City of Launceston

Launceston City Heart Project
Traffic Modelling Update
Adopted Scenario

June 2016

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1. Introduction

1.1 Background

GHD were engaged by the City of Launceston to undertake traffic modelling of the adopted Launceston City Heart Project scenario involving changes to several key roads within the CBD including Brisbane Street, Charles Street, Paterson Street and York Street.

This report will form an update to previous modelling undertaken for the project, however specific attention will be given to a detailed analysis of intersection performance along Cimitiere Street under the conditions imposed by the reduced capacity on other routes.

1.2 Launceston City Heart Project

The Launceston City Heart Project is a key project identified by the Greater Launceston Plan. This Council project initiative is aimed at revitalising Launceston's CBD and identifying a clear future 'Vision' and 'Direction' for the city. The project provides a rare opportunity to bring together the wider Launceston community, and build the local support that is necessary to create an active, vibrant city centre.

The Launceston City Heart Project objectives are the improvement of amenity and connectivity throughout, revitalisation of streetscapes and public spaces, activation of laneways by way of improved, high quality urban infrastructure, and development of key strategies for the city. Key development sites include the Brisbane Street Mall, Civic Square and the Quadrant Mall. The streets, public spaces and laneways that form the focus of the Launceston City Heart Project are within the area bounded by Cimitiere Street, Elizabeth Street, Wellington Street and Tamar Street.

The Project identifies a number of streets within the City Heart Project area which will have major changes to their function and operation with some streets having lane reductions and others being converted from one- to two-way traffic flow. The primary aims of these changes are to:

- Calm traffic and improve pedestrian and bicycle service within the Launceston City Heart
- Reduce the ‘traffic barrier’ effect created by high volume, multi-lane one-way streets
- Open up new opportunities for transport routes, inner city residential development and the local business community.

1.2.1 Previous Reports and Studies

Launceston City Heart Project Two-way Street Conversion Preliminary Traffic Assessment, GHD 2014

A brief literature review found that conversion of inner city streets to two-way traffic flow can result in reduced traffic volumes and speeds, and improved road safety performance for both vehicle and pedestrian traffic as well as improving pedestrian amenity, liveability and businesses and economic viability.

Examination of the existing traffic routes and the amount of vehicles parking within the Launceston CBD reveals the theoretical minimum traffic volumes on inner city streets to be around 33-37% of existing volumes. It is considered that traffic volumes could be reasonably reduced by around 10-15% on Brisbane Street, Paterson Street and Charles Street, with larger reductions (up to 50%) on George Street by the removal or diversion of through traffic.

The proposed changes reduce traffic volumes by allowing for alternative routes to key destinations within the CBD or by discouraging the inner city streets for through traffic, thereby diverting these vehicles via other routes.

No significant issues were identified over the course of the microsimulation modelling which would prevent the proposed changes from being implemented, however the modelling identified a need to consider additional capacity or reallocation of lanes on the following roads:

- Brisbane Street, between Margaret Street and Bathurst Street, and
- Cimitiere Street, between Charles Street and St John Street.

A potential trial scenario was also developed and was found to approximately simulate the anticipated traffic diversions which would be expected to occur due to reduced capacity within the Launceston CBD without requiring investment in major infrastructure change in the short term.

Launceston Bus Mall Traffic Modelling Report, GHD 2015

GHD investigated several proposed changes to the Launceston Central Bus Interchange including:

- Relocation of Stops E and F;
- Relocation of Stop H; and
- Relocation of Paterson Street layover.

In addition to the above, three separate options were considered for the configuration of St John Street:

1. Two-way St John Street (as per existing);
2. One-way St John Street southbound; and
3. One-way St John Street with contra-flow bus lane.

The focus of the project was on bus operations and the following key findings were obtained from the modelling:

- The proposal resulted in only a minor change in bus trip distances and travel times, with Option 2 providing slightly reduced performance compared to Options 1 and 3.
  - Note that, for buses, Option 1 and Option 3 are functionally identical with the only difference being a small amount of private car traffic on St John Street (northbound) under Option 1 which is not present in Option 3.
- The total distance travelled by out-of-service buses (i.e. 'dead runnings') was found to improve slightly compared to the existing situation under Options 1 and 3, however Option 2 resulted in increased circulation of buses due to St John Street being converted to one-way southbound.

York Street Lane Reduction Traffic Modelling Results, GHD 2015

GHD modelled potential changes to York Street including reducing the number of lanes from three to two between George Street and Wellington Street. The project arose as a result of road safety performance in recent years with 75 recorded crashes over a distance of just 485 metres, with 21% of those resulting in minor or serious injury.

The traffic modelling demonstrated that York Street can be reduced to two lanes albeit with some localised impacts on the section between George Street and St John Street, which may affect access to and from the multi-storey car park. It was recommended that any capacity

reductions be considered in the context of the wider Launceston traffic network in order to maintain adequate westbound capacity across the network as a whole.

1.3 Study Area

The Study Area is the Launceston CBD and immediate surrounds. The focus of this report is on the west-east routes comprising:

- Route 1: Brisbane Street – Charles Street – Paterson Street; and
- Route 2: Cimitiere Street

Other key roads, including Bathurst Street and Wellington Street (the Launceston North-South Couplet) and York Street are also considered. The Study Area is presented in Figure 1.

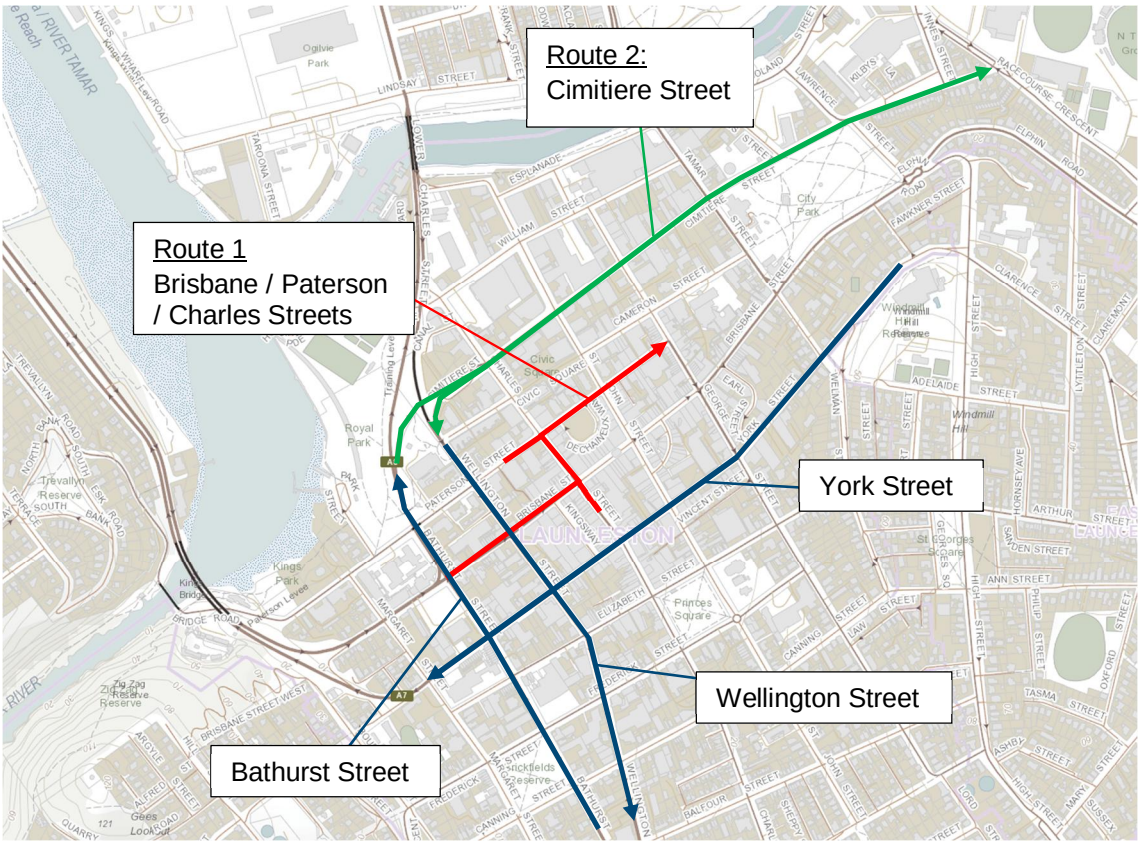


Figure 1 Study Area

Base image source: LISTMap, DPIPWE

1.4 Modelling Flowchart

The traffic modelling was undertaken using three different methods in a hierarchical system which are described as follows:

Mesoscopic Modelling

The Launceston Traffic Model was created in VISUM and covers a wide area, encompassing the Launceston CBD as well as many of the surrounding suburbs including Invermay, Kings Meadows, St Leonards, Prospect and Trevallyn. It was initially developed in 2013, with updates in 2014 and 2016.

Mesosopic modelling is capable of estimating driver route choice through the network and modelling changes in route choice based on large and small scale road network changes. This level of modelling has been used to feed changes in traffic volumes and key routes through to

the more detailed levels of modelling including microsimulation modelling and intersection modelling.

Microsimulation Modelling

The Launceston CBD Model is a microsimulation model, created in QParamics, and focussing on the CBD and immediate surrounding area. It has been updated several times since its initial development in 2013 for various purposes including the addition of bus routes and assessment of changes within the Launceston CBD. The CBD model is capable of providing key dynamic traffic information such as queuing, platooning and simulated travel times.

Intersection Modelling

SIDRA Intersection 6.1 will be used to assess individual intersections. It is a mathematical model and is primarily used to obtain statistical outputs including average control delays, queue percentiles and Level of Service. SIDRA is also able to optimise signal timing for specific performance outcomes.

A flowchart showing the data flow between the models and the key outcomes is presented in Figure 2.

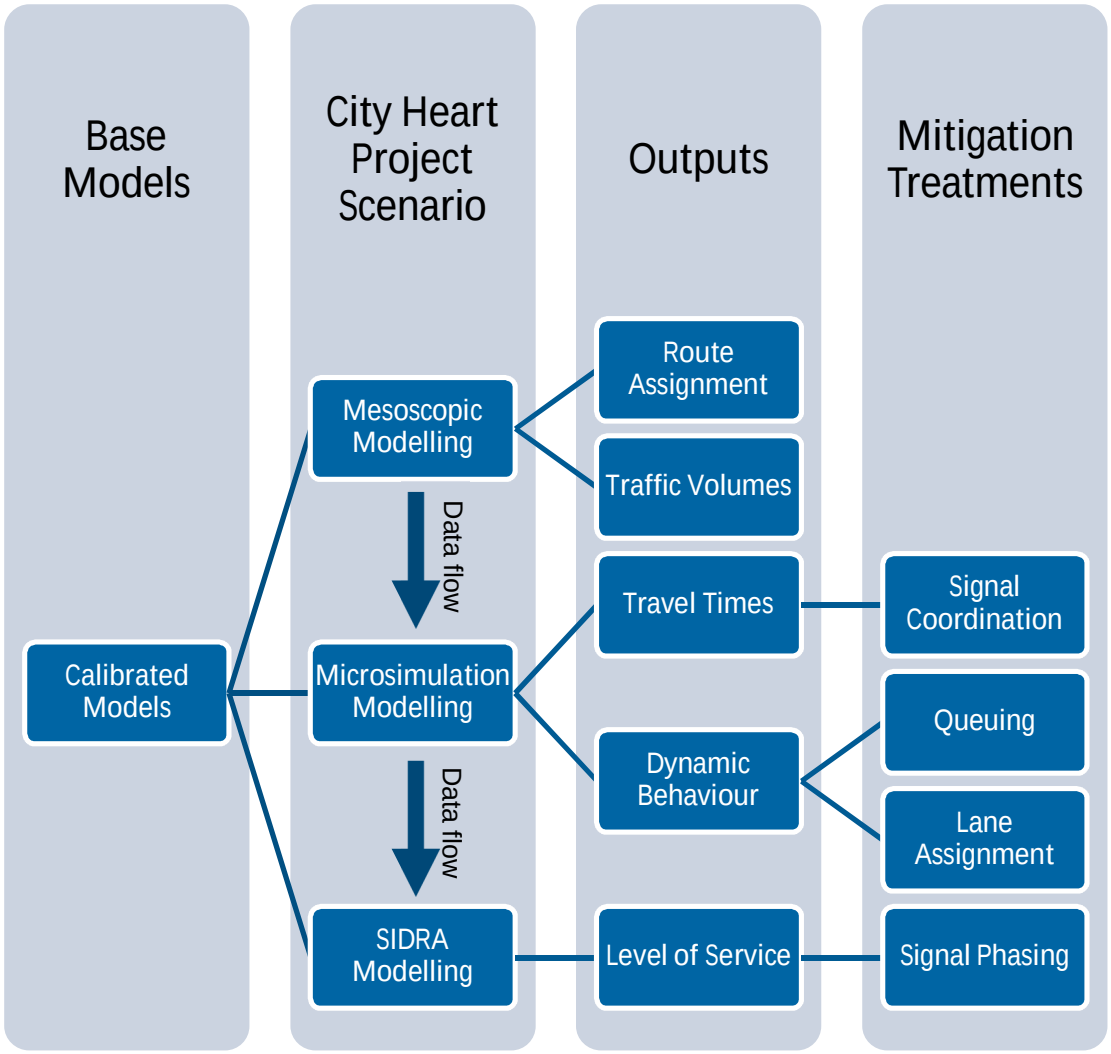


Figure 2 Traffic Modelling Flowchart

1.5 Data Collection

New turning movement and travel time surveys were undertaken to ensure that the Launceston Traffic Model and the Launceston CBD Model are calibrated and validated to current conditions in the areas of focus, including Cimitiere Street. These were at the following locations:

- Turning movement surveys – 9 February 2016
  - Goderich Street / Lindsay Street
  - George Street / York Street
  - Cimitiere Street / George Street
  - Cimitiere Street / St John Street
- Travel time surveys – 9 February 2016
  - Racecourse Crescent to Howick Street via Cimitiere Street and Launceston Couplet and return
  - High Street to West Tamar Highway via Launceston CBD and return

A summary of data collection to date is provided in Figure 3.

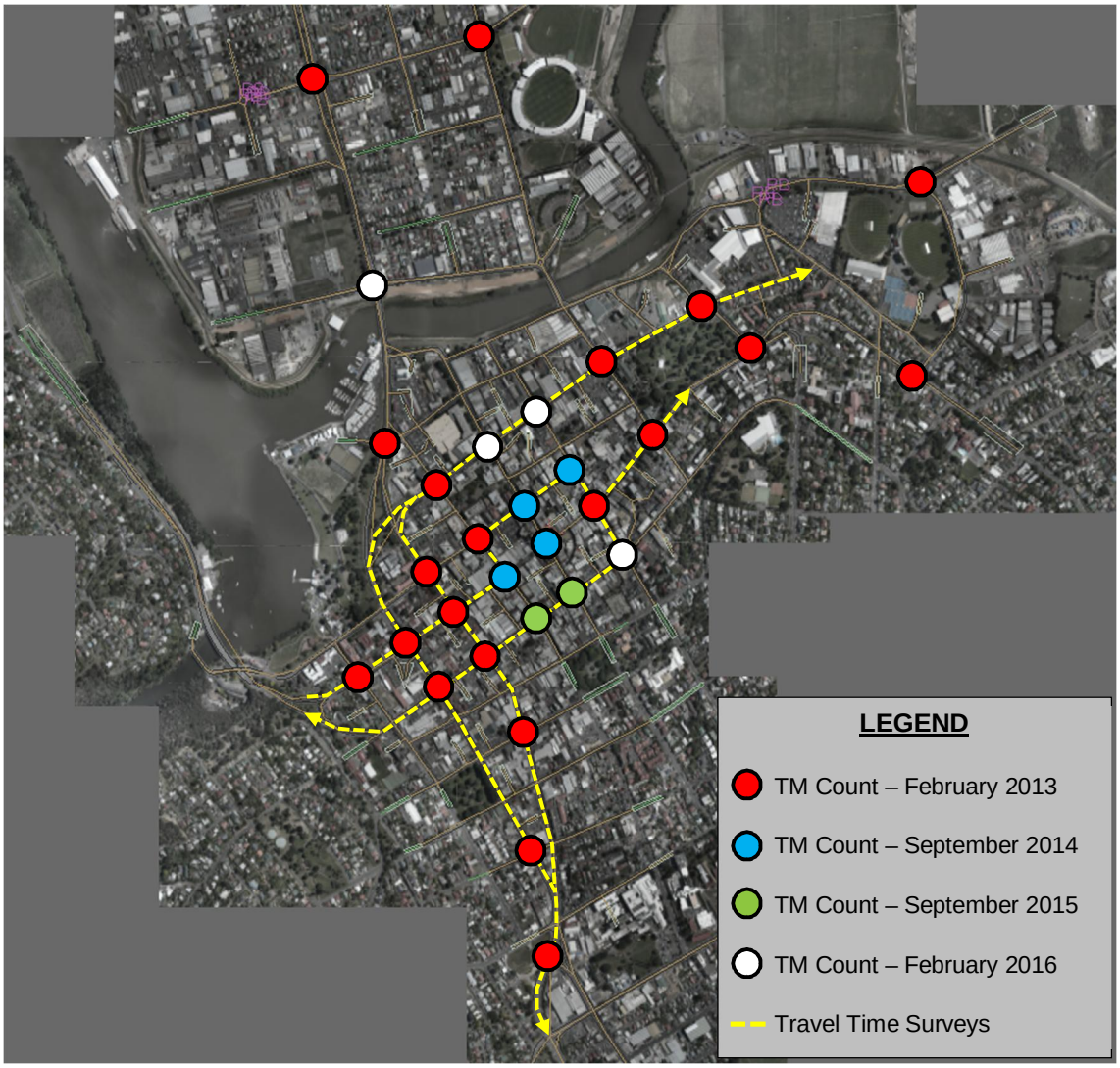


Figure 3 Traffic Surveys

2. City Heart Project Scenario

2.1 General Overview and Description

The Launceston City Heart Project scenario was adopted by Council at its meeting on 14th December 2015. It comprises several direction changes and lane reductions. The scenario is presented in Figure 4.

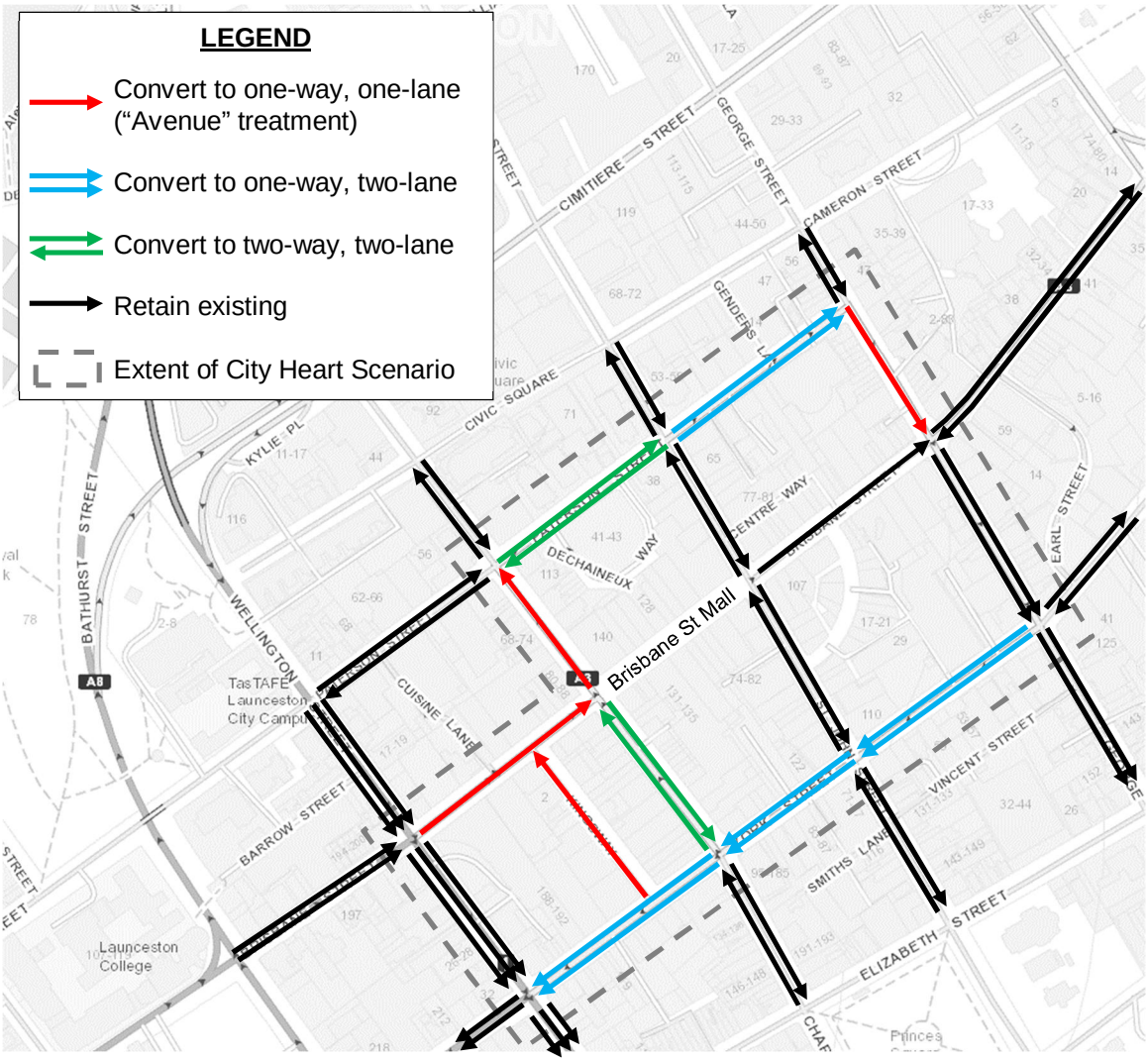


Figure 4 Launceston City Heart Project Scenario

Image source: City of Launceston

The proposal includes the following:

Direction Changes

- Kingsway to flow one-way northbound
- Charles Street to flow two-way between Brisbane Street and York Street
- Paterson Street to flow two-way between Charles Street and St John Street

Lane Reductions

- Brisbane Street reduced to one lane between Wellington Street and Charles Street
- Kingsway reduced to one lane
- Charles Street reduced to one lane between Brisbane Street and Paterson Street
- Paterson Street reduced to two lanes between St John Street and George Street
- George Street reduced to one lane between Paterson Street and Brisbane Street
- York Street reduced to two lanes between George Street and Wellington Street

2.2 Traffic Volumes

The proposed changes to the Launceston City Heart road network are expected to reduce traffic volumes on the Brisbane Street / Charles Street / Paterson Street corridor (the City Heart Route) due to the reduced capacity along these roads. It is anticipated that these changes will result in increased traffic volumes on the following routes:

- Cimitiere Street as the main alternative east-west corridor; and
- "Exit Routes" such as Paterson Street (westbound) and Charles Street (southbound) as vehicle divert off the City Heart route.

These routes are presented in Figure 5.

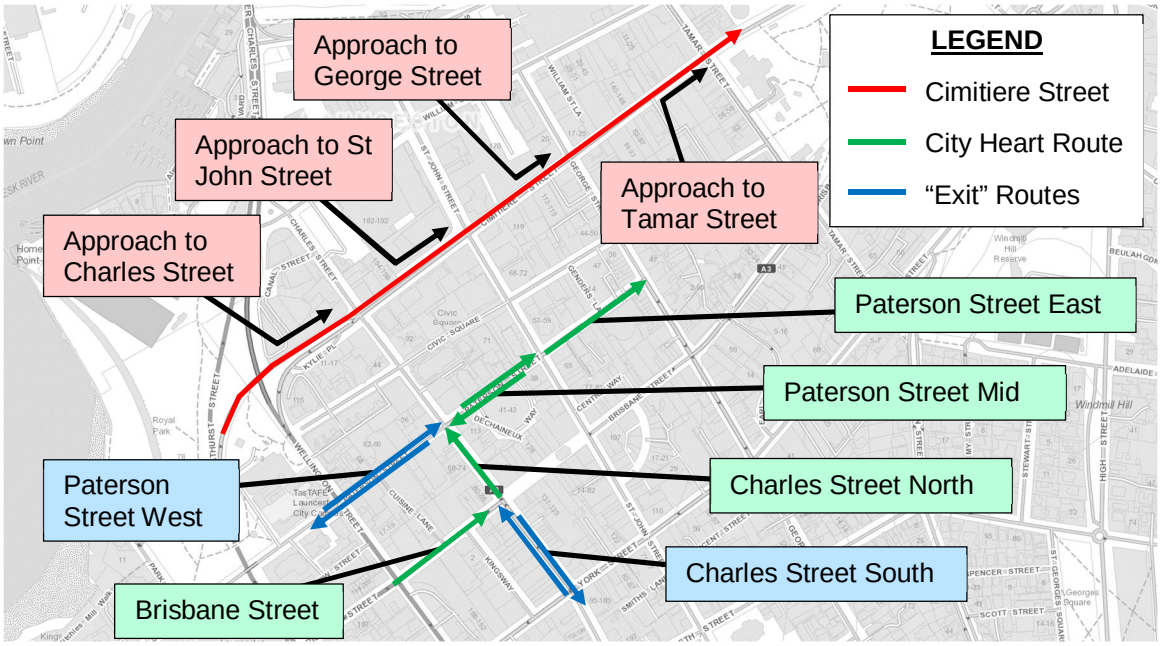


Figure 5 Key Routes

Base image source: LISTMap, DPIPWE

The change in traffic volumes that is anticipated on each of the above routes, as predicted by the Launceston Traffic Model, are summarised in Table 1.

Table 1 Anticipated Traffic Reassignment [2016 Conditions]

Location	Hourly Traffic Volumes AM Peak			Hourly Traffic Volumes PM Peak		
	Base Volume	City Heart Scenario	Change	Base Volume	City Heart Scenario	Change
Brisbane / Charles / Paterson Street (City Heart Route)						
Brisbane Street	250	210	-(40)	490	360	-(130)
Charles St (N)	340	280	-(60)	700	350	-(350)
Paterson St (Mid)	620	570	-(50)	700	610	-(90)
Paterson St (E)	570	530	-(40)	790	410	-(380)
Average	*7-18% Reduction Expected*			*13-50% Reduction Expected*		
"Exit" Routes						
Charles St (S)	190	280	+90	280	420	+140
Paterson St (W)	700	700	+0	620	730	+110
Cimitiere Street Corridor						
Approach to Charles	710	750	+40	530	700	+170
Approach to St John	660	750	+110	590	630	+40
Approach to George	560	570	+10	570	530	+60
Approach to Tamar	440	440	+0	500	530	+30

From Table 1, it is clear that the proposed changes are expected to result in a significant reduction in peak hour traffic volumes along the City Heart Route by approximately 7-18% in the morning and 13-50% in the evening. This is offset by a general increase in traffic volumes on the identified "Exit" routes of Charles Street southbound and Paterson Street westbound as well as on the Cimitiere Street corridor.

Similar traffic volume patterns were identified in the future (2033) traffic model scenarios as shown in Table 2.

A note on future models: The future models were developed in 2013 based on anticipated land use planning and population growth trends at a suburb by suburb level. The models predicted an average increase in total trips by approximately 1.0 – 1.3% per annum over the next 20 years, noting that some areas of Greater Launceston were predicted to grow significantly more than others.

This approach has limitations in that the impacts of major developments (such as UTAS), as well as major road projects and changed travel behaviour, cannot be taken into account specifically. Rather the future modelling is able to estimate how the road network might behave under increasing traffic volumes.

Table 2 Anticipated Traffic Reassignment [Future (2033) Conditions]

Location	Hourly Traffic Volumes AM Peak			Hourly Traffic Volumes PM Peak		
	Base Volume	City Heart Scenario	Change	Base Volume	City Heart Scenario	Change
Brisbane / Charles / Paterson Street (City Heart Route)						
Brisbane Street	310	270	-(40)	560	330	-(230)
Charles St (N)	410	370	-(40)	760	400	-(360)
Paterson St (Mid)	800	710	-(90)	890	710	-(180)
Paterson St (E)	760	700	-(60)	950	550	-(400)
Average	*8-13% Reduction Expected*			*20-47% Reduction Expected*		
"Exit" Routes						
Charles St (S)	230	350	+120	340	660	+320
Paterson St (W)	940	890	-(50)	790	800	+10
Cimitiere Street Corridor						
Approach to Charles	790	810	+20	570	800	+230
Approach to St John	820	860	+40	670	710	+40
Approach to George	650	660	+10	560	610	+50
Approach to Tamar	510	510	+0	600	630	+30

2.3 Route Choice

The Launceston Traffic Model assigns traffic to various routes based on the route that gives the lowest travel time between an origin and destination. The travel times are often increased by congestion, so once a particular route gets congested, other routes begin to take some of the traffic load. The end result is a model which reasonably represents the split of traffic travelling through the network on different routes and balances the flows so that no vehicle can travel to its destination faster by choosing another route.

The proposed changes to streets in the Launceston City Heart will result in reduced capacity on some routes. This means that these routes can accommodate fewer vehicles before congestion and delays cause some drivers to deviate via alternatives. Some changes, in particular the two-

way conversion of Paterson Street and Charles Street, will also open up new routes for vehicles to take.

The following sections contain a summary of the main issues and outcomes with regard to route choice through the Launceston CBD traffic network.

2.3.1 Paterson Street

The Launceston City Heart Project will reduce the eastbound capacity of Paterson Street by converting the mid-section (Charles Street to St John Street) to two-way traffic and reducing the eastern section (St John Street to George Street) to two lanes.

These changes will break up the heavy traffic flow currently travelling along Paterson Street and turning right onto George Street as presented in Figure 6. Vehicles will filter off via Charles Street or St John Street thereby dispersing the traffic through the CBD network rather than maintaining the existing, heavy arterial traffic flow onto George Street.

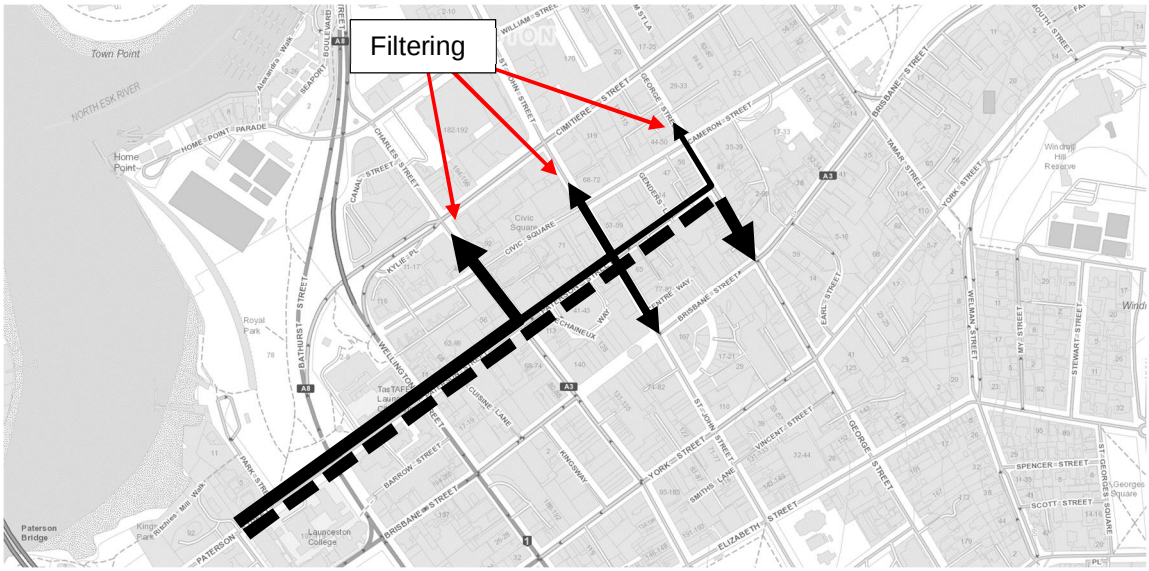


Figure 6 Paterson Street Route Choice

Base image source: LISTMap, DPIPWE

2.3.2 Cimitiere Street

The model also shows a clear diversion of traffic from the Brisbane Street, Charles Street (northbound) and Paterson Street (eastbound) route to Cimitiere Street, with traffic on Cimitiere Street filtering through Charles, St John and George Streets. This is presented in Figure 7.

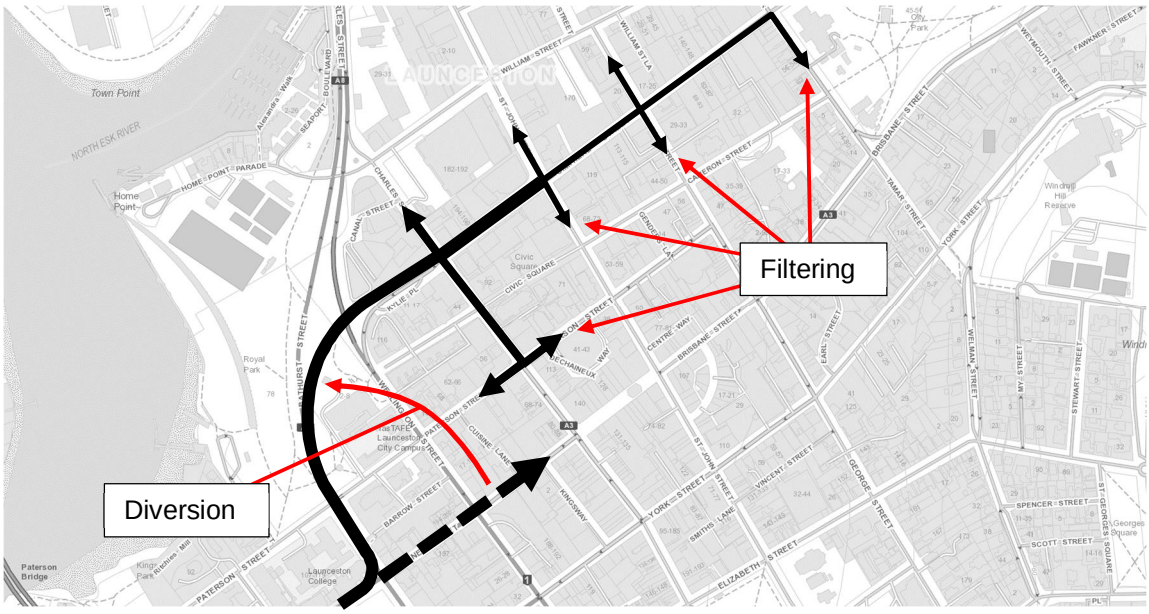


Figure 7 Cimitiere Street Route Choice

Base image source: LISTMap, DPIPWE

2.3.3 Charles Street

The conversion of Kingsway to one-way (northbound) and the conversion of Charles Street to two-way traffic between Brisbane Street and York Street sets up a 'circulation' route between these two roads as shown in Figure 8. This is evidenced by increased northbound traffic volumes on Kingsway, increased southbound volumes on Charles Street and decreased northbound traffic volumes on Charles Street.

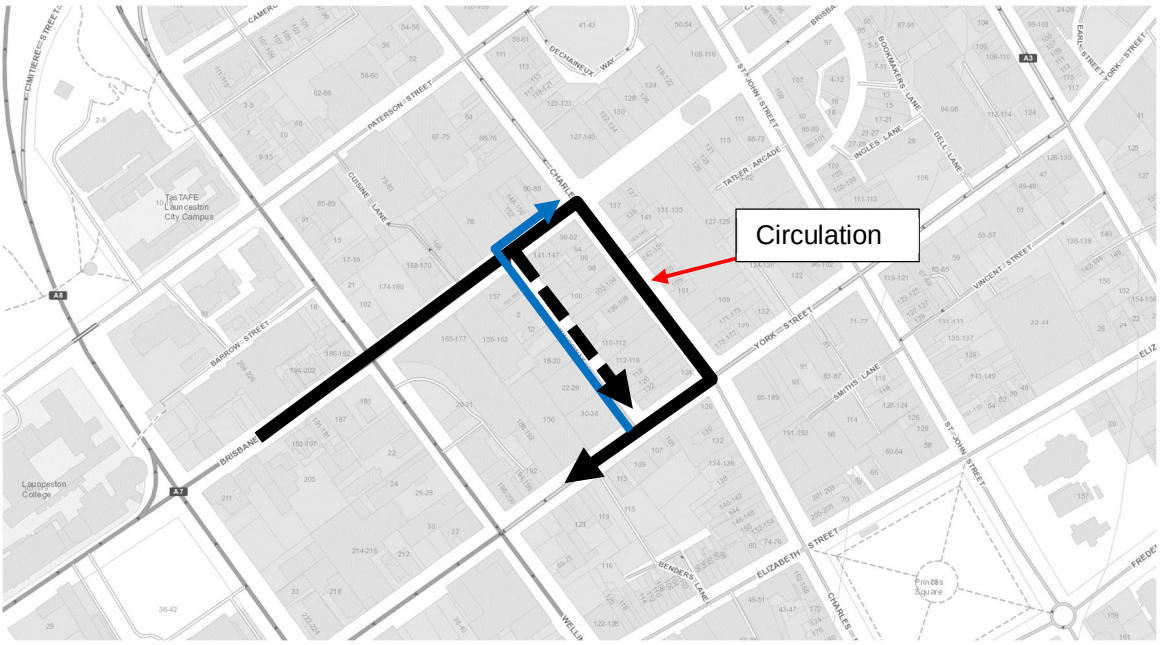


Figure 8 Charles Street Route Choice

Base image source: LISTMap, DPIPWE

There are three factors which are considered to contribute to this effect. These are listed below in order of greatest to least impact:

a. Trip attractors within Kingsway including on- and off-street car parking bays.

– *The conversion of Kingsway to one way travelling northbound results in vehicles no longer splitting between north (Brisbane Street) and south (York Street) when entering or exiting parking. Instead all vehicles circulate in a clockwise direction.*

b. Balancing of traffic flows and travel times travelling northbound across the two routes (Charles Street and Kingsway).

– *As traffic volumes are added to Charles Street in the model, travel times increase such that Kingsway becomes a more attractive route and therefore, while the majority of traffic is assigned to Charles Street, some northbound traffic sees Kingsway as the faster route.*

c. While this would not necessarily be represented in the model, the driving patterns of vehicles searching for parking spaces in the immediate area would also contribute to circulation flows across these two streets.

While it may not be possible to reduce the level of traffic parking and searching for parking on Kingsway, it may be appropriate to provide traffic calming treatments on Kingsway to discourage use of this road as a through route and to generally reduce vehicle speeds and improve pedestrian access and amenity.

2.3.4 York Street

The model indicates that the proposed road network changes will result in very little difference in the overall distribution of traffic on York Street, primarily with regard to route choice. During the PM Peak, there are some minor differences as follows:

- Vehicles redirecting from St John Street (northbound) to Bathurst Street;
- Fewer vehicles entering York Street from Paterson Street via George Street;

These are shown in Figure 9.

Both route diversions listed above align with the goals of the City Heart Project to reduce traffic volumes within the City Centre and to promote the use of arterial routes such as Bathurst Street.

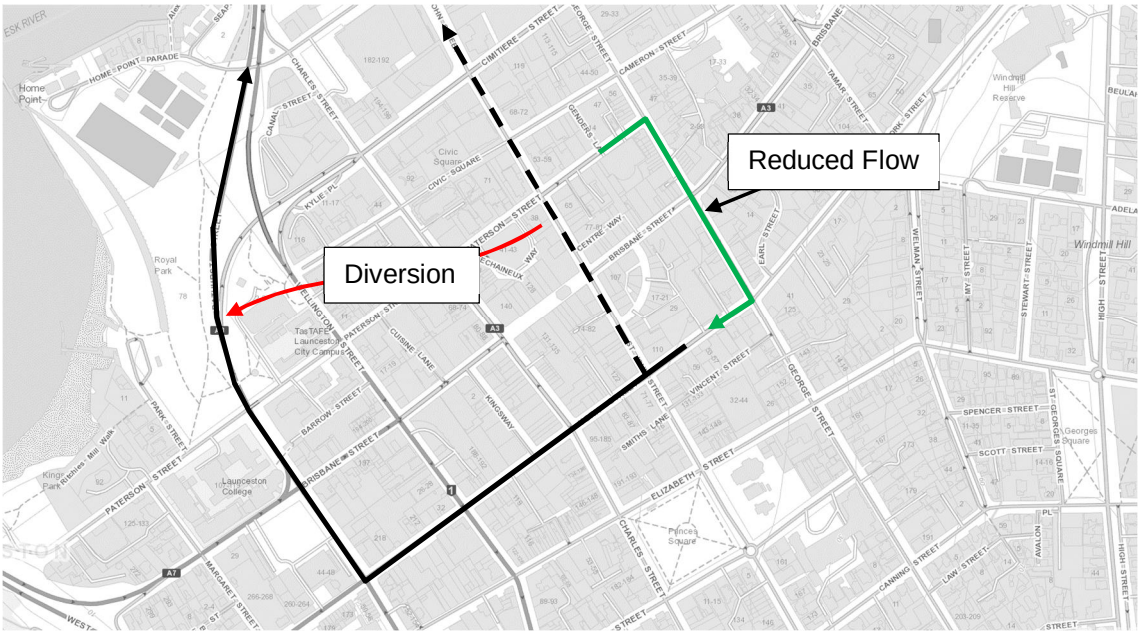


Figure 9 York Street Route Choice

Base image source: LISTMap, DPIPWE

2.3.5 Elizabeth Street

While outside of the immediate study area focus, route choice on Elizabeth Street was also examined. In both the base models and the City Heart Scenario models, Elizabeth Street is a key connecter between East Launceston and the Launceston CBD (via High Street).

During the PM Peak, the model shows a general *increase* in traffic on Elizabeth Street (travelling eastbound) by approximately 120 vehicles per hour. This suggests that Elizabeth Street is taking some of the transport load from Paterson Street. In particular, vehicles are turning right from Brisbane Street onto the new Charles Street two-way section to access Elizabeth Street as shown in Figure 10.

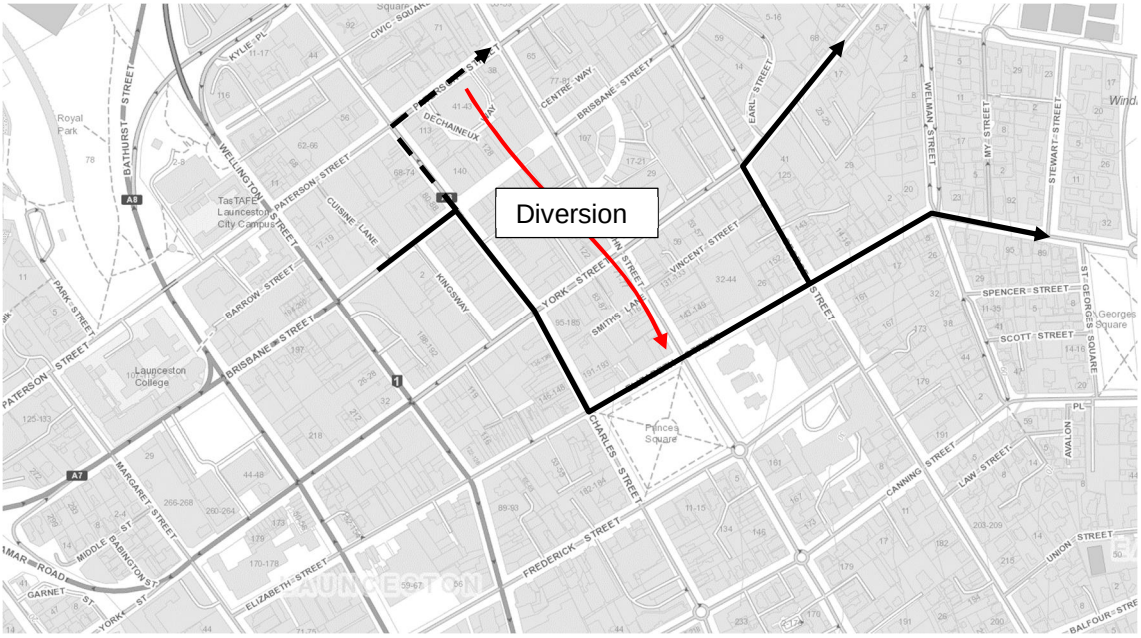


Figure 10 Elizabeth Street Route Choice

Base image source: LISTMap, DPIPWE

2.4 Traffic Network Performance

Overall, no significant issues were observed on the streets modified in either the AM or PM peak models. It is clear from Table 1 and Table 2 that the restrictions limiting the capacity of roads entering the City Heart boundaries, including Brisbane Street being reduced to one-lane and Charles Street being converted to two-way traffic, would serve to reduce traffic volumes, and therefore congestion, on these roads.

Notwithstanding, the modelling suggests that some roads outside the immediate area bounded by the Launceston City Heart will experience increased traffic volumes, delays and queuing including Cimitiere Street, Brisbane Street and Wellington Street.

While the model does not suggest that the increased congestion on these roads will impact significantly on the external road network, it will be important to ensure that that any additional delays and queuing is reduced as much as possible by increasing the available capacity in order to promote the preferred routes through the city where possible.

2.4.1 Brisbane Street

Additional delays and queuing are evident along Brisbane Street in the City Heart Scenario models, particularly in the AM Peak, as a result of the reduced capacity of Brisbane Street between Wellington Street and Charles Streets. The proposed treatments will result in a series

of step changes in capacity along Brisbane Street (Figure 11) as vehicles are encouraged to divert via Bathurst Street towards Cimitiere Street, or via Wellington Street.

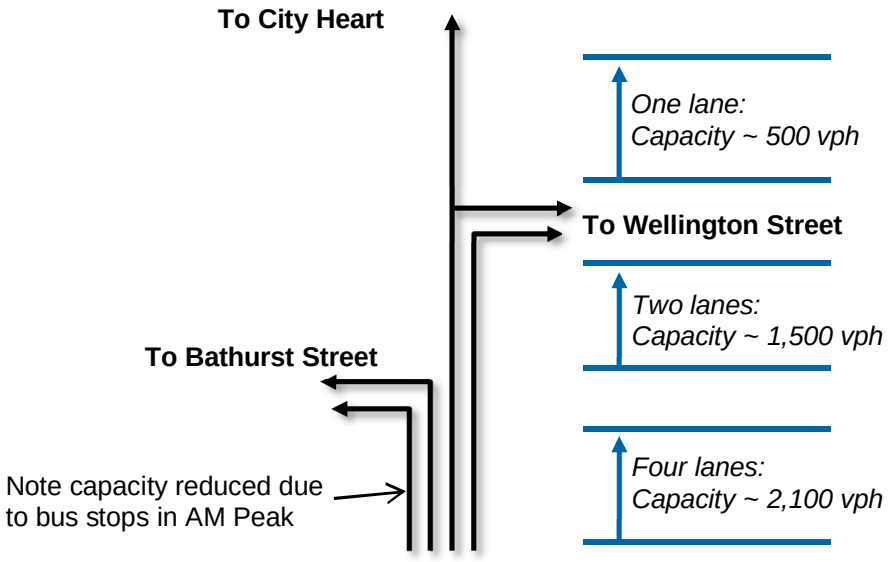


Figure 11 Brisbane Street Capacity (Proposed)

Base image source: LISTMap, DPIPWE

The capacity of the left-most lane on Brisbane Street travelling to Bathurst Street is significantly reduced in the morning peak period due to bus parking outside Launceston College. It is possible that this limited capacity may influence drivers to continue via Brisbane Street to the City Heart rather than divert to Cimitiere Street.

It may be appropriate to consider traffic management works including addressing lane allocation on Brisbane Street, between Margaret Street and Bathurst Street, to more effectively manage traffic flow on this link during the morning peak period.

2.4.2 Wellington Street

In the future (2033) models, additional congestion was identified on Wellington Street, for vehicles travelling southbound along the main arterial route between Cimitiere Street and Paterson Street. The intersection of Wellington Street and Paterson Street becomes a key capacity constraint in the network.

2.4.3 Cimitiere Street

In both the AM and PM peak models, it is clear that eastbound traffic is diverted away from the City Heart onto Cimitiere Street, filtering via the other available routes including Charles Street, St John Street and George Street. This results in increased right turn flows into these roads, creating additional delays and queuing along Cimitiere Street. A detailed assessment of Cimitiere Street is provided in Section 4 of this report.

2.4.4 York Street

The previous *York Street Lane Reduction Traffic Modelling Results* (GHD 2015) assessed the impacts of reducing York Street from three full-length lanes to two full-length lanes between George Street and Wellington Street, which aligns with the proposed changes to York Street in the adopted Launceston City Heart Project scenario.

The report concluded the following:

- *The proposed lane reduction on York Street had a negligible impact on travel times and network performance during the morning peak period.*

- *There was significantly higher congestion and delays experienced in the George Street to St John Street segment in the evening peak as a result of the proposed changes.*
- *Queues along York Street regularly blocked the multi-storey car park in the evening peak, preventing vehicles from entering York Street.*
- *There were no significant impacts on traffic performance outside of the immediate vicinity of York Street; this suggests that the additional congestion and travel times are localised impacts.*

The report demonstrated that York Street could be reduced to two lanes between George Street and Wellington Street, however it was recommended that any capacity reductions on York Street be considered in the context of the wider Launceston traffic network, including the proposed Launceston City Heart Project.

The results of the 2015 modelling and the current modelling are presented in Table 3 and Table 4 for the morning and evening peak periods respectively. Note that the tables show both the average travel time on each segment as well as a Level of Service measure derived from the criteria for signalised intersections provided in *Austroads Guide to Traffic Management Part 3: Traffic Studies and Analysis* (2013) where the delay is equal to the difference between the modelled travel time and the 'free flow' travel time.

Table 3 York Street (AM) Travel Time and [Level of Service]

Segment	2015 Report		Current Report	
	Base[1]	Proposed	Base	Proposed
George to St John	38 s [C]	40 s [C]	38 s [C]	39 s [C]
St John to Charles	28 s [B]	30 s [C]	29 s [B]	28 s [B]
Charles to Wellington	38 s [C]	37 s [C]	57 s [D]	52 s [D]
Total	***105 s***	***107 s***	***124 s***	***119 s***

Table 4 York Street (PM) Travel Time and [Level of Service]

Segment	2015 Report		Current Report	
	Base[1]	Proposed	Base	Proposed
George to St John	45 s [C]	61 s [D]	38 s [C]	39 s [C]
St John to Charles	39 s [C]	42 s [C]	26 s [B]	25 s [B]
Charles to Wellington	85 s [E]	63 s [D]	78 s [E]	76 s [E]
Total	***168 s***	***166 s***	***142 s***	***140 s***

[1] Note that the 2015 base models were calibrated and validated to turning movement counts undertake in 2015 and travel time surveys undertaken in 2012 respectively and therefore show different results to the current modelling which was updated using 2016 travel time surveys.

From the above tables, when modelled in conjunction with road network changes included in the Launceston City Heart Project, the proposed changes to York Street are not expected to significantly impact on the operation of this road.

2.5 Summary

The traffic modelling suggests that the proposed changes to the Launceston City Heart road network is capable of achieving the following general changes to route choice throughout the city:

- Improved use of preferred traffic routes including Wellington Street, Bathurst Street and Cimitiere Street;
- Reduced traffic through the centre of the city including on Paterson Street and St John Street;
- Breaking up of existing heavy through-traffic routes which are causing a traffic barrier effect and general dispersion of traffic through several available routes; and
- Creation of new route options through the conversion of two-way streets at Charles Street and Paterson Street.

From general observation of the microsimulation model, the were no significant issues identified within the City Heart or on alternative routes (such as Cimitiere Street) during either the AM or Pm peak periods. While there was increased traffic volumes and congestion on some routes, this was typically localised and did not appear to cause significant impacts on upstream or downstream junctions.

Notwithstanding the above, it will be important that any increased delays or queuing on preferred arterial routes, including Cimitiere Street, is effectively managed and reduced as much as possible in order to promote these roads as the primary routes through the city.

3. Intersection and Road Design

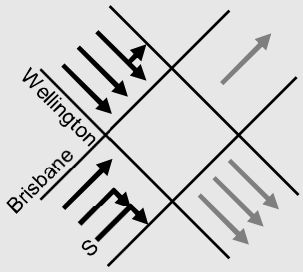
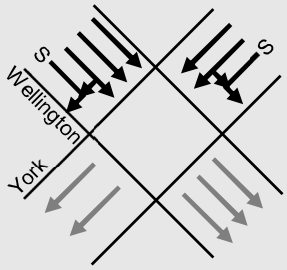
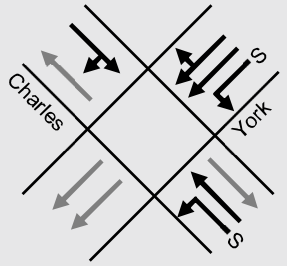
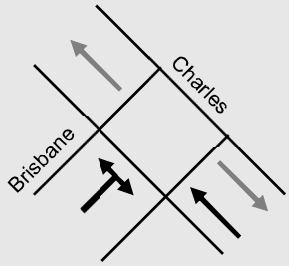
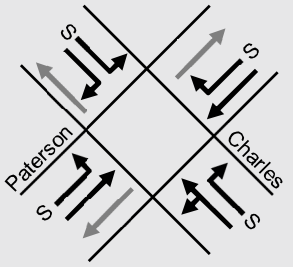
3.1 Intersection Design

The design of intersections and road links for the purpose of traffic modelling was undertaken based on the following principles:

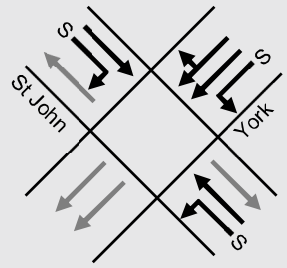
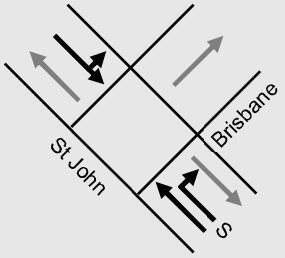
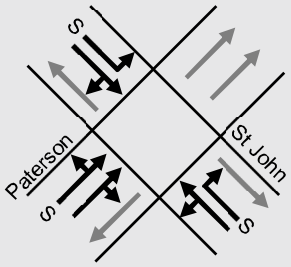
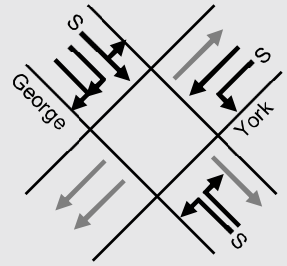
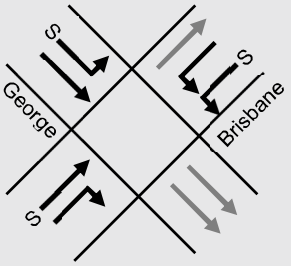
- Restricting access for vehicles into the CBD traffic network while simultaneously promoting paths travelling out of the CBD;
- Maintaining easy access to multi-storey and open air car parks on Paterson Street as well as maximising the supply of on-street parking;
- Reducing capacity to increase the level of congestion and limiting the ability for vehicles to travel at speed; and
- Minimising pedestrian crossing distances.

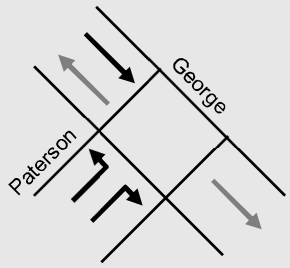
This results in a desire to provide the minimum number of lanes possible at each intersection while still maintaining sufficient capacity. The design of approaches at key intersections is summarised in Table 5. Note that Cimitiere Street is addressed in Section 4 of this report.

Table 5 Intersection Design

Intersection	Intersection Design Considerations	Indicative configuration
Brisbane Street / Wellington Street	The "Avenue" treatment on Brisbane Street will reduce this section to a single lane. The centre lane on Brisbane Street was converted to a right-turn only lane resulting in a single through lane to Brisbane Street.	
York Street / Wellington Street	The design of the York Street / Wellington Street junction will be as per the existing situation, however the left turn lane on York Street will be a short lane (approximately 35 metres).	
Charles Street / York Street	Southbound traffic volumes on Charles Street were low enough that only a single lane, providing both through and right turn movements, was required on approach to York Street. A short left-only lane was provided on York Street with a length of approximately 35 metres.	
Charles Street / Brisbane Street	Due to the lack of opposing movements, a single approach lane was provided on both the Charles Street (northbound) and Brisbane Street approaches. *Note it is recommended that pedestrian phases be separated from vehicle phases to eliminate or reduce potential conflicts on the Brisbane Street approach due to driver frustration waiting for pedestrians to cross Charles Street.*	
Charles Street / Paterson Street	While westbound traffic volumes on Paterson Street were very low, it is recommended to provide a short (20 metre) right turn lane due to high opposing traffic flows travelling eastbound during peaks[2]. Charles Street northbound requires a short right turn lane with a minimum length of 35 metres.	

[2] Note that the traffic modelling included only a single westbound approach lane on Paterson Street and indicated adequate performance, however it is recommended that the additional lane be provided in the interest of robustness.

Intersection	Intersection Design Considerations	Indicative configuration
St John Street / York Street	The existing left-through lane was replaced with a short left-only lane on York Street with a length of approximately 35 metres. It is recommended that a short southbound right turn lane on St John Street be retained in order to ensure that buses are not significantly delayed by right turning vehicles.	
St John Street / Brisbane Street	No changes were made to the existing St John Street / Brisbane Street junction in the model; however, it is considered that the southbound approach could be reduced to a single lane given that there are no conflicts for either the left or through movement. It is recommended that a short right turn lane be retained for the northbound approach to ensure that buses are not significantly delayed by right turning vehicles.	
St John Street / Paterson Street	No changes were made to intersection design, however there were slight modifications required to lane allocation due to the new contra-flow lane on Paterson Street. Two through lanes were retained on Paterson Street.	
George Street / York Street	The proposed changes to York Street will require changes to signal phasing at the George Street / York Street junction for safety purposes as discussed in Section 4.4.7 of this report.	
George Street / Brisbane Street	Changes to George Street / Brisbane Street intersection are required as a result of the “Avenue” treatment on George Street. A short left turn lane was provided on George Street.	

Intersection	Intersection Design Considerations	Indicative configuration
George Street / Paterson Street	Only minor changes were required at George Street and Paterson Street due to reduced number of lanes.	

3.2 Key Design Constraints

This section considers the physical and operational constraints that exist in the road network that might affect the design or overall feasibility of the proposed changes. For each location, issues have been identified as either design constraints, design considerations, or capacity constraints.

There were no specific constraints identified that would prevent the project from proceeding. However, several design constraints, management issues and potential opportunities were identified and these are outlined in the following sections.

One of the key design constraints relates to the movement of buses through the Launceston CBD street network. Council currently plan to retain the operation of the existing bus interchange with just some minor changes to stop locations. On this basis, the design of intersections should take into account the existing movement patterns of buses as presented in Figure 12.

Note that whilst Metro does not currently operate articulated buses in Launceston, it is appropriate to consider the future potential for such vehicles in the future, so that they are not "designed out".

Figure 12 Bus Movement Requirements

Base image source: LISTMap, DPIPWE

3.2.1 Brisbane Street

It is proposed to reduce Brisbane Street to a single lane, travelling in the eastbound direction, between Wellington Street and Charles Street. While no hard design constraints were identified, there are several issues which should be taken into account in the design process including the management of on-street parking and provision for bus services. The Brisbane Street constraints assessment is summarised in Table 6.

Table 6 Brisbane Street Constraints Assessment

Description	Comments
Design Constraints	
Brisbane Street / Charles Street intersection	Intersection design must accommodate the left turning swept path of a 12.5 metre rigid bus or a 19.0 metre articulated bus without encroachment into the oncoming traffic lane. This may require either a single approach lane on Brisbane Street, or allow buses to turn left from the right turn lane.
Design Considerations	
Management of on-street parking	With removal of one traffic lane, there will be additional road width available for parking. Angle parking could be considered, or alternatively, reduce the overall pavement width and widen footpaths.
Provision for bus services	There is an opportunity to expand the footpath at the bus stop opposite Kingsway.
Brisbane Street / Wellington Street intersection	The alignment of the departure lane on Brisbane Street should be designed for an appropriate travel path through the intersection.
Capacity Constraints	
Outputs from traffic modelling	The capacity of the left-most lane on Brisbane Street travelling to Bathurst Street is significantly reduced in the morning peak period due to bus parking outside Launceston College. It is possible that this limited capacity may influence drivers to continue via Brisbane Street to the City Heart rather than divert to Cimitiere Street. It may be appropriate to consider traffic management works including addressing lane allocation on Brisbane Street, between Margaret Street and Bathurst Street, to more effectively manage traffic flow on this link during the morning peak period.

3.2.2 Kingsway

Kingsway is a short, two-way laneway connecting between Brisbane Street and York Street. It would become one-way in the northbound direction under the proposed scenario, thereby restricting entry onto Brisbane Street. Kingsway is not part of any bus routes, however some bus services that stop at Brisbane Street currently turn onto Kingsway to access York Street and these will need to redirect via Charles Street. There is existing tree planting on the road

edge which constrains on-street parking provision. The Kingsway Constraints Assessment is summarised in Table 7.

Table 7 Kingsway Constraints Assessment

Description	Comments
Design Constraints	
Trees planting	Trees planted on the road edge constrain the available pavement width for parking and traffic calming.
Design Considerations	
Management of on-street parking	Potential to provide a meandering travel path (to reduce vehicle speeds and create wider footpath areas) by providing parking alternating between the east and west sides of the street.
Traffic calming	Traffic modelling suggests that a circulation route may be set up between Kingsway and Charles Street. Consider the provision of traffic calming on Kingsway to discourage heavy use of this as a through route between York and Brisbane Streets.
Capacity Constraints	
None identified	

3.2.3 Charles Street

Charles Street will be converted to two-way traffic flow between York Street and Brisbane Street. It will remain one-way between Brisbane Street and Paterson Street and reduced to a single lane with an “Avenue” treatment. Inbound bus services turn left from Brisbane Street onto Charles Street and right from Charles Street onto Paterson Street. The Charles Street constraints assessment is summarised in Table 8.

Table 8 Charles Street Constraints Assessment

Description	Comments
Design Constraints	
None identified	
Design Considerations	
Charles Street / York Street intersection	There is limited space available for provision of additional turn lanes without compromising on pedestrian footpath widths however traffic modelling suggests only a single approach lane should be required on Charles Street (southbound).
Charles Street / Paterson Street intersection	Buses will turn right onto Paterson Street to access the bus interchange or existing layover spaces. Buses must be able to undertake these manoeuvres without encroaching onto the opposing traffic lanes.

Description	Comments
Capacity Constraints	
None identified	

3.2.4 Paterson Street

It is proposed to convert Paterson Street, between Charles Street and St John Street, to two-way traffic flow. Note that Paterson Street, west of Charles Street, already caters for two-way traffic. Paterson Street, east of St John Street, will remain one-way travelling eastbound and will be reduced to two lanes.

Paterson Street provides access to a large open-air car park (between Charles and St John Streets) and to the Paterson Street East multi-storey car park (between St John and George Streets). There is significant bus activity at the junction of Paterson Street and St John Street with many buses turning right into the bus interchange or leaving the interchange travelling northbound. The Paterson Street constraints assessment is summarised in Table 9.

Table 9 Paterson Street Constraints Assessment

Description	Comments
Design Constraints	
Paterson Street / George Street intersection	Intersection design must accommodate the left turning swept path of a 12.5 metre rigid bus or a 19.0 metre articulated bus without encroachment into the oncoming traffic lane.
Design Considerations	
Management of on-street parking	Motorcycle parking on southern side of Paterson Street will need to be rearranged. Sight lines for exits from car parks could potentially be blocked by parked cars. Consider parking restrictions or provide indented parking bays.
Access to car parks	Car park entry (between Charles and St John Streets) may require provision of a short (15-20 metre) median right turn lane due to conversion to two-way traffic.
Bus layover spaces	Existing bus layover on Paterson Street severely constrains footpath width and limits available space for westbound lanes.
Pedestrian access	Observation indicates that there is demand for pedestrian crossings mid-block between Charles Street and St John Street. Consider provision of a pedestrian refuge island possibly in conjunction with a median right turn lane.
Capacity Constraints	
None identified	

3.2.5 Cimitiere Street

With the reduction in capacity on inner city streets, Cimitiere Street will become part of the preferred route for eastbound traffic around the Launceston CBD. The traffic modelling predicts that there will be a moderate increase in the level of traffic using Cimitiere Street during the peak periods and a significant increase in the demand for right turns onto Charles Street. The Cimitiere Street constraints assessment is summarised in Table 10.

Table 10 Cimitiere Street Constraints Assessment

Description	Comments
Design Constraints	
Cimitiere Street / Charles Street intersection	Due to level differences it may not be possible to provide an additional turn lane on Cimitiere Street (eastbound) at the Charles Street junction to accommodate increased right turn volumes.
Design Considerations	
Access for Police	A high level of access must be retained for the Police Station on Cimitiere Street east of the Charles Street intersection.
Capacity Constraints	
Outputs from traffic modelling	Given that there is insufficient space to provide an additional turn lane, it may be appropriate to ban the right turn movement from Cimitiere Street into Charles Street in order to retain adequate capacity at this intersection.
Cimitiere Street / Tamar Street intersection	This junction will become a major capacity constraint as traffic volumes on both Cimitiere Street and Tamar Street grow due to the background traffic growth, the City Heart Project and the proposed UTAS relocation.

3.2.6 York Street

York Street is proposed to be reduced to two lanes of traffic between George Street and Wellington Street, with additional short turn lanes on approach to intersections as appropriate. The York Street constraints assessment is summarised in Table 11.

Table 11 York Street Constraints Assessment

Description	Comments
Design Constraints	
None	

Description	Comments
Design Considerations	
George Street / York Street intersection	It is recommended that signal phasing be modified at the intersection of George Street and York Street in order to remove the potential conflict between left- and right-turning vehicles.
Bus Stops	The proposed reduction of York Street to two lanes creates an opportunity to improve bus infrastructure at Stop H between St John Street and Charles Street.
Capacity Constraints	
Multi-storey car park access	Traffic modelling previously undertaken by GHD *(York Street Lane Reduction Traffic Modelling Results, October 2015)* indicated localised congestion between George Street and St John Street which may affect access to and from the multi-storey car park.

4. Cimitiere Street Analysis

4.1 Summary of Traffic Flow Changes

A route analysis was undertaken in the Launceston Traffic Model for Cimitiere Street on the eastbound approach to Charles Street. The route analysis identifies where each vehicle using that link is travelling to and from within the model. A comparison between the 2016 Base Models and the 2016 City Heart Scenario Models is provided in Figure 13.

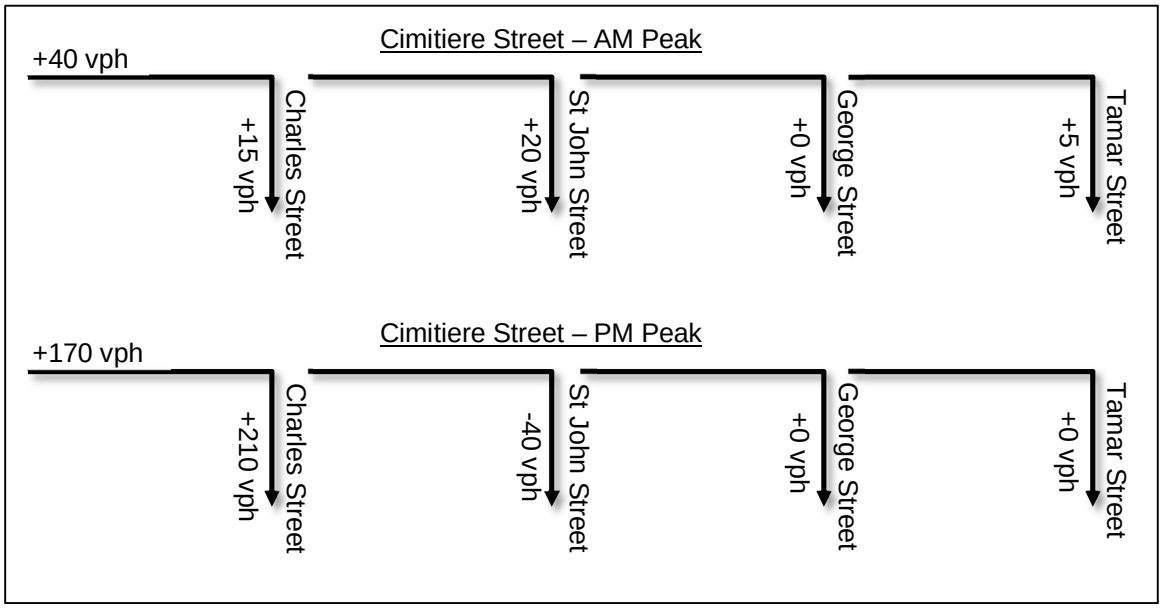


Figure 13 Cimitiere Street Eastbound Traffic Flow

In the morning peak, approximately 40 vehicles redirect to Cimitiere Street, with those vehicles filtering via Charles Street (15 vehicles), St John Street (20 vehicles) and Tamar Street (5 vehicles). The impacts during the evening peak are more pronounced, with around 170 vehicles redirecting to Cimitiere Street and an additional 210 vehicles turning right onto Charles Street.

Differences between AM and PM routes: From both Table 1 and Figure 13 it is clear that many more vehicles are redirecting via Cimitiere Street in the afternoon peak compared to the morning peak. In fact, the total traffic volumes on Cimitiere Street in the PM models begins to closely represent that seen in the AM models.

It is possible that during in the afternoon peak, more vehicles are travelling to, and parking within, the city centre for shopping and other general business than in the morning peak. This would create additional congestion within the boundaries of the City Heart thereby causing more vehicles to redirect via Cimitiere Street in the afternoon compared to the morning. This is evident by the significant increase in the number of vehicles turning right into Charles Street in the PM model and accessing car parking at Paterson Street.

4.2 Travel Times

4.2.1 North / Eastbound

Travel times along Bathurst Street and Cimitiere Street, travelling north and eastbound, were extracted from the model. The results are presented in Figure 14 and Figure 15 for the morning and evening peak periods respectively.

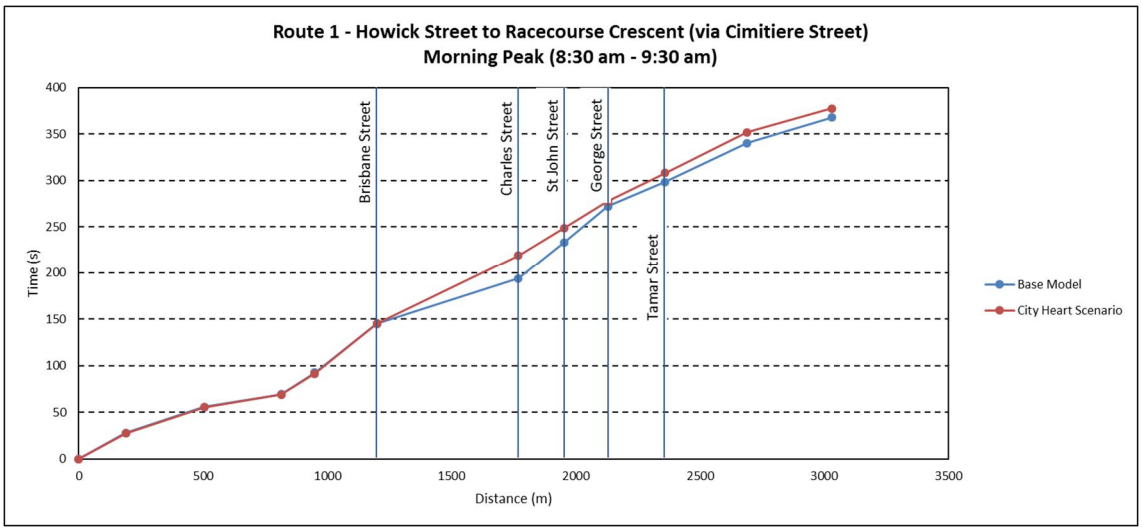


Figure 14 Travel Times – Eastbound AM Peak

In the morning peak, travel times on Bathurst / Cimitiere Street between Brisbane Street and Charles Street are expected to increase compared to current conditions by approximately 30 seconds which indicates possible congestion and delays on this link.

While there is congestion on this link, it is noted that travel times 'catch up' to the base scenario between St John and George Street. This is possibly due to capacity limitations at Charles Street restricting the total level of traffic which can pass the intersection.

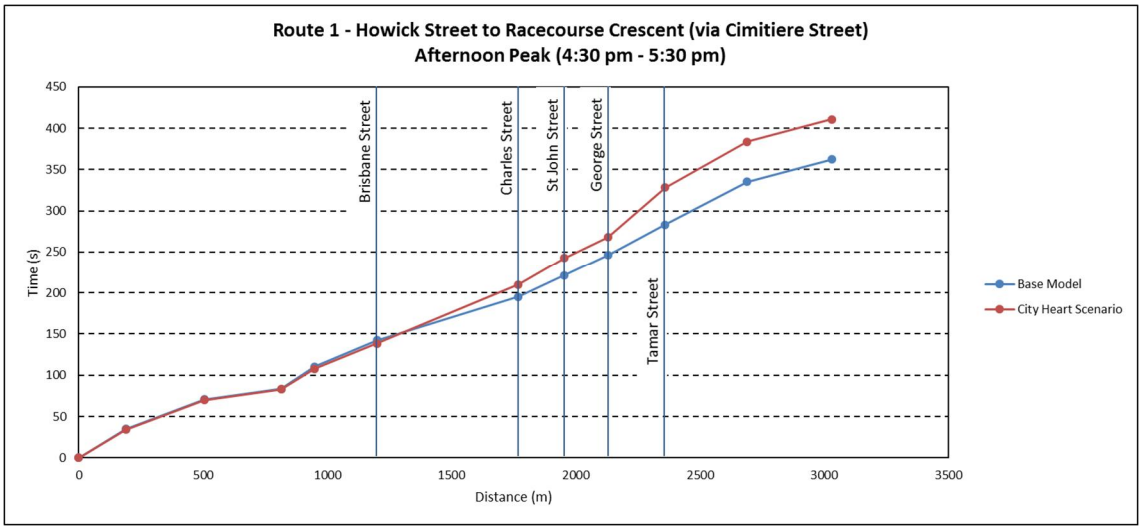


Figure 15 Travel Times – Eastbound PM Peak

In the evening peak, travel times on Cimitiere Street appear to increase progressively between Brisbane Street and Tamar Street. The largest delays are apparent on the link between George Street and Tamar Street. Over the Cimitiere Street corridor, the City Heart Project scenario models show that there may be an additional 45 seconds of travel time.

The average eastbound travel speed between Charles Street and Tamar Street is expected to decrease from 27 km/h to 23 km/h as a result of the additional congestion and delays on Cimitiere Street.

4.2.2 South / Westbound

There is no significant impact on westbound travel times in the morning peak as demonstrated in Figure 16.

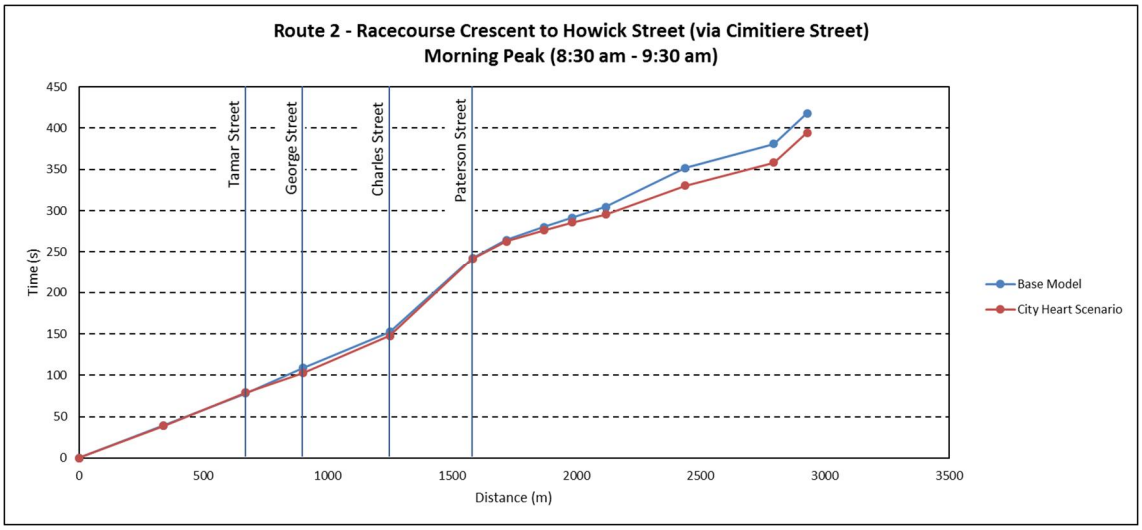


Figure 16 Travel Times – Westbound AM Peak

It is noted, however, that the models show a significant increase in travel times between Charles Street and Paterson Street for vehicles travelling westbound from Cimitiere Street onto Wellington Street in the afternoon peak. This is presented in Figure 17.

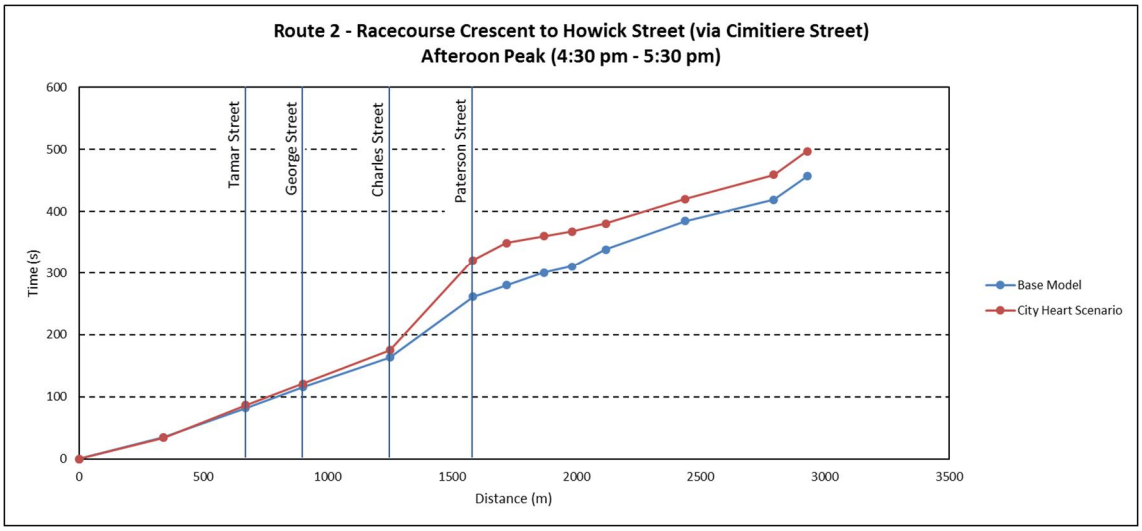


Figure 17 Travel Times – Westbound PM Peak

Observation of the model during operation indicates that the main factors are as follows:

- Increased use of Paterson Street in the City Heart Scenario models, in particular, more vehicles travelling westbound due to the conversion of Paterson Street to two-way traffic between Charles and St John Streets and opening of new routes using this link;
- Limited queue storage between the Wellington Street / Cimitiere Street signals and the Wellington Street / Paterson Street junction;
- Significant queuing is present along Wellington Street from Paterson Street due to traffic from Lower Charles Street (from Invermay) when Cimitiere Street is given a green signal, which limits the amount of traffic that can enter Wellington Street from Cimitiere Street travelling westbound.

The above issues are shown diagrammatically in Figure 18.

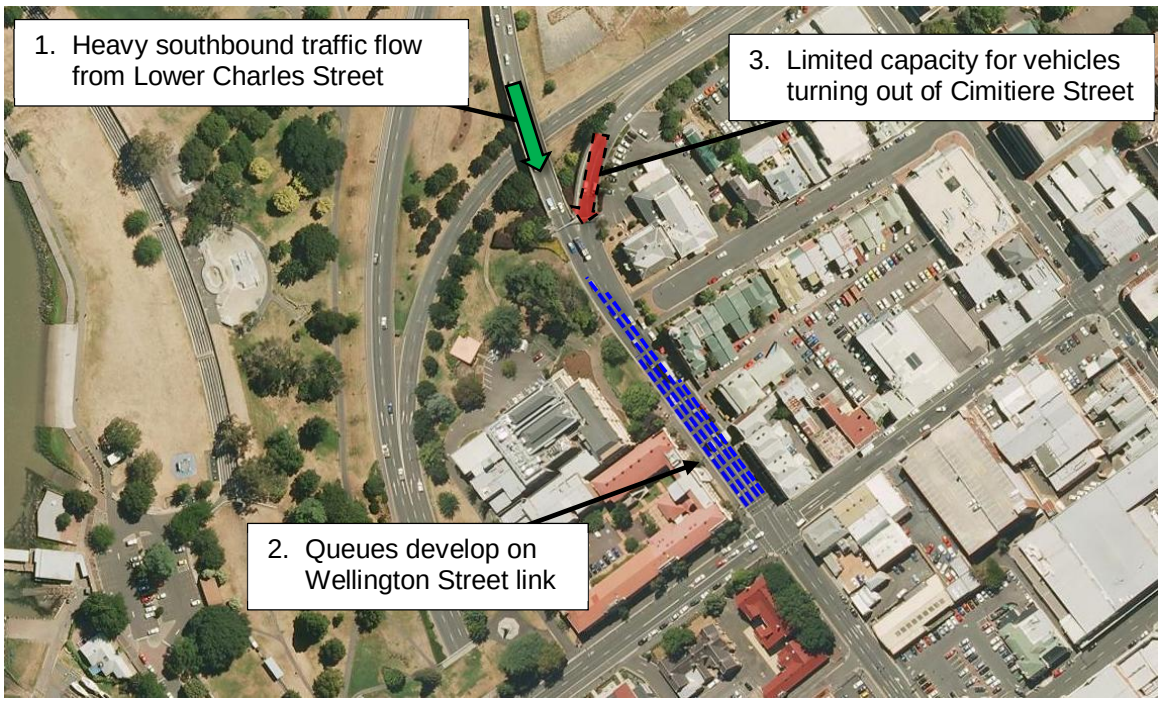


Figure 18 Wellington Street Congestion

Base image source: LISTMap, DPIPWE

4.3 Intersection Analysis

A SIDRA Intersection 6.1 Network Model was developed for the Cimitiere Street corridor based on turning movement volumes extracted from the Launceston CBD Microsimulation model. The results for each intersection under the City Heart Scenario are summarised in the following sections.

4.3.1 Cimitiere Street / Charles Street

The level of service for each movement at the intersection of Charles Street and Cimitiere Street are presented in Table 12.

Table 12 Charles Street SIDRA Model Level of Service (LOS) Results

Approach	AM Peak			PM Peak		
	Left	Through	Right	Left	Through	Right
Charles Street (NB)	C	D	D	C	E	F
Cimitiere Street (WB)	A	A	C	B	B	C
Charles Street (SB)	C	C	C	C	C	D
Cimitiere Street (EB)	A	F	F	B	F	F

Overall, the intersection of Charles Street and Cimitiere Street performs at a satisfactory level of service under the City Heart Scenario with the exception of the Cimitiere Street (eastbound) approach. This is primarily due to the increased traffic volumes on this approach and an

increase in the level of right turning traffic. This will need to be mitigated through the provision of a right turn phase or, alternatively, banning right turns into Charles Street.

4.3.2 Cimitiere Street / St John Street

The level of service for each movement at the intersection of St John Street and Cimitiere Street are presented in Table 13.

Table 13 St John Street SIDRA Model Level of Service (LOS) Results

Approach	AM Peak			PM Peak		
	Left	Through	Right	Left	Through	Right
St John Street (NB)	C	C	C	C	C	C
Cimitiere Street (WB)	A	A	B	B	A	B
St John Street (SB)	C	C	D	C	C	C
Cimitiere Street (EB)	A	B	B	A	B	B

The intersection of St John Street and Cimitiere Street operates at a high level of service due to very low traffic volumes on the St John Street approaches. Cimitiere Street can be given a high proportion of the total available green time, allowing east and westbound traffic to flow through the intersection. The results suggest that there is spare capacity in the intersection to accommodate additional turning movements.

4.3.3 Cimitiere Street / George Street

The level of service for each movement at the intersection of George Street and Cimitiere Street are presented in Table 14.

Table 14 George Street SIDRA Model Level of Service (LOS) Results

Approach	AM Peak			PM Peak		
	Left	Through	Right	Left	Through	Right
George Street (NB)	C	C	D	C	C	C
Cimitiere Street (WB)	A	A	A	A	A	A
George Street (SB)	C	C	C	C	C	C
Cimitiere Street (EB)	A	A	B	A	A	A

The intersection of George Street and Cimitiere Street operates at a high level of service due to very low traffic volumes on the George Street approaches. Cimitiere Street can be given a high proportion of the total available green time, allowing east and westbound traffic to flow through the intersection. The results suggest that there is spare capacity in the intersection to accommodate additional turning movements.

4.3.4 Cimitiere Street / Tamar Street

The level of service for each movement at the intersection of Tamar Street and Cimitiere Street are presented in Table 15.

Table 15 Tamar Street SIDRA Model Level of Service (LOS) Results

Approach	AM Peak			PM Peak		
	Left	Through	Right	Left	Through	Right
Tamar Street (NB)	B	C	C	C	D	D
Cimitiere Street (WB)	B	B	C	B	B	C
Tamar Street (SB)	C	B	C	C	C	C
Cimitiere Street (EB)	B	C	C	B	B	C

The SIDRA modelling results indicate that the Tamar Street junction will operate at a satisfactory level of service in both the morning and evening peak periods. The congestion and delays identified at Tamar Street in the microsimulation modelling (see Figure 15) were not picked up in the SIDRA modelling which indicates that dynamic traffic conditions may be contributing to delays in this area.

Note: The Launceston CBD Model simulates individual vehicles as they travel through the road network. Therefore, dynamic traffic conditions may contribute to delays and queuing when the parts of the network become congestion. Potential dynamic conditions include variations in the minute-by-minute traffic demand as opposed to an average hourly flow, upstream arrival flows and platooning, and the development and dissipation of downstream queuing.

It is noted that the arrival flows at Tamar Street travelling eastbound on Cimitiere Street were reduced in the SIDRA models due to capacity constraints at oversaturated upstream lanes (Charles Street junction).

Two main factors will contribute to decreasing performance at the Cimitiere Street / Tamar Street junction over time:

- Capacity improvements at Cimitiere Street / Charles Street will increase the level of traffic that can pass through this intersection, and therefore will increase the level of traffic travelling eastbound and approaching the Tamar Street junction; and
- The proposed UTAS relocation to Inveresk has the potential to significantly change traffic movements at the Cimitiere Street / Tamar Street junction, particularly for vehicles turning into and out of the Tamar Street (southbound) approach.

It is likely that the junction will require additional capacity in the short to medium term.

4.4 Potential Traffic Management Treatments

4.4.1 Charles Street Right Turn Ban

It is proposed to ban the right turn movement from Cimitiere Street into Charles Street.

Issue: The volume of right turns into Charles Street increases as a result of the proposed changes to the City Heart road network creating delays and queuing on Cimitiere Street, which is the preferred eastbound arterial route through the city.

General Summary of Benefits and Impacts

The proposed turn ban will improve the traffic performance of this junction, thereby reducing delays and queuing for vehicles travelling eastbound on Cimitiere Street. However, it is acknowledged that these vehicles will then need to travel via alternative routes. Some may choose to travel via Brisbane Street and Charles Street, thereby reducing the effectiveness of the City Heart Project treatments.

The SIDRA modelling provided in Section 4.3 suggest that there is spare capacity at both the St John Street and George Street junctions to accommodate additional right turn movements.

Road Safety

The crash history from 2011 to 2016 (inclusive) shows a total of 9 crashes occurred at the intersection of Charles Street and Cimitiere Street, with 4 of those resulting in injury. Five of those crashes were Right-Through crashes with the listed factors including a failure to give way and turning without care. There were also three pedestrian crashes, which involved a vehicle failing to give way to a pedestrian crossing the road.

The proposed right turn ban will eliminate one of the right turn movements at the junction which will have a direct impact on the crash rate. Furthermore, the removal of right turns will also remove vehicles propping within the intersection to turn right onto Charles Street (southbound), which will improve sight distance to oncoming vehicles for those vehicles turning right into Charles Street (northbound).

Summary of Modelling Results

Both the Charles Street right turn ban and the additional eastbound traffic lane (Section 4.4.2) were modelled using the Launceston CBD (microsimulation) Model. The changes had the following general impacts on traffic volumes:

- Generally reduced traffic volumes on Cimitiere Street approaching Charles Street; and
- Slightly increased right turning volumes onto George Street and Tamar Street.

The model suggests that when the turn ban is in place, drivers may prefer to avoid Cimitiere Street and instead use alternative routes (including Brisbane Street) to access Charles Street. Therefore, it will be important to promote use of Cimitiere Street and discourage use of inner city streets through traffic calming treatments within the City Heart and by restricting the capacity of Brisbane Street.

Travel Times

The congestion observed in the City Heart Scenario models (see Section 2.4) essentially disappeared with the introduction of the Charles Street right-turn ban and additional eastbound traffic lane between Charles Street and St John Street. The eastbound travel times extracted from the model are presented in Figure 19 and Figure 20.

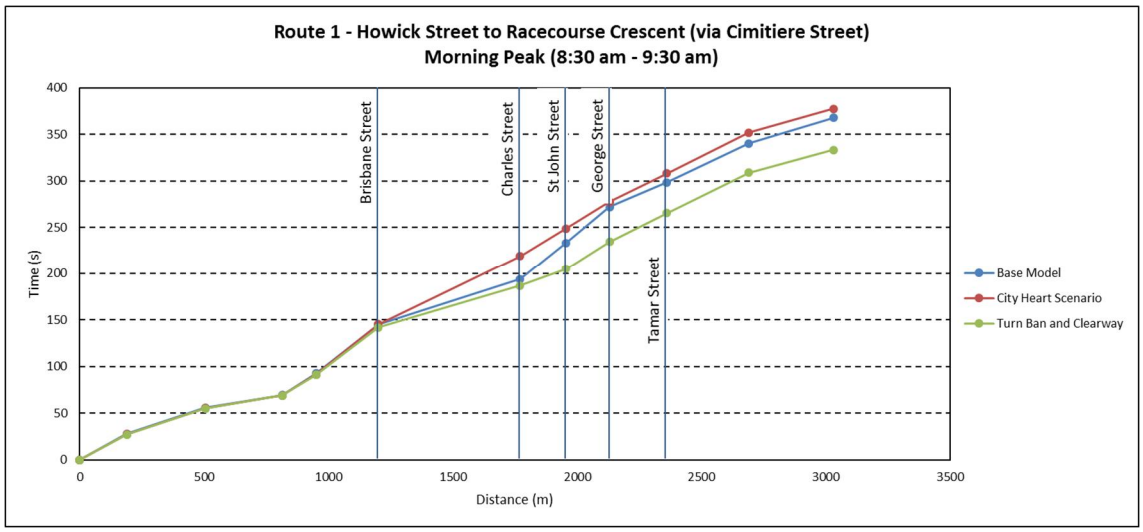


Figure 19 Travel Times – Eastbound AM Peak

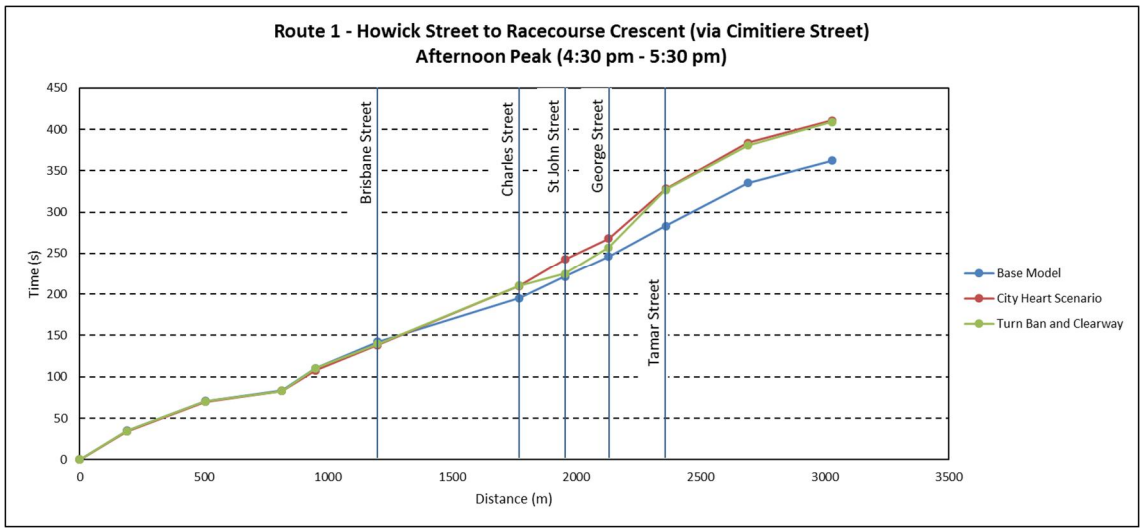


Figure 20 Travel Times – Eastbound PM Peak

Intersection Performance

The Cimitiere Street corridor was re-modelled in SIDRA 6.1 with the following changes to the base scenario:

- Right turn ban for Cimitiere Street eastbound into Charles Street;
- Additional eastbound traffic lane between Charles Street and St John Street
- Removal of St John Street slip lane; and
- Turning volumes extracted from the Launceston CBD Model.

The results are presented in Table 16.

Table 16 SIDRA Modelling Level of Service Results – Cimitiere to Charles Street Right Turn Ban

Approach	AM Peak			PM Peak		
	Left	Through	Right	Left	Through	Right
Charles Street Junction						
Charles Street (NB)	C	C	C	B	B	B
Cimitiere Street (WB)	B	A	B	B	B	C
Charles Street (SB)	C	C	C	B	B	B
Cimitiere Street (EB)	B	A	-	B	B	-
St John Street Junction						
St John Street (NB)	C	C	C	C	C	C
Cimitiere Street (WB)	B	A	B	B	A	B
St John Street (SB)	C	C	C	C	C	C
Cimitiere Street (EB)	B	B	B	B	A	B
George Street Junction						
George Street (NB)	C	C	D	C	C	C
Cimitiere Street (WB)	A	A	A	A	A	A
George Street (SB)	C	C	C	C	C	C
Cimitiere Street (EB)	A	A	B	A	A	A
Tamar Street Junction						
Tamar Street (NB)	B	E	E	C	C	D
Cimitiere Street (WB)	B	B	C	B	B	C
Tamar Street (SB)	C	B	D	C	C	C
Cimitiere Street (EB)	B	D	E	B	C	C

Based on the results in Table 16, there is sufficient capacity in St John Street and George Street to accommodate any the additional right turn volumes that might be redirected from Charles Street, and the Cimitiere Street intersections will continue to operate with a satisfactory Level of Service.

Of particular note is the reduced performance at the Tamar Street junction. This is likely due to:

- Increased capacity at Cimitiere Street / Charles Street allowing more eastbound vehicles to approach the Tamar Street junction; and

- Increased right turns at Tamar Street compensating for the right turn ban at Charles Street.

It will be important to manage traffic volumes and capacity at this junction to ensure adequate performance into the future.

4.4.2 Cimitiere Street Eastbound Lane

It is proposed to provide an additional eastbound traffic lane on Cimitiere Street, between Charles Street and St John Street, to increase the capacity on this link. The left turn slip lane from Cimitiere Street into St John Street will be removed and signalised with the St John Street junction. The proposed changes are presented in Figure 21.

Issue: Increasing volumes creating mid-block congestion and queuing on Cimitiere Street, which is the preferred eastbound arterial route through the city. Note that the right turn ban discussed in Section 4.4.1 exacerbates any congestion on this link.

General Summary of Benefits and Impacts

The project will result in general improvements to the total capacity of this section of Cimitiere Street, and in particular will improve the performance of the Charles Street junction since merging will no longer be required on the departure side of intersections. It is noted that the removal of the slip lane and incorporating the Cimitiere Street to St John Street left turn movement into the traffic signals will increase delays for this movement.

*Note: It is **not** recommended to implement the additional eastbound lane on Cimitiere Street without the turn ban at Charles Street. This is due to the existing lane allocation on Cimitiere Street. There is a high probability that vehicles utilising the left lane at Charles Street to bypass right-turning vehicles could set up a 'weaving-merging' situation immediately downstream of the Charles Street junction which presents a road safety concern.*

The additional eastbound traffic lane will increase the storage capacity of this section of Cimitiere Street. The benefits to traffic flow will be primarily related to improved stability under increasing traffic volumes. The extra storage capacity will ensure that any downstream capacity issues (for example at George Street or St John Street) will not influence the capacity of the Charles Street junction.

Road Safety

The 5-year crash history at the intersection of St John Street and Cimitiere Street includes several Cross Traffic, Side Swipe and Rear End collisions. The primary contributing factors reported are failure to obey traffic signals and turning without care. The crashes typically occurred outside of the peak periods when traffic volumes on Cimitiere Street are relatively low.

The crash history suggests that inattention and excessive speeds outside of peak times are contributing to red-light running behaviour. The proposed treatments will improve road safety between Charles Street and St John Street in the following ways:

- Traffic calming in the form of median islands to encourage reduced vehicle speeds;
- Removal of the slip lane and signalisation of the left turn from Cimitiere Street into St John Street;
  - *Due to low volumes on St John Street, there is currently a low expectation for vehicles turning left from Cimitiere Street onto St John Street that they will have to give way.*
- Generally improved storage capacity and reduced congestion within the Charles Street to St John Street link.

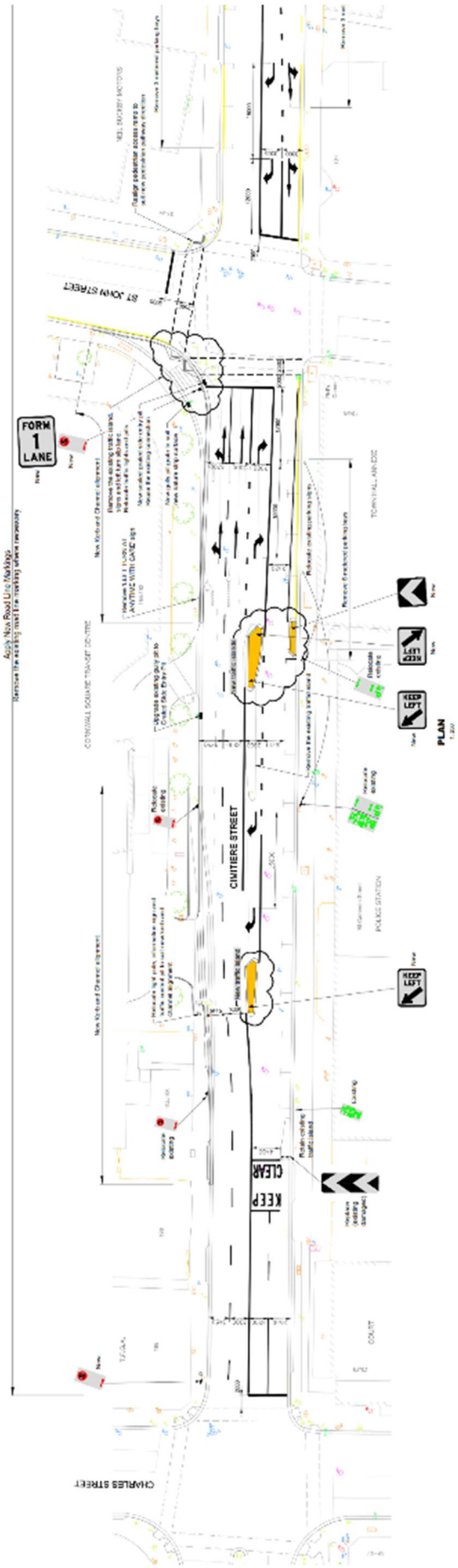


Figure 21 Cimitiere Street Traffic Management Concept

Image source: City of Launceston, February 2016

Traffic Modelling

The traffic modelling results for this treatment, along with the Charles Street right turn ban, are provided in Section 4.4.1 of this report.

4.4.3 Addressing Crash Record at George Street / Cimitiere Street

The 5-year crash history at the intersection of George Street and Cimitiere Street includes six Cross Traffic crashes, three Right Through crashes and three Pedestrian crashes. The crash diagram provided by the City of Launceston suggests that the majority of Cross Traffic crashes involved vehicles travelling westbound on Cimitiere Street although it is unclear which vehicle disobeyed the traffic signals.

It is noted that buildings are present on both sides of the eastern intersection leg up to the edge of the footpath, which significantly restrict sight distances. A vehicle legally entering the intersection from either George Street leg on a green signal may not have time to observe a vehicle running a red light on the Cimitiere Street westbound leg and stop before a conflict. This is shown in Figure 22.

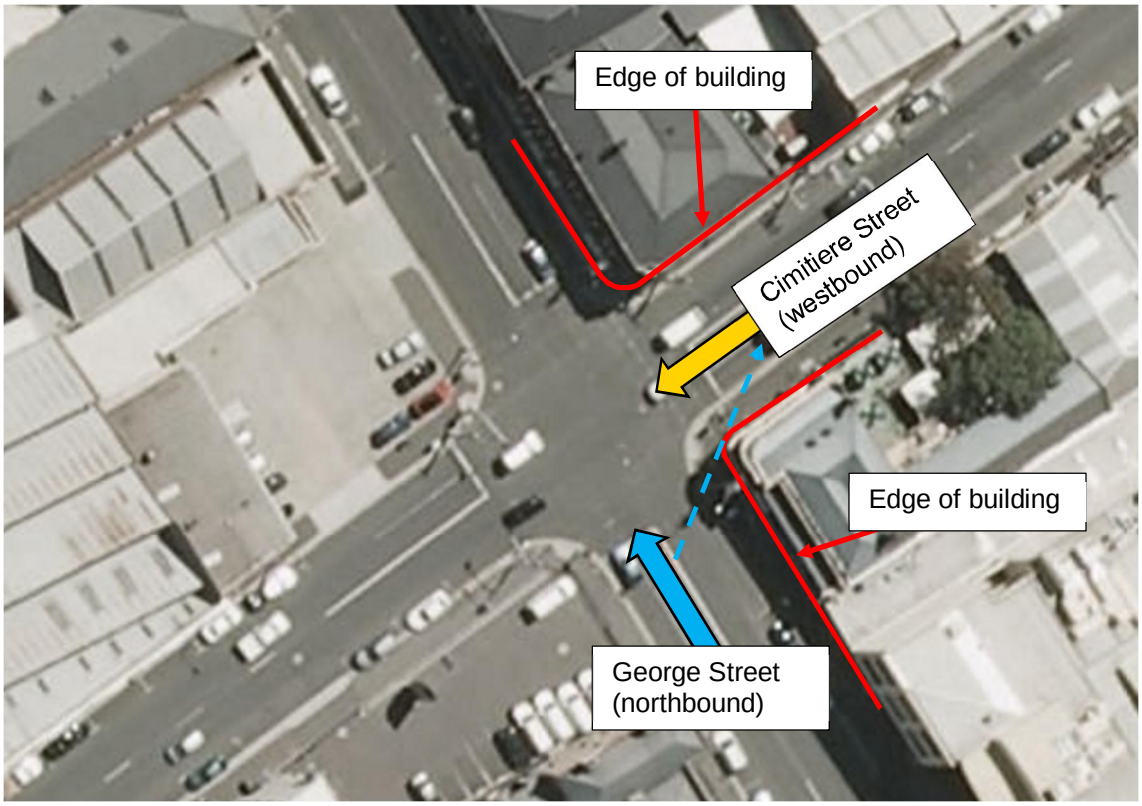


Figure 22 George Street / Cimitiere Street

Base image source: LISTMap, DPIPWE

Possible treatment options to address the crash record could include:

- Increase the yellow phase and all-red clearance times to increase separation between phases and allow more vehicles to filter right during the inter-green period at the end of the phase.
- Provision of a median island or other traffic calming treatment on Cimitiere Street to reduce vehicle speeds on these approaches.
- Provision of a pedestrian early start to protect pedestrian movements.

It is further noted that there are several signs and other road infrastructure which obstruct or confuse the view of traffic signals from the George Street approaches. In particular, light and

power poles are located in very close proximity to signal lanterns. It is recommended that further investigation of the visibility on these approaches be undertaken to further address the crash record at the intersection.

4.4.4 Addressing Crash Record at Tamar Street / Cimitiere Street

The 5-year crash history at the intersection of Tamar Street and Cimitiere Street includes a total of 21 crashes, with 6 of those resulting in injury. There were nine Cross Traffic crashes, six Right Through crashes and four Rear End collisions. The vast majority of Cross Traffic crashes involved vehicles travelling eastbound on Cimitiere Street which, similar to the George Street junction, is characterised by buildings located close to the road edge which restrict the available sight distances. The intersection is shown in Figure 23.

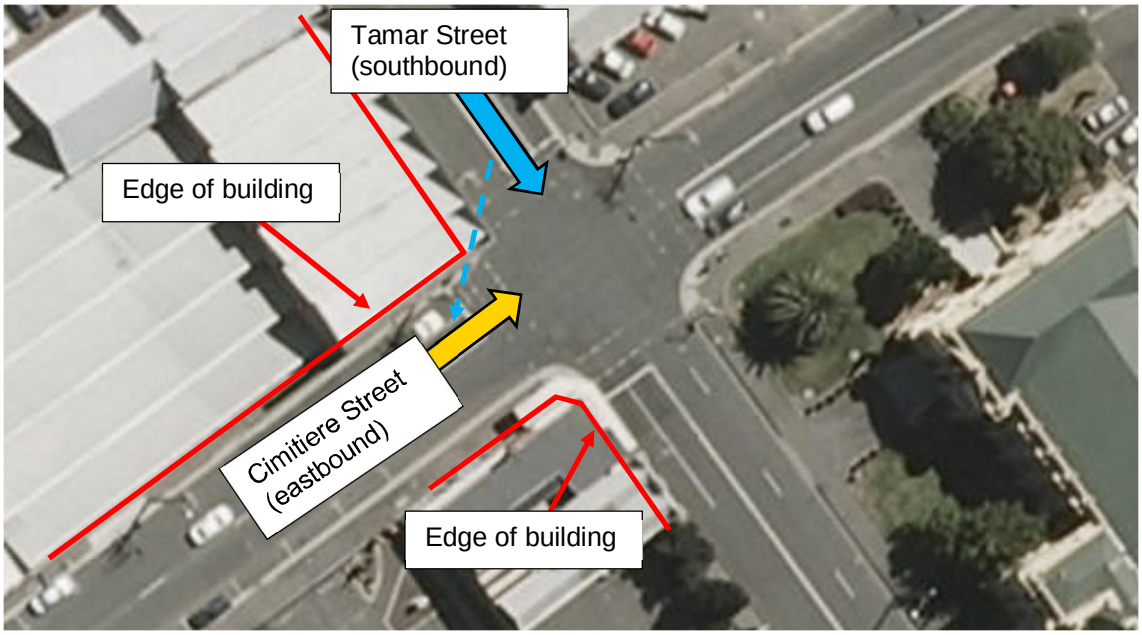


Figure 23 Tamar Street / Cimitiere Street

Base image source: LISTMap, DPIPWE

The crash diagram indicates that many Right Through crashes occur on Tamar Street between northbound vehicles turning right onto Cimitiere Street and southbound vehicles continuing through along Tamar Street. Right turning vehicles must cross two lanes of traffic against a relatively high opposing traffic volume.

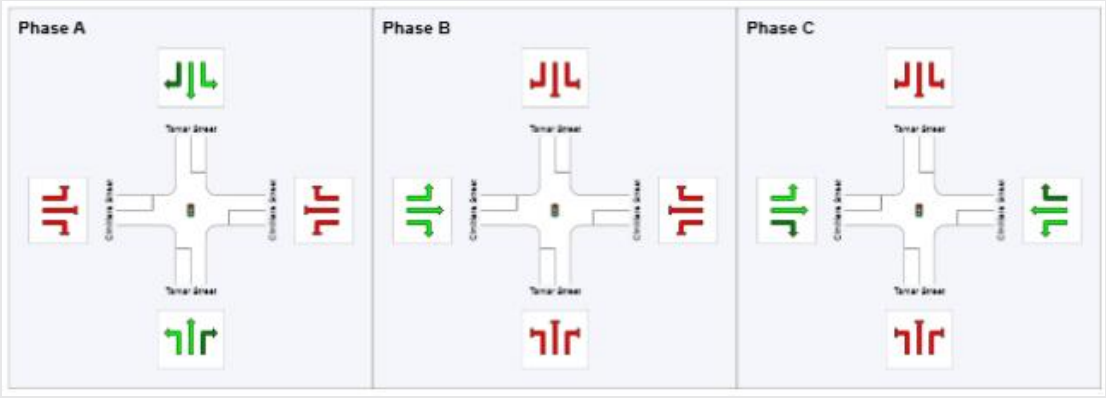
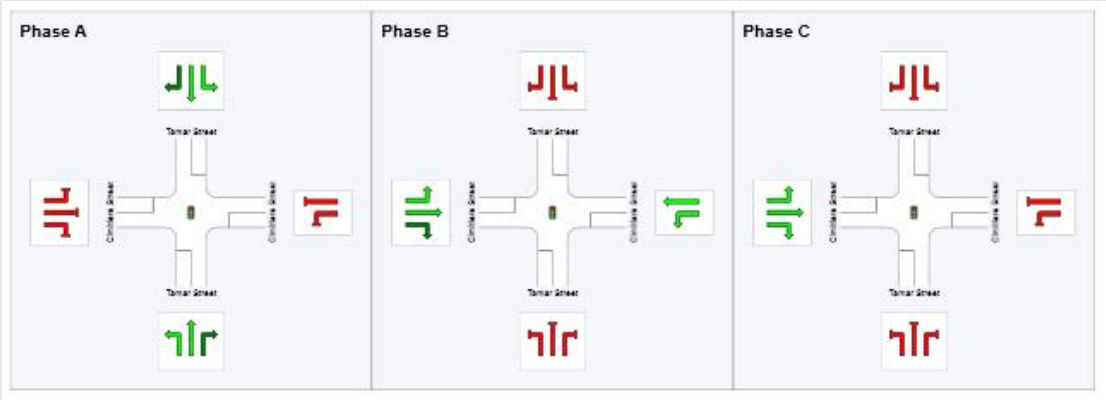
Possible treatment options to address the crash record could include:

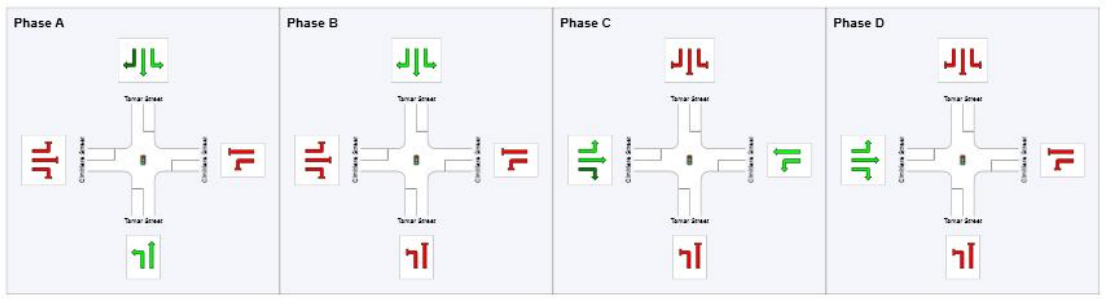
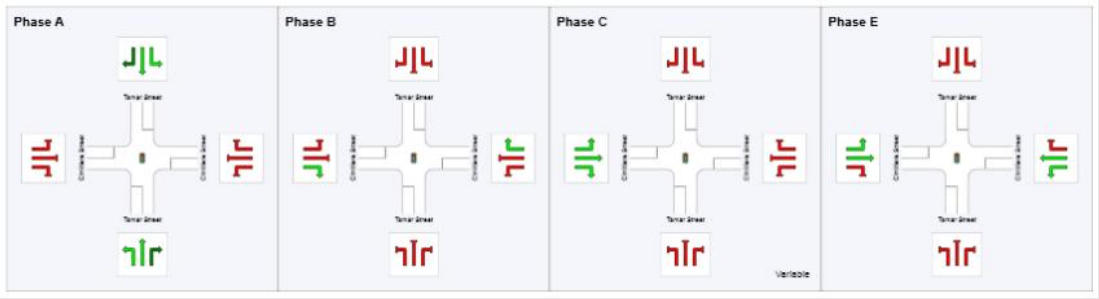
- Provision of a median island or other traffic calming treatment on Cimitiere Street to reduce vehicle speeds on these approaches.
- Increase the yellow phase and all-red clearance times to increase separation between phases and allow more vehicles to filter right during the inter-green period at the end of the phase.
- Provision of a pedestrian early start to protect pedestrian movements.
- Providing trailing right turn phases for Cimitiere Street (eastbound) and Tamar Street (southbound) and banning the opposing right turn movement (discussed below).

4.4.5 Tamar Street Signal Phasing

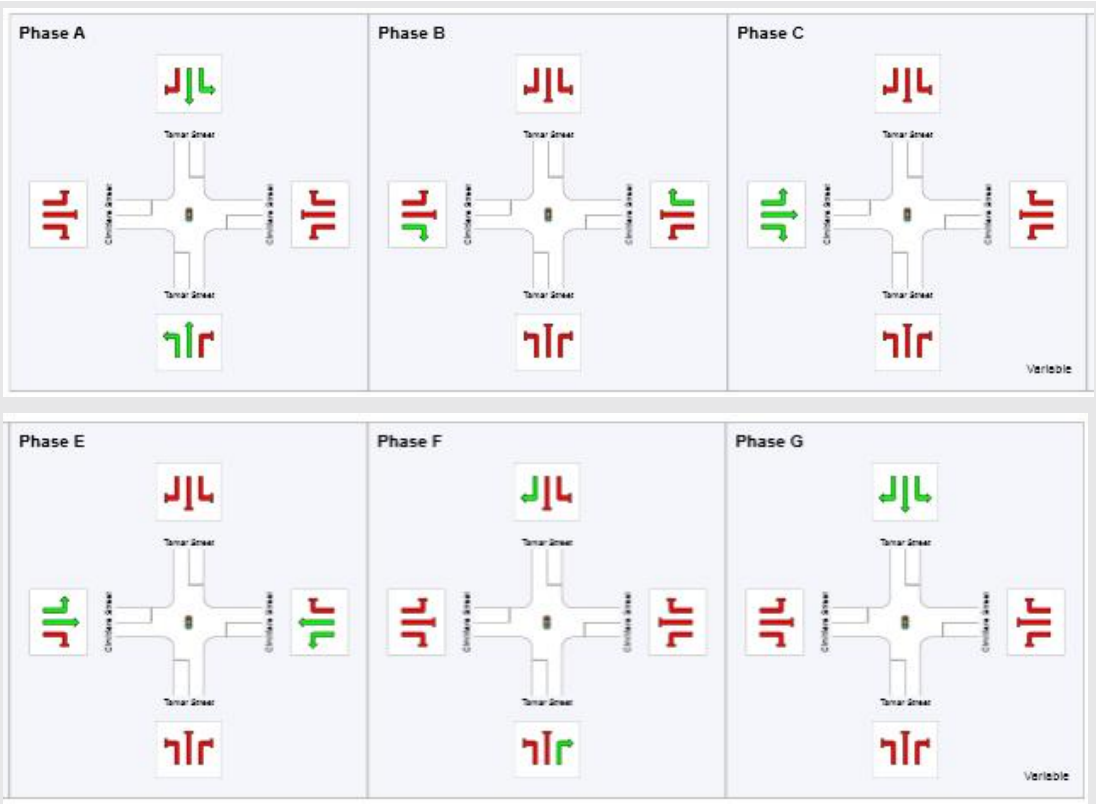
Approach volumes at the Tamar Street junction are typically weighted towards Cimitiere Street with a heavier eastbound traffic flow. A number of signal phasing options were investigated using SIDRA Intersection 6.1. The results are summarised in Table 17.

Table 17 Tamar Street Signal Phasing

Signal Phasing Option	Design Factors	Summary of Model Performance
Leading Right Turns (Cimitiere Street Eastbound)	No changes to lane allocation required.	Improved performance for Cimitiere Street (eastbound) due to leading right turn phase. Phase is called every cycle, therefore resulting in detrimental impacts to other approaches.
		
Trailing Right Turns (Cimitiere Street Eastbound) *Note that the westbound right turn movement may need to be banned to prevent filtering movements during the inter-green phase (for safety).*	No changes to lane allocation required.	Generally improved performance for Cimitiere Street (eastbound) due to trailing right turn phase. Phase may not need to be called every cycle, thereby limiting any potential adverse impacts on other approaches. The model suggests a high percentage call for the right turn phase in the AM peak and low in the PM peak which reflects the level of eastbound right turning volumes.
		

Signal Phasing Option	Design Factors	Summary of Model Performance
Trailing Right Turns (Cimitiere Street Eastbound and Tamar Street Southbound) *Note that the westbound and northbound right turn movements may need to be banned to prevent filtering movements during the inter-green phase (for safety).*	No changes to lane allocation required.	Generally good performance for the intersection at LOS B for both morning and evening peak periods. Model suggests a relatively low percentage call for the right turn phases in both peaks. Provides improved 'robustness' for increasing right turn volumes particularly from Tamar Street into Cimitiere Street which may increase with UTAS development at Inveresk.
		
Single Diamond Phasing (Cimitiere Street Only)	Dedicated right turn lanes required on Cimitiere Street.	Requires a relatively long cycle time to accommodate diamond phasing. Right turning vehicles on Cimitiere Street queue and block the through lanes. Model indicates generally poor performance with most approaches operating at LOS D or E with significant queuing and delays.
		

Signal Phasing Option	Design Factors	Summary of Model Performance
Double Diamond Phasing	Dedicated right turn lanes required on both Cimitiere Street and Tamar Street.	Requires a long cycle time to accommodate full diamond phasing. Right turning vehicles on Cimitiere Street queue and block the through lanes. Model indicates generally poor performance with most approaches operating at LOS D or E with significant queuing and delays.



From the SIDRA modelling, the only signal arrangement that is likely to improve traffic flow at the Cimitiere Street / Tamar Street junction *without banning turns* is to apply a leading right turn phase to the Cimitiere Street (eastbound) approach. Note that the phase would be called every cycle, thereby resulting in detrimental impacts to other approaches. No changes to lane allocation would be required.

An alternative option is to apply trailing right turn phases to some approaches and ban the opposing right turn to prevent filtering movements during the inter-green phases. This will significantly improve intersection performance.

It is noted that the proposed relocation of the UTAS campus to Inveresk may have implications for traffic flow and activity at the Tamar Street / Cimitiere Street junction and therefore further investigation of this junction will be required when the traffic patterns generated by the relocation can be more accurately predicted.

4.4.6 Improve Use of William Street

It has been proposed that Cimitiere Street, and in particular, the Cimitiere Street / Tamar Street junction, can be relieved by promoting increased use of the currently underutilised William Street as an alternative east-west route. William Street connects between Lower Charles Street and Tamar Street and has a wide carriageway.

The Launceston CBD model was used to estimate the impacts of transferring vehicles from Cimitiere Street to William Street. The key findings were as follows:

- It was very difficult to attract vehicles to William Street without significantly increasing the 'cost' of travelling on Cimitiere Street. That is, if William Street is to be promoted as a preferred route, the capacity of Cimitiere Street will have to be severely constrained.
- With increasing traffic volumes on William Street, vehicles experienced increased difficulty turning onto Tamar Street. In the PM peak model, queues regularly extended back along William Street to the George Street junction (> 200 metres).

It is considered that William Street could effectively draw eastbound traffic away from Cimitiere Street only if one or more of the following conditions are met:

- The eastbound capacity of Cimitiere Street (between St John Street and Tamar Street) is artificially constrained;
- Other routes in the immediate area are severed, for example, Tamar Street between William Street and Cimitiere Street;
- The safety and capacity of the William Street / Tamar Street is significantly improved.

It is recommended that Cimitiere Street and William Street continue their current functions.

4.4.7 York Street / George Street Treatments

The York Street / George Street junction is characterised by heavy southbound and westbound approach volumes and light northbound approach volumes. It currently operates under a two-phase signal arrangement.

The intersection carries significantly heavier traffic volumes in the evening peak compared to the morning peak. The proposed City Heart project is not expected to increase traffic flows at the junction, rather the models show a general reduction in the total level of traffic using the junction by around 5% during the evening peak.

Note: The reduction in traffic at the York Street / George Street junction is likely a result of the 'breaking up' of the existing Paterson Street -> York Street route, and creation of new routes for westbound traffic on Paterson Street.

The reduction of York Street from three lanes to two lanes creates a safety hazard given the current phasing arrangements. Vehicles on the northbound George Street approach turning left onto York Street will have priority over opposing traffic turning right onto York Street. However, the nature of this right turn, having two turn lanes, a heavier traffic flow and a channelizing island, can give the false impression of priority for these vehicles.

The York Street / George Street junction may be a candidate for split approach phasing. A SIDRA 6.1 model was developed for the junction based on the turning volumes extracted from the Launceston CBD Model. The results are presented in Table 18 and including signal phasing, average delay, level of service and 95th percentile queue lengths for each movement.

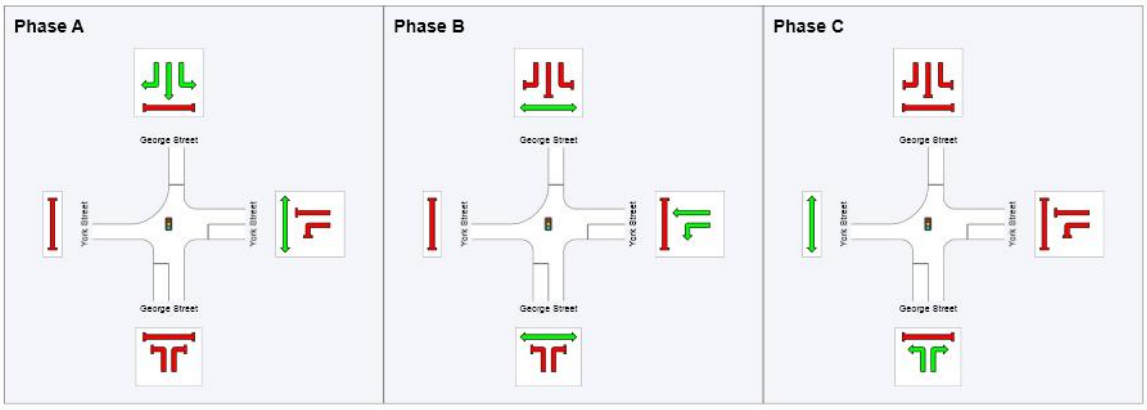


Figure 24 York Street / George Street Split Approach Phasing

Table 18 York Street / George Street SIDRA Modelling Results

Approach	AM Peak			PM Peak		
	Left	Through	Right	Left	Through	Right
George St (Northbound)	24 s [C] 1.8 veh	-	24 s [C] 2.0 veh	29 s [C] 1.3 veh	-	31 s [C] 3.1 veh
York St (Westbound)	21 s [C] 1.1 veh	20 s [B] 7.4 veh	-	24 s [C] 1.9 veh	24 s [C] 8.2 veh	-
George St (Southbound)	28 s [C] 6.3 veh	23 s [C] 6.3 veh	24 s [C] 3.6 veh	27 s [C] 9.7 veh	21 s [C] 9.7 veh	22 s [C] 4.8 veh

From Table 18, it is anticipated that the York Street / George Street junction would continue to operate at a satisfactory level of service under split approach phasing. There would be significant safety benefits as a result of the change including:

- Elimination of left / right turn conflicts for turns from George Street into York Street;
- Elimination of the conflict between pedestrians crossing York Street and the heavy right turn movement.

4.4.8 Traffic Calming at Kingsway

The models indicate that the proposed City Heart project may set up a 'circulation route' between Charles Street and Kingsway due to the conversion of Charles Street to two-way traffic and the reduction of Kingsway to one-lane in the northbound direction. It has been proposed to implement traffic calming measures on Kingsway to:

d. Discourage heavy use of Kingsway as a through route between York Street and Brisbane Street; and

e. Create a calmed traffic environment with a focus on pedestrian amenity.

The traffic calming on Kingsway will complement the future 'Avenue' treatment for Brisbane Street between Wellington and Charles Street.

The Issues

Vehicles will be turning into Kingsway from arterial York Street which is a heavily trafficked, three-lane arterial road. It will be important to clearly communicate to drivers that Kingsway is a local road with a calmed environment. It is recommended that a *threshold treatment* (such as tactile pavement) or *speed hump* be provided at the southern end of Kingsway.

Kingsway has a length of around 140 metres and is relatively straight with a current pavement width of around 10 metres. Unless the road is made significantly narrower, there will be a high incidence of speeding. It is also recommended that the design of Kingsway include a *wombat crossing* or *slow point* approximately central in order to manage vehicle speeds.

Brisbane Street, between Wellington Street and Charles Street, is to be reduced to a single lane with a traffic calmed 'Avenue' treatment. A *raised pavement treatment* at the Brisbane Street / Kingsway junction would ensure that traffic speeds remain low while transitioning from Kingsway to Brisbane Street and should be considered as part of an integrated design of these roads.

Summary

Therefore, it is recommended that an integrated re-design of Kingsway include the following traffic calming treatments:

- A threshold treatment or speed hump at the entry from York Street;
- A narrower pavement, kerb extensions and a wombat crossing central or slow point; and
- A raised pavement treatment at the intersection with Brisbane Street.

The locations are presented in Figure 25.

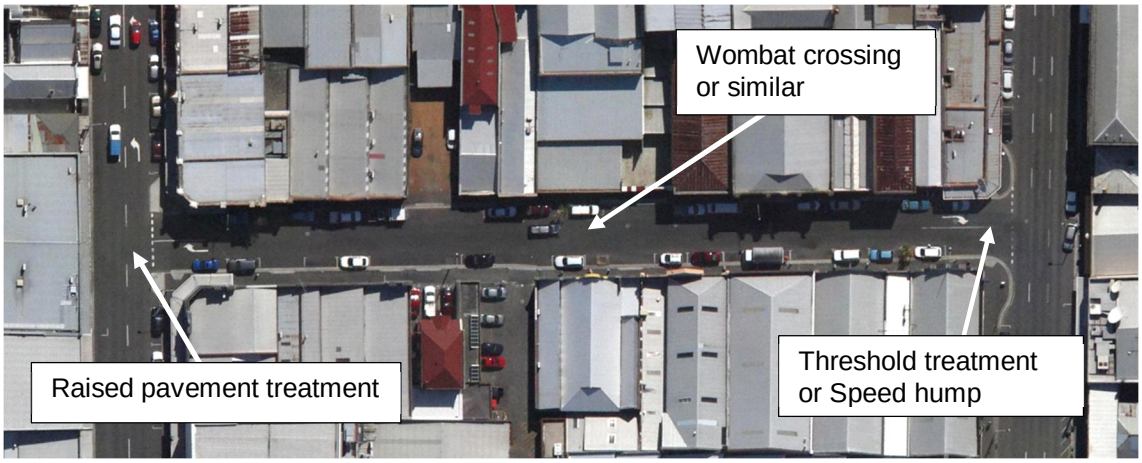


Figure 25 Kingsway Traffic Calming Treatments

4.5 Signal Coordination Discussion

The following sections provide an overview of signal coordination and the potential application of signal coordination to the Cimitiere Street corridor.

4.5.1 Signal Coordination (General)

Signal coordination is a method by which signal timings are adjusted so that drivers on a particular route get the maximum number of green signals while travelling through the network. An example showing the existing signal progression along Wellington Street is provided in Figure 26.

The traffic signals in Launceston are linked together by the SCATS network, which is able to adjust phase splits, cycle lengths and signal offsets based on real time information provided by vehicle detectors at each signalised intersection.

Some of the benefits of adaptive traffic signal systems such as SCATS include:

- Flexibility in signal timing plans at different times of the day;
- Able to respond to changing traffic conditions due to collection of real-time information; and
- Reduced travel time and vehicle operating costs.

In advanced signal networks, adaptive traffic signal systems are also able to provide priority to certain vehicles, for example, public transport or emergency vehicles.

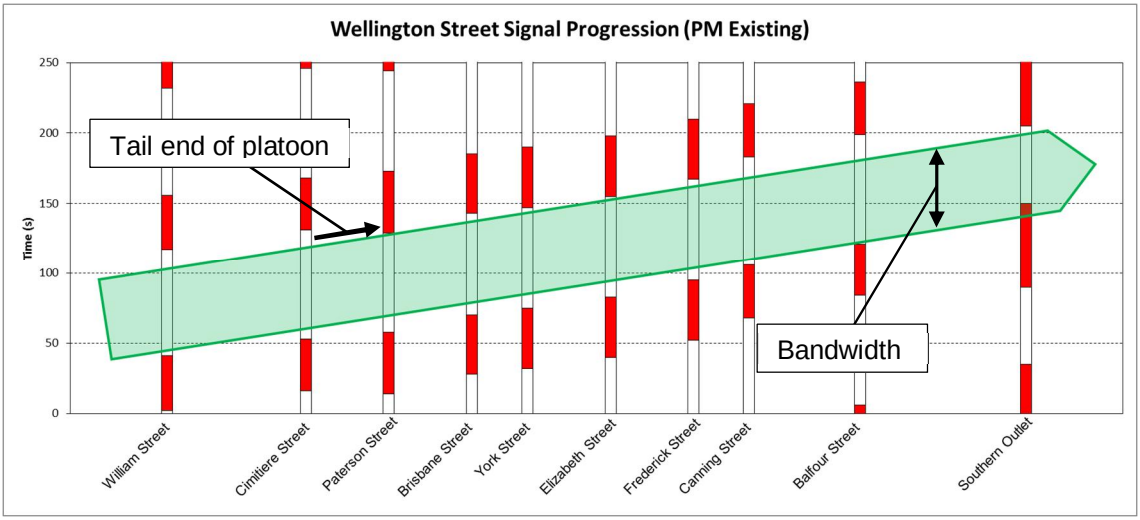


Figure 26 Wellington Street Signal Progression (PM Existing)

It is typically not possible to achieve good signal coordination in all directions of travel. Difficulties include the following:

- Varying travel times between intersections as they may not necessarily be equally spaced or because of variation in speeds between vehicles;
- Unequal green splits at successive intersections;
  - *For example, the side road approaches at Tamar Street and Charles Street require significantly more green time which influences the amount of green time that can be allocated to Cimitiere Street.*
- Specific phasing requirements at intersections interfering with good signal coordination;
  - *For example, if a variable trailing right turn phase is called only some of the time on Cimitiere Street, signal timing may vary.*
- Periods of very high demand where residual queues must clear at the beginning of the green time prior to the next platoon of vehicles arriving.

Therefore, designers often attempt to coordinate for the most important movements which are typically the peak through movements during the morning or evening peak periods.

4.5.2 Cimitiere Street Assessment

Westbound Coordination

Wellington Street is the primary coordinated route in the Launceston network. At the Wellington Street / Cimitiere Street junction, Wellington Street is coordinated with Lower Charles Street

(travelling southbound) rather than Cimitiere Street. Therefore, there is limited capacity to coordinate for Cimitiere Street travelling westbound as these vehicles would still have to queue at Wellington Street and may exceed the available storage space, creating detrimental interaction with the Charles Street junction. It is possible that upstream effects constrain the level of traffic approaching Wellington Street which may be desirable to manage queuing.

Launceston Master Subsystem

The Launceston Master Subsystem (reference site) is located at the intersection of York Street and Wellington Street. Intersections are coordinated together in a 'daisy chain' back from the reference site. It is noted that Cimitiere Street, particularly travelling further eastbound, is far removed from this junction which may introduce errors and discrepancies in the signal timing and offsets. These errors can take several cycles to resynchronise to the remainder of the network.

Impacts on Other Movements

The overall objective of signal coordination is to achieve the best overall flow of traffic across the network, rather than to coordinate for one particular movement. It is often the case that prioritising one direction through signal coordination can have significant, detrimental impacts on other movements.

For example: *If Cimitiere Street is coordinated in the eastbound direction for a desired speed of approximately 40 km/h, this means that signal offsets may be around 14 seconds (or 10-20% of the cycle time) for each intersection. This would result in significant detrimental impacts to westbound traffic flow which would have a high proportion of arrivals during the red phase.*

The available queue storage on side road approaches may also impact on the level of coordination that can be achieved. It is important that side roads be given enough green time to allow sufficient capacity so that other intersections in the network are not impacted by queuing. If side roads required significant green time, this can create queuing on Cimitiere Street which will impact on good signal coordination as queues need to clear prior to the next platoon of traffic arriving at the junction.

Summary

Overall, it is unclear what the impacts of signal coordination along the Cimitiere Street corridor may be primarily due to the variables listed above. It is likely that the Department of State Growth will need to utilise a 'trial and error' approach to managing signal offsets and coordination.

Further discussions with the Department of State Growth are required to determine the extent and effectiveness of signal coordination along the Cimitiere Street corridor.

5. Conclusions

5.1 Launceston City Heart Project Scenario

This report has investigated the impacts of the adopted Launceston City Heart Project scenario which includes the following changes to the road network:

Direction Changes

- Kingsway to flow one-way northbound
- Charles Street to flow two-way between Brisbane Street and York Street
- Paterson Street to flow two-way between Charles Street and St John Street

Lane Reductions

- Brisbane Street reduced to one lane between Wellington Street and Charles Street
- Kingsway reduced to one lane
- Charles Street reduced to one lane between Brisbane Street and Paterson Street
- Paterson Street reduced to two lanes between St John Street and George Street
- George Street reduced to one lane
- York Street reduced to two lanes between George Street and Wellington Street

The changes were modelled using the Launceston Traffic Model and the Launceston CBD (microsimulation) Model. The key findings of the network modelling are as follows:

- The proposed changes are expected to result in a significant reduction in peak hour traffic volumes along the City Heart Route by approximately 7-18% in the morning and 13-50% in the evening.
- The reduced volumes in the City Heart are offset by a general increase in traffic volumes on the identified “Exit” routes of Charles Street southbound and Paterson Street westbound as well as on the Cimitiere Street corridor.
- No significant traffic capacity or congestion issues were observed on the streets modified in either the AM or PM peak models due to the restrictions limiting the capacity of roads entering the City Heart boundaries including Brisbane Street and Charles Street.
- Some roads outside the City Heart area experienced additional congestion including Brisbane Street, Wellington Street and Cimitiere Street.

5.2 Cimitiere Street Analysis

A detailed analysis of Cimitiere Street was also undertaken using the Launceston CBD (microsimulation) Model and a SIDRA Intersection 6.1 network model developed for the project. The key findings of the Cimitiere Street assessment are as follows:

- A general increase in travel times for eastbound traffic provides evidence for possible capacity issues at the intersections of Cimitiere Street with Charles Street and Tamar Street.

- Increased use of Paterson Street may cause additional congestion on Wellington Street, on the block between Cimitiere Street and Paterson Street during the evening peak period.

Several traffic management treatments were investigated including:

- Banning right turns from Cimitiere Street into Charles Street;
- Provision of an additional eastbound traffic lane on Cimitiere Street between Charles Street and St John Street;
- Alternative signal phasing arrangements for the intersection of Cimitiere Street and Tamar Street;
- The impacts of improving utilisation of William Street as an alternative route;
- Conversion of the York Street / George Street intersection to split approach phasing;
- Traffic calming treatments at Kingsway; and
- The effectiveness and potential impacts of signal coordination along the Cimitiere Street corridor.

5.3 Summary of Recommendations

5.3.1 Short to Medium Term

In the short to medium term, it is recommended that:

- A right turn ban be implemented at the Charles Street / Cimitiere Street junction to improve capacity on Cimitiere Street;
- An additional eastbound traffic lane be provided on Cimitiere Street, between Charles Street and St John Street, as part of an overall traffic management scheme on this link;
- Split approach phasing be applied to the York Street / George Street junction; and
- The traffic calming treatments outlined in Section 4.4.8 of this report be included in the design for Kingsway.

5.3.2 Longer Term

In the longer term, it is recommended that:

- Signal phasing at Tamar Street and Cimitiere Street be modified to include either a leading right turn phase or a trailing right turn phase and turn bans as appropriate;
- Traffic management on Brisbane Street, between Margaret Street and Bathurst Street, be addressed; and
- The storage capacity of Wellington Street, between Cimitiere Street and Paterson Street, be investigated.

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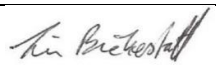
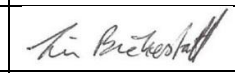
1	M. Petrusma	T. Bickerstaff		T. Bickerstaff		24.6.16

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