Turn Counts	Within 100 vph for flows <700 vph	>85% of cases	99%	97%
	Within 15% for 700 vph < flows < 2700 vph	>85% of cases	100%	100%
	Sum of all flows	Within 5%	2%	1%
	GEH statistics <5 for individual flows	>85% of cases	82%	82%
	GEH statistics for sum of all flows	<4	2.8	1.1
	R2 value modelled vs observed values	>0.85	0.97	0.97
	Percentage RMSE	<30%	25%	26%
Link Flows	Within 100 vph for flows <700 vph	>85% of cases	100%	93%
	Within 15% for 700 vph < flows < 2700 vph	>85% of cases	93%	94%
	Sum of all link/ movement flows	Within 5%	2%	1%
	GEH statistics <5 for individual flows	>85% of cases	85%	88%
	GEH statistics for sum of all flows	<4	3.7	1.8
	R2 value modelled vs observed values	>0.85	0.98	0.98
	Percentage RMSE	<30%	14%	13%
Screenlines	R2 value modelled vs observed values	>0.85	0.99	0.99
Journey Time	Travel times not greater than 6 minutes, within 1 minute	>85% of cases	88%	88%

Table 18 – Calibration Summary

The above table demonstrates the model adheres to the calibration/ validation criteria. The exceptions to this are the individual turn count GEH values less than 5 is not greater than 85% of case for both periods. This is considered acceptable given at least 97% of turn counts are within 15% or 100vph and in addition the link counts are shown to meet the criteria. Also all turning movements with values above 700 vph have GEH values less than 5 for both periods.

9. Summary and Conclusions

A traffic model for the Salisbury Town Centre has been developed using Aimsun simulation software version 6.1.3 to model a 2011 base year.

Statistical analysis demonstrates that the modelled network and output results are stable.

Comparisons have been made between the following modelled and observed measures:

- Turn count
- Link counts
- Screenlines
- Journey Times
- Queue lengths

Comparisons illustrate existing traffic conditions have been represented by the models for the both peak hours. Any deficiencies in all periods are noted and will be taken into consideration with any option testing undertaken.

It is considered that the Aimsun Salisbury Town Centre base models can be used for traffic analysis constrained to the study area.

Appendix A
Full Peak Period Turn Count Calibration Results

Appendix A – Turn Count Calibration

The following sections make comparisons between observed and modelled turn counts for each full two and a half and three hour period incorporating the shoulder periods. The comparison includes averaged modelled results from all ten runs. Graphical comparisons are also presented for each period.

Morning Peak Period Turn Count Comparisons

The following table shows the results achieved from comparing the observed and modelled count for each individual link with a survey target during the morning peak period. The links have been organised into ranges by their observed count.

Criteria and Measures	Calibration Acceptance Targets	Result	Number meeting criteria	Total number of counts
Within 100 veh, for Flows <700 veh	>85% of cases	89%	127	142
Within 15%, for 700 veh< Flows <2700 veh	>85% of cases	55%	6	11
Within 400 veh, Flows >2700 veh	>85% of cases	100%	1	1
Sum of All Flows	Within 5%	3%		
R2 value for modelled versus observed flows	>0.85	0.9674		
% RMSE	<30%	33%		

Table 19 - Morning two and a half hour observed versus modelled turn counts

The following graph presents a plot of observed counts against modelled counts for the morning peak period.

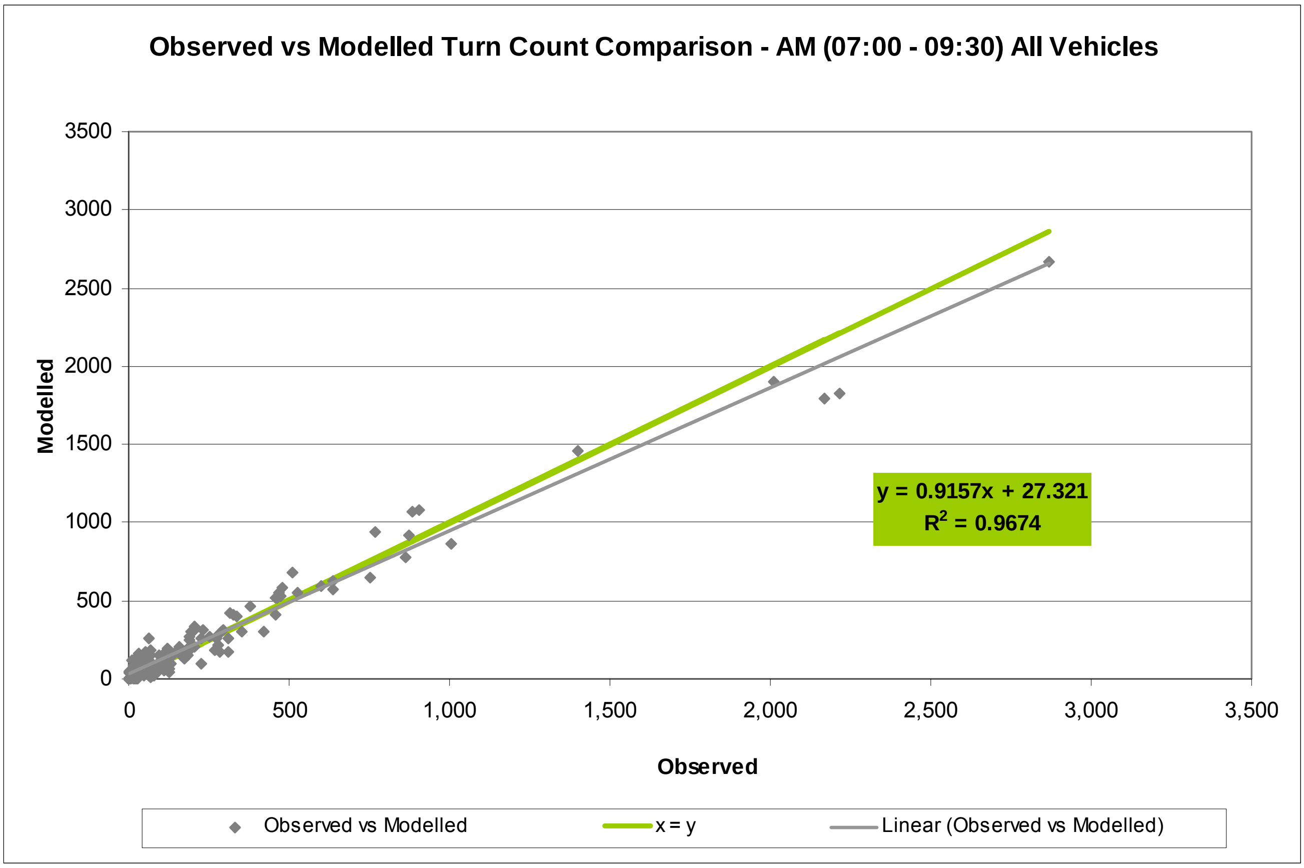

Figure 16 – Morning two and a half hour observed versus modelled turn counts

Evening Peak Period Turn Count Comparisons

The following table shows the results achieved from comparing the observed and modelled count for each individual turn with a survey target during the evening peak period. The turns have been organised into ranges by their observed count.

Criteria and Measures	Calibration Acceptance Targets	Result	Number meeting criteria	Total number of counts
Within 100 veh, for Flows <700 veh	>85% of cases	73%	97	132
Within 15%, for 700 veh< Flows <2700 veh	>85% of cases	83%	15	18
Within 400 veh, Flows >2700 veh	>85% of cases	100%	4	4
Sum of All Flows	Within 5%	2%		
R2 value for modelled versus observed flows	>0.85	0.9687		
% RMSE	<30%	28%		

Table 20 – Evening three hour observed versus modelled turn counts

The following graph shows a plot of observed counts against modelled counts for the evening peak hour period.

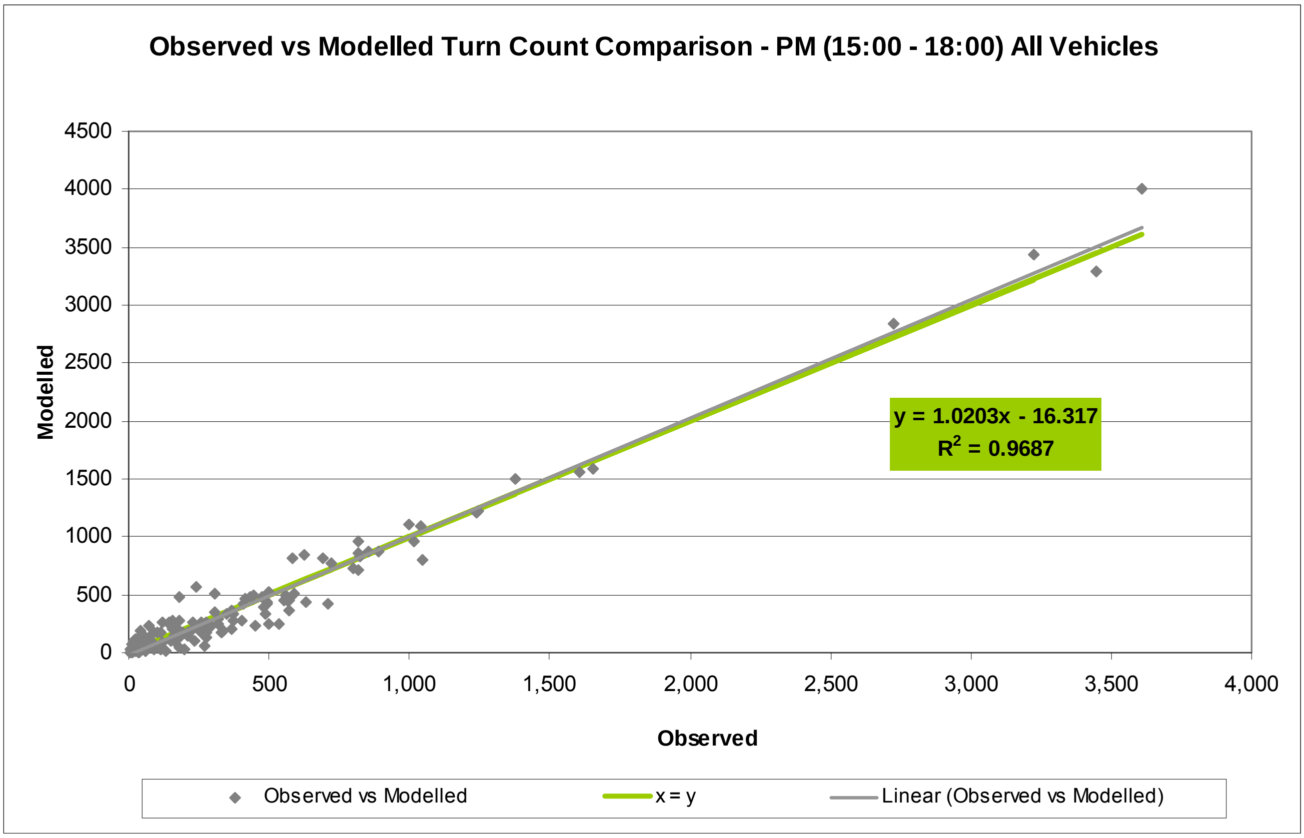

Figure 17 – Evening three hour observed versus modelled turn counts

Appendix B
Full Peak Period Link Count Calibration Results

Appendix B – Link Count Calibration

Link counts have been compared based on approach and exit link flows at intersections. That is, the link counts are comprised from the same set of data used for turn count comparisons.

The following sections compare the observed and modelled link counts for each three hour period, incorporating the shoulder periods. The comparison includes averaged modelled results from all ten runs. Graphical comparisons are also presented for each period.

Morning Full Peak Period Link Count Comparisons

The following table shows the results achieved from comparing the observed and modelled count data for each individual link with a survey target during the morning peak period. The links have been organised into ranges by their observed count.

Criteria and Measures	Calibration Acceptance Targets	Result	Number meeting criteria	Total number of counts
Within 100 veh, for Flows <700 veh	>85% of cases	76%	56	74
Within 15%, for 700 veh< Flows <2700 veh	>85% of cases	74%	14	19
Within 400 veh, Flows >2700 veh	>85% of cases	100%	6	6
Sum of All Flows	Within 5%	3%		
R2 value for modelled versus observed flows	>0.85	0.9762		
% RMSE	<30%	19%		

Table 21 – Morning two and a half hour observed versus modelled link counts

The following graph shows a plot of observed counts against modelled counts for the morning peak period.

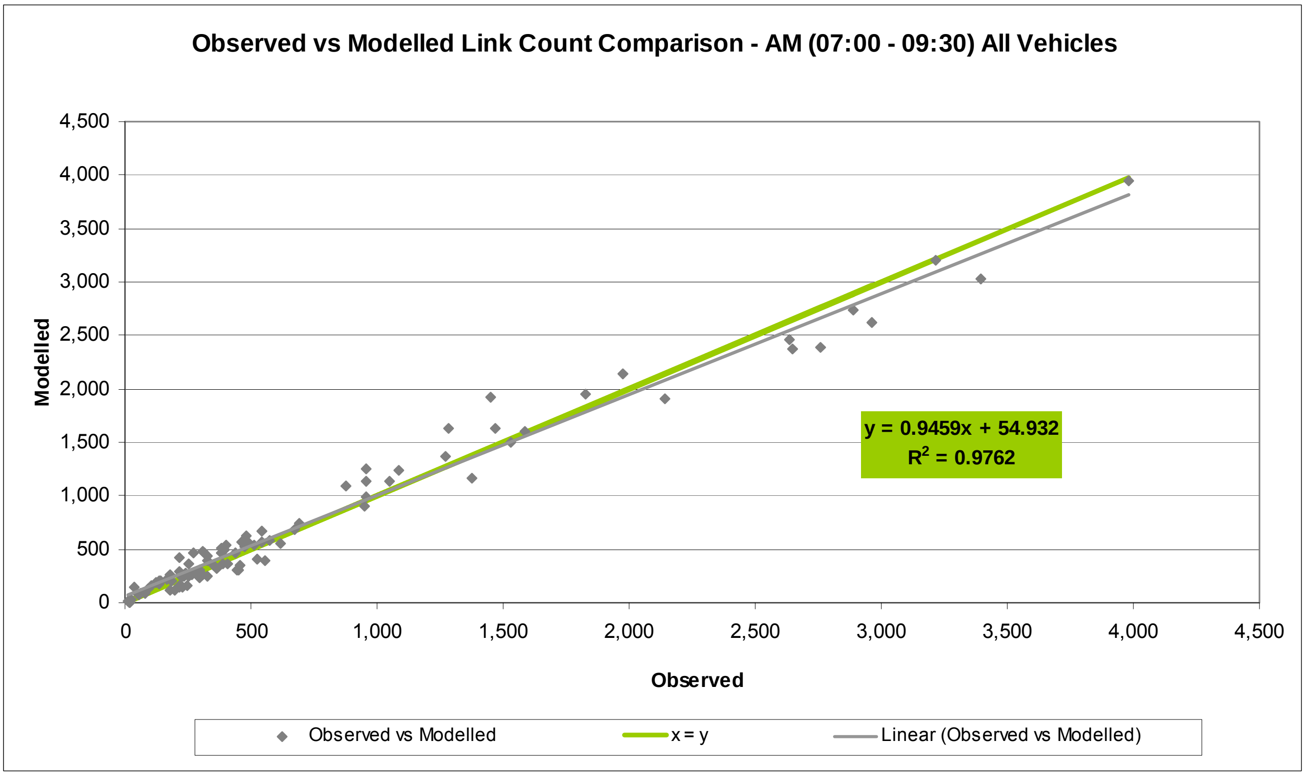

Figure 18 – Morning two and a half hour observed versus modelled link counts

Evening Full Peak Period Count Comparisons

The following table shows the results achieved from comparing the observed and modelled count data for each individual link with a survey target during the evening peak period. The links have been organised into ranges by their observed count.

Criteria and Measures	Calibration Acceptance Targets	Result	Number meeting criteria	Total number of counts
Within 100 veh, for Flows <700 veh	>85% of cases	71%	35	49
Within 15%, for 700 veh< Flows <2700 veh	>85% of cases	63%	25	40
Within 400, Flows >2700 veh	>85% of cases	100%	10	10
Sum of All Flows	Within 5%	2%		
R2 value for modelled versus observed flows	>0.85	0.9860		
% RMSE	<30%	13%		

Table 22 – Evening three hour observed versus modelled link counts

The following graph shows a plot of observed counts against modelled counts for the evening peak period.

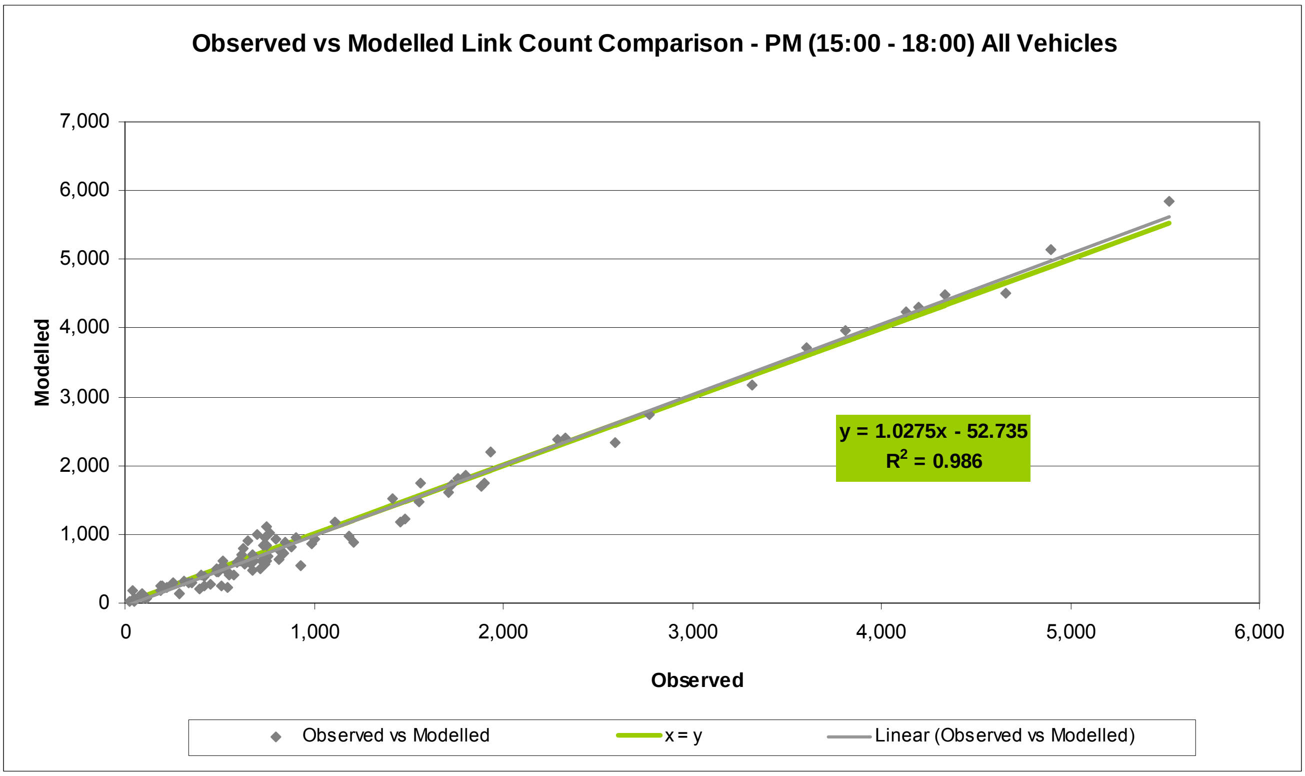

Figure 19 – Evening three hour observed versus modelled link counts

Appendix C
Full Peak Period Screenline Calibration Results

Appendix C – Screenline Calibration

Below are the screenline comparisons for the full peak periods incorporating the shoulder periods.

Screenline	Observed	Modelled	Diff	% Diff
S1 Perimeter Inbound	16,526	16,957	431	2.6%
S1 Perimeter Outbound	14,157	14,025	-132	-0.9%
S2 East-West Eastbound	4,714	4,795	81	1.7%
S2 East-West Westbound	4,941	4,858	-84	-1.7%
S3 North-South Northbound	5,173	4,976	-198	-3.8%
S3 North-South Southbound	4,500	4,181	-320	-7.1%
Sum of all screenlines	**50,011**	**49,790**	**-221**	**-0.4%**
R2 value	**0.9951**			

Table 23 – Morning two and a half hour period screenline comparisons

Screenline	Observed	Modelled	Diff	% Diff
S1 Perimeter Inbound	21,882	21,731	-151	-0.7%
S1 Perimeter Outbound	23,211	23,285	74	0.3%
S2 East-West Eastbound	7,450	7,528	-78	-1.0%
S2 East-West Westbound	6,917	6,804	-114	-1.6%
S3 North-South Northbound	6,860	6,486	-374	-5.5%
S3 North-South Southbound	7,545	6,999	-546	-7.2%
Sum of all screenlines	**73,865**	**72,832**	**-1,033**	**-1.4%**
R2 value	**0.9907**			

Table 24 – Evening three hour period screenline comparisons

Appendix D
All Data Peak Hour Turn Count Calibration Results

Appendix D – Turn Count Calibration

The following sections make comparisons between all the observed data including historical and modelled turn counts for the peak hour periods, by organising the observed counts into volume ranges. This allows the data to be assessed with more emphasis placed on the higher volume movements. The comparison includes averaged modelled results from all ten runs. Graphical comparisons are also presented for each period.

Morning Peak Hour Turn Count Comparisons

The following table shows the results achieved from comparing the observed and modelled count for each individual link with a survey target during the morning peak hour period. The links have been organised into ranges by their observed count.

Criteria and Measures	Calibration Acceptance Targets	Result	Number meeting criteria	Total number of counts
Within 100 vph, for Flows <700 vph	>85% of cases	99%	179	181
Within 15%, for 700 vph< Flows <2700 vph	>85% of cases	100%	6	6
Sum of All Flows	Within 5%	0%		
GEH < 5 for Individual Flows	>85% of cases	83%		
GEH for Sum of All Flows	GEH<4	0.7		
R2 value for modelled versus observed flows	>0.85	0.9770		
% RMSE	<30%	23%		

Table 25 - Morning peak hour observed versus modelled turn counts

The following graph presents a plot of observed counts against modelled counts for the morning peak period.

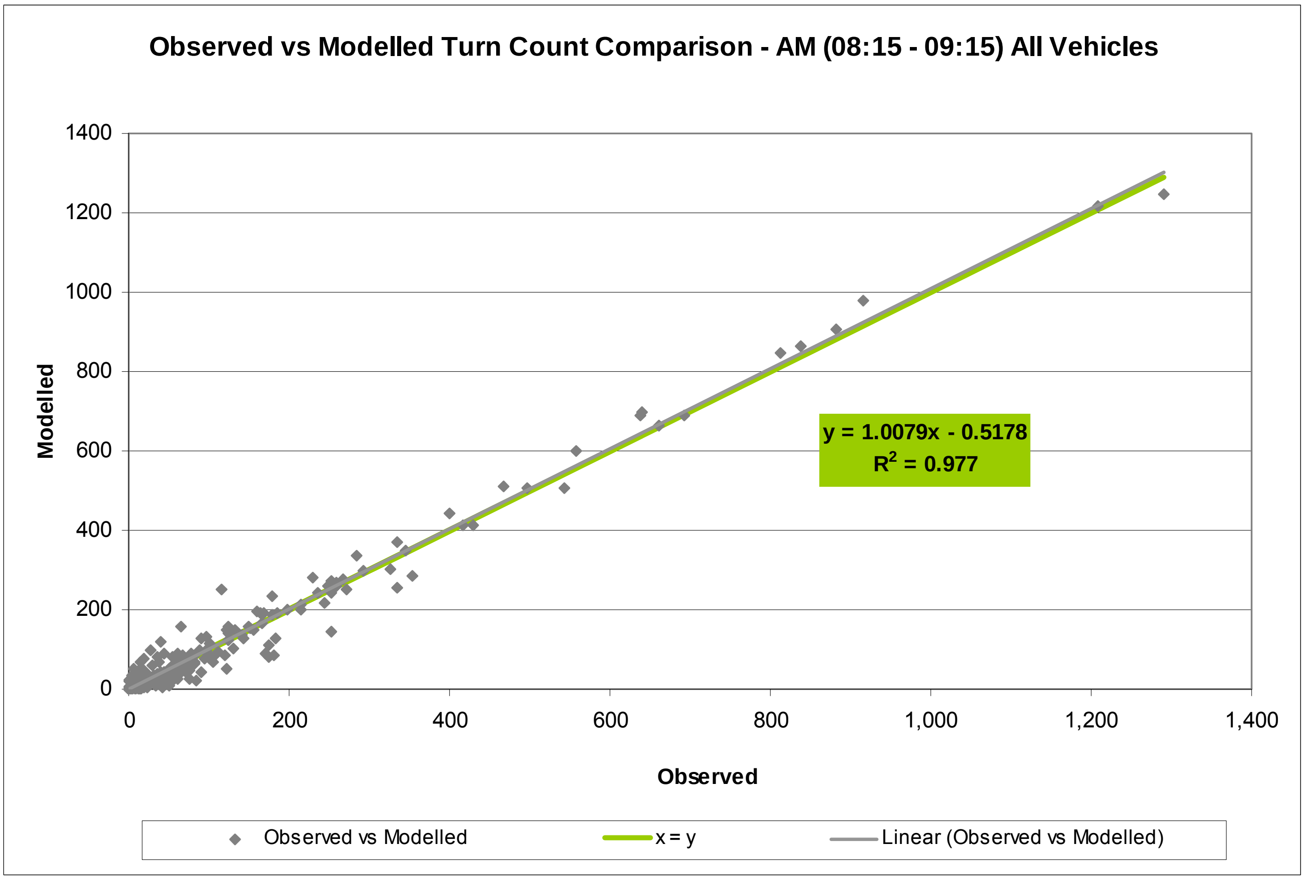

Figure 20 – Morning peak hour observed versus modelled turn counts

Evening Peak Hour Turn Count Comparisons

The following table shows the results achieved from comparing the observed and modelled count for each individual turn with a survey target during the Evening peak hour period. The turns have been organised into ranges by their observed count.

Criteria and Measures	Calibration Acceptance Targets	Result	Number meeting criteria	Total number of counts
Within 100 vph, for Flows <700 vph	>85% of cases	96%	173	180
Within 15%, for 700 vph< Flows <2700 vph	>85% of cases	100%	7	7
Sum of All Flows	Within 5%	1%		
GEH < 5 for Individual Flows	>85% of cases	83%		
GEH for Sum of All Flows	GEH<4	1.2		
R2 value for modelled versus observed flows	>0.85	0.9743		
% RMSE	<30%	24%		

Table 26 – Evening peak hour observed versus modelled turn counts

The following graph shows a plot of observed counts against modelled counts for the evening peak hour period.

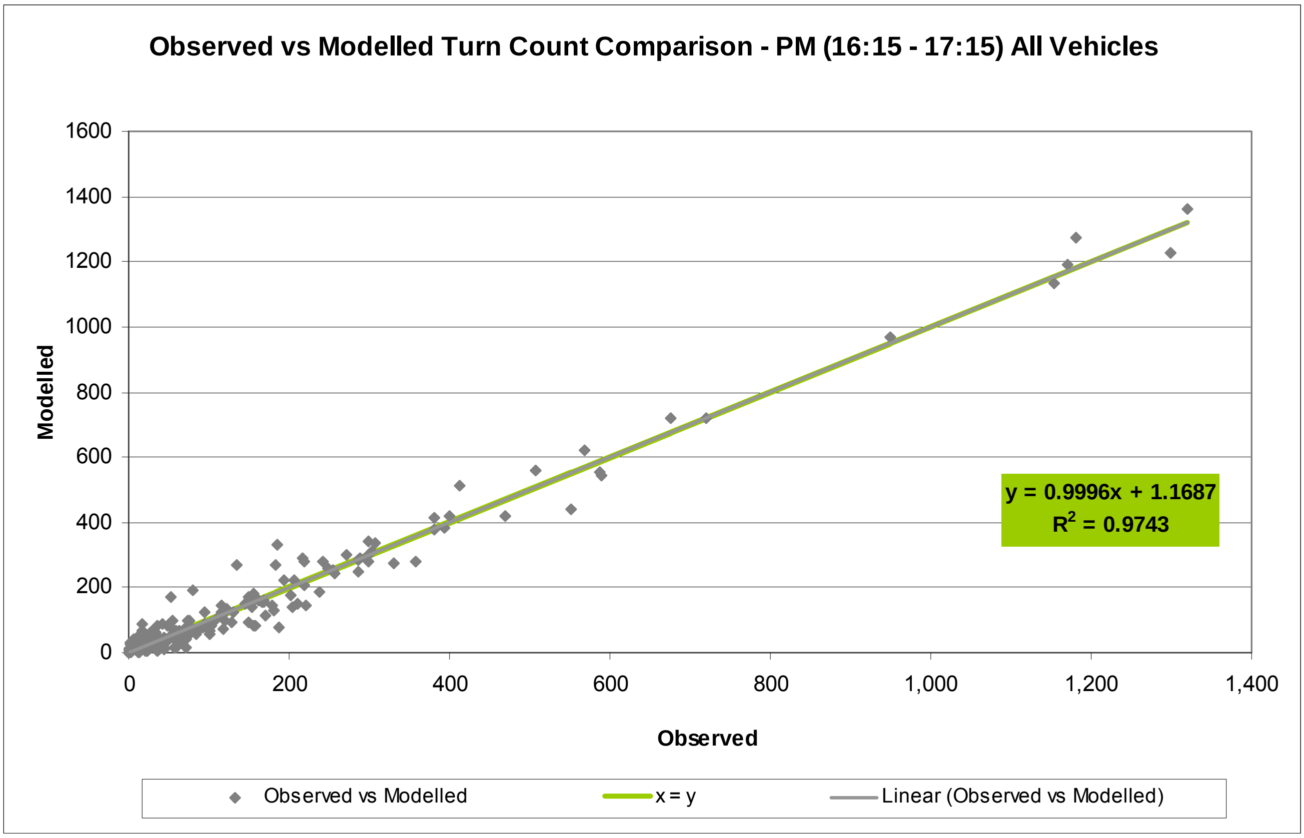

Figure 21 – Evening peak hour observed versus modelled turn counts

Appendix E
All Data Peak Hour Link Count Calibration Results

Appendix E – Link Count Calibration

Link counts have been compared based on approach and exit link flows at intersections. That is, the link counts are comprised from the same set of data used for turn count comparisons.

The following sections compare all the observed data including historical and modelled link counts for each three hour period, by organising the observed counts into volume ranges. This allows the data to be assessed with more emphasis placed on the higher volume movements. The comparison includes averaged modelled results from all ten runs. Graphical comparisons are also presented for each period.

Morning Peak Hour Link Count Comparisons

The following table shows the results achieved from comparing the observed and modelled count data for each individual link with a survey target during the morning peak hour period. The links have been organised into ranges by their observed count.

Criteria and Measures	Calibration Acceptance Targets	Result	Number meeting criteria	Total number of counts
Within 100 vph, for Flows <700 vph	>85% of cases	93%	95	102
Within 15%, for 700 vph< Flows <2700 vph	>85% of cases	95%	20	21
Sum of All Flows	Within 5%	1%		
GEH < 5 for Individual Flows	>85% of cases	88%		
GEH for Sum of All Flows	GEH<4	1.1		
R2 value for modelled versus observed flows	>0.85	0.9826		
% RMSE	<30%	14%		

Table 27 – Morning peak hour observed versus modelled link counts

The following graph shows a plot of observed counts against modelled counts for the morning peak period.

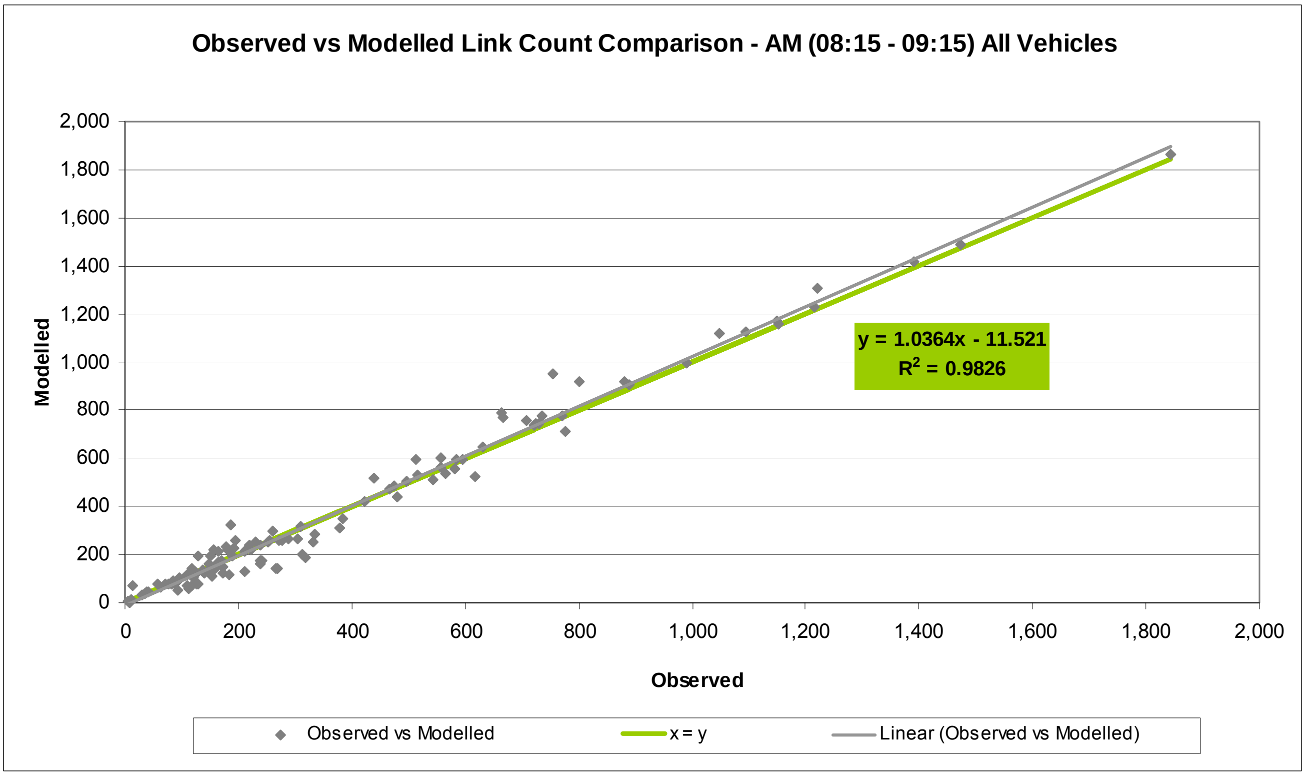

Figure 22 – Morning peak hour observed versus modelled link counts

Evening Peak Hour Link Count Comparisons

The following table shows the results achieved from comparing the observed and modelled count data for each individual link with a survey target during the evening peak hour period. The links have been organised into ranges by their observed count.

Criteria and Measures	Calibration Acceptance Targets	Result	Number meeting criteria	Total number of counts
Within 100 vph, for Flows <700 vph	>85% of cases	93%	94	101
Within 15%, for 700 vph< Flows <2700 vph	>85% of cases	91%	20	22
Sum of All Flows	Within 5%	1%		
GEH < 5 for Individual Flows	>85% of cases	89%		
GEH for Sum of All Flows	GEH<4	1.8		
R2 value for modelled versus observed flows	>0.85	0.9833		
% RMSE	<30%	13%		

Table 28 – Evening peak hour observed versus modelled link counts

The following graph shows a plot of observed counts against modelled counts for the evening peak period.

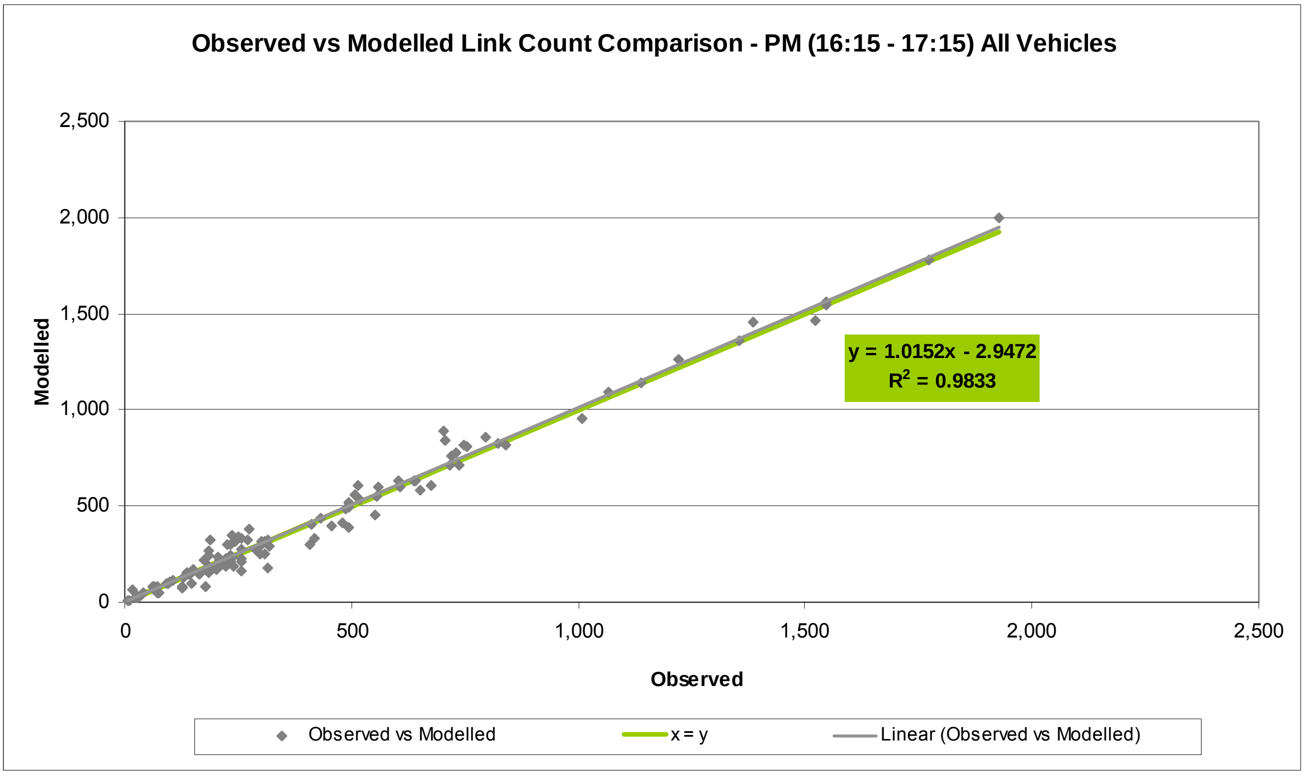

Figure 23 – Evening peak hour observed versus modelled link counts

Appendix F
Bus Routes

Appendix F – Bus Routes

Route Number	Bus Route	AM		PM	
		Start	Interval	Start	Interval
205F	City to Salisbury Interchange and Elizabeth Interchange	07:26	0:15:00	15:07	0:15:00
205F	Elizabeth Interchange and Salisbury Interchange to city	08:27	0:16:40	15:27	0:15:00
206F	City to Salisbury Interchange and Elizabeth Interchange	07:37	2:30:00	17:39	3:00:00
206F	Elizabeth Interchange and Salisbury Interchange to city	07:09	0:30:00	16:36	3:00:00
224, 224X, 224F	City to Elizabeth interchange	07:23	0:30:00	15:29	0:25:43
224, 224X, 224F	Elizabeth Interchange to City	07:08	0:21:24	15:02	0:30:00
225,225M,225F	Gepps Cross and Mawson Interchange to Salisbury Interchange	07:12	0:25:00	15:16	0:30:00
225,225M	Salisbury Interchange to Mawson Interchange and Gepps Cross with transfers to City	07:12	0:18:45	15:03	0:22:30
400	Salisbury North to Elizabeth Interchange	07:03	0:18:45	15:11	0:21:26
400	Elizabeth Interchange to Salisbury North	07:06	0:30:00	15:01	0:18:45
400A	Salisbury North to Elizabeth Interchange	08:22	1:15:00	-	-
400A	Elizabeth Interchange to Salisbury North	07:20	2:30:00	16:20	3:00:00
401,403,900	Paralowie and Salisbury North to Salisbury	07:17	0:16:40	15:07	0:15:00
401,403,900	Salisbury to Salisbury North and Paralowie	07:09	0:10:43	15:08	0:12:51
404-P1	Salisbury to Paralowie to Salisbury Anti-Clockwise Loop	07:01	0:50:00	15:07	1:00:00
404-P2	Salisbury to Paralowie to Salisbury Anti-Clockwise Loop	07:37	0:50:00	15:13	1:00:00
405-P1	Salisbury to Paralowie to Salisbury Clockwise Loop	07:16	0:50:00	15:22	0:45:00
405-P2	Salisbury to Paralowie to Salisbury Clockwise Loop	07:15	0:50:00	15:58	1:00:00
411	Mawson Interchange to Salisbury Interchange and Salisbury	07:03	0:16:40	15:07	0:13:51
411,411U	Salisbury and Salisbury Interchange to Mawson Interchange	07:12	0:15:00	15:12	0:15:00
415 to 404-P1	Greenwith to Salisbury Interchange	07:26	1:15:00	15:03	0:45:00
415 to 404-P2	Greenwith to Salisbury Interchange	07:30	2:30:00	15:07	0:45:00
415 to 405-P1	Greenwith to Salisbury Interchange	07:12	2:30:00	15:49	3:00:00
415 to 405-P1	Greenwith to Salisbury Interchange	07:16	1:15:00	15:53	3:00:00
415, 415V	Salisbury Interchange to Greenwith and Elizabeth Interchange	07:37	1:15:00	15:09	0:36:00
415, 415V	Elizabeth Interchange and Greenwith to Salisbury Interchange	08:13	2:30:00	16:42	1:00:00

Route Number	Bus Route	AM		PM	
421	Salisbury Interchange to Defence Science and Technology Organisation and Edinburgh	07:39	1:15:00	16:41	3:00:00
430	Salisbury Interchange to Greenwith and Elizabeth Interchange	07:15	0:50:00	15:13	0:45:00
430	Elizabeth Interchange and Greenwith to Salisbury Interchange	07:37	2:30:00	15:57	3:00:00
430 to 405-P1	Elizabeth Interchange and Greenwith to Salisbury Interchange	08:04	1:15:00	15:18	1:00:00
430 to 405-P2	Elizabeth Interchange and Greenwith to Salisbury Interchange	08:08	1:15:00	15:22	1:00:00
560,560A	Tea Tree Plaza Interchange to Mawson Interchange and Salisbury Interchange	07:30	0:50:00	15:23	0:25:43
560,560A	Salisbury Interchange and Mawson Interchange to Tea Tree Plaza Interchange	07:25	0:37:30	15:25	0:36:00
T500, 500X	City and Paradise Interchange to Mawson Interchange and Elizabeth Interchange	07:02	0:36:00	15:11	0:25:43
T500, 500X	Elizabeth Interchange, Mawson Interchange and Ingle Farm to City	07:04	0:16:40	15:40	0:30:00

Table 29 – Bus routes and scheduling

Appendix G
Calibrated Base Model (Aimsun)

Project: Salisbury Town Centre Revitalisation

Transport Assessment Report

Prepared for: City of Salisbury

Project: 217729

28 June 2012

Document Control Record

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3	28 June 2012	Final for Client		RB/MH	RH	RS
Current Revision		**3**				

Contents

Appendices

1. Introduction

Aurecon has been engaged by the City of Salisbury (Council) to undertake a Traffic Modelling and Local Network Strategy study for the Revitalisation of the Salisbury Town Centre (STC).

The City of Salisbury is undertaking a Structure Planning Study that will result in the Revitalisation of the Salisbury Town Centre. The transport planning and traffic modelling inputs to the master planning process will provide a level of confidence that an integrated solution is tailored to meet the objectives of the Revitalisation.

A successful Structure Plan for the Town Centre will be seen as providing an accessible road network with reduced levels of congestion and improved accessibility, designed to reduce car use and using the latest environmental sustainable practices to increase the levels of walking and cycling as transport modes and to provide high levels of permeability and legibility.

1.1 Study Context

The Salisbury Town Centre is a strategic centre earmarked as a Transit Oriented Development by the State Government as part of its 30 Year Plan for Greater Adelaide. As a result the Town Centre has been subject to a master planning process. With the future investment in transport infrastructure and development interests from private sector, the opportunity to build on to its strengths and enhance its vitality has been investigated.

The Salisbury Town Centre Revitalisation Project will assess the opportunities and constraints for the Salisbury Town Centre. It will develop a policy framework and action plan to guide existing and future land uses while enhancing economic, social and environmentally sustainable development opportunities. The project will take a pragmatic approach in ensuring that the outcomes can be implemented particularly in relation to recognising the commercial reality associated with strategic property development objectives. This development of the Structure Plan has been undertaken by Hames Sharley in consultation with City of Salisbury and Leedwell Strategic.

A broader master planning approach to the Salisbury Town Centre will ensure integrated planning and delivery of various elements that would contribute to the "vitality" of the Salisbury Town Centre.

1.2 Project Objectives

The City of Salisbury has commenced a Master Planning process for the Salisbury Town Centre. A focus of the Master Planning process for this year will be the development of a Structure Plan for the Town Centre and include a Council Property Development Strategy. The outcome of both projects will be to define a future investment strategy for the Town Centre that will continue after completion of the structure plan outcome.

Accessibility is a key element to good urban design. An integrated transport network that facilitates the objectives of the revitalisation of the Town Centre is the desired outcome. The City of Salisbury in partnership with the Department of Planning, Transport and Infrastructure (DPTI) recognise the need for the development of a transport model that informs the development of the structure planning process and future investments in the Centre.

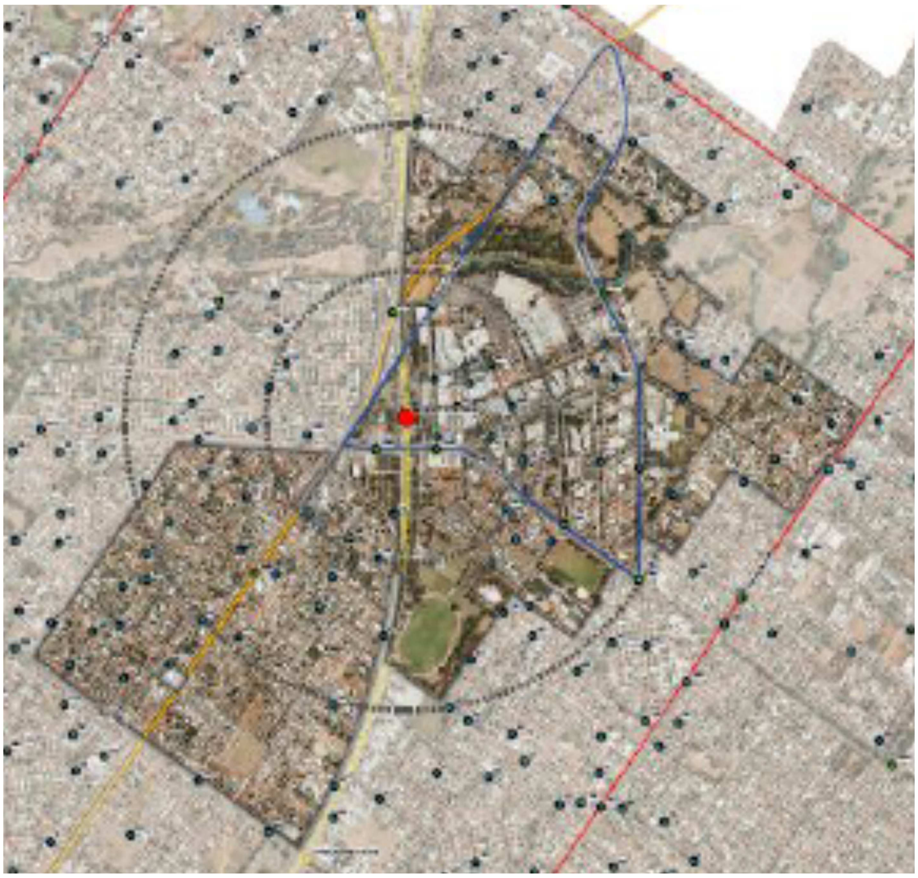


Figure 1 – Study area

1.3 Scope of the Study

The original scope of the traffic modelling and local network strategy as indicated in the Study Brief included the following:

- Model the regional network effect of the Saints Road extension to increase the opportunity to capture passing traffic to the Salisbury Town Centre.
- Model the existing local network condition, and provide a current assessment of the network report at a technical level.
- Provide input to the draft structure plan development process by contributing at both internal staff workshops and community workshops.
- Model the structure plan options generated including the outcomes of the Saints Road review, and develop a report on these options identifying opportunities, constraints and first order costings.
- Model the preferred structure plan outcome and develop a local road network strategy in conjunction with the structure planning program and strategic property developments identified in the master planning process.
- Assess the options developed for the proposed future operation and concept plan developed by DPTI for the Salisbury Interchange with particular focus on Park Terrace and Gawler Street.

During the Study the above scope was changed to reflect the additional requirement of the Council and stakeholders to provide a Parking Strategy with the Master Plan.

1.4 Project Study Area

The extent of the study is based upon the need to identify two objectives.

The assessment of the likely impacts of the Saints Road extension on the **regional network** and specifically on traffic entering the Town centre:

- Park Terrace
- Commercial Road, and,
- Salisbury Highway

The assessment of the opportunities associated with the structure planning process to the **local network** servicing the Town Centre including the local streets within that network including:

- John Street
- Gawler Street
- James Street
- Church Street
- Mary Street
- Ann Street
- Wiltshire Street
- Ponton Street

1.5 Study Process

The study was undertaken in five key phases as indicated below:

1. Undertake Strategic Modelling of the Saints Road extension to determine if benefits warrant inclusion into the Structure Plan;
2. Undertake existing Aimsun model development and assessment of existing transport conditions. The key deliverable was the Aimsun Calibration report which was accepted by DPTI;
3. Assist Hames Sharley with the development of the Structure Plan for the Town Centre
4. Develop a high level Parking Strategy for the Town Centre based on the agreed Structure Plan;
5. Undertake Aimsun modelling of the transport infrastructure for the preferred Structure Plan scenario, including assessing options for John Street and bus services.

2. Existing Assessment

2.1 Road Network

2.1.1 Arterial Roads

The arterial network in the study comprises three main routes as indicated below:

Salisbury Highway: This road is a major north south road that connects Salisbury and Elizabeth with the metropolitan area. It is a four lane divided road with minimal access between Park Terrace and Gawler Street. The remaining sections provide direct access to abutting properties. Traffic volumes are typically in the order of 40,000 vehicles per day

Park Terrace: This road is a major east-west road that connects Salisbury Highway with Main North Road. The cross section of this road varies with two lanes in each direction. It is a four lane divided road with minimal access between Park Terrace and Wiltshire Street and east of Fenden Road. A wide single lane section occurs between Wiltshire Street and Fenden Road. Direct access is provided to abutting properties. Traffic volumes typically vary between 19,000 and 23,000 vehicles per day.

Commercial Road: This road connects Park Terrace with John Rice Avenue and is one of the key access roads to Edinburgh Parks and Elizabeth industrial areas. It is a two lane un-divided road with direct access along its full length. Traffic volumes are typically in the order of 10,000 vehicles per day.

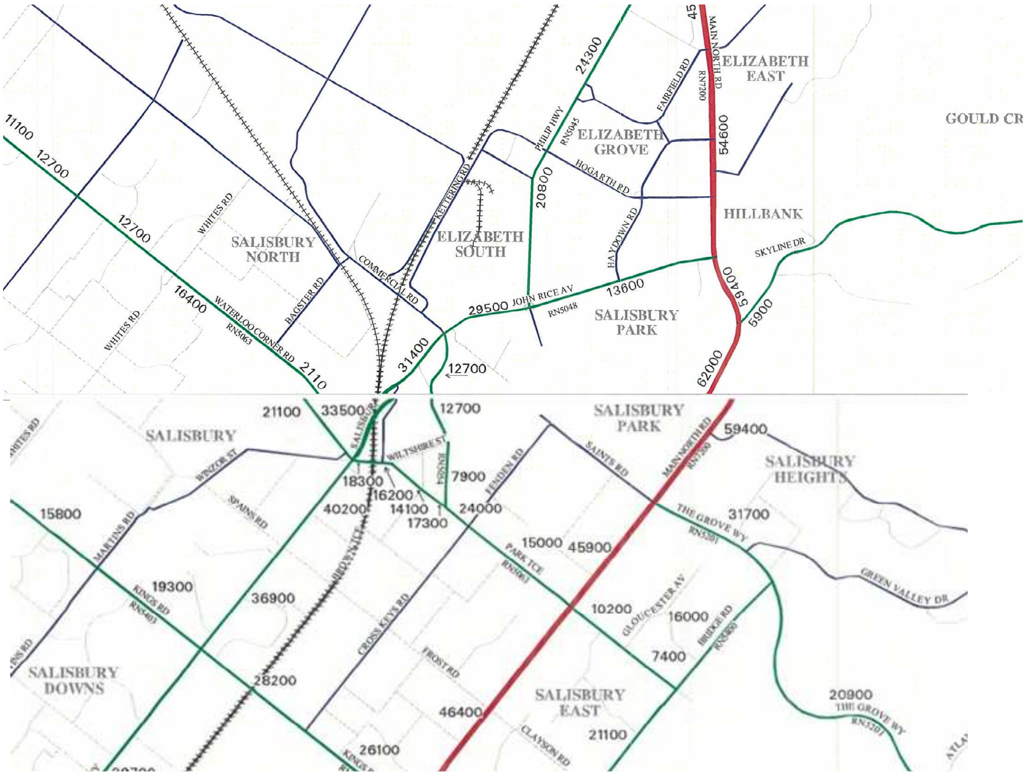


Figure 2 – Daily Traffic volumes (Source DPTI)

Waterloo Corner Road and John Rice Avenue whilst forming part of the study area do not impact on traffic operation. The daily traffic volumes for the area are shown in Figure 2.

2.1.2 Local Roads

The key local roads that provide access to the Town centre are Wiltshire Street, Gawler Street and John Street. The local road network in the Town Centre comprises two lane undivided roads, except for a section of John Street between Gawler Street and Ann Street which is 1-way travelling in an easterly direction.

On-street parking is provided on all of the roads, although it is restricted in some sections to provide for bus stops or increased footpath width. Bicycle lanes are only provided on a short section of Gawler Street north of Park Terrace to John Street.

2.2 Traffic Operation

Vehicular travel patterns around the Town Centre are very much influenced by the constraints which exist. These include:

- The one way access along the major portion of John Street requires traffic to circulate more than necessary.
- Access along Park Terrace in the vicinity of the rail crossing and the impact this has on roads like Gawler Street and Wiltshire Street within the local network.
- The lack of a clear or indirect access around the immediate CBD area. On the northern side this is affected by the undeveloped nature of Commercial Road and the proximity of the Little Para River. On the southern side access is compromised by the rail crossing and the lack of crossing opportunities this presents.
- The inadequacy of Ponton Street to handle the significant volumes emanating on a daily basis from the eastern suburbs.
- In addition to the above it is clear that the city does indeed have peak travel flows in both the morning and afternoon periods suggesting that significant activity is being generated by travel to and from work in the CBD and the major Schools within the area on Park Terrace and Commercial Road. These peaks highlight the delays and deficiencies when trying to gain access to roads like Ponton Street and Gawler Street in the local network and Main North Road, Commercial Road, Park Terrace and Salisbury Highway in the major network. Currently attempts to manage this via traffic signal phases, is not working effectively.

2.3 Parking

The existing parking demand has been briefly assessed based on the QED Report (dated September 2003) and review of aerial photography over the last 3 years. The key points of this review are:

- The Judd and Sexton Street car parks appear to be fully utilised.
- The car parks on the western and southern side of Parabanks are also well utilised and so are the car parks located to the western side of Gawler Street (primarily with the interchange).
- The eastern Parabanks car park appears to be 60 to 80 % utilised, with the northern car park only 20% utilised.
- The private car parks located on the businesses between John and Wiltshire Streets vary in utilisation but overall they are well utilised (greater than 70%)

The review of the parking data and previous reports indicates that within the core area of the Town Centre a large proportion of the available car parking spaces is still being used for long term parking, in particular by workers. The QED study of 2003 surveyed 183 staff of businesses within the Town Centre and indicated a strong unwillingness to walk further than 2 minutes from a car park to their intended destination. Whilst this is a small sample of the employees in the Town Centre it is reinforced by parking surveys that show a high occupation rate in centrally located car parks and low occupancy of the parking areas on the fringes of Town Centre. This equates to a desire to walk less than 150 m, and as such it would be ideal to locate parking facilities within 100m of the destinations for employees, shoppers and residents.

2.4 Public Transport

The Town Centre is well served by public transport and in addition to the rail and bus interchange bus routes through the city centre exist via Gawler Street, James Street, Church Street, Wiltshire Street and the eastern end of John Street. However there are many routes and the Passenger Transport Services Division of DPTI have indicated this has resulted in confusion with some users of the system. Facilities at bus stops and the connections to bus stops via the network of paths are considered substandard and need to be significantly improved, particularly for disabled users.

2.5 Cycling and Pedestrians

In respect to the provision of pedestrian and cycling access this is not prevented to any degree but connectivity is often disrupted due to either the spread of facilities or inconsistencies in the quality and continuity of footpaths that exist.

Pedestrian

The following observations have been made regarding pedestrian movement around the Salisbury Town Centre:

- Facilities are considered satisfactory within the Town Centre area
- The pedestrian network is considered underutilised, particularly its connections to surrounding community facilities. This due to the poor state or lack of facilities in some locations and a lack of signage indicating particular locations within the Town Centre
- There are particular issues with connectivity across Salisbury Highway / Rail Corridor particularly safety.
- The rail crossing and Park Terrace provides an impediment to north south movement along the rail corridor

Cyclist

Major links to external routes from the Town Centre do exist as part of the Local Area Bicycle Plan, reviewed in 2006, and cover a number of roads including Cross Keys Road, Saints Road and Fenden Road where dedicated bicycle lanes exist. However within the core area only a short section of Gawler Street provides on-road bicycle lanes.

These are further supplemented by the local road network as part of the “bike direct” initiative where local roads are used to add to the network on the basis that local roads with low traffic volumes are safer for cycling access. Specific “bicycle lockers” are provided at the Salisbury interchange.

3. Town Centre Structure Plan

This section briefly outlines the structure planning process undertaken to provide the relevant inputs into the detailed Aimsun modelling of the preferred Structure Plan. The Structure Plan was prepared by Hames Sharley, together with separate report that outlines the process together with recommendations on how to implement the plan. The following section briefly summarises key components of the structure plan that impact on the transport modelling study.

3.1 Objectives and Planning Principles

The key project objectives for the revitalisation of the Salisbury Town Centre have been developed by the overall project team and include:

Objective A – Sustainable Capital Investment – Ensure that any capital investment is underpinned by a sustainable return on investment

Objective B – Market Acceptance – Ensure that the adopted strategies to reposition the Town Centre are underpinned by a structure that the market will support, participate in and invest capital / human resources

Objective C – Appropriate Spatial Framework – An appropriate spatial framework (structure plan and precinct development) will be developed in conjunction with the local community and key stakeholders

Objective D – Fosters Social Vitality – Fostering social vitality is a key to establishing community ownership on a variety of levels

Objective E – Environmental Sustainability – Ensure the Salisbury Town Centre can adapt to future variations in climate condition and does not detrimentally affect the environment and still achieve the renewal outcomes

Objective F – Embody Flexibility – Ensure the strategy remains flexible, such that development is promoted where it satisfies the criteria identified in the implementation strategy.

These objectives have been created to compare and assess high level structure plan options that will in turn inform the economic rationale for the implementation strategy.

Extensive community, government agency and key stakeholder consultation was undertaken by the Structure Plan project Team. This consultation provided a basis for a number of community aspirations that have been translated into project objectives as well as planning principles that underpin the preparation of the structure plan options. These planning principles are highlighted below.

1. Provide progressive leadership and being economically deliverable;
2. Has a consolidated core;
3. Is framed by a legible and easy to understand movement network
4. Provides active and functional public spaces and streets;
5. Cultivates social vitality and environmental sustainability
6. Has a flexible, responsive built form and density framework

3.2 Scenarios

Three structure plan scenarios have been developed in line with the above Planning Principles. These scenarios are briefly described below.

Scenario 1 **Scenario 2** **Scenario 3**

Figure 3 – Structure Plan Scenarios

Scenario 1 – Revitalise the Current Heart of the Salisbury Town Centre

In this scenario future development is focussed around John Street with minimal changes elsewhere in the Town Centre.

Scenario 2 – Reinforce and Extend the Heart of the Salisbury Town Centre

In this scenario future development is focussed around John Street and an extended Church Street with higher density developments surrounding these roads. The road hierarchy is modified so that John and Church Streets become high/main streets.

Scenario 3 – Relocate the Heart of the Salisbury Town Centre to the Interchange

The focus of future development moves to the west closer to the rail interchange with high density developments located close to the new core.

The three scenarios were assessed against the project objectives and with Scenario 2 the preferred scenario, which was also supported by the community.

3.3 Recommended Scenario

The recommended structure plan is shown in Figure 6 and has the following key elements:

- Improve pedestrian connectivity within and surrounding the Salisbury Town Centre
- Improve the road network to facilitate movement into the Salisbury Town Centre
- Create a focus for civic development
- Bring green space into the Salisbury Town Centre

- Create active frontages along Church and John Streets
- Provide active frontages surrounding the Civic Square as well as softening the landscaping to promote use
- Create opportunities for development of key sites
- Increase densities within the Salisbury Town Centre
- Provide opportunities to establish residential and mixed-use developments to increase the permanent resident population within the Salisbury Town Centre
- Develop entrance statements at key entry points surrounding the Salisbury Town Centre
- Simplify bus movement and facilitate stronger linkages between the Town Centre and an upgraded transport interchange

Figure 4 – Preferred Structure Plan

3.3.1 Development profile

In developing the structure plan consideration was given by the project team to the level of development that could be supported within the Town Centre. On this basis the following was developed by Hames Sharley that would be used in assessing the transport infrastructure:

Tier 1 Sites - Considered to be sites that require no significant intervention from Council - rather they are controlled by a single entity and require innovative procurement strategy/ market thirst to facilitate and should be undertaken within a 3 year time frame;

Tier 2 Sites - Considered to be sites that can be availed for development within a 3 to 7 year period, however may require intervention from local/State Government, and

Tier 3 Sites – Considered to be sites that are held tightly, or difficult to establish a quantum of site area. These sites are unlikely to occur in the short term but are desirous to underpin the long term viability of the Town Centre development, and should be undertaken after 7 years.

Figure 5 – Location of Development Sites

Figure 5 above shows the location of the various sites within the Town Centre with Appendix A providing the expected levels of development including provision of parking for each location. A summary for each tier of development is provided in Table 1 below.

Table 1: Summary of Development Profile

	Retail (m2)	Commercial (m2)	Medium rise residential	Low density residential	aged care residential
Tier 1 Total	14063	27224	399	34	0
Tier 2 Total	20182	4600	1192	120	302
Tier 3 Total	16328	4725	739	0	0
Combined Total	**50573**	**36549**	**2330**	**154**	**302**

3.3.2 Transport Infrastructure

The proposed Structure Plan has identified a range of improvements to the road network, public transport operation and pedestrian / cycling connectivity. A list of the key components is provided below.

Pedestrian Network

Key Actions

Strengthen existing links from the Salisbury Town Centre to open spaces and key destinations

Establish a legible, connected pedestrian network that identifies strategic/historic sites within the Salisbury Town Centre through an interpretive walk

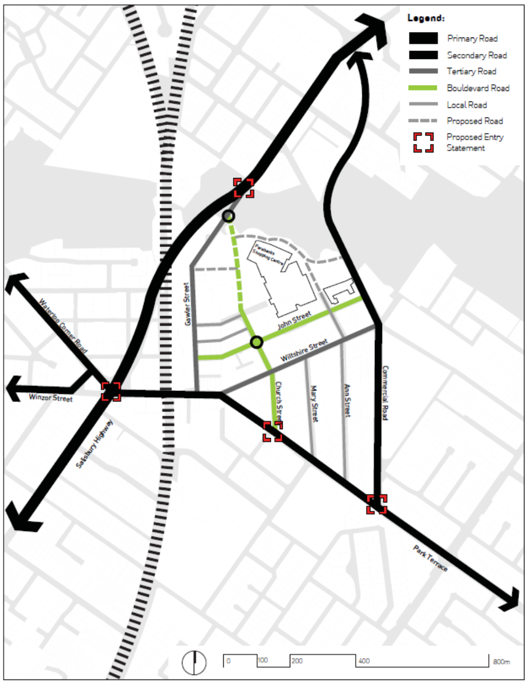
Provide visual and physical amenity to pedestrians

Ensure safety through passive surveillance and active frontages

Augment pavement treatment

Ensure accessibility to all

Vehicle Network



Key Actions

Extension of Church Street to Salisbury Highway, becoming the primary North-South link within Salisbury Town Centre

Creation of a ring road to the north of Parabanks

Extension of Ann Street to the ring road

John Street remains one-way, possibly becoming two-way in the long-term to maximise efficiency

High quality gateway statements at key entry points

Public Transport Network

Key Actions

Update interchange and simplify bus movement

Assess options for bus movement on Wiltshire Street or John Street

Provide a bus stop that services the core area of the Town Centre

4. Parking Strategy

This section details the development of the Parking Strategy for the Salisbury Town Centre. It includes a review of existing conditions and reports, development of the key principles and assessment of the parking associated with the proposed Structure Plan.

4.1 Review of previous parking studies

Previous parking studies have been reviewed as part of developing a future parking strategy for Salisbury Town Centre including:

- Salisbury Town Centre Parking and Implementation Strategy (PPK Consultants, 1993)
- Salisbury Town Centre: Technically, are there enough parks? (Author unknown, undated)
- Salisbury Town Centre Car Parking Review (QED, 2003)
- Salisbury Town Centre Car Park Review (Luke Gray, 2011)

These studies were solely based on the current or past layout of the Town Centre and as such many of the findings would not be relevant to a drastically changed future Salisbury Town Centre. However, the problems that would remain unchanged are the needs of the local people, habits, preferences and their opinions on all things parking. The elements of the previous studies that will be relevant to the future Town Centre are summarised below.

Parking supply and demand

- Surveyed shortfall of short term parking spaces during peak times in the Core area.
- Encourage employees away from short term central parking to long term remote locations.
- Employees unlikely to walk further than 100 m to 200 m unless short term parking incurs a charge and long term is free.
- Staff using central parking areas, up to 60% of all spaces of individual car parking areas.

Utilisation of private car parks.

- No integrated parking between businesses.
- Shared-use of parking facilities to be encouraged through pedestrian and vehicle interconnections between private parking areas.
- Encourage shared use of parking as 60% of shoppers visited only one business, with 22% visiting 3 or more.
- A shared use discount of 20% may be applied to parking demand calculations. To be considered when developing a Parking Plan.

New parking areas.

- Provide new parking areas particularly to the west of Gawler Street.
- Provide decked parking on Parabanks.

Parking rates / Restrictions / Controls.

- Development Plan rates - parking rates over estimating parking demand.
- Introduce permit system for STC and traders
- Most convenient parking limited to 1 hour. Including Sexton Car Park.

- Suggest introduction of pay and display for on-street parking in most convenient locations, e.g. John Street, for a maximum stay of 30 minutes to encourage higher parking turnover.
- Least convenient parking limited to 4 hours. (PPK 1993)
- Paid Parking - Staff and shoppers unwilling to pay for safe and secure parking.
- Whilst encouraging the growth of Salisbury Town Centre paid parking should be limited to the most convenient locations. After a sustained period of growth parking charges could be introduced to manage parking demand more effectively.

Connectivity.

- Poor pedestrian links.
- Good quality pedestrian links between car parks and from car parks to key destinations to be provided.
- Safety and security and adverse weather cited in survey as a deterrent to walking between parking areas and destination.
- Provide covered and well lit footpaths on main pedestrian paths from parking areas to town centre and other key destinations.
- Surveyed willingness to walk: with 54% less than a 1 minute walk or 75 m and 30% less than 2 minute walk (150 m).
- 100 m should be considered a reasonable distance to walk from car to destination.

4.2 Proposed Master Plan

Three options were considered for the Salisbury Town Centre Master Plan with the preferred scenario to reinforce and extend the heart of the Centre. It has indicated that car parking be provided behind buildings to maintain active frontages. This could include provision of multi-deck car parks in specific locations to underpin development as well as ensuring that visitors walk within the centre to provide opportunities for further street activation.

Three tiers were used to support the Master Plan with Tier 1 being of highest priority (next 3 years) and located close to existing heart of the Town Centre. Tier 2 locations have a medium priority and hence development could be expected to occur in 3 to 7 years with Tier 3 locations to be developed after 7 years. The proposed locations are shown in Figure 5.

4.3 Master Plan Parking Strategy

The parking strategy should aim to utilise car parking as a tool to activate the distinctive precincts of Salisbury Town Centre whilst providing a safe, connected, economically viable, and an integrated car parking outcome. The Salisbury Town Centre will need to be an attractive and convenient place to live and shop when compared to other district centres; this need for convenience requires a parking strategy that accommodates the parking demand to within reasonable levels.

Key principles in formulating the car parking strategy are as follows:

Long Term car parking

Where practical provide separate facilities for long term parking on the periphery of the Town Centre. This will free up spaces in the core area for short term parking associated with retail and other uses. Possible locations include the hotel car park just west of the rail station, the DPTI car park west of the rail line south of Park Terrace and the current under-utilised spaces in Parabanks northern car park (Short term only). It is also suggested that any sites that could be redeveloped in the area between

Wiltshire Street and Park Terrace also be considered for long term parking. A key requirement for all of these sites is to ensure that pedestrian movement to the core area is safe and convenient.

On-street parking

Encourage short term high turnover parking along John Street and Church Street including its extension to Gawler Street. It should be noted that parking restrictions of less than 1 hour are difficult to enforce by patrolling parking enforcement officer marking tyres. Parking meters with pay and display tickets provide a quicker means of identifying vehicles flaunting parking regulations. Charge users for the most convenient on-street parking spaces with maximum stay of 30 minutes but provide free or smaller fee for all-day parking in a more remote location. This will deter employees parking all day or shuffling between short term parking areas.

Development Parking

The Structure Plan indicates various locations for mixed use development. These typically occur where there is existing at-grade parking. For these sites the following should be considered:

- Separate out residential parking (but not visitor) from other uses with retail parking provided in basements and/or rooftop depending on development.
- Where practical the parking associated with retail uses should be located close to the retail uses
- Use of parking rates comprising a value range to allow for future flexibility in development strategies and determination.
- Interconnect individual parking areas for separate developments, primarily at basement level.
- Allow vehicles to utilise all available parking spaces to facilitate the shared use of parking spaces, taking advantage of the differing peak parking demands of different land uses.
- Group together land uses that have non-competing peak parking demands to further facilitate shared parking.
- Contribution to a car parking fund where a particular development provides a net loss in overall number of car parks including existing spaces.

In addition to limit parking supply, consideration should be given to adopting lower rates for provision of parking for developments located within the core area of the Town Centre.

Alternative Parking Arrangements

To reduce the overall parking demand consideration should be given to:

- New residential development to provide share pool cars to reduce car dependency with a resultant reduction in parking demand.
- In the long term consider parking tariffs for staff car parking areas.
- Promote sustainable transport modes.
- Develop an associated financial plan to test the viability of a multi-deck car park including consideration of a Car Parking Fund and the effect of pricing.
- Annual monitoring of parking trends to establish parking rates and factors that can be incorporated into a parking plan, including:
- Survey of TOD parking trends (demand and utilisation / turnover) with the results defining the Salisbury Town Centre parking rates.
- An inventory of parking provision as land is developed.

4.4 Future Parking Demand

The future parking demand was estimated using data provided by Hames Sharley, which the location, development type, floor areas, and approximate number of parking spaces available on each site for Tier 1 to Tier 3 sites.

Due to the difficulty in predicting future parking scenarios, high, medium and low parking demands have been considered as follows:

1. High - based on the current Salisbury (City) Development Plan (DP).
2. Medium - Planning SA Parking Bulletin – Parking Provisions for selected land uses (2001).
3. Low - based on the parking rates used for the Bowden Urban Village Master Plan transport orientated development (TOD).

The lower TOD parking rates represent a more sustainable transport policy that is gaining momentum in all levels Government and is a specific principle of the 30-Year Plan for Greater Adelaide.

The parking rates stipulated in the current Salisbury (City) Development Plan (DP) are considered high as recent data of parking demand for land uses in district centres indicates that the DP rates are relatively high compared to items 2 and 3 above.

The parking demand scenarios are shown in Table 2.

Table 2: Parking Demand Rates

Land Use	High (Salisbury Development Plan rates)	Medium (Planning SA Parking rates)	Low (TOD rates)
Dwelling	2 per dwelling	None given assumed 1.5 per dwelling.	1 per dwelling
Office	4 per 100m^2 of total floor area	4 per 100m^2 of total floor area	1.5 per 100m^2 of total floor area
Retail	7 per 100m^2 of total floor area	5 per 100m^2 of total floor area	3 per 100m^2 of total floor area

It should be noted that other land uses typically associated with a town centre, such as restaurants, gymnasiums, consulting room were not indicated by Hames Sharley. Consequently theses uses have not been considered as part of the parking demand calculation.

The number of parking spaces provided on-site, the high, medium and low parking demand, the surplus or deficit of parking (provided on-site parking less the parking demand) and the number of parking spaces lost to development based on total capacity and current utilisation are summarised in Table 3.

Table 3: Summary of Parking Demand, Supply and Balance

Tier	Parking provision of developed areas	Loss of existing parking due to developed land	High Parking Demand	Parking provision less High parking demand	Medium Parking Demand	Parking provision less Medium parking demand	Low Parking Demand	Parking provision less Low parking demand
Tier 1 Total	1,373	474 (474)	2,948	-1,575	2,444	-1,071	1,267	106
Tier 2 Total	3,436	1,620 (745)	4,828	-1,392	3,615	-179	2,290	1146
Tier 3 Total	1,234	421 (374)	2,952	-1,718	2,161	-927	1,371	-137
Total	**6,053**	**2,515 (1,593)**	**10,728**	**-4,685**	**8,221**	**-2,178**	**4,928**	**1,115**

The loss of existing parking due to developed land indicated in column 2 in the above table has to components; the first is the total number of car park spaces lost, whilst the number in brackets refers to the number of existing utilised spaces that could be lost.

Key points from the table are:

- For the high and median demand scenarios the number of parking spaces provided by the developable areas does not satisfy the parking demand, with a shortfall ranging between 4,700 and 2,200 spaces.
- This shortfall increases to between 3,800 and 6,300 spaces if the loss of existing car parking is taken into account.
- There is a surplus of 1,110 car parks if the low (or TOD) demands are used. However there would be a shortfall of 480 spaces if the loss of existing car parking is taken into account.

In addressing the shortfall, consideration should be given to providing the extra car parking either side of Church Street (including its extension to Gawler Street) or increasing the number of levels of car parking for the Judd Street site. The provision of the extra car parks around the existing Church or John Street sites would benefit areas of existing need.

5. Transport Modelling Assessment

5.1 Introduction

This section details transport modelling undertaken for the study, which comprises two parts.as indicated below:

- MASTEM strategic modelling of the impacts of providing the Saints Road Extension
- Aimsun microscopic modelling of the existing conditions, future modelling of options and the recommended scheme in the vicinity of the Town Centre area.

5.2 MASTEM – Saints Road Assessment

This assessment has been undertaken using DPTI's strategic transport model MASTEM model for metropolitan Adelaide. The study area for the MASTEM model is shown in Figure 6 below. It extends from Main North Road in the east to Bagsters Road in the west, John Rice Avenue to the north and just south of Park Terrace.

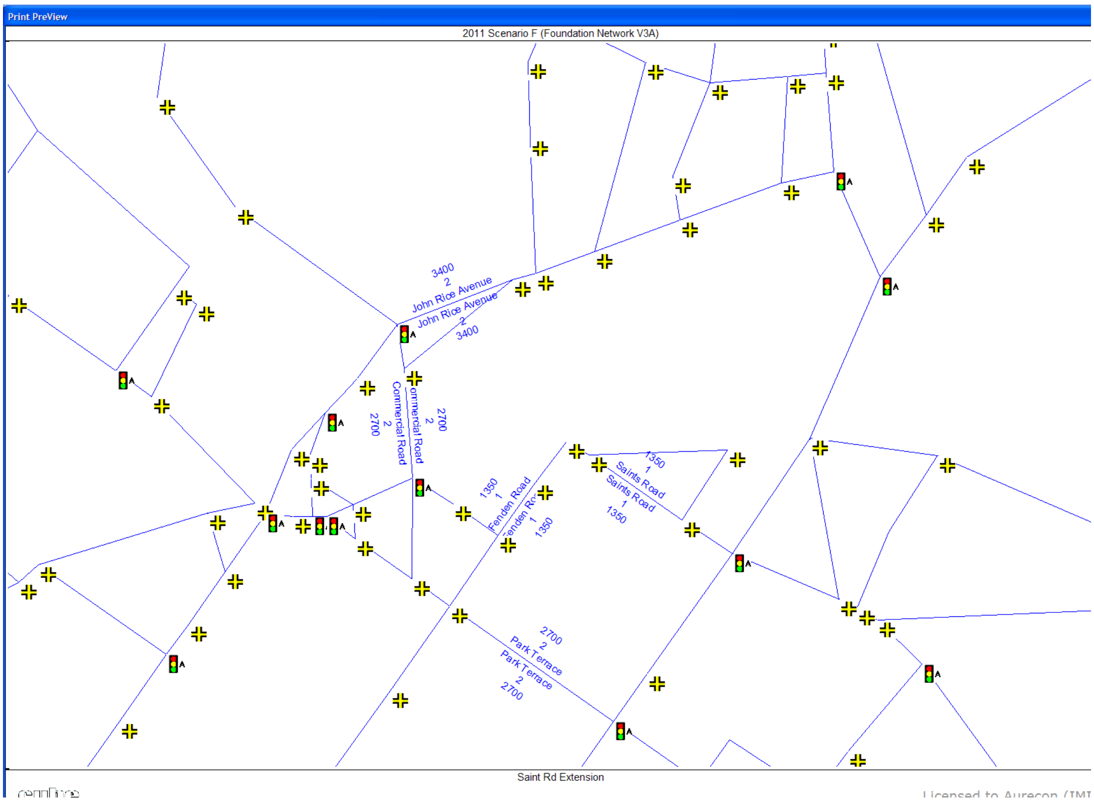


Figure 6 – Model area

5.2.1 Model Review

The Base Model was reviewed to ensure appropriate linkages and intersection treatments were coded into the model. The review highlighted that there was no connection of Bagsters Road from Waterloo Corner Road to Commercial Road. This link is considered essential in providing traffic movements to the Edinburgh Parks area and has been included in the model.

The initial model indicated a daily volume in the order of 2,500 vehicles per day (vpd) on Ponton Street compared to the traffic count of about 7,500 vpd. This is not considered unexpected as the MASTEM model has the zone for the Salisbury Town Centre being located south of Park Terrace with connections to the road network on Park Terrace at Commercial Road and Salisbury Highway. The result of these connections is that the amount of through traffic within the study area is considered appropriate. However the traffic into the Town Centre is considered low with minimal traffic on Gawler Street.

Further refinement of the model has shown a better distribution of traffic into the Town Centre by making modifications to the locations of the zone centroid connector (relocated to James Street) and the actual zone (shifted further north). As a result of these changes traffic now enters the Town Centre area from Gawler Street, Waterloo Corner Road and Wiltshire Road. Based on the revised layout it is estimated that the daily traffic on Ponton Street would be in the order of 6,000 to 6,500 vehicles per day.

The Saints Road Extension was then added to the Base Model for the above mentioned networks. This new road connection extended from the current Saints Road / Fenden Road junction to the Commercial Road / Wiltshire Street signalised intersection. Ponton Street was realigned to form a junction with the new road. The new road consisted of a single lane in each direction with a travel speed of 60kph.

5.2.2 Model Comparisons

Two methods have been used to assess the traffic impacts of the Saints Road Extension; link and screen line volumes, and select link assessment. The assessment was undertaken for both the AM and PM peak periods.

Volume Assessment

The volume assessment reviewed data on the road links along Saints Road and Commercial Road and across three screen lines (west of Main North Road, west of Fenden Road and west of Salisbury Highway).

The AM peak link volumes without and with the Saints Road Extension in 2011 are shown in Appendix B. They indicate the volume on the new link is 604 and 245 vehicles per hour (vph) in the westbound and eastbound directions respectively. There is an increase of 205 vph in the westbound (peak) direction on Saints Road just east of Fenden Road. In the PM peak the corresponding volumes are 162 and 576 vph for west and eastbound directions, with about a 60 vph increase in the eastbound direction on Saints Road.

The model indicates that the AM peak traffic volume increases from 713 in 2011 to 807 vph two-way in 2031. A slightly larger increase occurs for the PM peak from 738 to 846 vph (two-way). On this basis the daily traffic volume on Saints Road Extension is expected to be in the order of 7,000 to 7,500 vpd in 2011 and is expected to increase to about 8,500 vpd in 2031.

A review of the volumes indicates that the majority of volume on the new link is a straight transfer from traffic that was using Ponton Street and Park Terrace. The model shows that with the Saints Road extension no traffic is using Ponton Street in either direction.

Traffic volumes across three screen lines have been reviewed and they indicate the following changes in traffic patterns during the AM peak:

- At Main North Road - an increase of 160 vph in the westbound direction on Saints Road and 80 vph decrease on Park Terrace,

- At Fendon Road – an increase of 110 vph in the westbound direction on Saints Road and 65 vph decrease on Park Terrace, and
- At Salisbury Highway – an increase of 70 vph on Commercial Road and a decrease of 60 vph on Waterloo Corner Road in the westbound direction. Note there is also a 80 vph reduction in the southbound volume on John Rice Avenue.

Similar changes occur in the PM peak in the eastbound direction but the changes in volumes are lower with only an 80 vph increase on Saints Road west of Main North Road

The traffic volume changes indicated above are typically within 5 to 15 percent of the model link volume.

Select Link Assessment

The select link assessment provides an indication of the origin and destination of traffic using a road link in the model as well as the route chosen to use the particular link. In this assessment it has been used to identify the origins and destinations of traffic using the proposed Saint Road Extension.

The assessment indicates the majority of traffic using the proposed link has an origin to the east of Main North Road along the Grove Way road corridor. However the destination of traffic is essentially a 50 / 50 split between the Town Centre and Elizabeth/Edinburgh Parks. A review of the traffic entering the Town Centre zone indicates that there is a slight reduction of 30 vph in traffic entering the zone from the east. However at Saints Road (east of Fenden Road) there is a 100 vph increase in traffic entering the Town Centre with a decrease of 60 vph along Park Terrace. This indicates that the additional traffic the Saints Road extension is attracting is not destined to the Town centre but beyond to Edinburgh Parks / Elizabeth.

For the PM peak the split favours traffic from the Town Centre with approximately 60% of the traffic on Saints Road extension. The traffic volumes indicate that there is no change in traffic entering the zone from the east. As for the AM peak there is a slight increase of 20 vehicles in traffic on Saints Road from traffic generated by the Town Centre again transferred from Park Terrace.

Appendix C provides the outputs of the select link assessment for the 2011 and 2031 AM and PM peak periods. The 2031 select link plots indicate that the distribution of traffic changes between 2011 and 2031. For 2031 the directional split between the Town Centre reduces to approximately 30% in both peak periods.

5.2.3 Conclusion

DPTI's MASTEM model has been used to identify the traffic demands for the proposed Saints Road Extension. The original model had to be revised to better distribute traffic to the Salisbury Town Centre.

Traffic volume on the proposed link is expected to be in the order of 7,000 to 7,500 vpd in 2011 and increasing to 8,500 vpd in 2031. Peak traffic volume (one-way) on the Saints Road Extension is expected to increase from 604 vph in 2011 to 715 vph in 2031.

The modelling indicates that the proposed Saints Road Extension caters for traffic travelling to the Salisbury Town Centre and Edinburgh Parks / Elizabeth South from Salisbury East / Golden Grove. The traffic on the proposed extension is primarily traffic diverted from Ponton Street and Park Terrace, and to a lesser extent from John Rice Avenue. The review of traffic patterns indicates that the provision of the Saints Road Extension does not increase traffic flow into the Town Centre.

5.3 Aimsun Modelling

The Aimsun modelling comprises two parts; the first is the development of a base model with the second part identifying and testing of options. The models have been developed to reflect both the morning and evening peak periods and with dynamic route capability to reflect the vehicle route choice and their reaction to the prevailing traffic conditions. This provides an additional level of confidence regarding the Salisbury model operation in calibration and more importantly option testing.

A separate report provides the details of the Base model calibration (Appendix D) and option testing assessment. Summaries of these reports are provided below.

5.3.1 Base Model

Stage 1 of this process was the development of a fully calibrated/ validated base Aimsun model reflecting existing traffic conditions. The subsequent stages assess the future probable schemes and associated traffic generation/ growth associated with the Salisbury Town Centre.

The base Aimsun model has been developed reflecting traffic conditions in the morning period, 07:00-09:30 and evening period, 15:00-18:00, replicating observed traffic conditions for the year 2011.

The road network was constructed and calibrated utilising the Aimsun microscopic traffic simulation software. Detailed coding of lane and junction descriptions were developed using aerial photographs of the region, on-street measurements and knowledge of the network operation. During the calibration process, model parameters have been adjusted, to improve model operation.

The first stage of the model build was to ascertain the traffic movements through the study area. These were derived from the higher tier MASTEM modelling with a cordoned trip matrix extract reflecting the Aimsun study area. Development of the matrices utilised traffic count data to derive appropriate trip matrices for both the morning and evening periods.

The second stage involved comparisons of observed and the modelled data comparing the following statistics:

- Turn counts
- Link counts
- Screenline counts

Lastly the validation process centred on the following elements:

- Journey time analysis
- Queue length assessment

The analysis concludes that the Aimsun Salisbury Town Centre model is appropriately calibrated/ validated reflecting existing conditions for both peak periods. Therefore it is considered that the model is a suitable tool to analyse the performance and connectivity issues and to test the proposed actions associated with the local road network within the study area.

5.3.2 Future Scenarios

The following future scenarios have been assessed for this study. They have been agreed to by DPTI and Council.

2021 Base	2021 model without development
2021 Option 1	2021 model with all Tiers of development provided, bus movement along Wiltshire Street and John Street operation as existing
2021 Option 2	2021 model with all Tiers of development provided, bus movement along Wiltshire Street and John Street with two-way operation
2021 Option 3	2021 model with all Tiers of development provided, bus movement along John Street and John Street two-way operation

All the option models contained the following infrastructure requirements:

Road Infrastructure

<u>DPTI Roads</u>

- Commercial Road – provide new junction with the Ring Road and a painted median from Park Terrace a to new junction with the Ring Road
- Park Terrace – provide new signalised junction with Church Street and modify the Gawler and Wiltshire Street junctions to provide bus priority to the Interchange

<u>Council Roads</u>

- Extend Church Street from Jane Street to Gawler Street
- Provide traffic signals at the Church Street / Park Terrace intersection including change in layout for Gawler Street
- Provide Ring Road behind Parabanks Shopping Centre to connect with Ann Street and Commercial Road
- Extend Ann Street from John Street to the Ring Road
- Provide a connection between Gawler and Church Streets north of the existing Council office.

Public Transport

- Train frequency as per requirements of the electrification project at 7.5minute frequencies in both directions
- Bus routes all routes were to use Wiltshire or John Streets for the respective options. However for bus services using Salisbury Highway / Gawler Street, they travel along the Ring Road and Ann Street.
- A single stop provided between Church and Ann Streets
- For the Wiltshire Street bus services (Options 1 and 2) a bus lane is provided from just north of Park Terrace to the entry into Gawler Street.
- For John Street (Option 3) bus services would enter the interchange via new roadway directly in line with John Street

Figure 7 provides a pictorial view of the model.

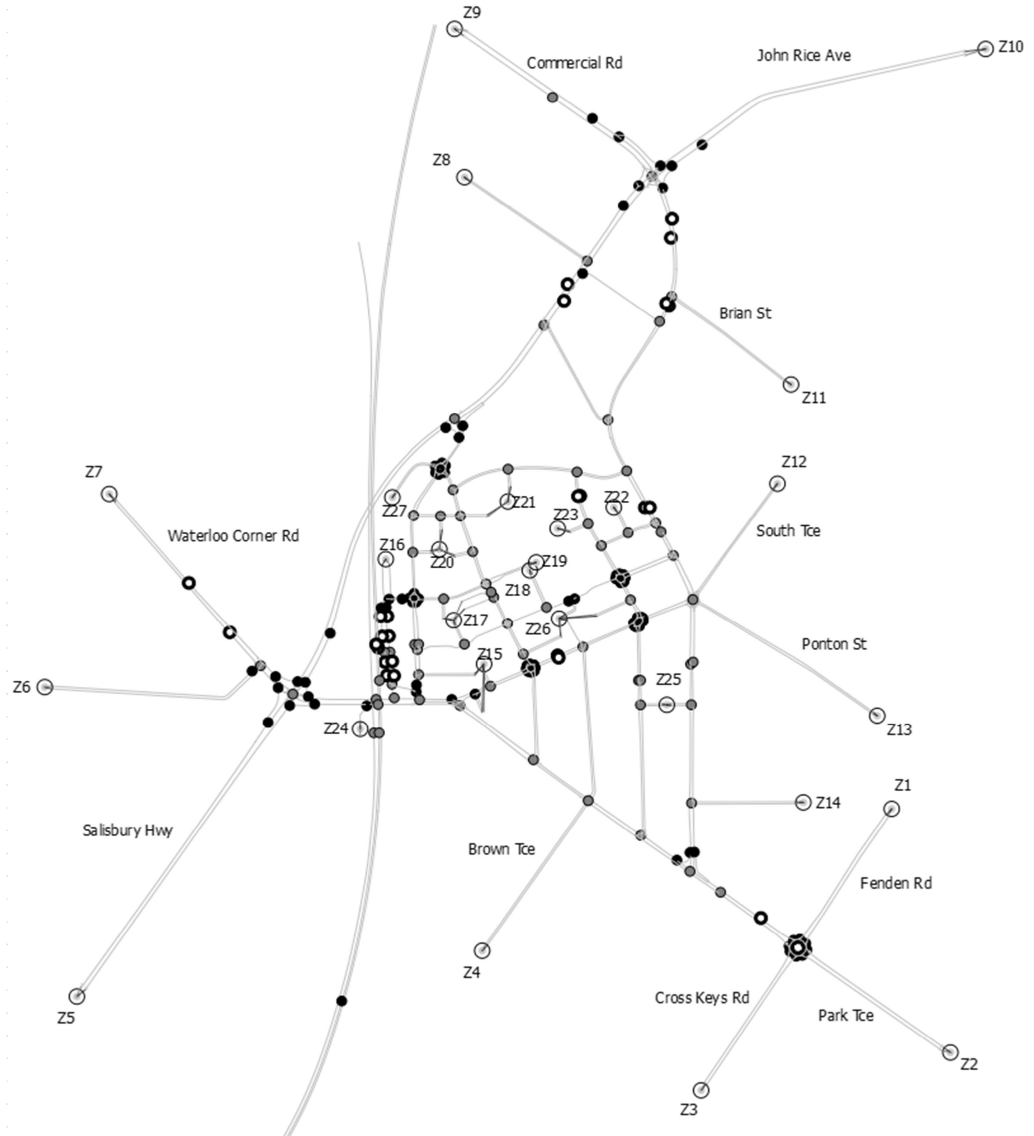


Figure 7 – 2021 Aimsun Model, general layout

5.3.3 Future Traffic demands

The future traffic demands for the 2021 base model were determined from DPTI's MASTEM model. For the options the traffic demands were based on the development profile estimated by Hames Sharley for the proposed Structure Plan. The total development for the structure plan was provided as follows:

- Residential development – 2,886 units with 2,330 medium density residential and 330 aged care
- Commercial development – 36,550 m2 of office space
- Retail development – 50,550 m2 of retail development which includes cafes, restaurants and shopping

The following rates were used to estimate the total number of AM and PM peak hour trips generated by the above development:

- Residential rates range from 0.2 trips per unit for aged care to 0.6 trips per unit for medium density residential
- Commercial rate is 2 trips per 100m2 of office space
- Retail rate is 8 trips per 100m2 of retail space.
- The retail trips were reduced by 20% to account for shared usages
- The retail rate for the AM peak is assumed to be 25% of the PM peak rate due to the reduced number of shoppers.

The generated traffic (3,080 and 5,380 trips in the AM and PM peak hour respectively) was assigned to each of centroids as the Structure Plan indicated the location of individual developments within the Town Centre. The distribution of traffic was assumed to be the same as the Salisbury Zone in the MASTEM model.

These additional demands were then added to the 2021 Base model to provide the OD trip matrix for the Aimsun assessment. In addition some minor changes were made to the MASTEM traffic patterns as it appeared there was a significant increase in traffic travelling to Winzor Street. This traffic was redirected to Salisbury Highway. This was also undertaken for Ponton Street and with some minor redirection to Park Terrace.

5.4 Aimsun Modelling Outcomes

5.4.1 Model Operation Comparison

A visual comparison of the three models indicates that the traffic operation is similar for all the models and is primarily determined by the operation of the signalised intersections along Salisbury Highway (Park Terrace, Gawler Street and Commercial Road) and the Park Terrace rail crossing. The roads within the Town Centre area operate satisfactorily during both peak periods. However there are times when congestion levels are high for short periods. Typically the congestion clears within 10 to 15 minutes.

Screen shots of the model at specific times during the peak periods are shown in Appendix B and a number provided in the following figures below to highlight specific locations.

Gawler Street / Salisbury Junction

For all options there are times within the peak periods where there is significant congestion at this location. Primarily it is caused by

a) high turn volumes entering / exiting Gawler Street;
b) insufficient phase time provided at the traffic signals, but particularly to the right turn out to head north and
c) the large number of buses turning at this location.

The queues block through traffic along Salisbury Highway and Gawler Street. Along Gawler Street the queues extend back to the junction with the Church Street Extension and restrict traffic flow along the Ring Road.

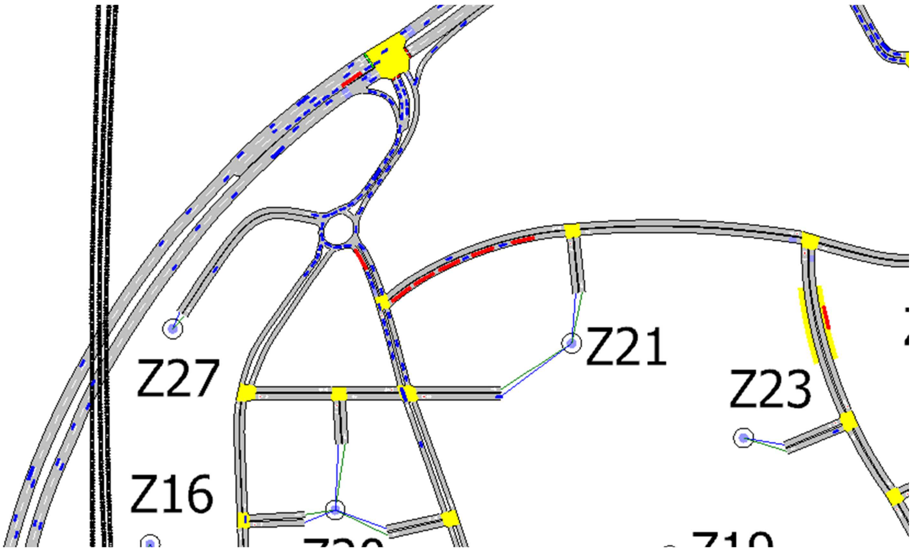


Figure 8 – 2021 Option 1 Model, morning peak

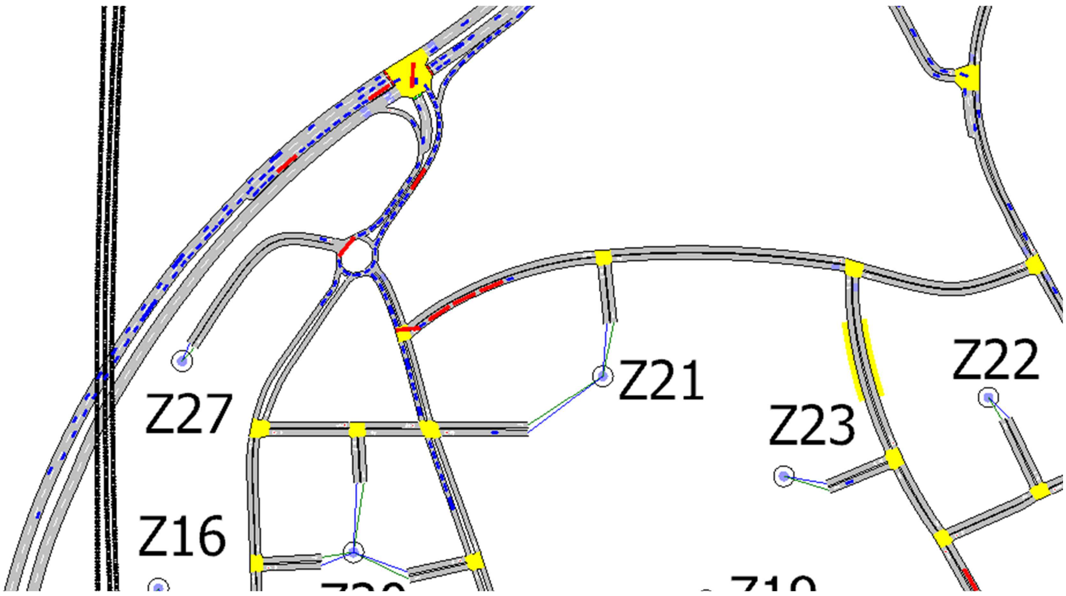


Figure 9 – 2021 Option 3 Model, morning peak

Wiltshire Street Bus lane

For Options 1 and 2 the proposed bus lane for Wiltshire Street results in increased congestion along a short section of the street and is exacerbated by the operation of the Park Terrace rail crossing. Typically the congestion is for short periods of time. In some instances the location of the bus stop between Church and Mary Streets results in buses queuing and blocking car traffic.

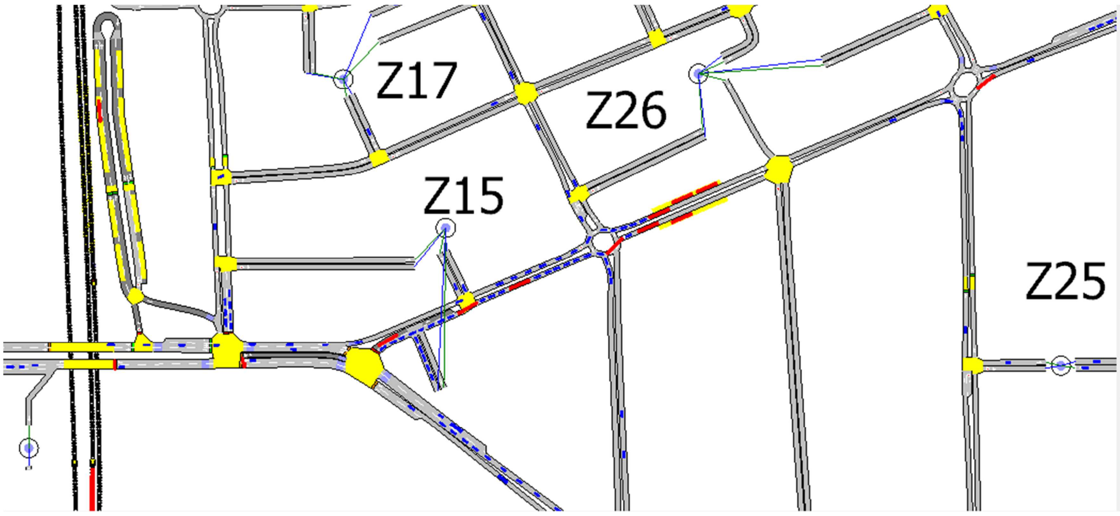


Figure 10 – 2021 Option 2 Model, evening peak

Commercial Road / Ring Road junction

For all options this junction was coded with no storage lane to reduce impact on the Little Para River bridge. However, for all options there are periods where vehicles wishing to undertake a right turn into the Ring Road delay through traffic travelling along Commercial Road. In some instances the queues from this location extend back to Bridge Street.

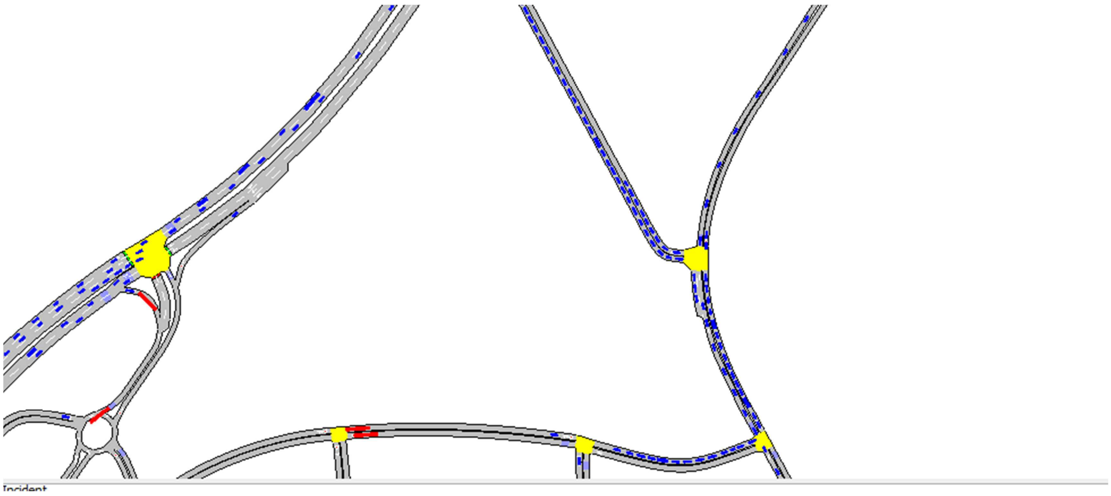


Figure 11 – 2021 Option Model, morning peak

Park Terrace Rail Crossing

In the both peak periods the impacts of the rail crossing results in significant delays / congestion along Park Terrace east of the rail crossing and on the Salisbury Highway / Park Terrace intersection. Typically the queues along Park Terrace extend beyond Wiltshire Street and in the worst cases the queues can extend back to Commercial Road. However it was noted that the queues did clear within a five to ten minute period.

The delays at the Salisbury Highway intersection did impact on movement eastbound on Park Terrace as vehicles were queued along Waterloo Corner Road and on the left and right turns into Park

Terrace. These queues took longer to dissipate as the signals catered for the primary north south movement along Salisbury Highway.

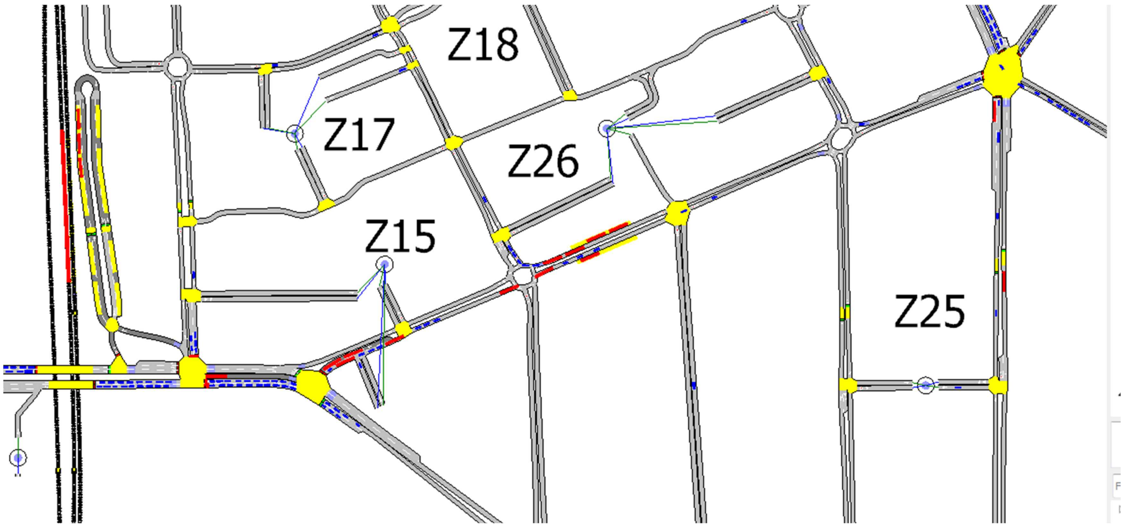


Figure 12 – 2021 Option 1, evening peak

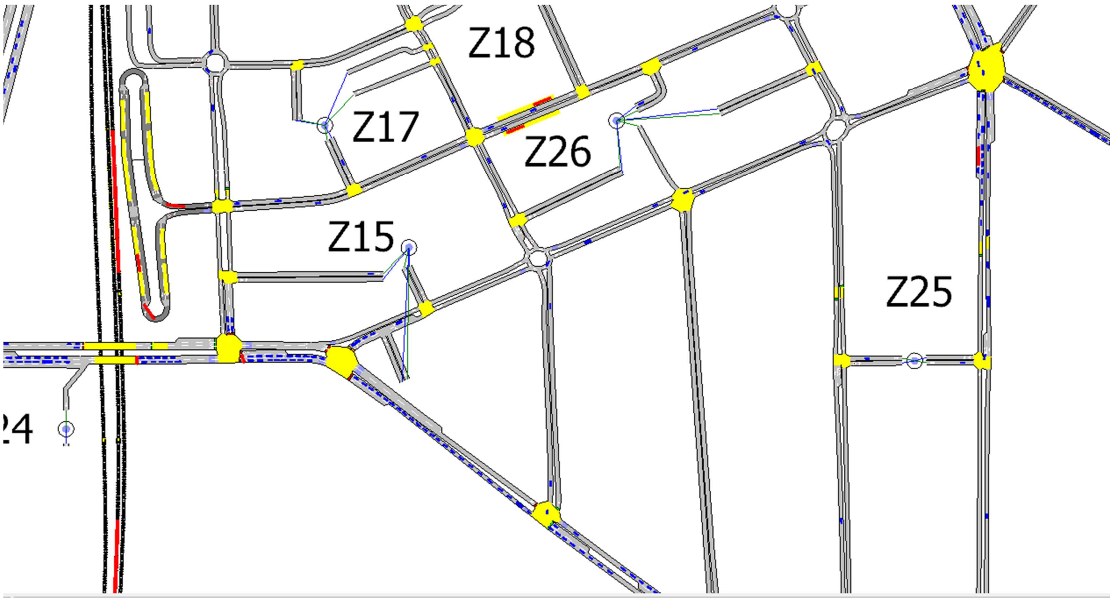


Figure 13 – 2021 Option 3 morning peak

5.4.2 Network Statistics

The overall network delay, travelled distance, number of vehicles, speed, unreleased vehicles (number of vehicles that cannot enter the network) and lost vehicles are compared between the three options.

The coefficient of variance values which indicate the relative stability of the models varies between in the AM and PM peaks, typically the value should be less than 5%. However for this assessment we have selected five replications that run smoothly in all three models as well as both peak periods.

Consequently this value has a greater range. As shown in **Table 4**, the overall network statistics are very similar between the three options in the AM peak period.

Table 4 – 2021 Network Statistics in Morning Peak (08:00-09:00)

Morning Peak	Mean Delay (sec/km)			Total Distance (km)			Total Number Vehicles (veh/h)		
	Option 1 AM	Option 2 AM	Option 3 AM	Option 1 AM	Option 2 AM	Option 3 AM	Option 1 AM	Option 2 AM	Option 3 AM
MEAN	168	164	160	4,498	4,482	4,523	8,922	8,946	8,985
STD DEV	10	11	16	43	18	47	87	65	127
MIN	156	152	142	4,429	4,454	4,442	8,860	8,848	8,852
MAX	180	179	179	4,546	4,496	4,561	9,068	9,020	9,148
RANGE	24	27	37	117	42	119	208	172	296
CoV	5.7%	6.5%	10.1%	1.0%	0.4%	1.0%	1.0%	0.7%	1.4%
	Mean Speed (km/h)			Unreleased Vehicles			Lost Vehicles		
	Option 1 AM	Option 2 AM	Option 3 AM	Option 1 AM	Option 2 AM	Option 3 AM	Option 1 AM	Option 2 AM	Option 3 AM
MEAN	28	29	28	128	129	107	24	18	16
STD DEV	0	0	1	32	39	13	2	2	5
MIN	28	28	27	94	91	93	22	14	12
MAX	29	29	29	158	193	127	27	20	22
RANGE	1	1	2	64	102	34	5	6	10
CoV	1.6%	1.2%	3.8%	N/A	N/A	N/A	N/A	N/A	N/A

Table 5 shows that the 2016 Option model has a slightly higher mean delay than the 2016 Do-Min model in the PM peak period.

Table 5 – 2021 Network Statistics in Evening Peak (17:00-18:00)

Evening Peak	Mean Delay (sec/km)			Total Distance (km)			Total Number Vehicles (veh/h)		
	Option 1 PM	Option 2 PM	Option 3 PM	Option 1 PM	Option 2 PM	Option 3 PM	Option 1 PM	Option 2 PM	Option 3 PM
MEAN	81	88	80	4,881	4,903	4,901	9,842	9,940	9,904
STD DEV	4	6	4	32	49	29	78	85	66
MIN	78	77	76	4,850	4,823	4,859	9,716	9,852	9,828
MAX	87	91	86	4,929	4,943	4,940	9,928	10,068	9,972
RANGE	10	14	10	79	120	80	212	216	144
CoV	4.6%	6.7%	4.5%	0.7%	1.0%	0.6%	0.8%	0.9%	0.7%
	Mean Speed (km/h)			Unreleased Vehicles			Lost Vehicles		
	Option 1 PM	Option 2 PM	Option 3 PM	Option 1 PM	Option 2 PM	Option 3 PM	Option 1 PM	Option 2 PM	Option 3 PM
MEAN	30	30	31	2	21	9	19	22	19
STD DEV	0	1	0	3	24	9	6	7	8
MIN	30	29	30	1	1	0	12	15	8
MAX	31	31	31	7	55	18	29	32	27
RANGE	1	1	1	6	54	18	17	17	19
CoV	1.5%	1.8%	1.0%	N/A	N/A	N/A	N/A	N/A	N/A

5.4.3 Traffic Volume comparisons

Traffic volumes on key roads within the modelled area have been compared and indicated in Tables 6 and 7 below for the AM and PM peak periods respectively. It should be noted that these volumes are average volumes recorded from 5 different replications of the model. Figure 16 shows the location of the traffic counts indicated in the tables.

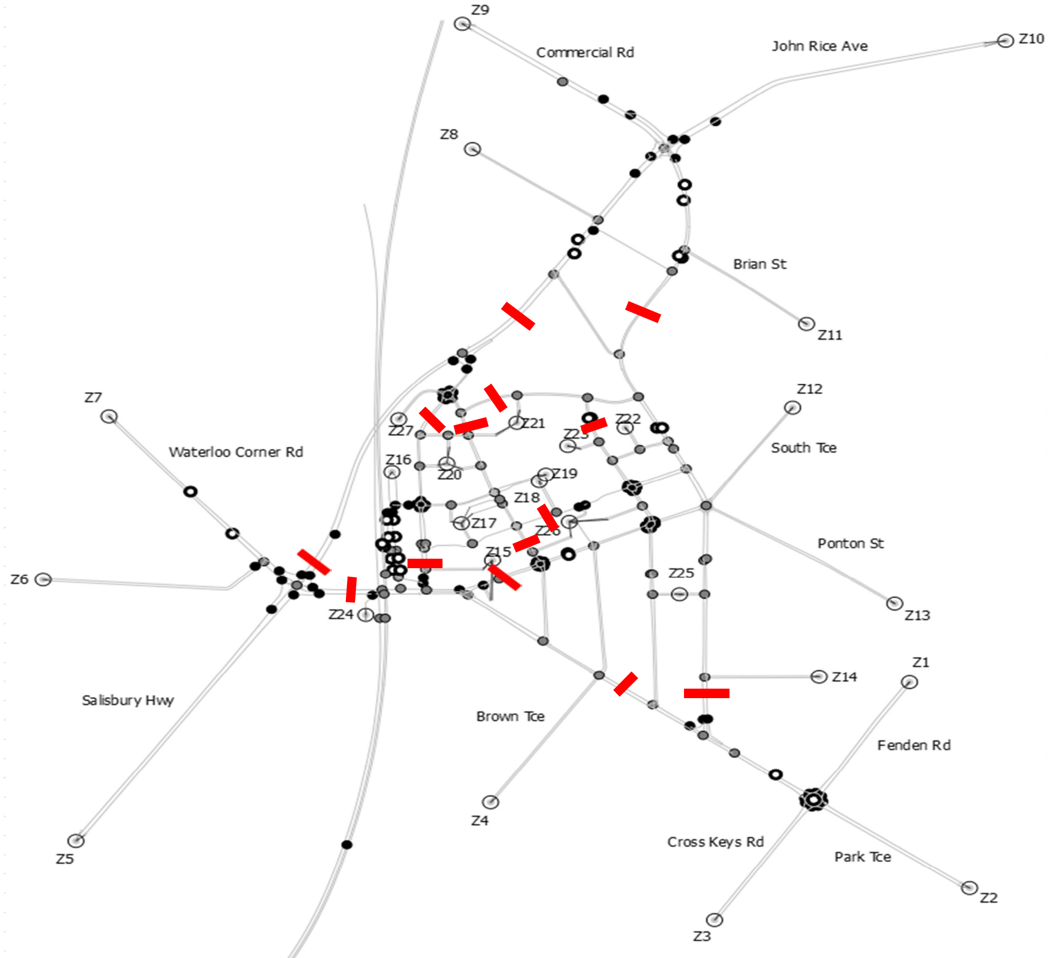


Figure 14 – Location of traffic count comparisons

Table 6 – Stream Statistics in Morning Peak (08:00-09:00)

Road	Flow Direction	AM Peak Hour Volume			
		Option 1	Option 2	Option 3	Existing (2011 vol)
Gawler Street south	Northbound	114	118	144	206
	Southbound	187	262	246	172
Gawler Street north	Northbound	78	69	83	110
	Southbound	142	113	119	307
Church Street south	Northbound	422	354	320	250
	Southbound	204	177	187	111
Church Street north	Northbound	212	233	251	0
	Southbound	549	531	479	0
Link Road	Eastbound	132	119	131	191 (1)
	Westbound	140	103	91	89 (1)
Ann Street	Northbound	132	98	134	NA
	Southbound	131	132	139	NA
John Street	Eastbound	66	50	127	94
	Westbound	0	187	222	0
Wiltshire Road	Eastbound	291	272	240	178
	Westbound	237	205	203	86
Commercial Road south	Northbound	666	664	566	610
	Southbound	317	320	303	168
Commercial Road north	Northbound	874	888	844	764
	Southbound	696	773	716	505
Park Terrace east	Eastbound	523	542	573	520
	Westbound	689	633	613	575
Park Terrace west	Eastbound	757	765	838	770
	Westbound	848	843	854	600
Salisbury Highway south	Northbound	1626	1633	1599	1489
	Southbound	1270	1260	1293	1049
Salisbury Highway north	Northbound	1425	1427	1410	1317
	Southbound	1498	1461	1455	1147

The main points of an analysis of the traffic data indicate the following:

- Traffic growth occurs on the external arterial road network.
- There is little variation in traffic volumes for the three options on the arterial road network during the peak periods for the peak periods
- In the AM peak period there is more variation in the traffic volumes between the options on the selected local roads than the PM peak.
- Traffic volumes reduce on Gawler Street but increase on Church Street. This highlights the new role of Church Street as the main focus access into the core area of the Town Centre.
- There is significant growth in traffic volumes on Wiltshire Street with or without buses using the road.
- A comparison of volumes on Wiltshire and John Streets indicates that if the road is used as a bus route traffic is displaced to other roads
- Traffic volumes on the Ring Road are lower than existing due to the difference recording location as existing traffic measured at the Gawler Street roundabout whereas model volumes are recorded midblock.

Table 7 – Stream Statistics in Evening Peak (17:00-18:00)

Road	Flow Direction	PM Peak Hour Volume			
		Option 1	Option 2	Option 3	Existing (2011 vol)
Gawler Street south	Northbound	145	156	189	209
	Southbound	171	209	147	137
Gawler Street north	Northbound	155	145	132	253
	Southbound	74	57	65	240
Church Street south	Northbound	231	237	207	185
	Southbound	329	329	415	277
Church Street north	Northbound	359	337	369	0
	Southbound	319	327	303	0
Link Road	Eastbound	208	159	172	298 (1)
	Westbound	110	98	88	329 (1)
Ann Street	Northbound	159	141	135	NA
	Southbound	95	113	136	NA
John Street	Eastbound	91	114	210	149
	Westbound	0	92	93	0
Wiltshire Road	Eastbound	385	384	328	181
	Westbound	358	321	345	183
Commercial Road south	Northbound	216	223	192	429
	Southbound	602	598	573	344
Commercial Road north	Northbound	619	620	595	551
	Southbound	890	926	883	614
Park Terrace east	Eastbound	682	687	704	497
	Westbound	557	549	554	580
Park Terrace west	Eastbound	973	975	1007	788
	Westbound	854	859	867	860
Salisbury Highway south	Northbound	1640	1618	1616	1460
	Southbound	1685	1678	1691	1445
Salisbury Highway north	Northbound	1632	1611	1620	1500
	Southbound	1635	1595	1616	1541

5.4.4 Bus Operation

The new routes were assessed on the number of buses and the travel time improvements expected for either the Wiltshire or John Street option.

In terms of bus numbers along the two streets the modelling indicates that during the peak hour, typically there are between 110 and 120 buses travelling in both directions. This is expected to reduce to about 60 buses in the off-peak periods during the day and even less at night. The following figures show the distribution of buses in the eastbound direction for the AM peak in Option 1 (Wiltshire Street) and the PM peak in Option 3 (John Street). Appendix E provides the remaining graphs for comparison purposes.

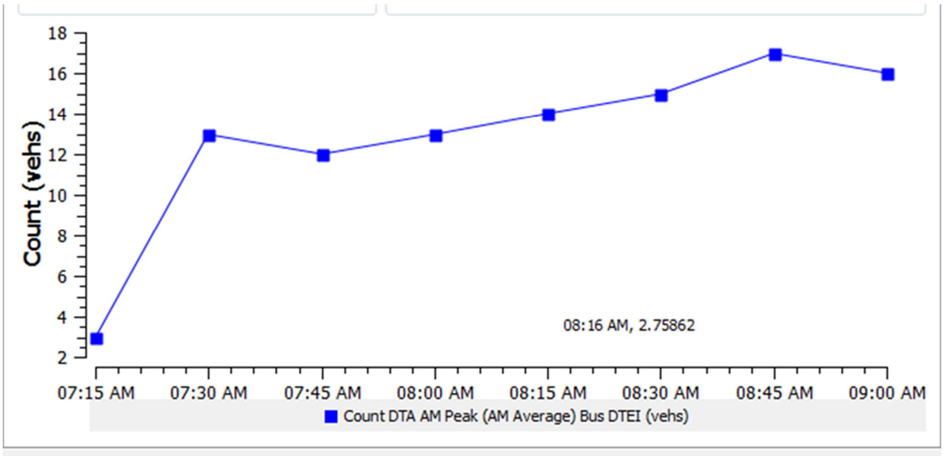


Figure 15 – Bus Volume Option 1 Wiltshire Street Morning Peak (eastbound)

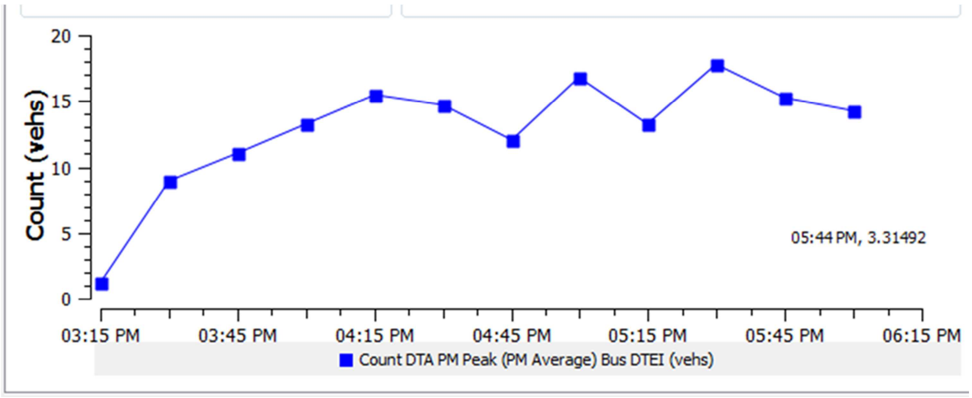


Figure 16 – Bus Volume Option 3 John Street Evening Peak (eastbound)

A travel distance (TD) analysis was adopted for the assessment of bus operation between the three options. The TD plots are provided for one route (No 205) with Appendix E showing two other routes.

As shown in **Figure 17 and 18** there is significant travel time benefits with Option 3 compared to the routes using Wiltshire Street. The difference of between two to three minutes is due to the delays associated with traffic using Park Terrace and in particular the interaction with rail crossing. The same differences are evident in the PM peaks and for other bus routes within the Town Centre.

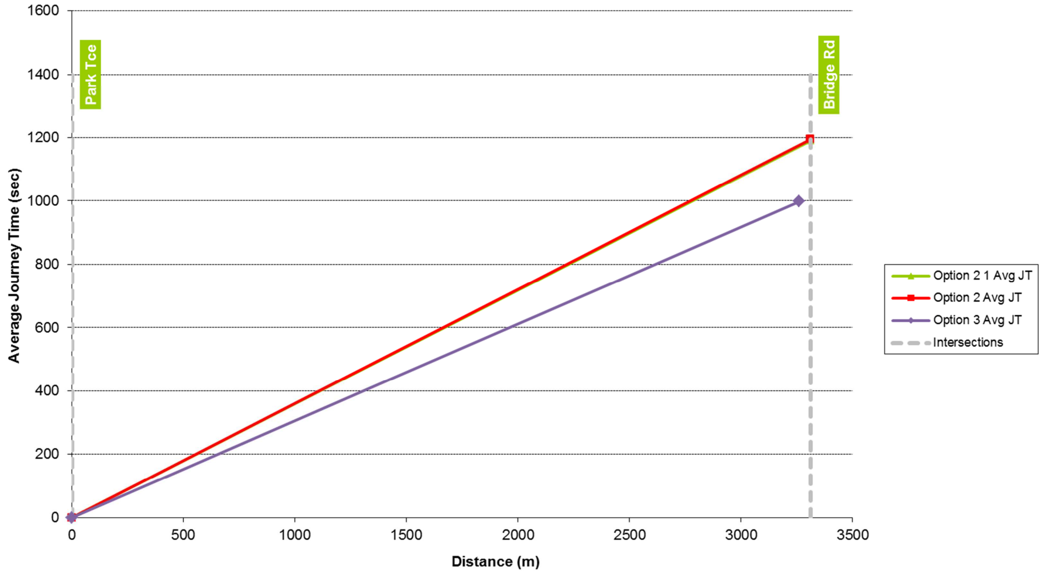


Figure 17 – Bus TD Plot for Route 205 northbound Morning Peak (08:00-09:00)

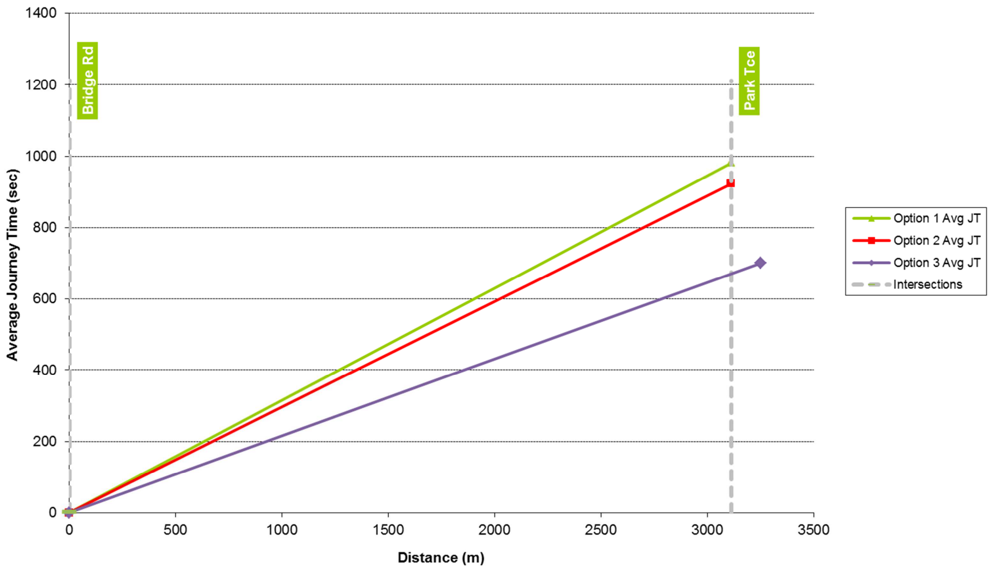


Figure 18 – Bus TD Plot for Route 205 southbound Morning Peak (08:00-09:00)

5.4.5 Summary

The key outcomes of the modelling are indicated below:

- There is congestion along Park Terrace as a result of the rail crossing. However it typically clears within 5 to 10 minutes. The longer periods result when passenger trains stop at the interchange. The major intersections with the Salisbury Highway at Park Terrace and Commercial Road show high levels of congestion during peak periods, primarily due to high turn volumes.

- In addition there are short periods of high congestion at the Commercial Road / Ponton Street intersection and the Park Terrace / Fendon Road roundabout in both peak periods.
- The proposed road improvements within the Town Centre such as the Church Street extension, Ring Road and Ann Street improve traffic flow through the Town Centre.
- There are times during the modelling period when there are significant levels of congestion at the Gawler Street / Church Street / Ring Road roundabout. Although this is also attributed to queues extending back from the Gawler Street / Salisbury Highway junction
- For each scenario there are between 110 and 120 buses travelling in both directions in the peak hour that use either Wiltshire or John Streets. It is acknowledged that outside of the peak hour the number of buses would reduce by approximately half. However this still equates to one bus every minute passing any one point.
- Overall traffic operation within the Town Centre is better with Scenario 3 (John Street bus operation). This is primarily due to reduced congestion along Wiltshire Street and interaction with Park Terrace rail crossing and less delay associated with the interchange operation.
- The provision of two-way traffic along the full length of John Street only improves traffic flow marginally within the Town Centre
- The modelling highlighted the need to investigate the form of a number of junctions within the model to improve overall operation. These include
    - The Church Street / Gawler Street roundabout – this junction should be relocated south and include the Ring Road leg. This is expected to have two advantages with reduced delay for buses using the Ring Road and additional queuing space to Salisbury Highway.
    - The Commercial Road / Ring Road junction – the initial modelling did not provide a storage lane for right turn traffic into the Ring Road from Commercial Road. The modelling showed that this resulted in long queues (up to 8 vehicles) forming along Commercial Road and restricting through movement along this road.

6. Transport Infrastructure Plan

This section details the preferred transport infrastructure provision to support the proposed Structure Plan. Included in this section is a very preliminary estimation of construction costs as well as an indication of the timing of works.

6.1 Road Network

The following sections detail the road improvements suggested to support the proposed Structure Plan. Preliminary impact assessment and cost estimates have been prepared for each item. A 25% contingency has been allowed for in the estimates but design or project management fees are not included. The estimates costs do not include pavement upgrading to cater for the new bus routes and landscaping / urban design treatments beyond the kerb line.

6.1.1 DPTI Roads

Commercial Road

Painted median – this involves the provision of a painted median from Park Terrace through to the junction with Ring Road to allow for safe storage for right turning traffic. It also allows for the provision of a peak period cycle lanes and protected pedestrian refuges. It is proposed to retain the current lane arrangements at Ponton Street intersection.

A proposed cross section would be to provide a 3.3m wide lane and 1.35m bike lane in each direction with a 2.9m wide painted median. It is intended that this cross section continue to just north of Little Para River. However the existing lane arrangements at the intersection with Ponton Street should remain.

Key impact is the loss of on-street parking during the peak periods but this is considered a minor issue. The estimated cost for this work is $250,000.

Modify and widen Little Para River bridge - this involves the widening of the Little Para River Bridge to allow for the provision of a right turn storage lane and on-road cycle lanes. The current width is 9.2m (6.9m wide roadway) and includes a pedestrian path on the western side. The proposed width is 14.6m. Key impact is on the Little Para River reserve and possibly services that may be located within the road reserve. The estimated cost for this work is $500,000.

Park Terrace

New Signalised intersection with Church Street – this involves the construction of a new set of traffic signals at the Park Terrace / Church Street junction to encourage traffic to enter the core of the Town Centre. Line marking changes will be required to provide the right turn lane into Church Street. It is not intended to provide the right run out as this movement can be undertaken at Wiltshire Street. No major impacts are expected. The estimated cost for this work is $500,000.

Gawler Street / Wiltshire Street Bus lane – this bus lane extends along Park Terrace from Gawler Street to Wiltshire Street and then along Wiltshire Street. It involves removing the solid median along Park Terrace and reducing the number of right turn lanes on Wiltshire Street as well banning the right turn into Gawler Street from Park Terrace for general traffic. Key impacts are expected to be change in travel patterns for banning the right turn, but alternative entry is available via Church Street, and increased congestion on Wiltshire Street.

A proposed scheme has been developed (refer Appendix F) which shows the changes to the junctions. The estimated cost for this work including the junction treatment is $450,000.

6.1.2 City of Salisbury Roads

Provide Ring Road – this involves the upgrading of the existing road to cater for buses and to improve the horizontal alignment, particularly near the western end, as well as providing an extension to Commercial Road through the eastern Parabanks car park. The existing width varies but is typically greater than 7.5m wide. A proposed cross section would be to provide a 3.2m wide lane and 1.2 bike lane in each direction with 2.2m wide parking lanes if required.

Depending on future development of the shopping centre there could future provision to widen to provide a larger footpath to activate the frontage of the building. Key impacts are loss of car parking and possible removal of vegetation to improve the alignment or widen the roadway. The estimated cost for this work is $350,000 and does not include any land acquisition costs.

Church Street Extension – this involves the extension of Church Street northwards to provide a new intersection with Gawler Street and the Ring Road. It is proposed that the existing road would also be upgraded to provide an improved urban design outcome. The road would be configured as a two lane road with 3.0m wide lanes, 1.2 bike lanes and 2.2m wide parking lanes.

Minor impacts include a loss of car parking and possible removal of vegetation to provide the new road. The estimated cost for this work is separated into 3 components; extend new road at $1,500,000 excluding land acquisition costs, new junction with Gawler Street at $300,000 and upgrade existing at $150,000.

Ann Street Extension – this involves the extension of Ann Street northwards from John Street to the new Ring Road. An existing road already exists but would need to be upgraded to cater for increased traffic loading as a bus route. It is proposed that the existing road would also be upgraded to provide an improved urban design outcome. The road would be configured as a two lane road with a proposed cross section comprising 3.2m wide lanes, 2.6m wide bus stops, and where possible 2.2m wide parking lane.

Key impact is a loss of car parking in the eastern Parabanks car park. The estimated cost for this work is $100,000.

John Street –

John Street Two-way – this involves converting the existing one-way operation to two-way with parallel parking. Widening and kerb alignment changes would be required. The proposed cross section would comprise 3.0m wide traffic lanes and 2.2m wide parking lanes in each direction.

The main impact is expected to be related to loss of trade to abutting properties during construction. The estimated cost for this work is $2,500,000. As indicated previously the changes to the streetscape design is not included in the costs.

6.2 Public Transport

6.2.1 Option Assessment

In the development of the Structure Plan various options were considered to improve public transport services with the town centre. These included upgrading the interchange, provision of improved pedestrian connections across the rail lines, changes in routes to concentrate services to particular roads and provision of "super" stops.

Discussions were held with the Public Transport Services Division (PTSD) of DPTI regarding these options with their preferred option to concentrate all services along John Street. An alternative of using Wiltshire Street was considered a viable alternative by PTSD. Consideration was given to providing a couplet arrangement of bus travelling away from the interchange on John Street and to the interchange on Wiltshire. However given that objective of improving the simplicity of bus movement this was not considered viable.

The Aimsun modelling has shown that by concentrating services to one route, either John Street or Wiltshire Street, the number of buses services along this route in 2021 varied between 100 and 120 buses per hour in both directions. It is expected that the bus volumes would reduce to 60 to 65 per hour between the peak periods and 40 per hour at night.

A review of other locations within the Adelaide indicates the following:

- Hutt Street (south of Wakefield Street) – 30 buses per hour in peak periods
- Pulteney Street (south of Wakefield Street) – 45 buses per hour in peak periods
- King William Street (south of Gouger Street) – 26 buses per hour in peak periods
- O'Connell Street (north of Ward Street) – 105 buses per hour in peak periods
- No buses currently travel along Rundle Street or Gouger Street.

It is intended that John Street and to a lesser extent Church Street be considered main streets in a road hierarchy for the town centre. Key components of this are activation of the street areas to improve safety and provision of café /outdoor dining and possible retail areas with residential development. Whereas Wiltshire Street is expected to be more of major collector road, and hence will provide access to the office / educational (TAFE) precinct. Consequently the level of traffic associated with the bus use is not expected to impact on the function of the abutting land uses.

It should be noted that for O'Connell Street whilst there is an equivalent number of buses using the road compared to John Street, the overall traffic volume is also quite high. Hence the difference in ambient noise between the two locations would expect to be significant with John Street having less than 4,000 vehicles per day compared to the 25,000 vpd on O'Connell Street.

6.2.2 Preferred Operation

The Structure Plan provides for flexibility in the provision of public transport within the Town Centre with a number of routes available for use with the preferred routes indicated below:

- Wiltshire Street as predominant route through the Town Centre
- Gawler Street / Ring Road / Ann Street for services accessing the Town Centre from Salisbury Highway
- Commercial Road for services from the east on Park Terrace.

In terms of bus stops it is proposed key stops are proposed along Wiltshire Street between Church and Mary Streets, Ann Street between John Street and the Ring Road and along Commercial Road.

The major impacts are that the number of buses increases significantly on Wiltshire Street, which could have an impact on pavement life, if the pavement strength is insufficient. This is also expected to be an issue for the Ring Road and Ann Street.

The proposed operation of the interchange is subject to further investigations by DPTI to improve safety and connectivity to the Town Centre and west across the rail lines. Aimsun modelling has shown that the existing interchange arrangement can cater for the proposed bus services using Park Terrace / Wiltshire Street. In particular the bus lane entry operates satisfactorily with some minor queuing during peak periods. For the exit from the interchange there is some congestion when Park Terrace traffic flows but this quickly dissipates when the Park Terrace is closed due to the rail crossing.

However, the preference in the long term would be to modify the entrance to the interchange from Park Terrace so that it operates similarly to the Mawson Interchange where passengers board / exit on the platform side. This would require a new right turn lane entrance to the interchange just east of the rail crossing and restricting access to Gawler Street to left in /out only.

6.3 Implementation Plan

The timing for the infrastructure detailed above will be dependent on the future development patterns within the Town Centre, including private land owners.

The following works would be considered to match the three tiers of development identified in section 3.3 of this report.

Tier 1 (1 to 3 years)

- Commercial Road median
- Pedestrian connection improvements
- Church Street / Park Terrace intersection – improve to provide access to core of Town Centre

Tier 2 (4 to 7 years)

- Provide Church Street extension to Gawler Street
- Provide and upgrade Ring Road to Commercial Road
- Upgrade and extend Ann Street
- Church Street / Park Terrace intersection – signalise
- Modify bus routes after completion of Ring Road and Ann Street works

Tier 3 (after 7 years)

- Wiltshire Street and Park terrace bus lane
- Modify John Street to two-way flow
- Streetscape improvements to Church and Gawler Streets

7. Summary

The City of Salisbury is developing a Structure Plan and Implementation Strategy that will result in the Revitalisation of the Salisbury Town Centre. The transport planning and traffic modelling inputs to the Structure Plan provide a level of confidence that an integrated solution is tailored to meet the objectives of the Revitalisation.

Existing Conditions

The existing traffic operation and conditions in the Town Centre are primarily influenced by the rail crossing on Park Terrace. This is particularly so during the peak periods where queues can extend beyond Wiltshire Street and block access to key streets. There are times where peak movements from schools in the area can result in increased traffic congestion. The use of Ponton Street as a bypass route for traffic to Edinburgh Parks results in significant congestion at its intersection with Commercial Road.

Parking demand within the Town Centre is concentrated around the southern end of the Town Centre whereas (spare) supply is concentrated towards the northern end of Gawler Street within the Parabanks Shopping Centre. It is also noted that a large proportion of long term parking is still concentrated round John Street (particularly within the Parabanks car parks) even though some timed parking has been implemented at the Sexton and Judd Street car parks.

Public transport accessibility is good although there is confusion with the location of stops outside of the Interchange.

Pedestrian linkages across the town centre are inconsistent, particularly across the rail line to the west of the Town Centre. There is a need to improve pathways to key destinations within the Town Centre and linkages to outside destinations. The cycle network within the Town Centre is considered poor with only a short section of Gawler Street providing bike lanes for on road cyclists. Other connections are considered satisfactory.

Structure Plan Inputs

Integrated transport planning and infrastructure investment will be required to support the Structure Plan. The key objectives for the development of the Structure Plan include;

- Improving and simplifying public transport access within the Town Centre;
- Improving access to all areas within the Town Centre for vehicular traffic
- Improving pedestrian and cycle links within and external to the Town Centre
- Identifying a parking strategy to support the proposed development

Options were considered for improving public transport access to the Town Centre including provision of loop services and modifying the operation of the interchange. DPTI's Public Transport Services Division provided input into the preferred treatments for bus movement and connectivity to the Town Centre.

Road infrastructure improvements considered key opportunities for:

- Removing through traffic from the Town Centre
- Providing Main / High Streets through the core of the Town Centre
- Ring Roads to provide alternative routes to areas within the Town Centre

The figure below shows the how transport infrastructure is provided with the proposed structure plan.

Parking Strategy

The parking strategy for the Town Centre should aim to utilise car parking as a tool to activate the distinctive precincts of Salisbury Town Centre whilst providing a safe, connected, economically viable, and an integrated car parking outcome. The Salisbury Town Centre will need to be an attractive and convenient place to live and shop when compared to other district centres; this need for convenience requires a parking strategy that accommodates the parking demand to within reasonable levels.

Key principles in formulating the car parking strategy are as follows:

Long Term car parking

Where practical provide separate facilities for long term parking on the periphery of the Town Centre. This will free up spaces in the core area for short term parking associated with retail and other uses. Possible locations include the hotel car park just west of the rail station, the DPTI car park west of the rail line south of Park Terrace and the current under-utilised spaces in Parabanks northern car park (Short term only). A key requirement for all of these sites is to ensure that pedestrian movement to the core area is safe and convenient.

On-street parking

Encourage short term high turnover parking along John Street and Church Street including its extension to Gawler Street. This should be undertaken using parking meters with pay and display tickets with maximum stay of 30 minutes but provide free or smaller fee for all-day parking in a more remote location. This will deter employees parking all day or shuffling between short term parking areas.

Development Parking

The Structure Plan indicates various locations for mixed use development. These typically occur where there is existing at-grade parking. For these sites the following should be considered:

- Separate out residential parking (but not visitor) from other uses with retail parking provided in basements and/or rooftop depending on development.
- Use of parking rates comprising a value range to allow for future flexibility in development strategies and determination.
- Contribution to a car parking fund where a particular development provides a net loss in overall number of car parks including existing spaces.

Saints Road Assessment

DPTI's MASTEM strategic model has been used to identify the traffic demands for the proposed Saints Road Extension. The review was undertaken based on existing (2011) and a future year (2031). The original model had to be revised to better distribute traffic to the Salisbury Town Centre.

Traffic volumes on the proposed Saints Road Extension are expected to be in the order of 7,000 to 7,500 vehicles per day in 2011 and increasing to 8,500 vehicles per day in 2031. Peak traffic volume (one-way) on the Saints Road Extension is expected to increase from 604 vehicles per hour in 2011 to 715 vehicles per hour in 2031.

The modelling indicates that the proposed Saints Road Extension caters for traffic travelling to the Salisbury Town Centre (40%) and Edinburgh Parks / Elizabeth South (60%) from Salisbury East / Golden Grove. The traffic on the proposed extension would be primarily traffic diverted from Ponton Street and Park Terrace, and to a lesser extent from John Rice Avenue. The review of traffic patterns indicates that the provision of the Saints Road Extension does not increase traffic flow into the Town Centre.

The strategic modelling has highlighted that Saints Road Extension does not increase traffic volumes into the Town Centre but provides more of bypass for movement to Edinburgh Parks and Elizabeth South.

Aimsun Modelling

The Aimsun modelling of the Structure Plan was undertaken to determine impacts of the proposed development and test alternatives for future bus provision and included development of:

- An Existing model – used for calibration and a basis for future models
- Future models (based on the year 2021) – that included testing of three scenarios)

The Structure Plan has identified a range of transport improvements to support the revitalisation of the Salisbury Town Centre. These have been modelled to identify a preferred route for buses and treatments for junction and intersections on the proposed road network.

All the models provide for the future residential, retail and commercial development targets indicated for all three tiers indicated in the Structure Plan as well as the increase in train / bus frequencies. The base year for the future model is 2021 and the increase in traffic generated by the future developments was estimated using the RTA Guidelines for traffic generation and distributed in the same manner as DPTI's MASTEM strategic model.

Key transport infrastructure improvements recommended in the Structure Plan to support the revitalisation are included in the scenarios. DPTI and Council agreed to the road improvements to be modelled in the three scenarios. However the specific recommendation that in the long term John Street reverts to two-way operation was modelled as a separate option. On this basis the three future scenarios modelled are:

- Scenario 1 – John Street one way with bus travel focussed on Wiltshire Street
- Scenario 2 – John Street two way with bus travel focussed on Wiltshire Street
- Scenario 3 – John Street two way with bus travel focussed on John Street

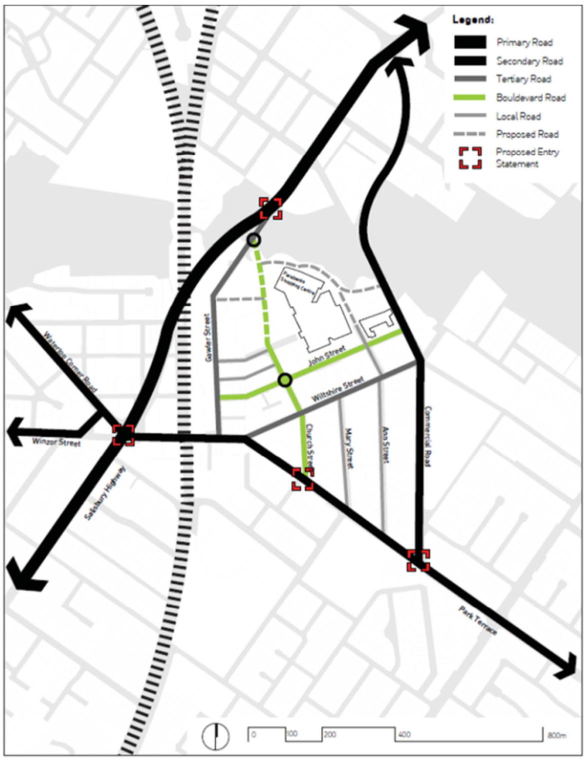
The key outcomes of the modelling are indicated below:

- There is congestion along Park Terrace as a result of the rail crossing. However it typically clears within 5 to 10 minutes. The longer periods result from when passenger trains stop at the interchange. The major intersections with Salisbury Highway at Park Terrace and Commercial Road show high level of congestion during peak periods, primarily due to high turn volumes.
- In addition there are short periods of high congestion at the Commercial Road / Ponton Street intersection and the Park Terrace / Fendon Road roundabout in both peak periods.
- The proposed road improvements within the Town Centre such as the Church Street extension, Ring Road and Ann Street are expected to improve traffic flow through the Town Centre.
- There are times during the modelling period when there are significant levels of congestion at the Gawler Street / Church Street / Ring Road roundabout. Although this is also attributed to queues extending back from the Gawler Street / Salisbury Highway junction
- For each scenario there are between 110 and 120 buses travelling in both directions in the peak hour that use either Wiltshire Street or John Street. It is acknowledged that outside of the peak hour the number of buses would reduce by approximately half.
- Overall traffic operation within the Town Centre is better with Scenario 3 (John Street bus operation). This is primarily due to reduced congestion along Wiltshire Street and interaction with Park Terrace rail crossing and less delay associated with interchange operation.
- The provision of two-way traffic along the full length of John Street only marginally improves traffic flow within the Town Centre
- The modelling highlighted the need to investigate the form of a number of junctions within the model to improve overall operation. These include
  - The Church Street / Gawler Street roundabout – this junction should be relocated south and include the Ring Road leg. This is expected to have two advantages with reduced delay for buses using the Ring Road and additional queuing space to Salisbury Highway.
  - The Commercial Road / Ring Road junction – the initial modelling did not provide a storage lane for right turn traffic into the Ring Road from Commercial Road. The modelling showed that this resulted in long queues (up to 8 vehicles) forming along Commercial Road and restricting through movement along this road.

The Aimsun modelling has highlighted that a two way John Street provides improved traffic operation as it allows for better distribution traffic. From a road operation perspective the preferred bus strategy is to provide for buses along John Street. However the modelling indicates that if current services remain that there could be between 100 and 120 buses (two-way) travelling along the road in the peak hour. This would reduce to about 60 buses (two-way) outside of the peak periods.

Recommendations

The preferred road improvements are indicated in the figure below and would support the proposed Structure Plan.



DPTI Roads

- Commercial Road – modify to provide single lane in each direction with a painted median and widen the bridge over the Little Para River
- Park Terrace – Provide new traffic signals at junction with Church Street and modify junction with Gawler Street to restrict right turn to bus only movements. Consider modifying the junction with Commercial Road to prioritise movement to Commercial Road.

City of Salisbury Roads

- Provide a Ring Road between Gawler Street and Commercial Road, which will act as a bus route from the west.
- Ultimately convert John Street to two way operation
- Extend Church Street to Gawler Street and provide new intersection with the Ring Road and Gawler Street.
- Extend Ann Street to the Ring Road, which will cater for buses from the Ring Road.

Public Transport

- Use of Wiltshire Street as predominant bus route based on amenity principles
- Locate a super stop between Church and Mary Streets.
- Extra stops located on Commercial Road and Ann Street to facilitate access to Parabanks Shopping Centre

Appendix A

Structure Plan Development Profiles

Appendix B

Saints Road Extension Traffic Volumes

Appendix C

Saints Road Select Link Plots

Appendix D

Existing Aimsun Calibration Report

Appendix E

Bus Operation Comparison Graphs

Appendix F

Park Terrace / Wiltshire Street Junction Scheme

Salisbury Town Centre
Strategic Development Sites

	Assumptions	All caluclations assume a 15% plant and utility space		All retail/ commercial floor space calculated at 85% of total floor space per level, except for ground floor which assumes 60% of the floor level			All residential development calculated at 85% of useable floor plate, which is then divided by 75 sqm (average two bedroom apartment size	All car parking calculated at 85% of useable floor plate, which is then divided by 35 sqm (typical car parking space calculation including manoeuvring area)	All car parking calculated at 85% of useable floor plate, which is then divided by 25 sqm (typical car parking space calculation including manoeuvring area)	**Existing Parking Loss**				
	Tier 1 Sites - Considered to be sites that require no significant intervention from Council - rather they are controlled by a single entity and require innovative procurement strategy/ market thirst to facilitate	**Approx Site Area (sqm)**	**Likely Development**	**Commerical/ retail (sqm) @ 85%**			**Residential @ 75 sqm/ unit**	**Car Parking Spaces @ 35sqm/ space**	**Car Parking Spaces @ 25sqm/ space**					
					Commercial	**Retail**					**Capacity**			**Comment**
1	Sexton Street Car Park	6900	6 Level mixed use - 2 x retail/commercial, 1 x car park, 3 x residential	10005	50%	50%	234	167	235	CP1 Sexton CP	122	100%	122	QED 2003: 122 spaces, STC CP Review L Gray 2011: 158 spaces
2	Council at-grade Car Park	2397	4 level offic/civic	7550.5	100%	0%				CP10 Para Banks (East)	70	100%	70	QED 2003: 192 spaces, STC CP Review L Gray 2011: not given
3	Spaceland Site	7318	7 level mixed use - 1 x retail, 2 x office, 2 x car park, 2 x residential	16831	65%	35%	165	355	497	CP4 Space Land CP	98	100%	98	QED 2003: 98 spaces, STC CP Review L Gray 2011: 79 spaces
4	Judd Street Car Park	4291	4 level car park					416	582	CP2 Judd Street	141	100%	141	QED 2003: 141 spaces, STC CP Review L Gray 2011: 80 spaces
5	Anglicare	11619	6 level mixed use (at grade parking (1500 sqm) - 3 x retail/commercial, 3 x residential (only part of site (3000 sqm) being developed)	6900	50%	50%	34	42	59	Anglicare car park	43	100%	43	QED 2003: 43 spaces, STC CP Review L Gray 2011: none given
Tier 1 Total				**41286.5**			**433**	**980**	**1373**		**474**		**474**	

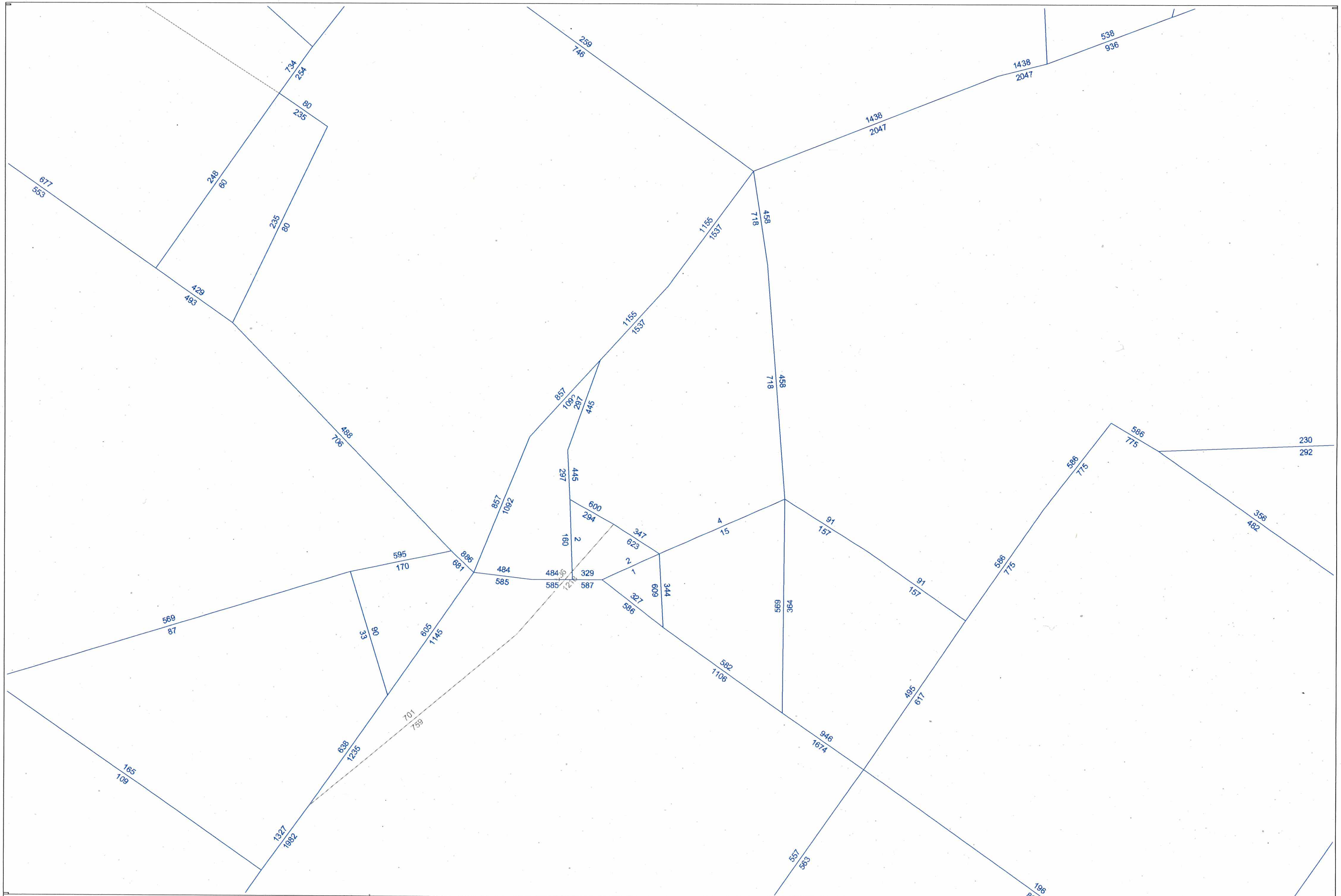
	Tier 2 Sites - Considered to be sites that can be availed for development within a 3-10 year period, however require interbention from local/State Government	**Approx Site Area (sqm)**	**Likely Development**	**Commerical/ retail (sqm) @ 85%**			**Residential @ 75 sqm/ unit**	**Car Parking Spaces @ 35sqm/ space**	**Car Parking Spaces @ 25sqm/ space**		**Capacity**			
6	New Retail Pad Site - Parabanks	7375	single level retail	4425	0%	100%				CP10 Para Banks (East)	192	90%	173	QED 2003: 192 spaces, STC CP
7	Existing Council Office site	3990	7 level vertical aged care - ground level retail, 1 x car park, 5 x residential	2394	0%	100%	226	97	136	CP12 Council offices CP	10	100%	10	QED 2003: none given, STC CP Review L Gray 2011: 100
8	Church Street Gateway Site (Opposite Anglicare)	1711	4 level mixed use - retail ground level, 1 x car park, 2 x residential	1026	0%	100%	38	41	58	Unknown	9	100%	9	QED 2003: none given, STC CP Review L Gray
9	Existing Council Library Site	3000	7 level mixed use - 1 x retail, 2 x office, 2 x car park, 2 x residential	6900	65%	35%	68	72	102	None		0%	0	
10	Proposed Deck Car Park site behind existing council office site	6164	5 level car park		0%	0%		748	1047	CP12 Council offices CP	100	90%	90	QED 2003: none given, STC CP Review L Gray
										CP11 Para Banks (NE)	0	20%	0	QED 2003: 450 estimated, STC CP Review L Gray 2011: none given
11	North Western gateway site on Parabanks at-grade car park site	5998	6 level mixed use - 1 x retail, 2 x car park, 3 x residential	3598.8	0%	100%	203	291	407	CP11 Para Banks (NE)	300	10%	30	
12	North Eastern gateway site on Parabanks at-grade car park site	3497	6 level mixed use - 1 x retail, 2 x car park, 3 x residential	2098.2	0%	100%	118	169	237	CP11 Para Banks (NE)	120	20%	24	
13	Newly created site on Commercial road (on Parabanks at-grade car park)	7234	6 level mixed use - 1 x retail, 2 x car park, 3 x residential	4340.4	0%	100%	245	351	491	CP8 Para Banks (E)	400	80%	320	QED 2003: 400 estimated, STC CP Review L Gray
14	Existing at-grade car park adjacent to the Stockade Tavern	2123	6 level mixed use - 5 x service apartments, 1 x car park		0%	0%	120	51	72	CP16 Stockade (S)	69	100%	69	QED 2003: none given, STC CP Review L Gray 2011: 69
15	DPTI Park 'n' Ride Site on south western corner of Park Tce rail intersection	11477	6 level mixed use - 4 x residential, 2 x car park		0%	0%	520	557	780	CP19 Park'n'Ride	420	5%	21	QED 2003: none given, STC CP Review L Gray
16	Uniting Church Cemetery Site	15279	Single level lifestyle village (@200 sqm w/ 1 car park)		0%	0%	76	76	106	None		0%	0	QED 2003: none given, STC CP Review L Gray 2011: none given
Tier 2 Total				**24782.4**			**1614**	**2453**	**3436**		**1620**		**745.8**	

	Tier 3 - Considered to be sites that are held tightly, or difficult to establish a quantum of site area. These sites are unlikely to occur in the short term but are desirous to underpin the long term viability of the Town Centre	Approx Site Area (sqm)	Likely Development	Commerical/ retail (sqm) @ 85%			Residential @ 75 sqm/ unit	Car Parking Spaces @ 35sqm/ space	Car Parking Spaces @ 25sqm/ space					
17	John Street Parabanks Frontage	4732	Single level retail with 1 x basement parking	2839.2	0%	100%		53	74	CP7 Para Banks (S)	133	100%	133	QED 2003: 133, STC CP Review L Gray 2011: 134
18	Cash Convertors' & 'CBA' Site on John St	6149	three level mixed use, with 50% ground floor retail and two levels of residential abve (car parking at-grade on balance of ground level	1844.7	0%	100%	139	87	122	CP5 Cash Converters	60	100%	60	QED 2003: 60, STC CP Review L Gray 2011: 60
19	Balawedjr Site at gateway to John St	3000	5 level mixed use - 1x retail, 1 x car park, 3 x residential	1800	0%	100%	102	72	102	None			0	
20	Consolidated site at northern gateway to John St (opposite site 19 above)	3000	5 level mixed use - 1x retail, 1 x car park, 3 x residential	1800	0%	100%	102	72	102	None			0	
21	Site directly west of Civic Square	2000	6 level mixed use - 1x retail, 2 x car park, 3 x office	6300	0%	100%		97	136	None			0	
22	Disparate SA Govt Tenancy Sites on southern side of John St	5561	three level mixed use, with 50% ground floor retail and two levels of residential abve (car parking at-grade on balance of ground level	1668.3	0%	100%	126	79	111	CP6 Bank SA	59	100%	59	QED 2003: 59, STC CP Review L Gray 2011: 28
23	Consolidated gateway site at eastern side of John St	7944	6 level mixed use - 1 x retail, 2 x car park, 3 x residential	4766.4	0%	100%	270	385	539	Salisbury Tavern Area CP	74	100%	74	QED 2003: none given, STC CP Review L Gray 2011: none given
24	Council Owned site adjacent to rail corridor on Southern side of Park Tce intersection	6896	3 level residential with at-grade parking (200 sqm per dwelling + car park)	34	0%	100%		34	48	CP	95	50%	48	QED 2003: none given, STC CP Review L Gray 2011: none given
Tier 3 Total		39282		21052.6			739	879	1234		421		374	
Combined Total				87121.5			2786	4312	6043					

Number of employment outcomes @ 10/100 sqm	Number of Residents @ 2 per household
8712.15	5572

	One-way	two-way	
John Street on-street parking	71	59	12

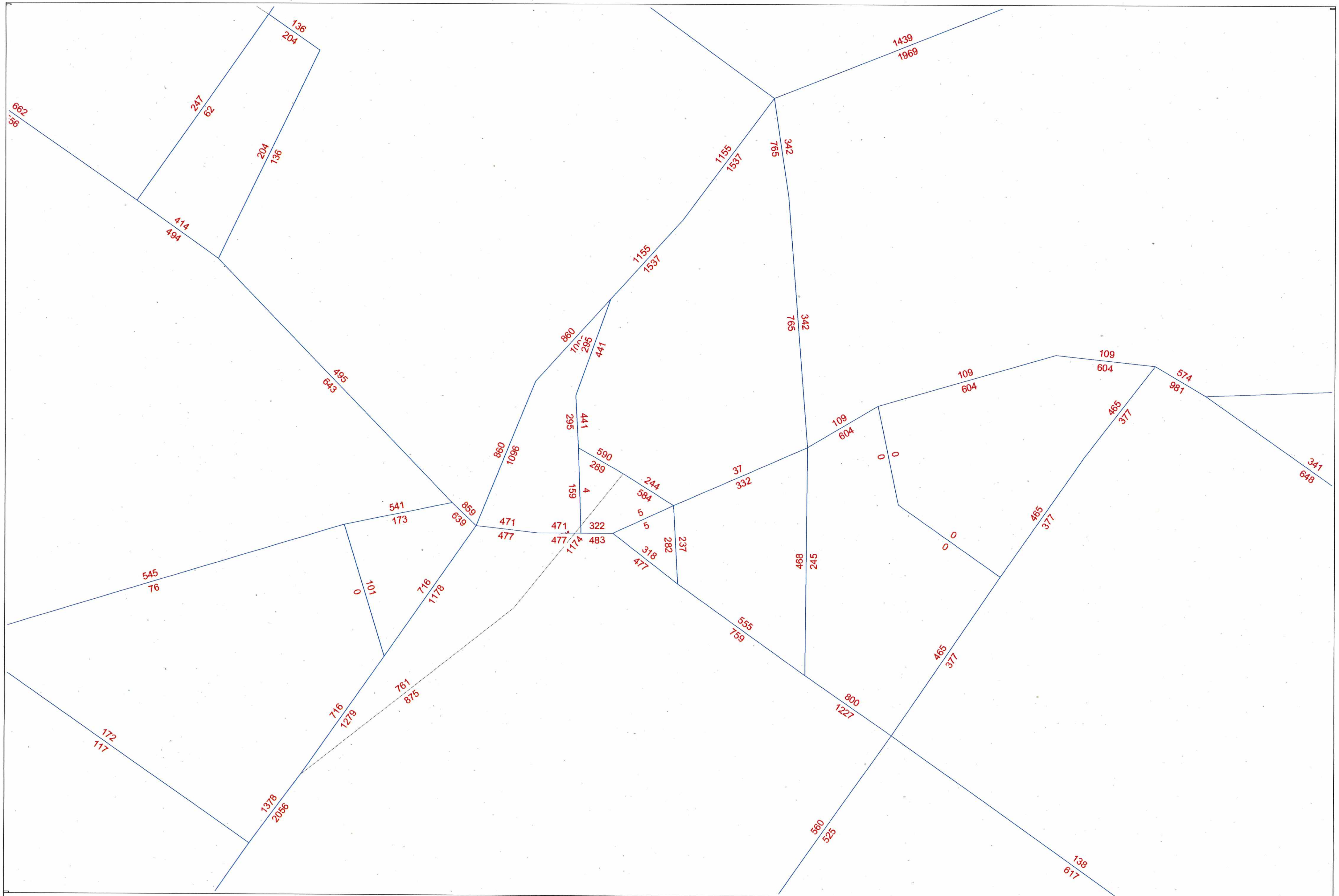
	Loss of parking	1605.3



AM Volumes - Centroid has been moved

cube

2011 - No Saints Road

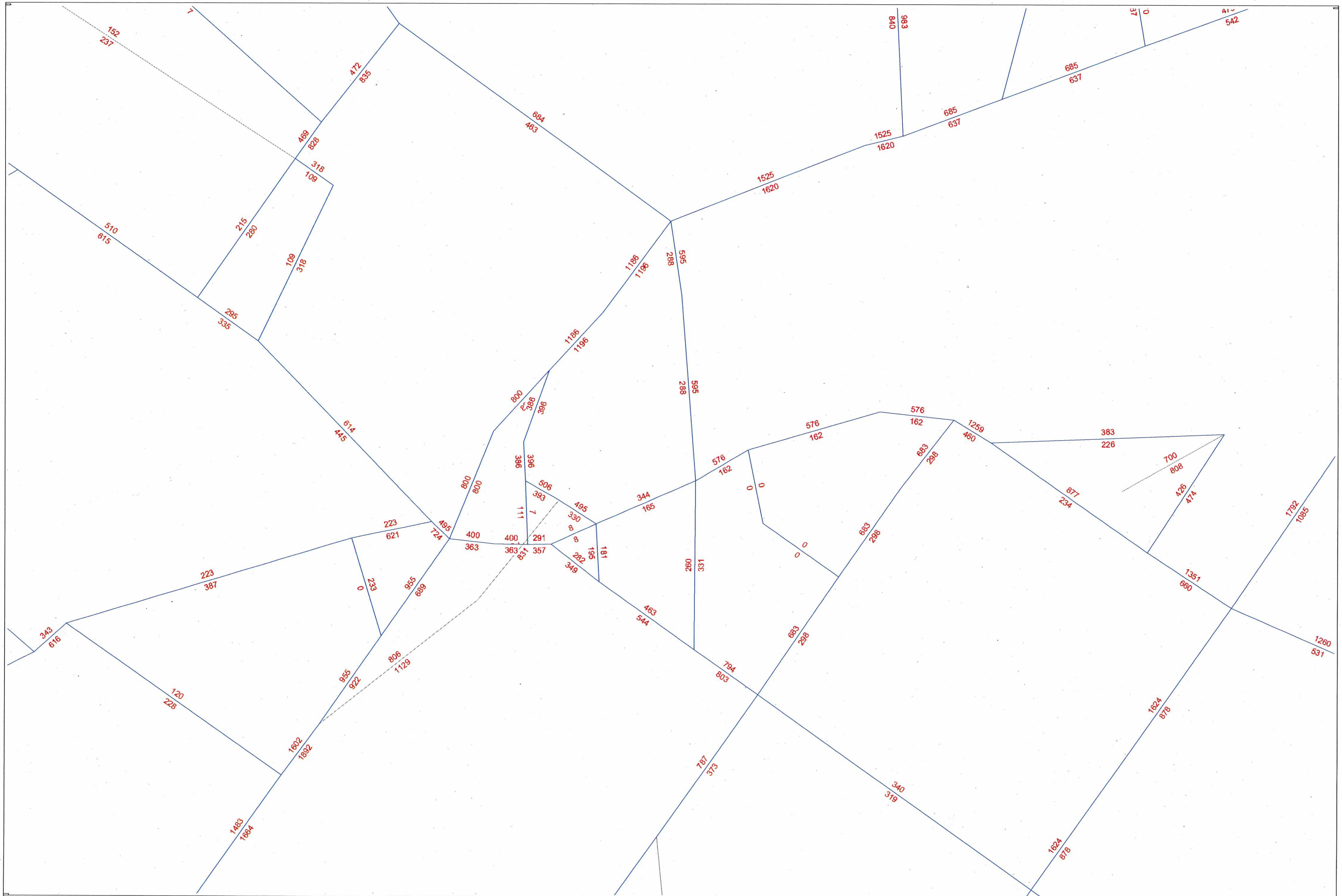


Saint Rd Extension - AM Volumes

cube

2011 with Saints Rd. Extn

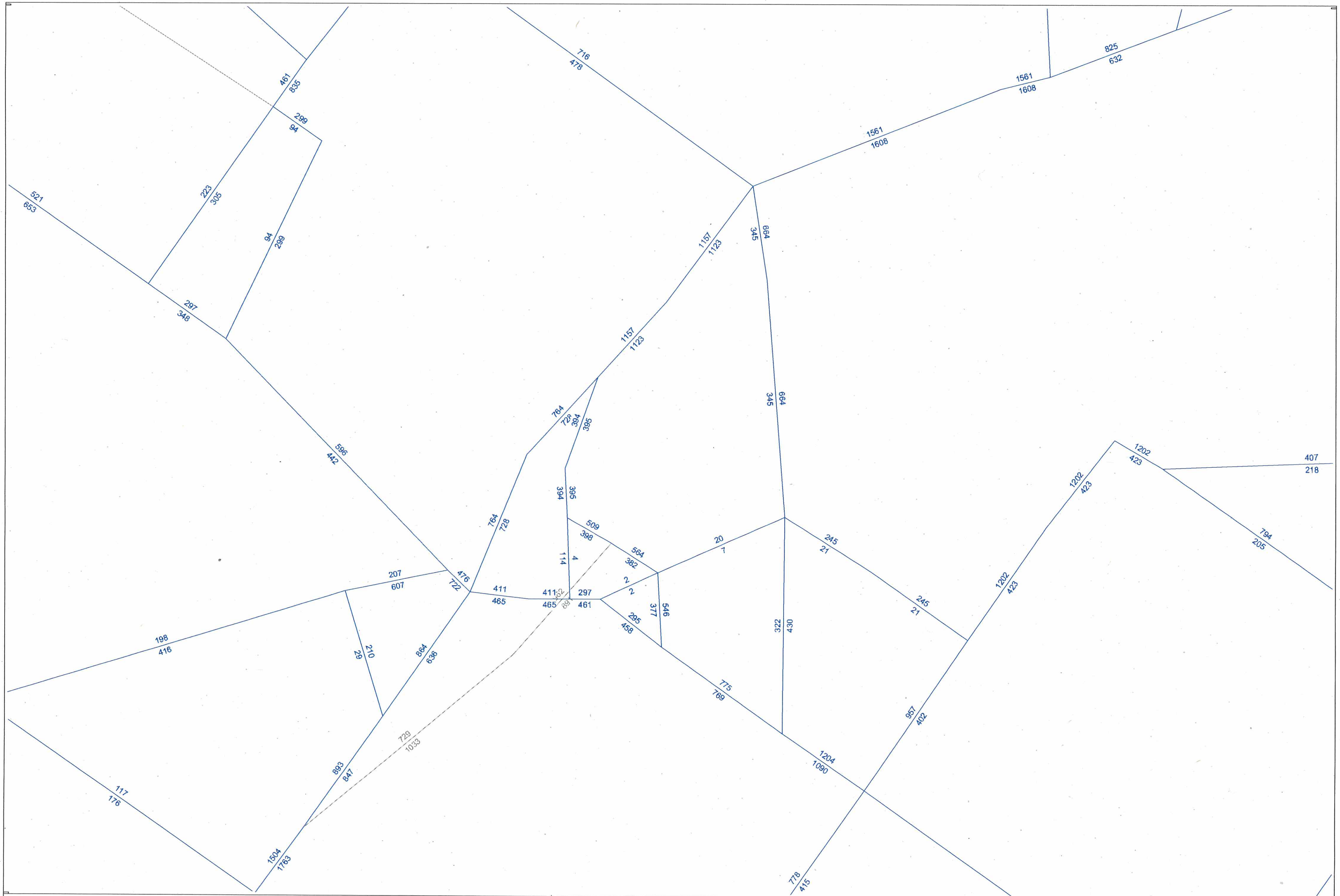
Licensed to Aurecon (IMIS)



Saint Rd Extension - PM Peak

2011 with Saints. Road Extn

cube

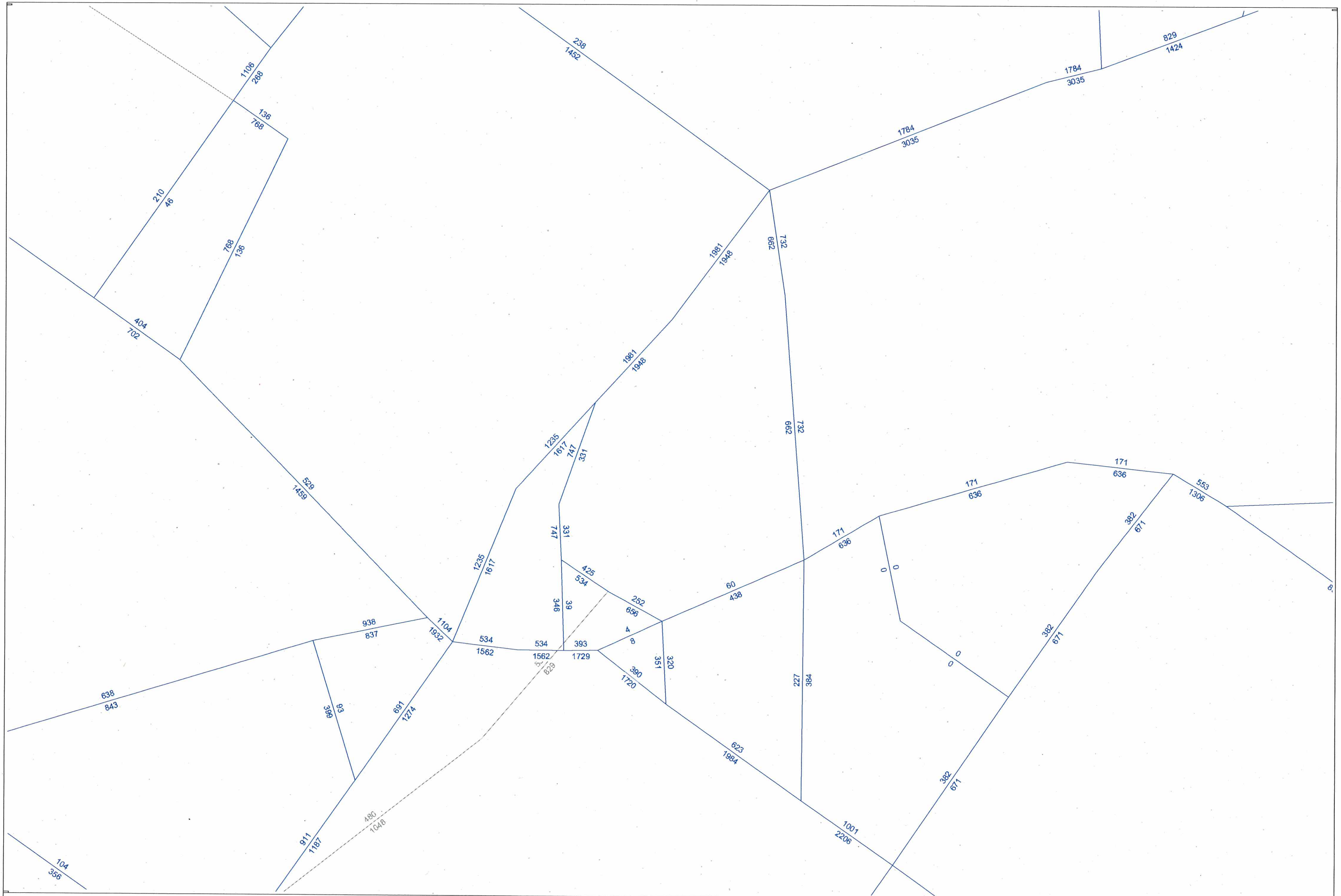


PM Volumes - Centroid has been moved

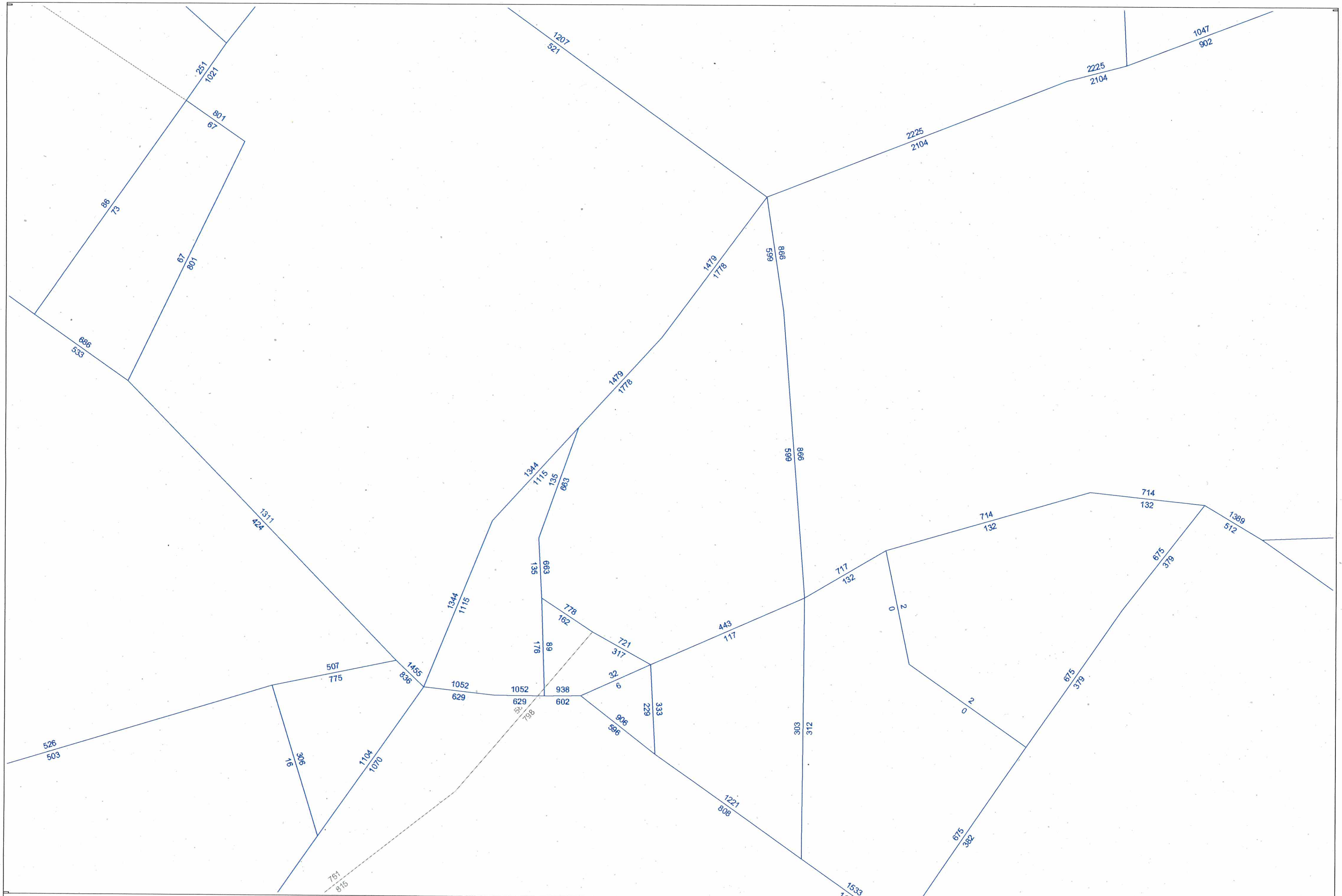
2011 - No Saints Road

cube

Licensed to Aurecon (IMIS)



2031 AM Volume with Saints Rd Ext



PM Volume

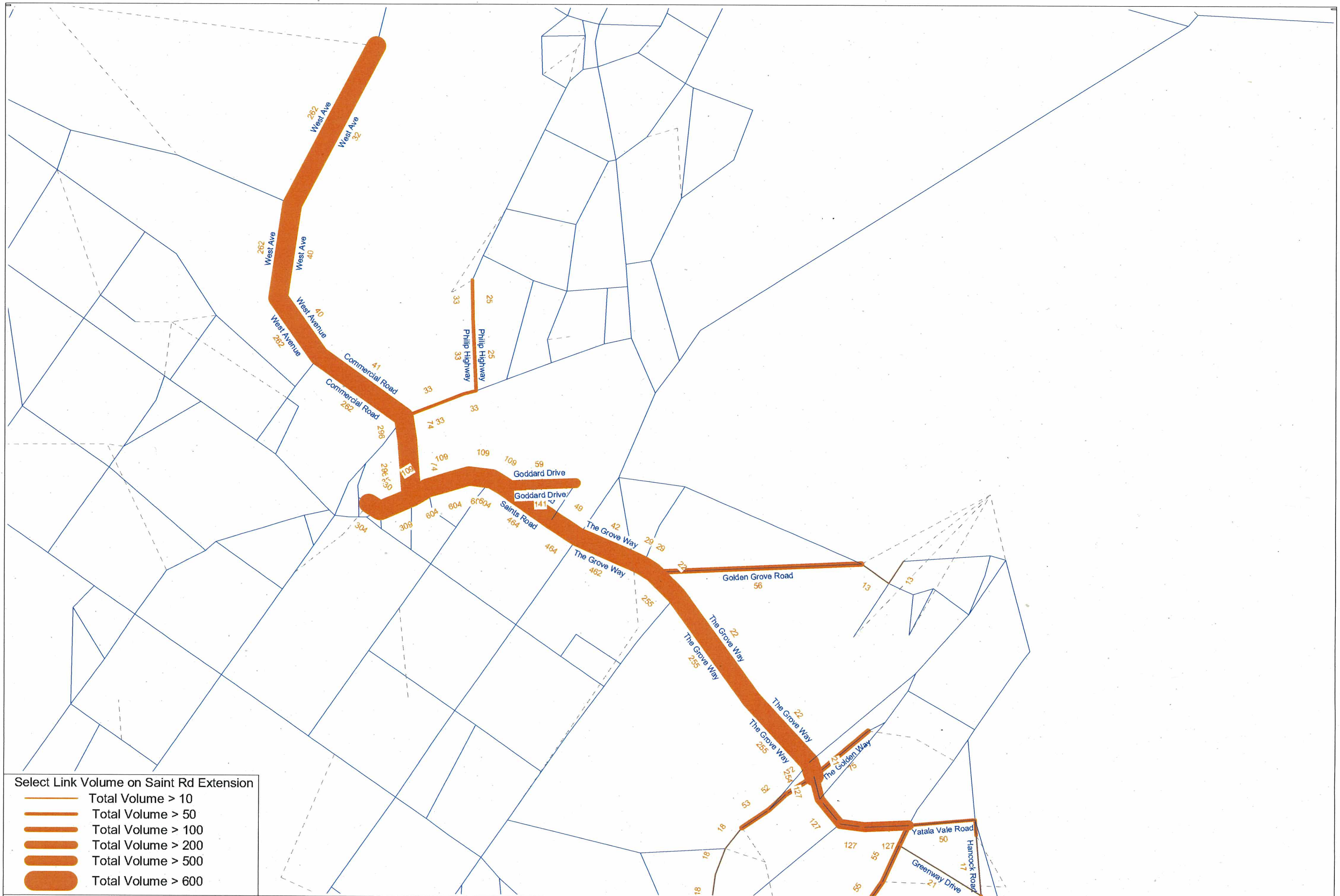
cube

2031 with Saints Rd Ext

UFN V3A - ver4 (select link on centroid connector)

2011 AM Peak - ~~No~~ Existing

cube



AM Typical Hour (Car + Truck)

cube

2011 AM with Saints Rd.

Select Link Analysis on the connector - AM Peak

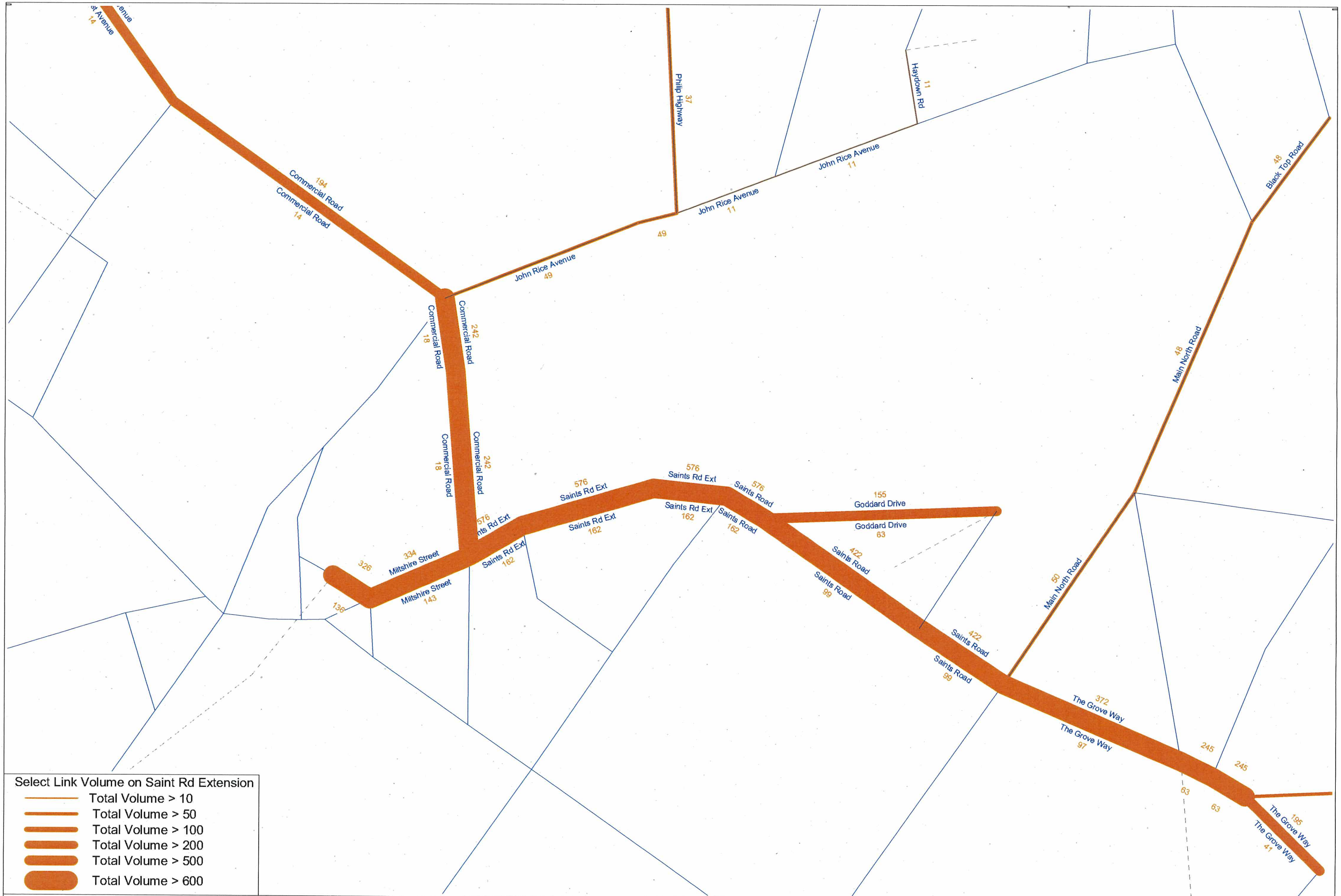
2011 AM with Saints Rd Ex

cube

PM Typical Hour (Car + Truck) - Select Link on connector

2011 - No Saints Road

cube



PM Typical Hour (Car + Truck)

2011 Select link Saints Road

cube

Select Link Analysis on the connector - PM Peak

2011 With Saints Road Extn

cube

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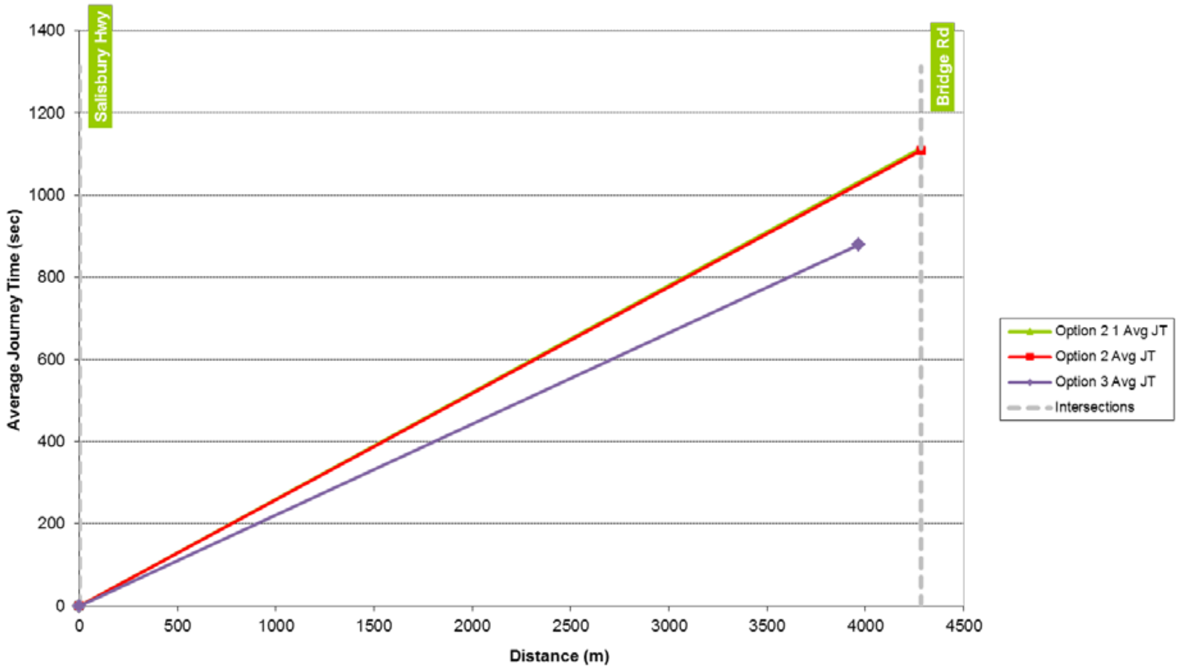
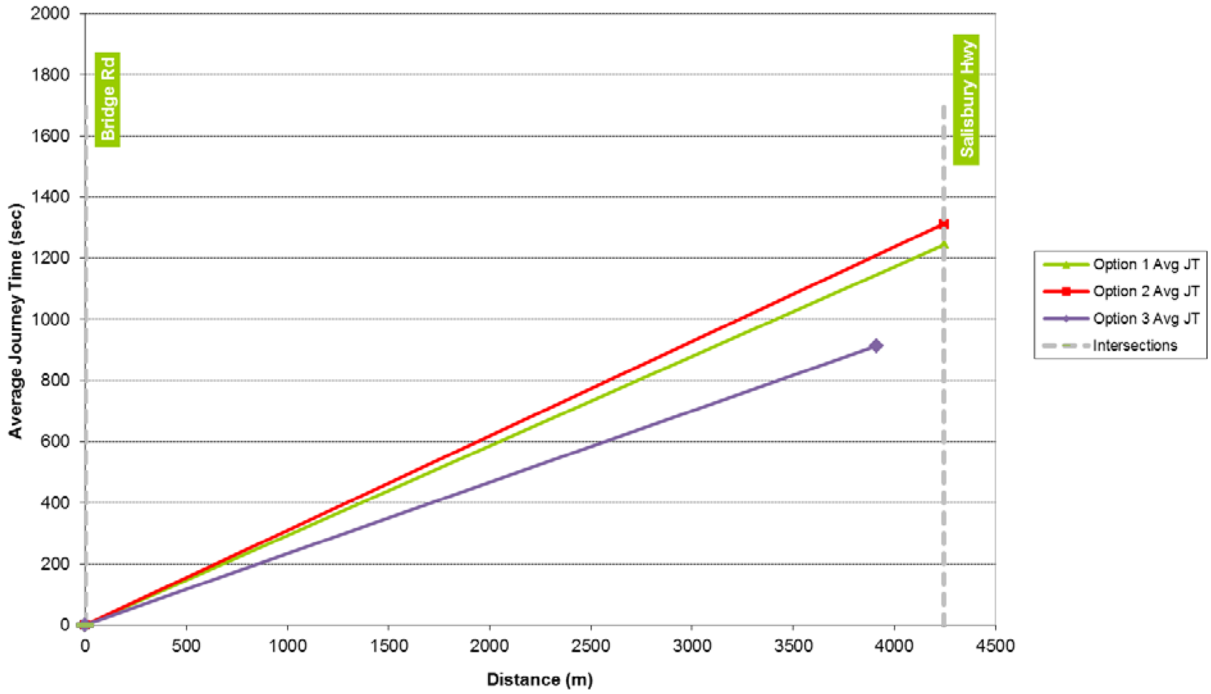
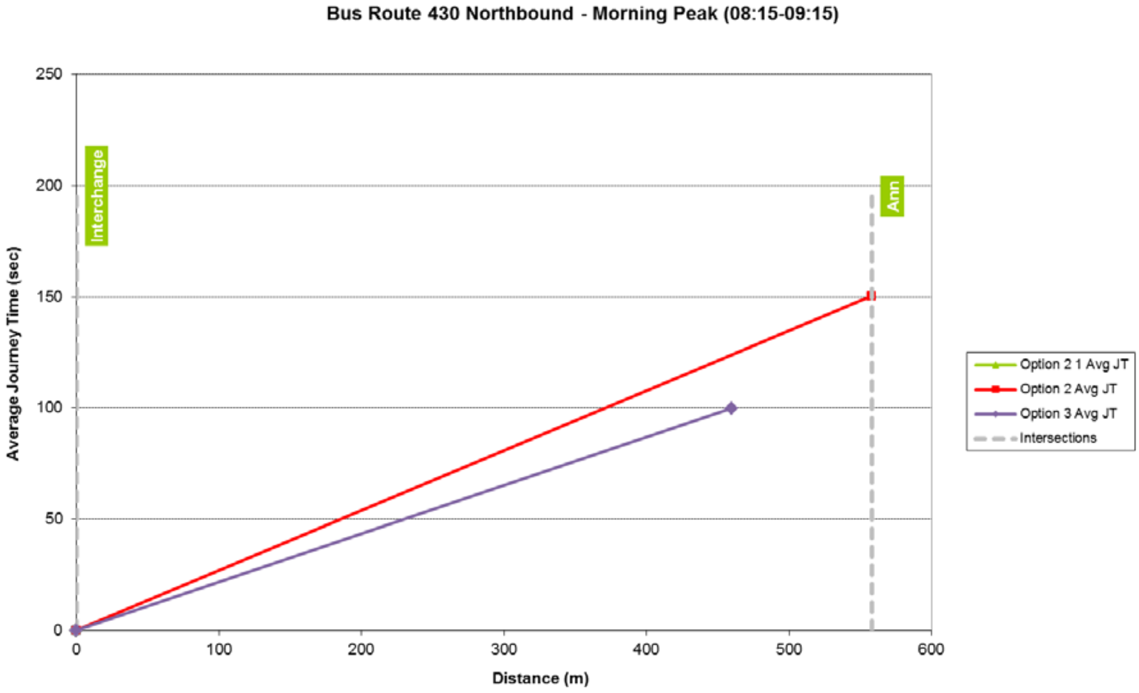
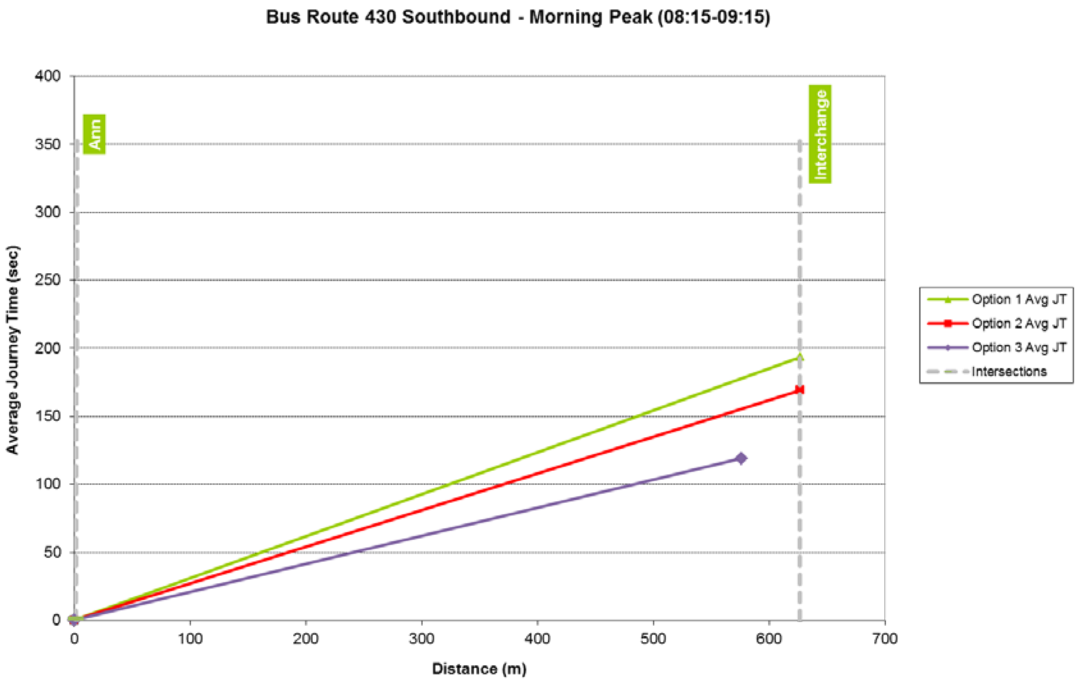
Bus Route 224 Northbound - Morning Peak (08:15-09:15)

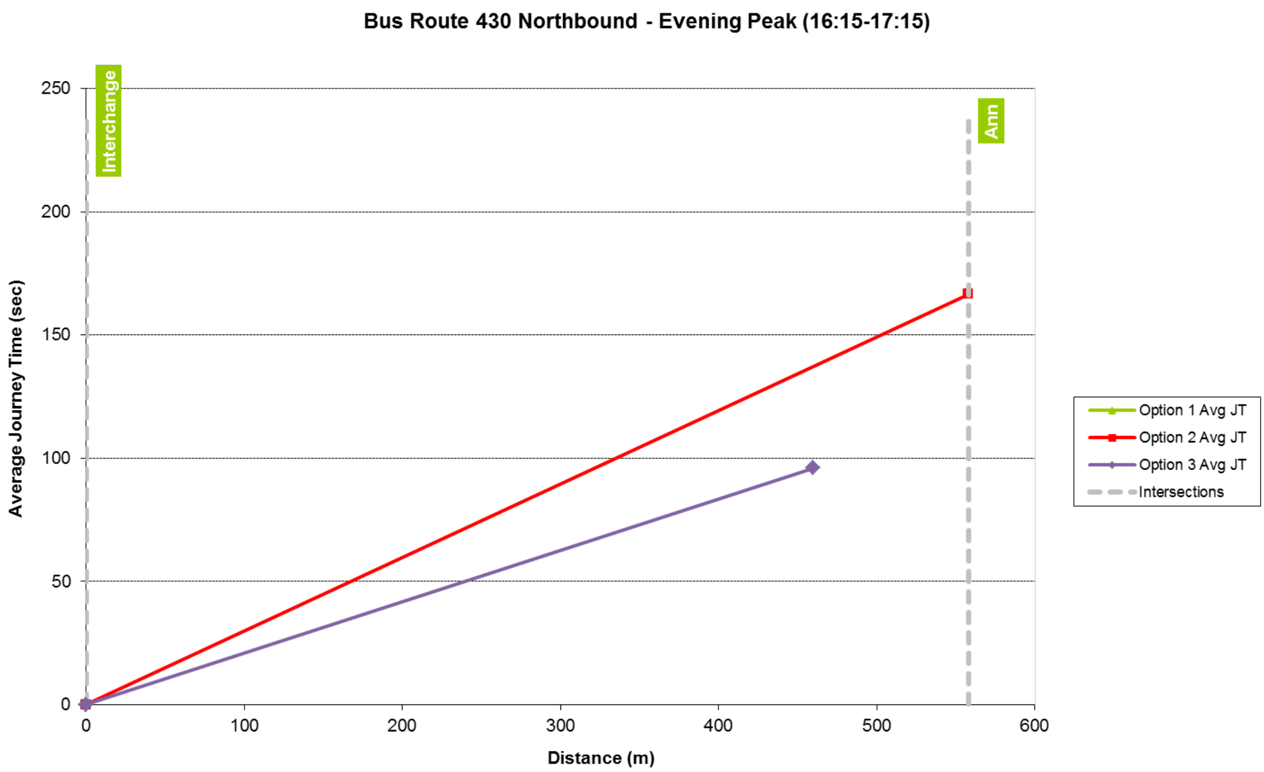


Bus Route 224 Southbound - Morning Peak (08:15-09:15)

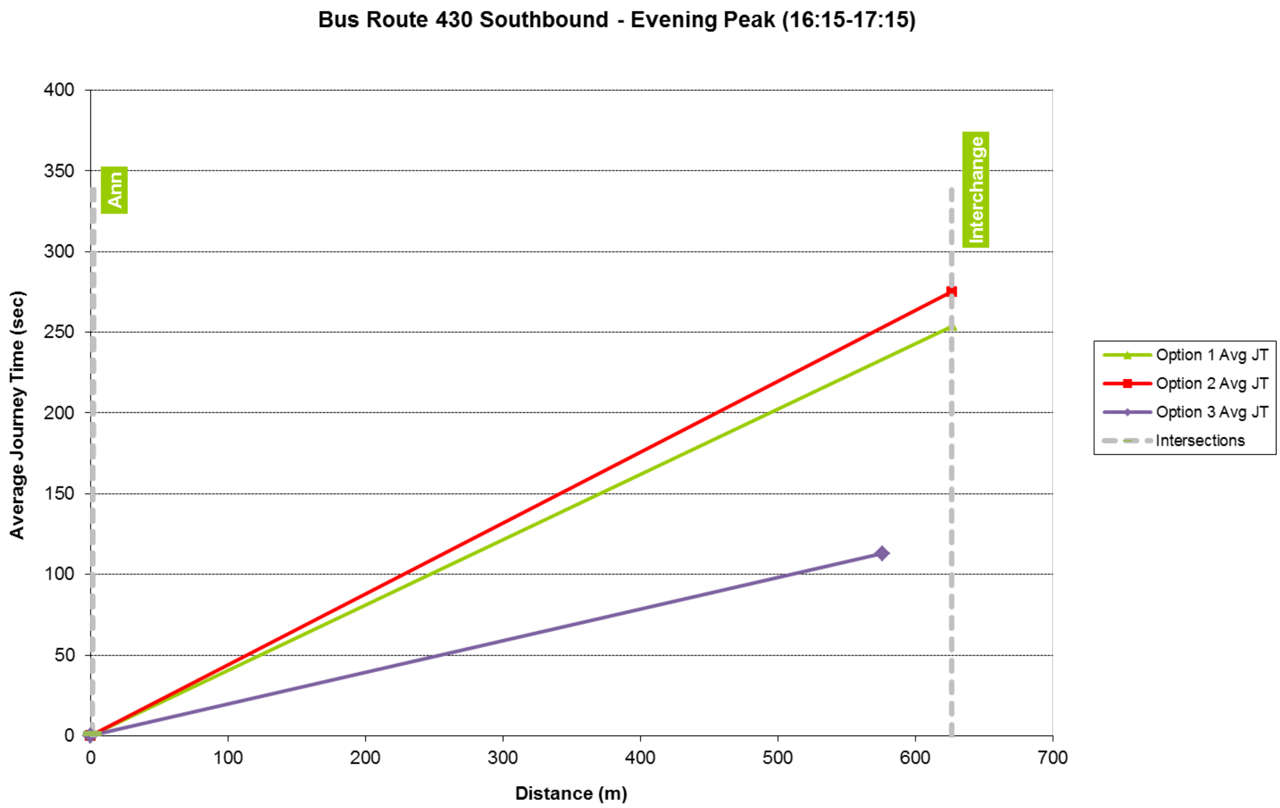



Bus Route 430 Northbound - Morning Peak (08:15-09:15)
Average Journey Time (sec)
Distance (m)
Interchange
Ann
Option 2 1 Avg JT
Option 2 Avg JT
Option 3 Avg JT
Intersections

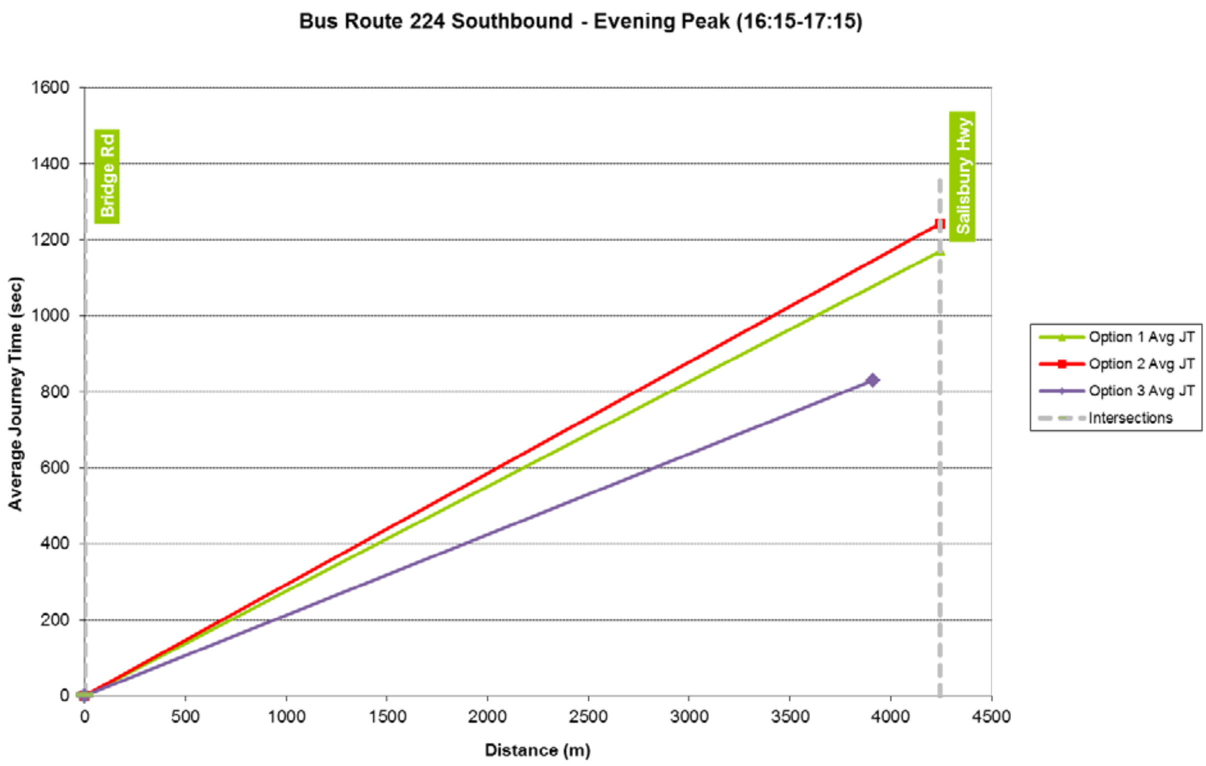

Bus Route 430 Southbound - Morning Peak (08:15-09:15)
Average Journey Time (sec)
Distance (m)
Ann
Interchange
Option 1 Avg JT
Option 2 Avg JT
Option 3 Avg JT
Intersections

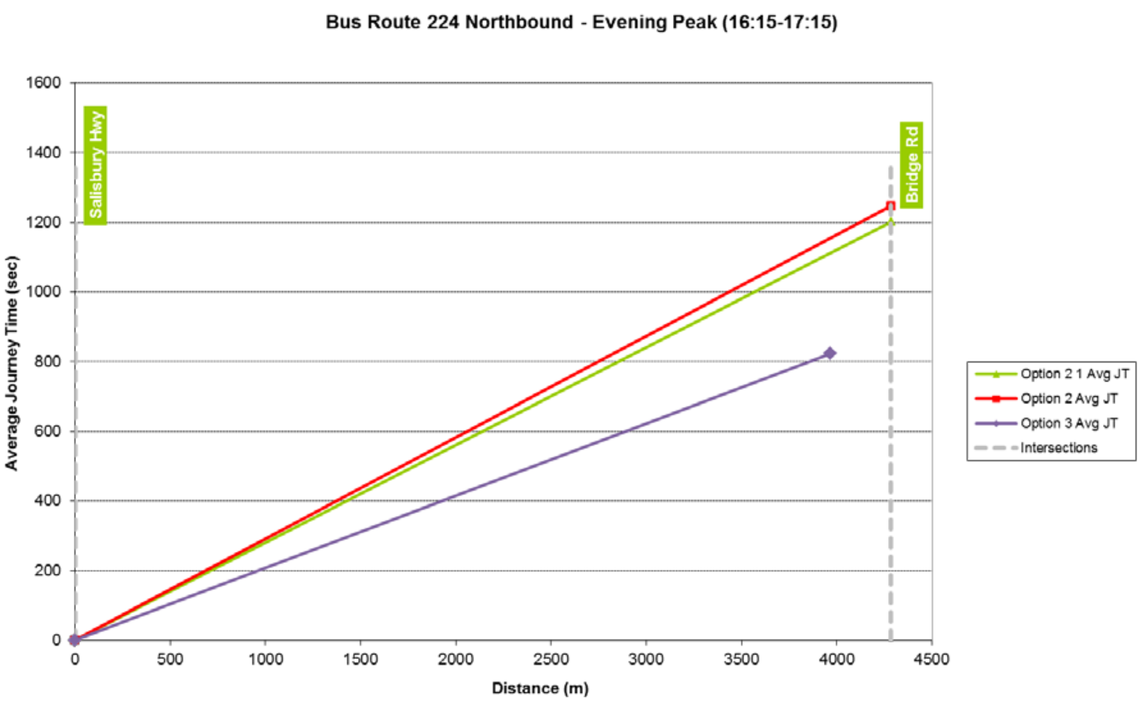


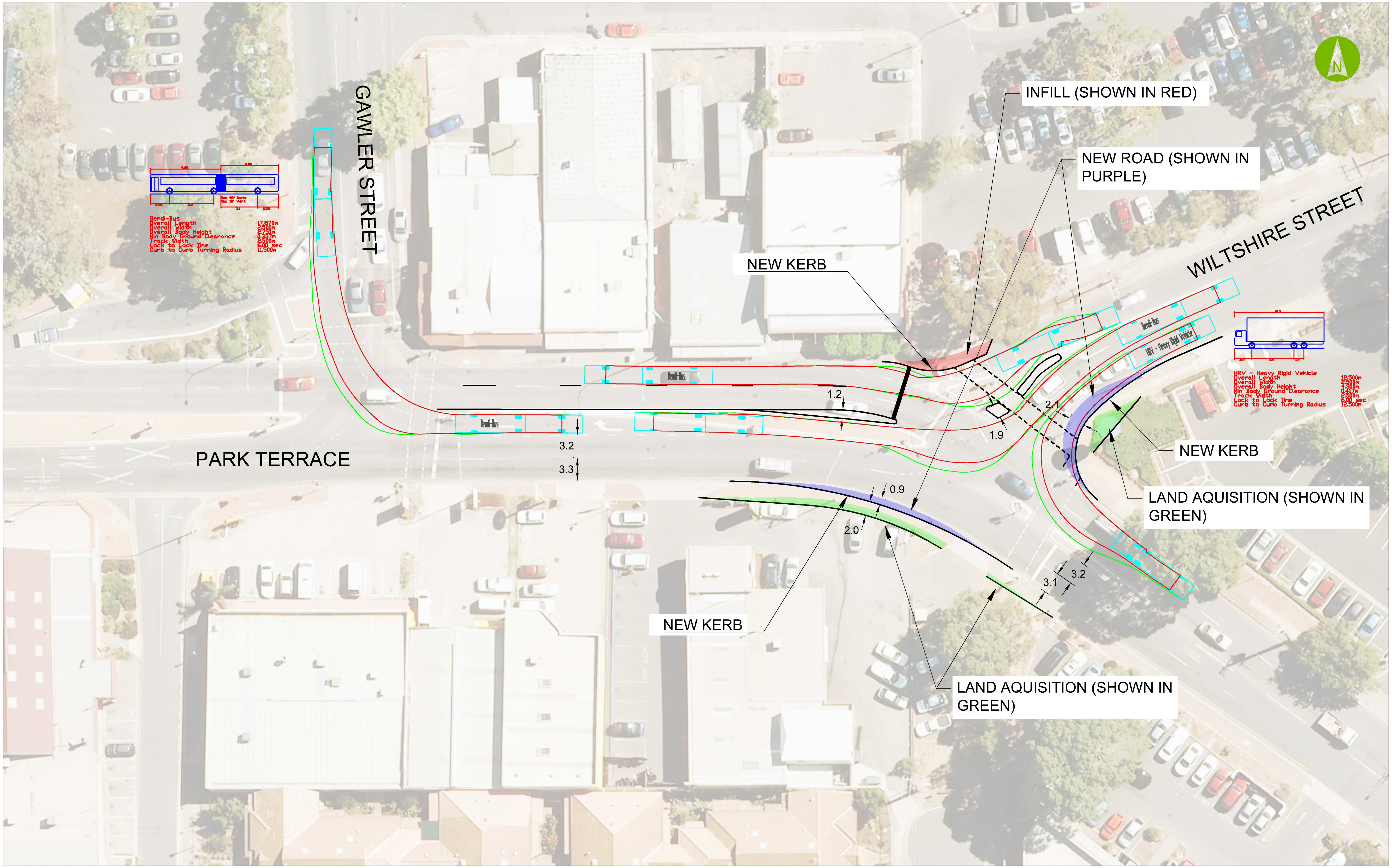
Bus Route 430 Northbound - Evening Peak (16:15-17:15)
Interchange
Ann
Average Journey Time (sec)
Distance (m)
0
50
100
150
200
250
0
100
200
300
400
500
600
Option 1 Avg JT
Option 2 Avg JT
Option 3 Avg JT
Intersections



Bus Route 430 Southbound - Evening Peak (16:15-17:15)
Ann
Interchange
Average Journey Time (sec)
Distance (m)
0
50
100
150
200
250
300
350
400
0
100
200
300
400
500
600
700
Option 1 Avg JT
Option 2 Avg JT
Option 3 Avg JT
Intersections


Bus Route 224 Southbound - Evening Peak (16:15-17:15)
Average Journey Time (sec)
Distance (m)
Bridge Rd
Salisbury Hwy
Option 1 Avg JT
Option 2 Avg JT
Option 3 Avg JT
Intersections
0
200
400
600
800
1000
1200
1400
1600
0
500
1000
1500
2000
2500
3000
3500
4000
4500


Bus Route 224 Northbound - Evening Peak (16:15-17:15)
Average Journey Time (sec)
Distance (m)
Salisbury Hwy
Bridge Rd
Option 2 1 Avg JT
Option 2 Avg JT
Option 3 Avg JT
Intersections
0
200
400
600
800
1000
1200
1400
1600
0
500
1000
1500
2000
2500
3000
3500
4000
4500



CLIENT

REV	DATE	REVISION DETAILS	APP
1	26-06-12	PRELIMINARY ISSUE	RB

DRAWN: C.HARDMAN
DESIGNED: R.BREMERT
CHECKED: R.HANSLIP
APPROVED:
DATE

PROJECT: SALISBURY TOWN CENTRE STUDY

TITLE: Wiltshire St - Park Tce - Gawler St Junctions
Bus Concept

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No. 208219

SCALE: NTS
SIZE: A3
DRAWING No. SK01
REV: 1