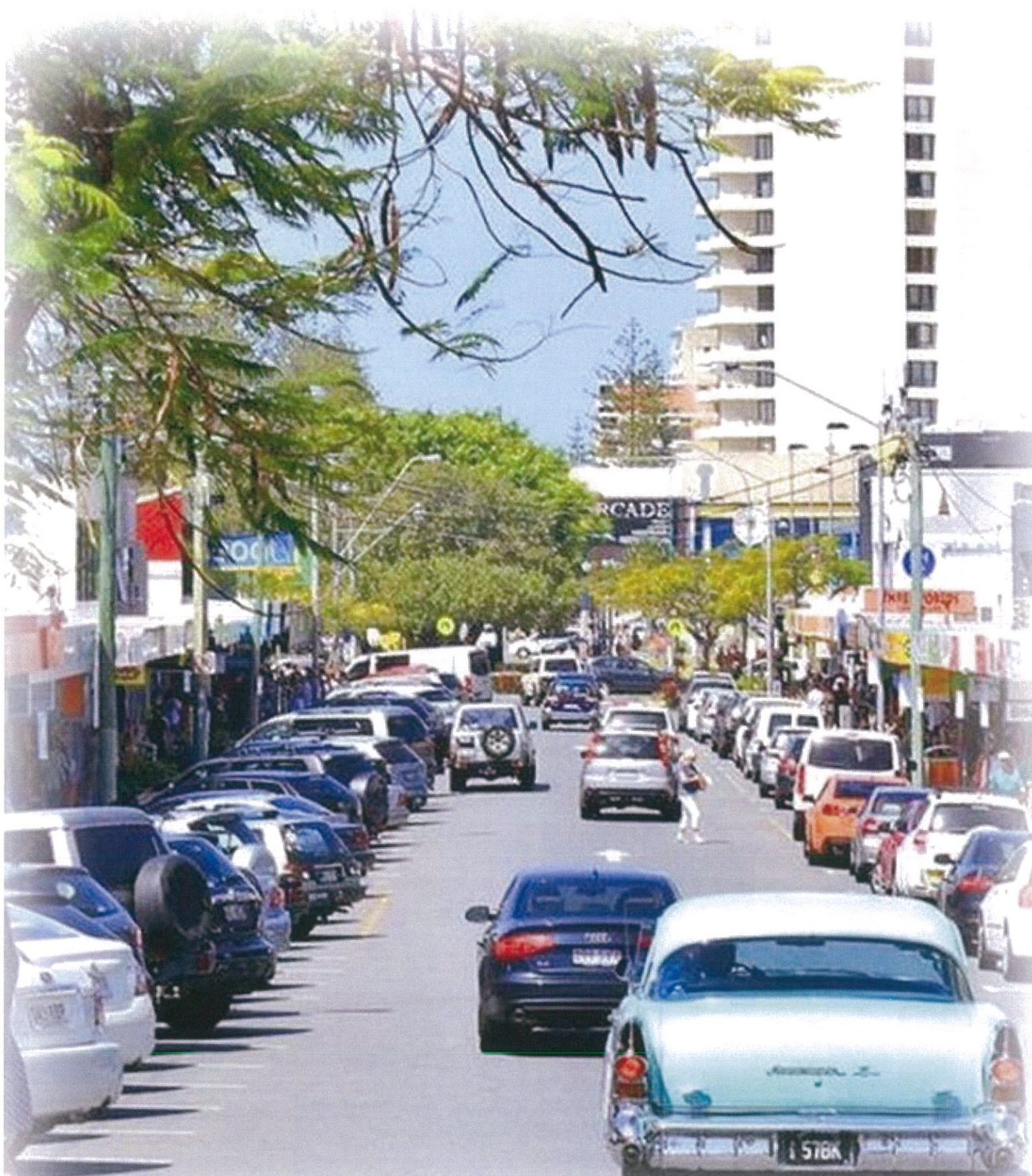


GCLR3 Construction Period

Burleigh Heads Traffic Impacts and Improvements

City of Gold Coast

14 October 2020



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EXECUTIVE SUMMARY

Background and Study Purpose

The construction of GCLR3 is likely to exacerbate congestion in Burleigh Heads and significantly impact key right turn movements. Beyond the construction period, light rail will create permanent traffic accessibility changes to / from side streets between Burleigh Heads and Broadbeach and will reduce the green time available for competing traffic movements at key intersections.

A rapid assessment of the traffic impacts in and around Burleigh Heads during and post-construction of GCLR3 has been undertaken using microsimulation modelling and first principles efficiency and safety considerations. The key outcomes of the assessment and recommendations are provided below.

Recommended Short Term Actions

- Progress the design, cost estimates and construction timeframes for the extension of Stanley Street to intersect with West Street including determining the preferred intersection orientation at the Stanley Street / West Street intersection to cater for the steep grades at this location
- Further assess (using current traffic data), design and implement the works to remove the right turn out of George Street East and consult with TMR on the introduction of a U-turn facility in the northern approach of the Gold Coast Highway / Ikkina Road intersection
- Assess (with current traffic data) the intersection of Ocean Parade / Reserve Street, assess sight lines and design and implement a re-orientated intersection configuration to align through movement priority with the dominant east-west movements at the intersection
- Develop a traffic management scheme for Acanthus Avenue between Starling Street and Sandpiper Drive that preserves local traffic accessibility to / from side streets and manages speed conflicts between vehicles, parking movements, pedestrians and cyclists
- Assess (with current traffic data) the intersection of Hayle Street / George Street East, assess sight lines and design and implement a re-orientated intersection configuration to align through movement priority with the dominant north-west movements at the intersection
- Develop a traffic management scheme for Tabilban Street and Park Avenue that manages speed conflicts between vehicles, parking movements, pedestrians and cyclists
- Investigate the removal of on-street parking along the eastern side of Hayle Street south of Nathan Street, line marking the parking lane / bays on the western side and the creation of 90 degree bays along the western side of Hayle Street between Goodwin Terrace and Nathan Street to offset the parking loss further south.

Long Term Opportunities

- Undertake an options analysis to assess the benefits and impacts of options generally involving signalling the Stanley Street / West Burleigh Road intersection as a full movement intersection and removing the James Street approach to the Gold Coast Highway / Burleigh Street / James Street intersection (including associated works at James Street / West Street). The assessment should be based on current traffic data using a localised model of West Burleigh Road between the Gold Coast Highway and Stanley Street and including West Street and its intersections with James Street, Park Avenue and Stanley Street (proposed).

Further Studies

- Undertake a traffic and transport study for the Burleigh Heads centre which considers multi-modal effects and needs associated with GCLR3 and any associated redevelopment expected in the centre. The study should include updated traffic modelling, and in an integrated way, develop a traffic, parking, public transport and active transport strategy for the centre to maximise the opportunities and minimise the risks associated with GCLR3
- Complete a broader network modelling assessment using the GCSCAM or the GCSTM-MM to assess the broader route choice influences GCLR3 beyond the localised impacts / needs determined in this study.

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1. INTRODUCTION

1.1 Background

Gold Coast Light Rail Stage 3A (GCLR3) will extend the existing light rail line southwards from Broadbeach to Burleigh Heads with construction proposed to commence in 2021. City of Gold Coast Council (Council) has identified the need to understand the likely traffic impacts in and around Burleigh Heads during construction of GCLR3 and what works could be implemented to mitigate some of the identified impacts. Council has also identified the need to understand what traffic improvement works could be beneficial to the centre beyond the construction period, or could be augmented with additional works to the ongoing benefit of the area.

The key objectives for this study were:

- Determine what is the likely source and scale of construction period traffic impacts in and around Burleigh heads
- Identify (and test) 'quick fix' items to mitigate the expected traffic impacts (Upgrades Package 1)
- Identify other potential works that may be implemented for the long term (Upgrades Package 2).

Bitzios Consulting has been commissioned to complete a rapid assessment of the traffic impacts in and around Burleigh Heads during and post-construction of GCLR3.

The assessment did not have time to build a completely new traffic model to support the investigations and the Gold Coast Southern and Central Area Aimsun Model (GCSCAM) was relied upon for the modelling. The GCSCAM has a year 2018 base and is a mesoscopic simulation model. A cordon area of the model was extracted and the traffic demands updated using available traffic count data at a number of key intersections in the study area for February 2020. That is, the sub-area model used was not calibrated and validated to the level of detail ordinarily required for detailed options assessment. The limitations of the simulation models developed for this study are further discussed in Section 3.1.3.

The construction period traffic management scheme for GCLR3 will be confirmed once the preferred construction contractor has been determined in the future. For this assessment, an assumed traffic management scheme has been used based on local knowledge and experiences in previous light rail stages. In addition, broader traffic diversions are likely around the study area during construction and some drivers would be expected to completely avoid Gold Coast Highway and West Burleigh Road during construction. These broader diversions have not been accounted for thereby representing a 'worst case' traffic demand scenario.

Given the above limitations, the modelling outputs were supplemented with local knowledge and first principles considerations to identify likely traffic congestion and safety issues, to develop improvement options and to assess those options in forming recommendations for council to take forward.

1.2 Study Process

The study process involved the following tasks:

- Create a year 2020 Base Aimsun microsimulation model from a 'cut out' of the GCSCAM
- Use growth rates from traffic counts to factor up to a 2022 Base Model (assumed year of construction)
- Code in the 'likely' construction management plan, including allowable movements, lanes and speed limits to create a 2022 GCLR Construction Base model
- Run the 2022 GCLR Construction Base model and identify key congestion issues
- Identify preliminary shorter term and longer term improvement options
- Agree with Council the shorter term (Works Package 1) and the longer term (Works Package 2) options to assess with the model
- Run the options for the 2022 weekday (AM and PM) peak periods as well as run a sensitivity test of the options for a Saturday holiday period model
- Identify the preferred options for both works packages and prepare concept designs for them
- Present the draft recommendations to Council and confirm the preferred options
- Prepare the traffic impacts assessment report (this report).

1.3 Study Area

The study area focusses on Burleigh Heads with the modelled network shown in Figure 1.1.



Figure 1.1: Study Area and Modelled Network

2. CONSTRUCTION PERIOD IMPACTS

2.1 Key Assumptions

A number of changes to the network have been assumed as part of the construction of GCLR3 construction. These include banned right turns, one-way sections and speed reductions. Figure 2.1 shows the assumed GCLR3 construction network changes. It is important to highlight that some of the restrictions may only apply for some of the construction period depending on the traffic management strategy to be implemented by the preferred construction contractor.



Figure 2.1: GCLR3 Construction Traffic Management Assumptions

2.2 Broader Route Choice Considerations

The modelling did not consider potential broader route choice effects of construction activity in/around Burleigh Heads for longer distance movements that would otherwise pass through Burleigh Heads. These potential movements and their logical diversion routes are shown in Figure 2.2. Further and broader modelling (i.e. beyond the study area) would be required to include these effects. The modelling undertaken for this project considers the worst case of no broader route diversions.

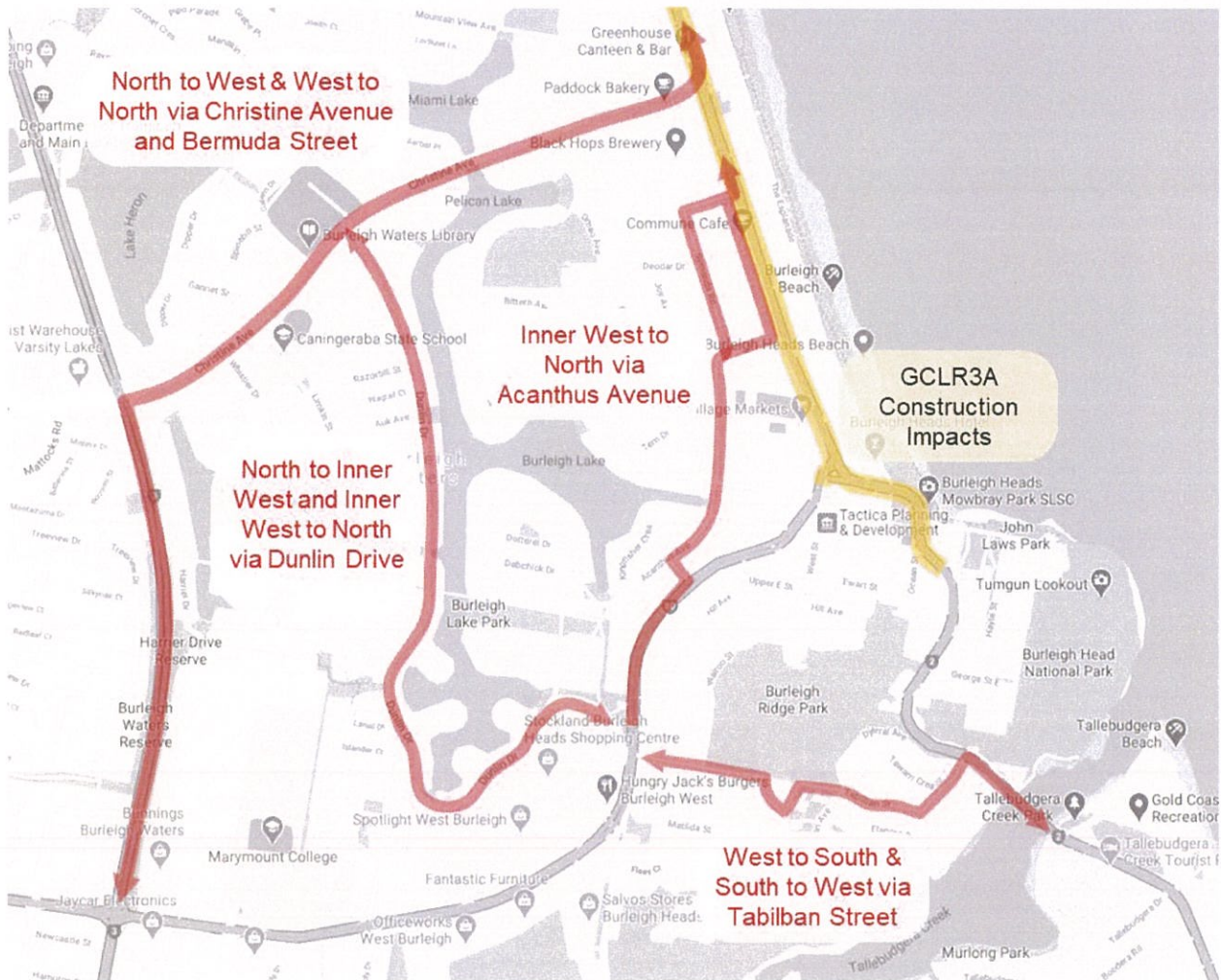


Figure 2.2: Broader Route Choice Considerations

It should also be noted that existing through traffic usage of the Tabilban Street route is likely to reduce once Nineteenth Avenue is connected to the Pacific Motorway via the new western service road as part of the current M1 upgrade works.

These traffic pattern changes is not anticipated until late 2023 after the GCLR3 construction has commenced in 2021 .

3. MODEL DEVELOPMENT

3.1 Localised Model Updates

3.1.1 Input Models and Data

Council provided the 2016 GCSCAM for AM (0700-0900) and PM (1600-1800) peaks. Council also provided traffic signal and intersection count data for the AM and PM weekday peaks for the following intersections:

- West Burleigh Road / Burleigh Street / James Street (Wednesday, 12/02/2020)
- Gold Coast Highway / West Burleigh Road (Wednesday, 12/02/2020)
- Gold Coast Highway / Connor Street / The Esplanade (Wednesday, 12/02/2020)
- Gold Coast Highway / Goodwin Terrace (Wednesday, 12/02/2020)
- West Burleigh Road / Dunlin Drive / Tabilban Street (Wednesday, 30/11/2016)
- Gold Coast Highway / Ikkina Road (Thursday, 01/12/2016).

The intersection counts for the West Burleigh Road / Burleigh Street / James Street intersection and the Gold Coast Highway / Goodwin Terrace intersection available for 2016 and 2020 were used to determine growth rates from 2016 to 2020. These growth rates were then used to estimate 2020 intersection volumes at the West Burleigh Road / Dunlin Drive / Tabilban Street intersection and the Gold Coast Highway / Ikkina Road intersection for use in the year 2020 traffic demand estimation.

Saturday holiday period traffic data was provided in the form of loop counts for the following signalised intersections:

- West Burleigh Road / Burleigh Street / James Street (Saturday, 04/01/2020)
- Gold Coast Highway / West Burleigh Road (Saturday, 04/01/2020)
- Gold Coast Highway / Connor Street / The Esplanade (Saturday, 04/01/2020)
- Gold Coast Highway / Goodwin Terrace (Saturday, 04/01/2020).

The early January 2020 traffic count data for Saturday was firstly analysed to determine its peak hour across the day as being 10:00am to 11:00am.

3.1.2 Traffic Demands Development

The models were developed using a cordon (or 'cut out') of Council's 2016 GCSCAM along with the abovementioned traffic count and signal phasing data. *Aimsun Next 20* was used to create Base (existing conditions) microsimulation model networks and estimate traffic demands for:

- 2020 (Weekday) AM Base: 7:00am to 9:00am
- 2020 (Weekday) PM Base: 4:00pm to 6:00pm
- 2020 (Holiday Period) Saturday Base: 10:00am to 11:00am.

The cordon area of the 2016 GCSCAM provided initial weekday AM and PM 2-hour peak traffic demands. These demands were adjusted to match the model's assigned intersection turn flows to those provided for year 2020 at the six key intersections within the study area. Initial review of the Saturday peak data revealed it closely matched the weekday PM peak movements in terms of total flows and the directionality of approach flows. The 2020 Saturday peak traffic demand was subsequently estimated using the weekday PM peak traffic demands as its starting position and then adjusted using the Saturday loop count data.

Further detail of the model's development, calibration and validation is included in the *GCLR3 Construction Modelling Base Model Development Technical Note* provided in **Appendix A**.

3.1.3 Limitations of the Model

The models have been developed using a limited amount of data and still rely heavily on the previous modelling undertaken (for the GCSCAM). Confidence in the Saturday Base model is further limited due to its reliance on signal detector data (i.e. loop counts) and no initial demand 'pattern' from GCSCAM due to it being a weekday only model. The AM and PM peak turn count calibration at the six key intersections is still considered to be sufficient for the purposes of this study, with the modelling primarily being used to confirm traffic pattern implications of construction works and expected congestion consequences on the primary road network.

Outside of the key routes, there are intersections and routes throughout the modelled network that have not been explicitly considered in the model calibration. However, the simulation model was observed and local knowledge was used to make any minor adjustments to the surrounding local road network to better reflect observed traffic and queueing patterns in these streets. These locations included:

- Intersections along the north / south travel route on the Lower Gold Coast Highway
- Intersections along the north / south travel route on Acanthus Avenue and Symonds Road
- Intersections along the north / south travel route on The Esplanade as well as east/west traffic between The Esplanade and the Gold Coast Highway
- Intersections along the east / west travel route on Park Avenue
- Circulating traffic and impacts within the Burleigh Heads centre
- The Gold Coast Highway / George Street East intersection.

The implications of the above are that the model should be used as a tool to inform the assessment of light rail construction impacts and the identification / assessment of options to mitigate these impacts. Further modelling based on current, local data should be undertaken during the development of any business cases or detailed designs for any works which are chosen to be progressed.

3.2 2022 Construction Period Base Model Development

3.2.1 2022 Traffic Demands

Year 2022 was nominated as the assessment year for GCLR3 construction impacts. The 2022 traffic demands were based on the 2020 traffic demands with a nominal 2% growth (1% per annum) applied across the model. Analysis of the growth between 2016 and 2020 identified almost no increase in traffic, however 1% linear per annum was adopted to account for recent traffic dampening due to COVID-19 influences.

The construction period base model includes the assumed network changes detailed in Section 2.1..

3.2.2 2022 Weekday AM Peak Conditions

In the AM peak, the Gold Coast Highway to West Burleigh Road right turn movement is assumed to be reduced to a single lane. This results in queues filling this pocket and extending beyond the pocket northwards along the Gold Coast Highway. To cater for the reduction in right turn capacity and better balance delays (as would be expected in the field), the West Burleigh Road approach and Gold Coast Highway south approach phase times have been reduced, resulting in longer queues northbound on the Gold Coast Highway as well. Figure 3.1 shows the typical AM peak conditions.

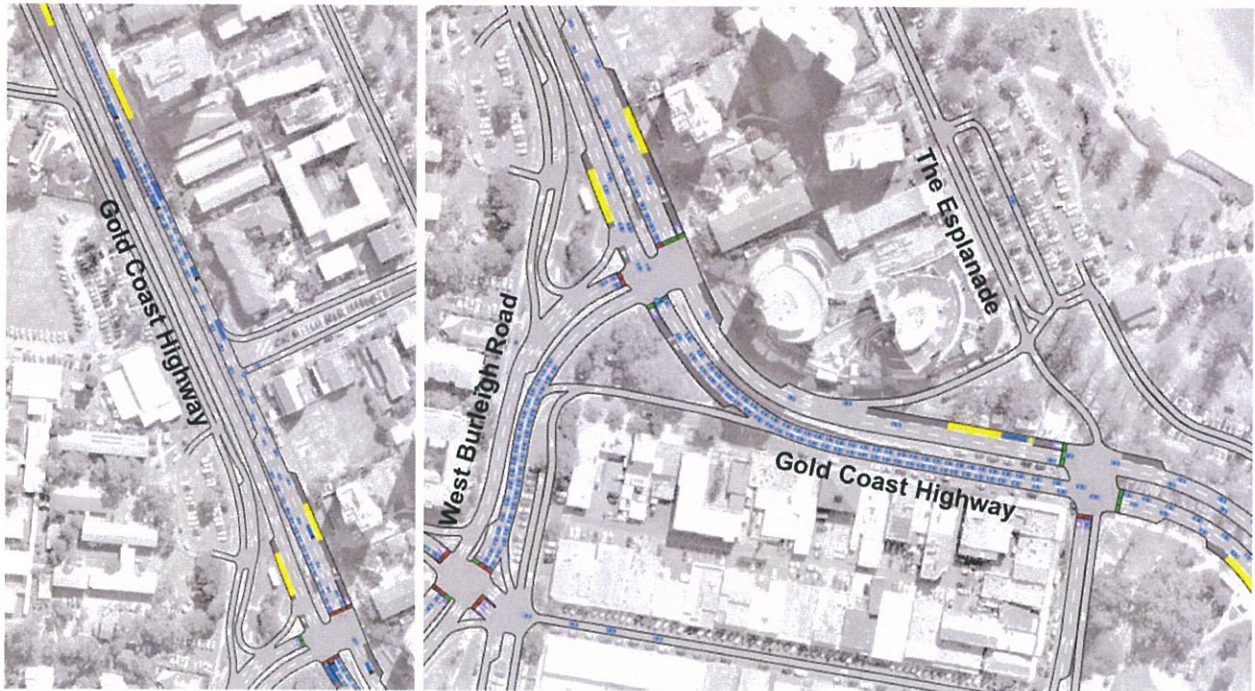


Figure 3.1: 2022 AM Construction Period Conditions

3.2.3 2022 Weekday PM Peak Conditions

In the PM peak, the Gold Coast Highway to West Burleigh Road right turn also shows queues that extend beyond the available pocket, although to a lesser extent than the AM peak. There are also impacts at the West Burleigh Road / Burleigh Street / James Street intersection with the right turn from West Burleigh Road into James Street queuing out into the through lane. Figure 3.2 shows typical traffic conditions in the PM peak period.



Figure 3.2: 2022 PM Construction Period Conditions

3.2.4 2022 Saturday Mid-Morning Peak Conditions

In the Saturday peak, the Gold Coast Highway to West Burleigh Road right turn generates longer queues than the weekday peaks, spilling out of the pocket and into the adjacent southbound through lane. Similar to the AM peak, there is also some northbound queuing on the Gold Coast Highway approach to this intersection as well. The West Burleigh Road / Burleigh Street / James Street intersection also shows greater additional queuing for traffic trying to leave the Burleigh Heads centre and queuing into West Street. Figure 3.3 shows typical traffic conditions in the Saturday peak period.



Figure 3.3: 2022 Saturday Construction Period Conditions

The above issues and other observed capacity and safety issues across the study area are discussed further in the following sections.

4. TRAFFIC CONGESTION AND SAFETY ISSUES

4.1 James Street / West Burleigh Road / Burleigh Street

The West Burleigh Road / Burleigh Street / James Street intersection is expected to be at capacity during construction in the 2022 Saturday peak period. This intersection generates long queues now, mostly on summer weekends. The traffic movements in and out of Burleigh Street and James Street are the key movements affected. The right turn from West Burleigh Road into James Street extends beyond its turn pocket. A westbound 'rat-run' through the Burleigh Heads centre via Park Avenue also increases as a result of the GCLR3 construction as traffic bypasses the queues on the Gold Coast Highway northbound extending back from the West Burleigh Road intersection. Figure 4.1 shows typical queues on each approach in the 2022 Saturday peak.



Figure 4.1: West Burleigh Road / Burleigh Street / James Street Intersection Queues

4.2 George Street East / Gold Coast Highway

The Gold Coast Highway / George Street East intersection is a priority-controlled (give-way) intersection. Currently, vehicles use the centre median as a two-staged crossing for the right turn out of George Street East. With construction effects at the Goodwin Terrace intersection further north, more of the catchment to the east of the Gold Coast Highway in the Hayle Street area is expected to try and turn right out of George Street East rather than at Goodwin Terrace / Gold Coast Highway. At the same time, more traffic will turn right into George Street East at its intersection with the Gold Coast Highway, opposing the right turn out.

Although the queues are not significant, the average delay to the vehicles performing the right turn out of George Street is over 26 seconds peak (see Figure 4.2) which is equivalent to a Level of Service (LOS) D. It should be noted that Aimsun uses a decreasing gap acceptance value over time (to mimic less driver patience with longer delays). As a result, if this intersection was modelled in SIDRA, the reported average delays would be expected to be much higher.

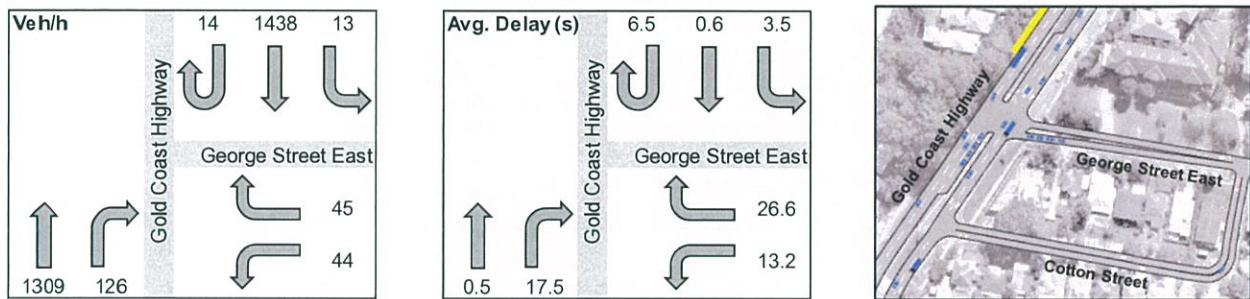


Figure 4.2: Gold Coast Highway / George Street, 2022 Saturday Volumes, Delays and Queues

While the right turn out volume is not high, the combination of poor sight distance and excessive delays leading to pre-emptive gap selection exacerbating existing safety concerns (see Figure 4.3).



Source: Google Maps Australia – Streetview

Figure 4.3: Gold Coast Highway / George Street East Safety Issues

While this issue has been identified for the 2022 GCLR3 Construction period, it is expected that additional delays to traffic turning right from Goodwin Terrace into the Gold Coast Highway would continue once light rail is operational based on the additional demands on the intersection green time from light rail and additional pedestrian movements. As such, the additional right turns out of George Street East are expected to be an ongoing issue of concern into the future.

4.3 Tabilban Street Route

Tabilban Street is a commonly used 'short cut' for traffic travelling between the Gold Coast Highway from Palm Beach and West Burleigh Road (near Stockland Shopping Centre). Although the Tabilban Street route is used throughout the day, including in off-peak times, its most significant use is during the morning peak period where northbound congestion on the alternative Gold Coast Highway – West Burleigh Road route encourages its use.

The Ocean Parade / Reserve Street intersection is a priority-controlled intersection, with Reserve Street as the stop-controlled approach to Ocean Parade. Figure 4.4 show the current intersection arrangement. In effect, the major traffic movement is required to stop under this arrangement, yielding to the minor flow movement.



Source: Google Maps Australia – Streetview

Figure 4.4: Existing Ocean Parade / Reserve Street Intersection

During the 2022 GCLR3 construction period and particularly in the AM peak, there is increasing westbound traffic in Tabilban Street due to additional delays in Burleigh Heads. The stop-controlled intersection at Ocean Parade / Reserve Road consequently shows long queues and delays on its Ocean Parade approach, as presented in Figure 4.5.



Figure 4.5: Ocean Parade / Reserve Street Queues, 2022 AM GCLR3 Construction

The extent of this queue also creates a safety concern as movement from Tabilban Street to Reserve Street westbound is over a sharp crest with limited sightlines to vehicles stopped at the back of the queue.

4.4 Acanthus Avenue

The modelling has identified the potential for increased usage of Acanthus Avenue as an alternate west-to-north route from West Burleigh Road to the Gold Coast Highway, in order to bypass the congested construction-affected intersections near the Burleigh Heads centre. This route is shown in Figure 4.6.

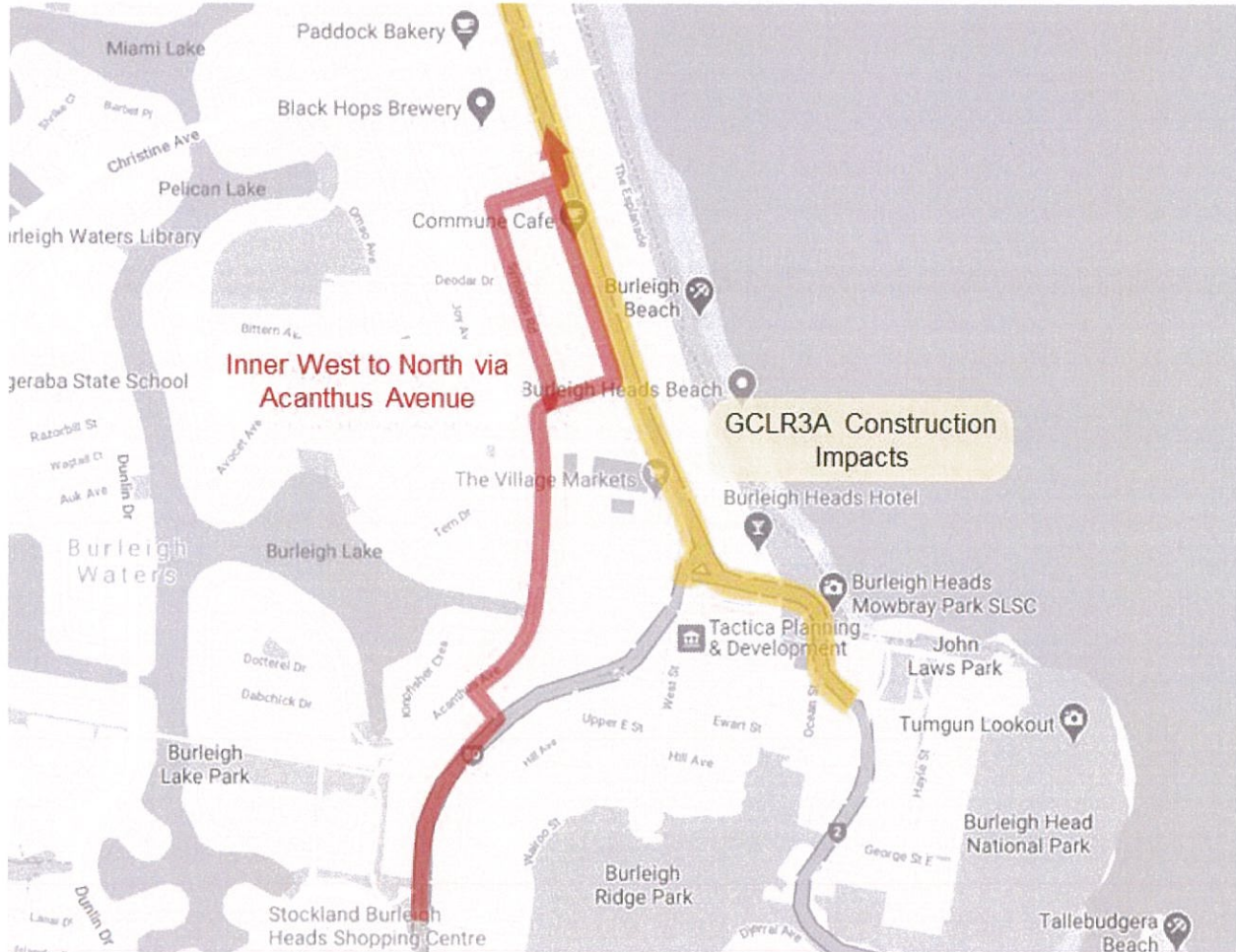


Figure 4.6: Acanthus Avenue Route

The Acanthus Avenue volume increases are moderate during weekday peak periods however the busier Saturday peak shows the potential for significant increases, as shown in Table 4.1.

Table 4.1: Acanthus Avenue Volumes

Scenario	AM Peak		PM Peak		Saturday Peak
	7 to 8	8 to 9	4 to 5	5 to 6	10 to 11
2022 Base	61	149	153	181	200
2022 GCLR Construction Base	64	239	231	268	561

Acanthus Avenue is a residential collector street with a 40 km/h school zone. Any additional traffic would increase conflicts between local movements, through movements, pedestrians and cyclists in this area.

4.5 Hayle Street

Hayle Street east of the Gold Coast Highway has known issues related to its on street parking and the limited remaining road width to safely and efficiently provide for two-way traffic flow, as shown in Figure 4.7. There is a short section of parking on the eastern side between Short Street and Albert Street where pedestrians cannot use the footpath / verge to access parked vehicles due to the steep grade of the verge.



Source: Google Maps Australia – Streetview

Figure 4.7: Hayle Street Parking Influences

With GCLR3 construction-related congestion near Goodwin Terrace / Gold Coast Highway, more traffic is expected to use Hayle Street to / from George Street East and its intersection with the Gold Coast Highway (see Figure 4.8). This traffic will exacerbate the identified on street parking concerns. Furthermore, the current priority at the George Street East / Hayle Street intersection is east-west, however, it is anticipated the dominant flow will be north-west (George Street East to / from Hayle Street).



Figure 4.8: Burleigh Hill Area Access Routes

5. UPGRADES PACKAGE A ASSESSMENT

5.1 Upgrades Summary

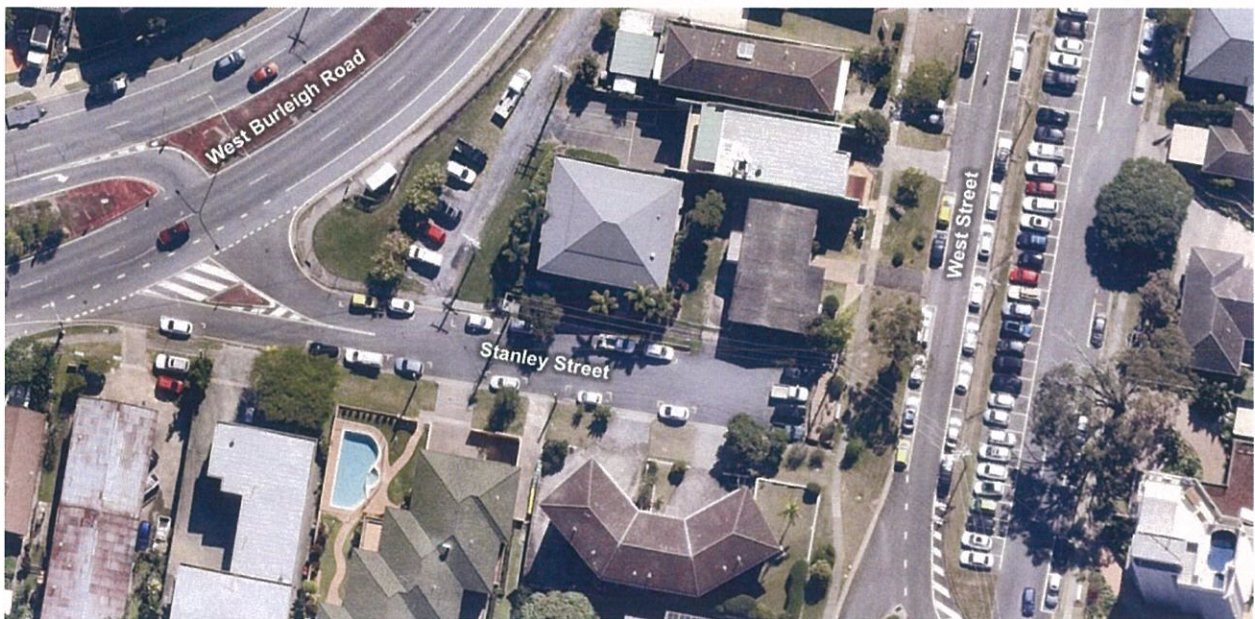
The upgrades have been sorted into short and long-term 'packages' depending on how quickly they can be carried through detailed assessment, design and construction relative to the timing of construction commencing for GCLR3. Each package has been modelled in Aimsun and assessed based on geometrical and safety considerations. **Package A** includes:

- Connecting Stanley Street through to West Street
- Removing the right turn from George Street East to the Gold Coast Highway
- Re-prioritising the Ocean Parade / Reserve Street intersection
- LATM at Acanthus Avenue
- Revised priorities at Hayle Street / George Street East
- Parking changes at Hayle Street.

Improvement ideas have been identified in the Acanthus Avenue and Hayle Street areas as well. These have not been modelled as part of Package A but have been assessed in this chapter.

5.2 Stanley Street Extension to West Street

Connecting Stanley Street through to West Street has been identified as an option to 'split' right turn in and left turn out movements associated with the Burleigh Heads centre at the West Burleigh Road / Burleigh Street / James Street intersection to use the Stanley Street / West Burleigh Road intersection as well. The existing configuration in this area Stanley Street is shown in Figure 5.1.



Source: Nearmap

Figure 5.1: Existing Stanley Street Configuration

Extending Stanley Street eastward to meet West Street can be achieved using available road reserve. A priority-controlled intersection would be created with right turn median storage between the two West Street carriageways adjacent to the central parking. A concept of the Stanley Street / West Street intersection is provided in Figure 5.2. Approximately 20 parking bays will need to be removed as a result of the connection.



Figure 5.2: Stanley Street / West Street Intersection Concept

West Street runs steeply downwards from south to north in this location and an alternative concept may need to be considered which changes the intersection priority to have the West Street (north)-to-Stanley Street (west) movement as the major movement with the West Street south leg as the minor approach leg. This may be required to better deal with the adverse grades that would occur if the 'standard' T configuration shown above were implemented.

The Aimsun modelling has revealed that the Stanley Street connection reduces the volumes and queues for the right turn from West Burleigh Road into James Street as well as the left turn from West Street to West Burleigh Road, as shown in Figure 5.3. Importantly, the modelling shows that queues no longer extend out of the right turn pocket and impact through traffic flow. The modelling also shows that the existing West Burleigh Road / Stanley Street intersection has sufficient capacity to cater for this redistribution in traffic. It should be noted that this improved accessibility may increase 'rat-running' through the centre from the Gold Coast Highway to West Burleigh Road via Park Avenue and additional calming treatments may need to be considered for Park Avenue.

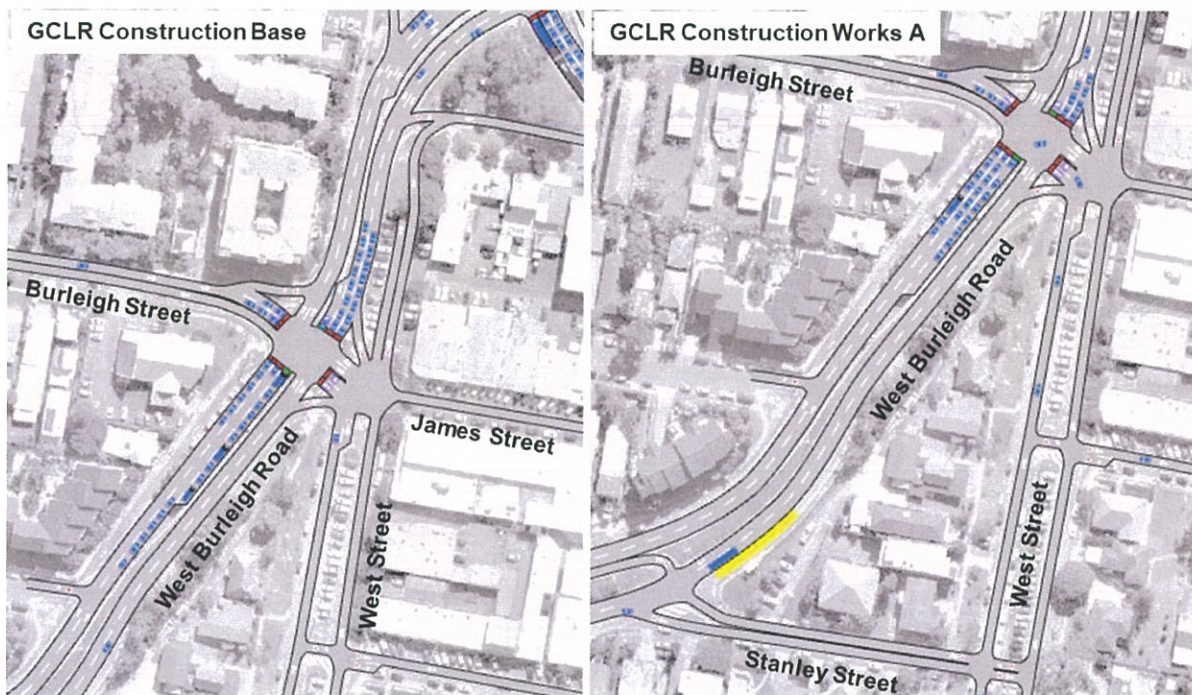
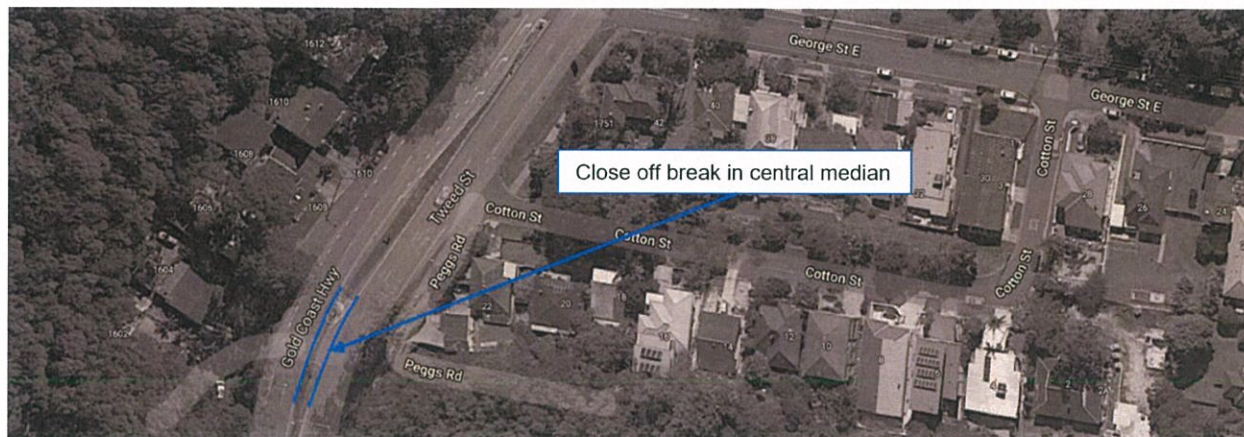


Figure 5.3: West Burleigh Road / Burleigh Street / James Street Intersection Queues

5.3 George Street East / Gold Coast Highway

Removing the right turn from George Street East to the Gold Coast Highway has been proposed due to the safety concerns with this movement being exacerbated in the future. With the removal of the right turn, vehicles can either access the Gold Coast Highway to head north via Hayle Street and Goodwin Terrace or via a proposed new north-to-north U-turn movement at the Ikkinia Road / Gold Coast Highway intersection.

With a U-turn provided at Ikkinia Road, consideration could also be given to removing the break in the central median just south of George Street East which currently provides right turn in access to properties on the western side of the Gold Coast Highway (see Figure 5.4).



Source: Google Maps

Figure 5.4: Gold Coast Highway Removal of Break in Central Median

A concept design for the Gold Coast Highway / George Street East intersection is provided in Figure 5.5.

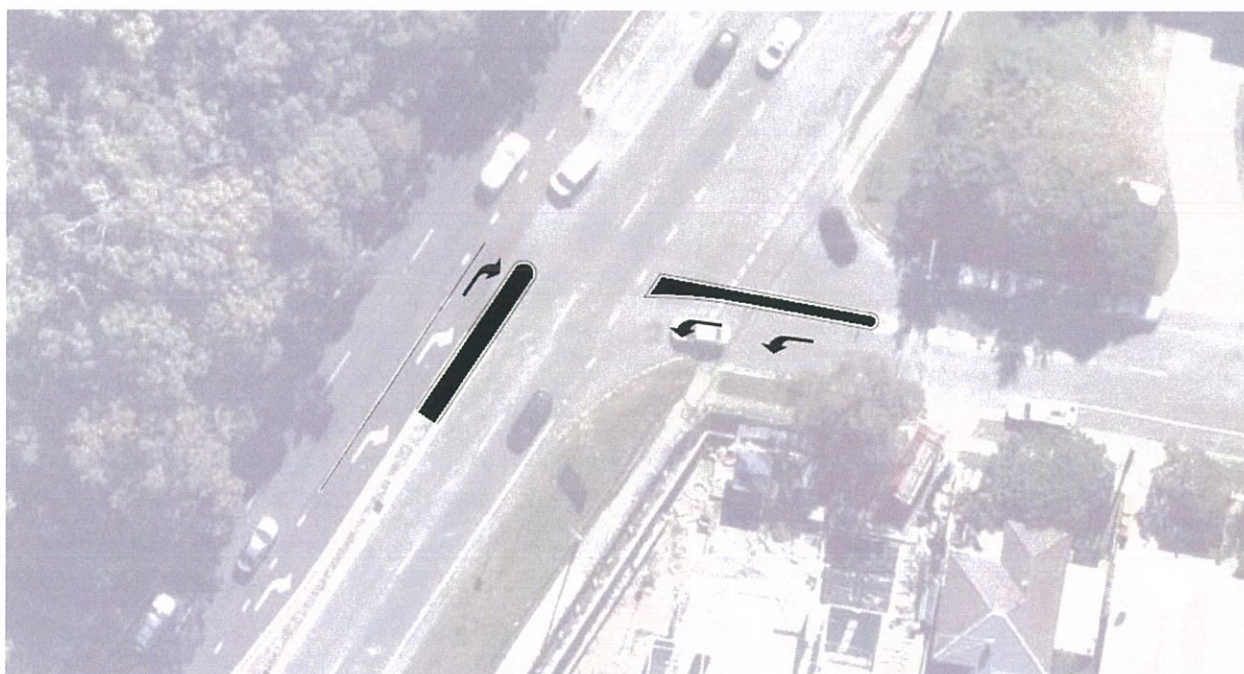


Figure 5.5: Gold Coast Highway / George Street East Intersection Concept

The modelling showed that, with the right turn from George Street East to the Gold Coast Highway removed, the majority of traffic redistributes to Goodwin Terrace. Only three (3) vehicles used the

proposed U-turn at the Ikkina Road / Gold Coast Highway intersection, which has sufficient capacity to cater for the U-turn traffic within the right turn pocket and signal phase.

It should be noted that no turning movement data was available for this intersection for input into the model calibration. A more recent traffic count should be undertaken when investigating this concept further to confirm the volume of traffic that would be impacted by the right turn closure.

5.4 Tabilban Street Corridor

Two changes along the Tabilban Street route between the Gold Coast Highway and West Burleigh Road have been identified to improve safety and efficiency, including:

- Re-prioritising the Ocean Parade / Reserve Street intersection
- Developing a traffic management scheme - Local Area Traffic Management (LATM) to manage speed conflicts between vehicles, parking movements, pedestrians and cyclists.

Currently Reserve Street is stop-controlled on approach to Ocean Parade, however, the major traffic flow at this intersection is between Reserve Street and Ocean Parade (west). To improve the efficiency and safety of the intersection, it is proposed to re-prioritise the intersection to give priority to the major east-west movements.

A concept design for the Ocean Parade / Reserve Street intersection is shown in Figure 5.6.

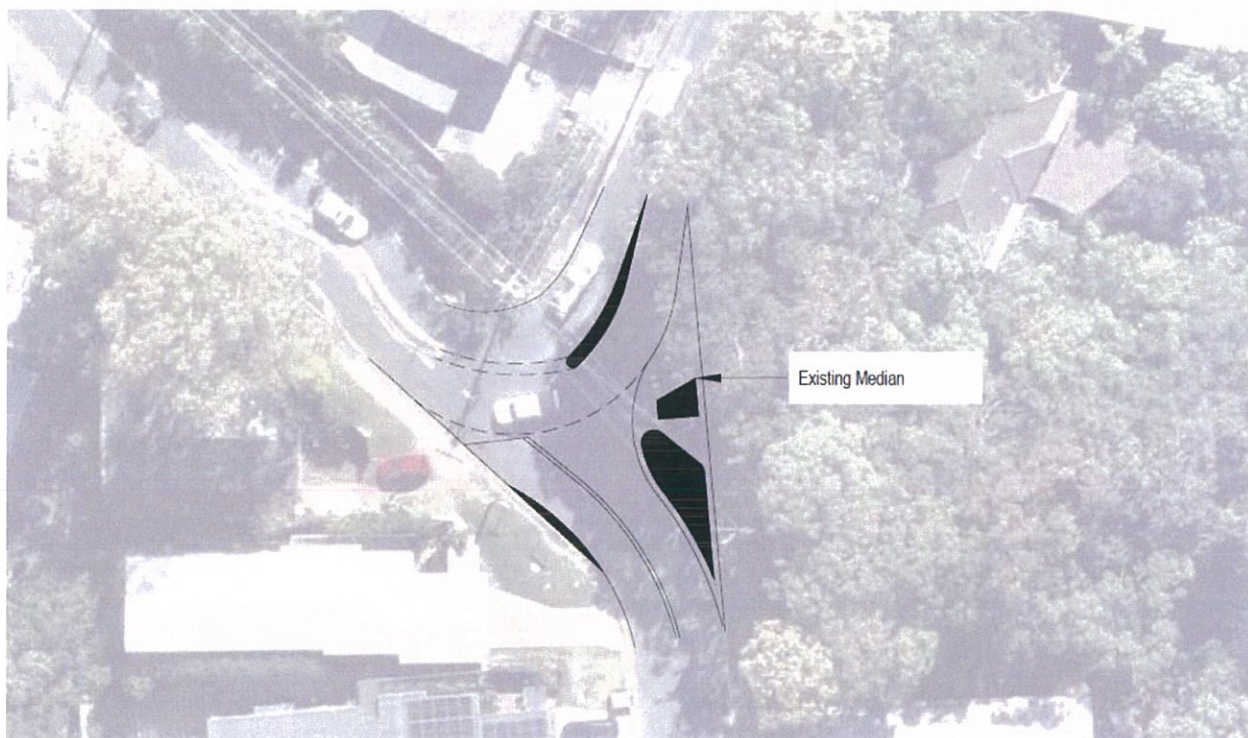


Figure 5.6: Ocean Parade / Reserve Street Intersection Concept

The re-prioritisation of the intersection results in reduced queuing and delays in all modelled periods. Figure 5.7 shows reduction in queues in the AM peak.

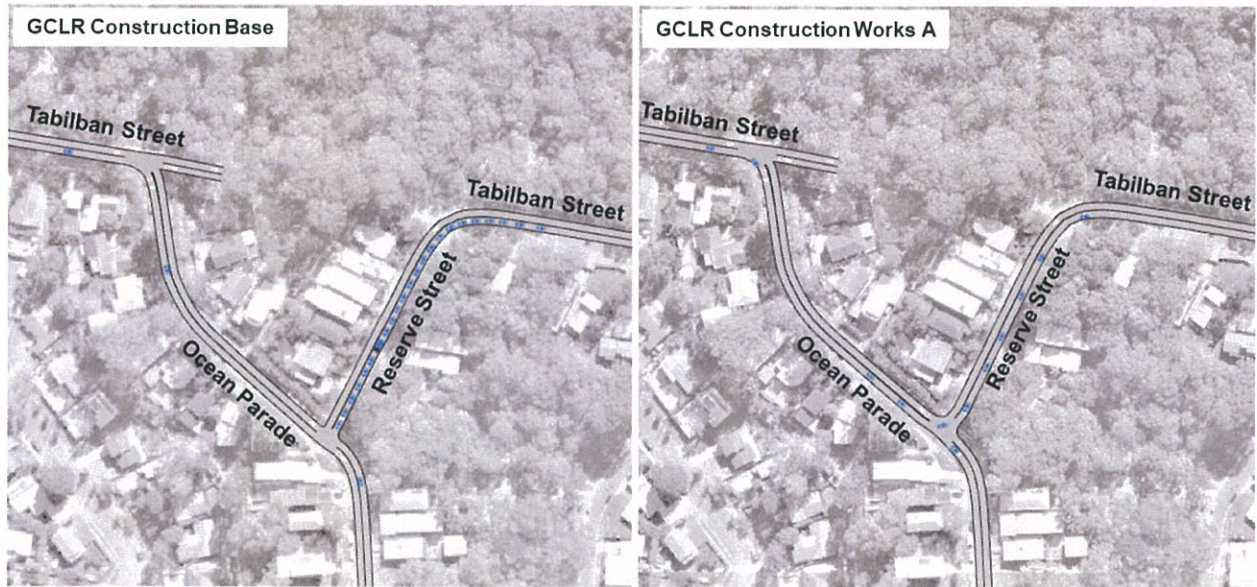


Figure 5.7: Ocean Parade / Reserve Street Intersection Queues

Travel times along the Tabilban Street route between Koel Street and Pindari Avenue are compared in Table 5.1. The results show that in the AM peak the average travel times reduce by up to 1-minute westbound with the re-prioritisation of the Ocean Parade / Reserve Street intersection. In all other scenarios with lower westbound volumes and hence less queues and delays under the current configuration, the re-prioritisation results in a reduction in average travel time of between two seconds and nine seconds.

Table 5.1: Tabilban Street Route – Package A Average Travel Time Comparison (in seconds)

Configuration	Westbound			Eastbound		
	AM	PM	Saturday	AM	PM	Saturday
Existing Intersection (GCLR Construction Base)	98.0	44.4	44.1	39.2	42.1	41.7
Re-prioritised Intersection (GCLR Construction Package A)	38.3	35.8	35.3	37	38.2	38.3
Travel Time Reduction	59.7	8.6	8.8	2.1	3.8	3.4

It should be noted that the Ocean Parade / Reserve Street intersection was not included in the model calibration and therefore the actual volumes may differ from what has been modelled. Traffic counts should be undertaken at the intersection as part of progressing the analysis and design development. Also, as part of further design development, sight distance checks would be required to ensure that these vehicles now yielding to turn right from Ocean Parade north to Ocean Parade south have sufficient sight lines to observe and stop for westbound through vehicles.

5.5 Acanthus Avenue

It is likely to be challenging to discourage the additional traffic expected from using Acanthus Avenue from west to north during the GCLR3 construction period however a key priority will be to manage speeds for safety of parking, walking and cycling movements and to maintain accessibility of side street movements. Further investigation into mechanisms to achieve this is required with some early ideas presented in Figure 5.8.



Source: Nearmap

Figure 5.8: Acanthus Avenue Considerations

5.6 Re-prioritisation of George Street East / Hayle Street Intersection

Re-prioritisation of the George Street East / Hayle Street intersection by converting the “corner movement” as the dominant flow, as shown in Figure 5.9.

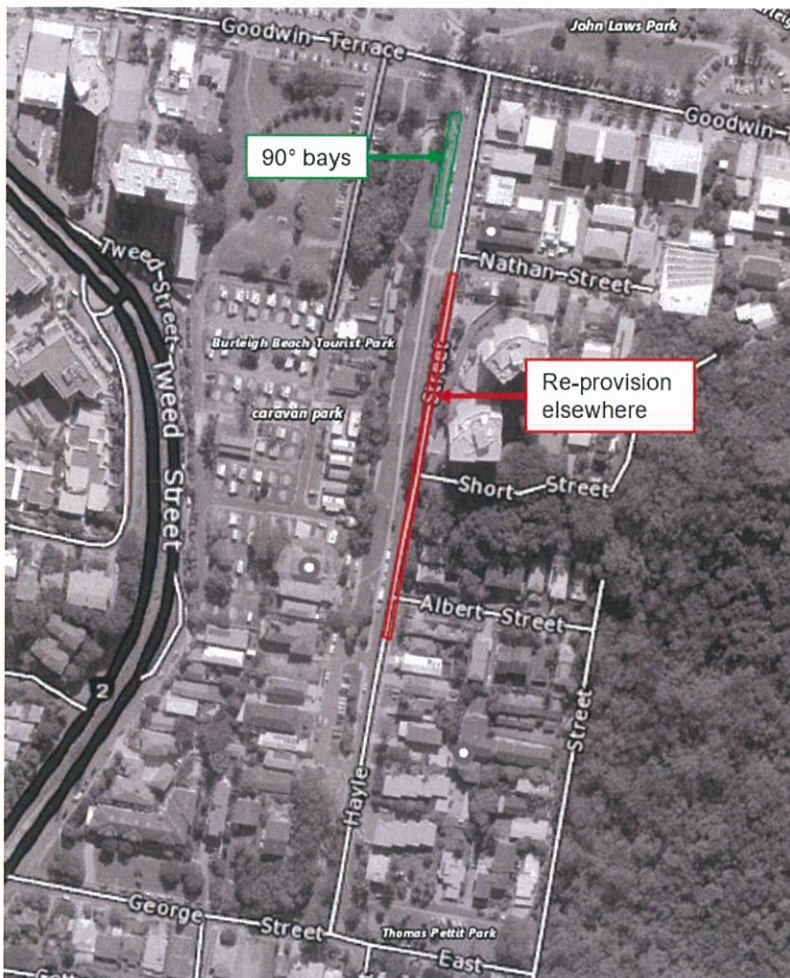


Source: Google Maps Australia – Streetview

Figure 5.9: George Street East / Hayle Street Intersection Re-Prioritisation Concept

5.7 Parking Changes to Hayle Street

Removal of parking on the eastern side of Hayle Street and re-provision of it elsewhere can be considered, as shown in Figure 5.10. Removing parking on the eastern side would allow for parking on the western side to be marked as a lane or bays and allow for conventional width traffic lanes to improve safety. An opportunity for further investigation is the creation 90 degree bays along the western side of Hayle Street between Goodwin Terrace and Nathan Street to offset the parking loss further south.



Source: Queensland Globe

Figure 5.10: Hayle Street Re-Prioritisation Concept

6. UPGRADES PACKAGE B ASSESSMENT

6.1 Upgrades Summary

Package B includes longer-term upgrade options to be considered for implementation post-construction of GCLR3. These options include:

- Signalling the West Burleigh Road / Stanley Street intersection and providing all turn movements
- Re-configuring the West Burleigh Road / Burleigh Street / James Street intersection to remove the James Street approach and make it a one-way departure from the intersection only
- Connecting the 'missing link' on Tabilban Street between Ocean Parade and Reserve Street.

The assessment of these options detailed in the following sections. Preliminary concepts have been prepared however more detailed investigations would be required to assess their feasibility.

6.2 West Burleigh Road Intersections

Removing the James Street approach to West Burleigh Road, while reducing 'green time' demands on the other intersection movements, also removes a number of conflict points at the adjacent James Street / West Street intersection (see Figure 6.1). This area is known to be confusing to motorists, pedestrians and cyclists.



Source: Nearmap

Figure 6.1: Existing West Burleigh Road / Burleigh Street / James Street Intersection

The removal of the James Street approach to the West Burleigh Road / Burleigh Street intersection requires the West Burleigh Road / Stanley Street intersection to be converted to a signalised intersection to allow for right turn movements from Stanley Street to West Burleigh Road. Concepts for both intersections are shown in Figure 6.2 and Figure 6.3.

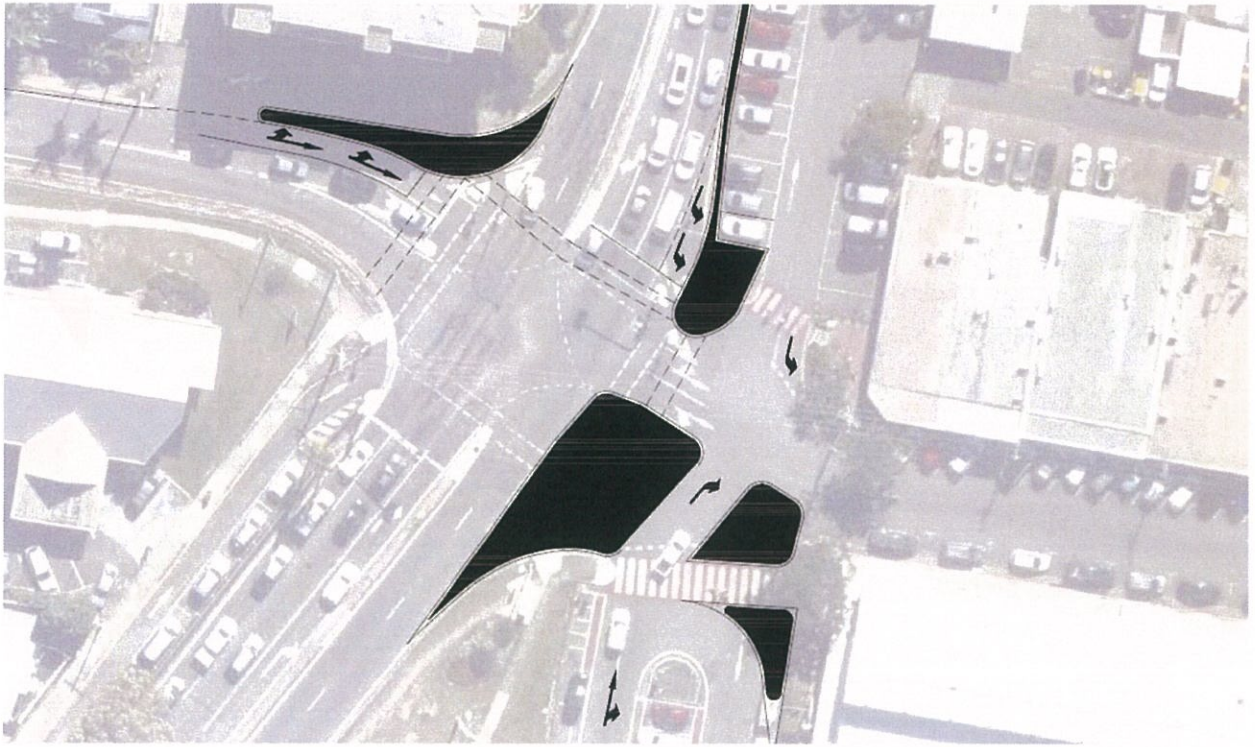


Figure 6.2: West Burleigh Road / Burleigh Street / James Street Intersection Concept

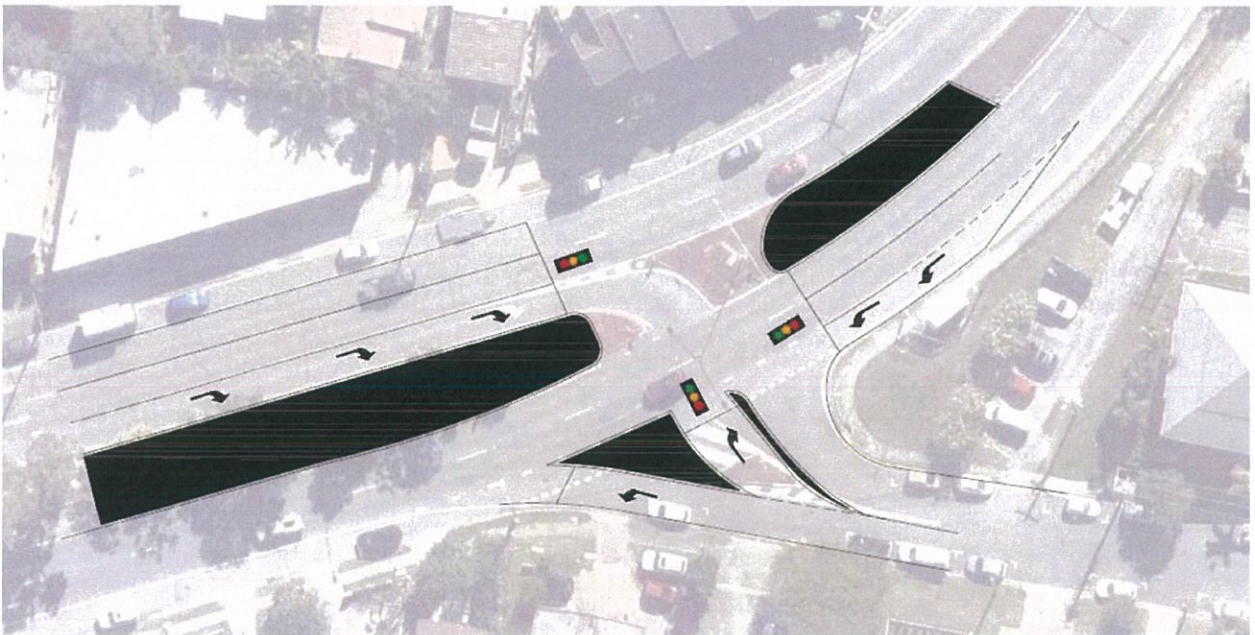


Figure 6.3: West Burleigh Road / Stanley Street Intersection Concept

The Aimsun modelling of these upgrades showed a substantial reduction in queueing in the area, particularly in West Street in the PM peak and in the AM peak, in Burleigh Street and in the right turn pocket from West Burleigh Road into James Street, as shown in Figure 6.4.

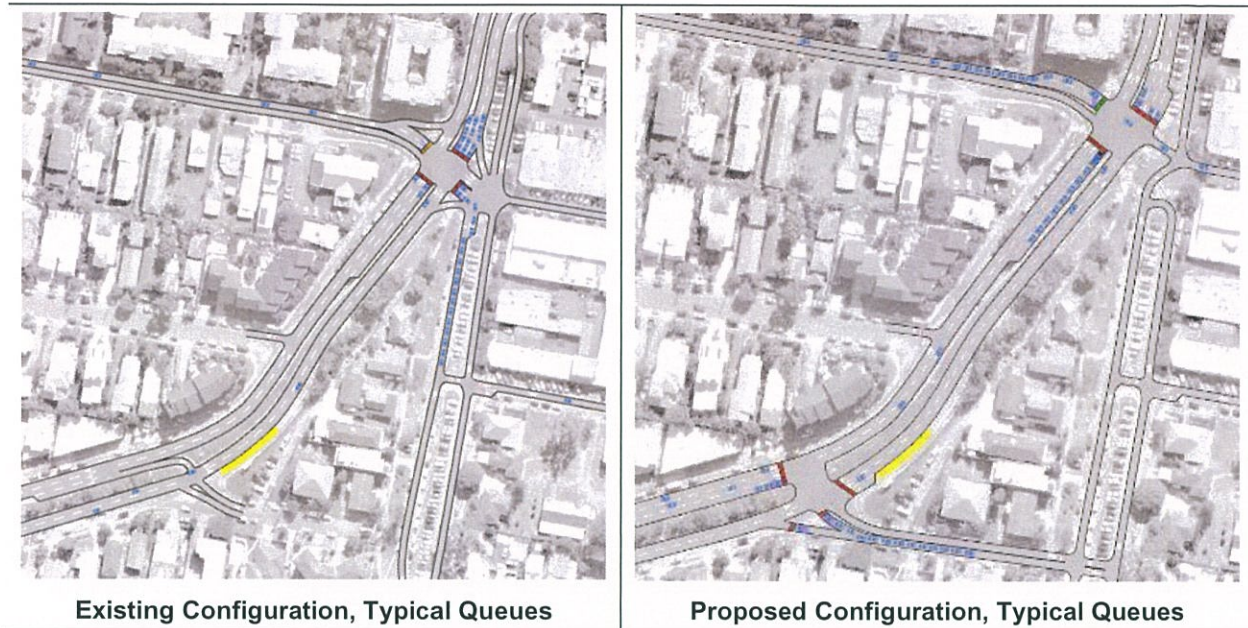


Figure 6.4: West Burleigh Road Intersection Upgrades, Comparison of Modelled Queues

There is some queueing noticeable for the left turn and right turn out of Stanley Street into West Burleigh Road. These queues are contained within Stanley Street which is an improvement over how they are currently stored in West Street blocking the James Street / West Street intersection.

Under the proposed configuration, the opportunity also exists to introduce a U-turn at the Stanley Street signals from West Burleigh Road north to West Burleigh Road north. What this allows then is the removal of the short right turn pocket from West Burleigh Road into Burleigh Street which often queues out of its pocket. This queue can be better stored in the proposed U-turn pocket and would also reduce one phase of the signals at the James Street / Burleigh Street / Gold Coast Highway intersection.

6.3 Tabilban Street Link

Vehicles using Tabilban Street are currently diverted from Tabilban Street to Reserve Street and Ocean Parade to continue along the Tabilban Street route. The 'missing link' within the Tabilban Street road corridor is shown in Figure 6.5.



Source Queensland Globe

Figure 6.5: Tabilban Street Missing Link

The likely road grades for this missing link have been calculated in order to assess the likely feasibility of the link. Source Queensland Globe

Figure 6.6 shows the that the grades for the missing link would be similar to the existing Tabilban Street grade to the east of Reserve Street and probably greater to provide a platform with sufficient sight distance at the crest.



Source Queensland Globe

Figure 6.6: Tabilban Street Contours and Grades

Travel times along the Tabilban Street route between Koel Street and Pindari Avenue are compared in Table 6.1. The connection of the missing link has been compared to the re-prioritised Ocean Parade Reserve Street upgrade option (included in Package A). The results show that the average travel times reduce by up to nine seconds with Tabilban Street connected.

Table 6.1: Tabilban Street Route – Package B Average Travel Time Comparison (in seconds)

Configuration	Westbound			Eastbound		
	AM	PM	Saturday	AM	PM	Saturday
Re-prioritised Intersection (GCLR Construction Package A)	38.3	35.8	35.3	37	38.2	38.3
Missing Link (GCLR Construction Package B)	30.1	27.8	27.5	28.2	29.2	29.3
Travel Time Reduction	8.2	8	7.8	8.8	9	9

Given the reduction in travel time is only nine seconds, the grades of the link, its safety considerations and potential property impacts, it is highly unlikely that constructing the missing link would provide benefits that would outweigh its significant cost.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 Key Conclusions

The construction of GCLR3 is likely to exacerbate congestion in Burleigh Heads and reduce the number and / or the capacity of key right turn in movements. Beyond the construction period, light rail will create permanent traffic accessibility changes to / from side streets between Burleigh Heads and Broadbeach and will reduce the intersection green time available for competing traffic movements from the signals.

The future movement of traffic into, out of and around Burleigh Heads will be affected and the most likely impacts identified in this study were:

- Additional queueing at the James Street / Burleigh Street / West Burleigh Road intersection to get into and out of the Burleigh Heads Centre
- Additional delays for traffic turning out of George Street East, particularly right turning traffic, due to higher demands and higher opposing flows. This exacerbates the existing safety issues associated with limited sight lines for this turn
- Additional usage of the Tabilban Street route, particularly westbound in the AM peak, substantially increasing queues and delays at the Reserve Street approach to Ocean Parade
- Acanthus Avenue may attract increasing traffic from West Burleigh Road (west) to Gold Coast Highway (north) to 'bypass' congestion in Burleigh Heads
- Hayle Street is likely to see more traffic which would exacerbate issues related to limited carriageway widths which are constrained by on street parking.

The key findings of the assessment of the options raised to address the above issues are:

- The connection of Stanley Street to West Street reduces congestion at the West Burleigh Road / Burleigh Street / Gold Coast Highway intersection
- The removal of right turns out of George Street East significantly reduce the safety concerns at this intersection. A U-turn at the Ikkinia Road / Gold Coast Highway intersection will assist in catering for the relatively low volume of displaced movements
- Re-aligning the Ocean Parade / Reserve Street intersection reduces the queueing and delays expected with more traffic using the Tabilban Street route during (and post) GCLR3 construction
- A traffic management scheme in Acanthus Avenue between Starling Street and Sandpiper Drive could be used to maintain local traffic accessibility and limit the impacts of the expected additional through traffic during GCLR3 construction
- Removal of one side of on-street parking in Hayle Street would better allow for the increases in two-way traffic flow expected and this parking may be able to be re-provisioned elsewhere. Re-orientating the intersection of George Street East with Hayle Street will also better match the intersection alignment with the dominant flow, thereby improving legibility and safety.

In the longer term, further consideration could be given to signalling the Stanley Street / West Burleigh Road intersection to allow all movements which will then enable the removal of the James Street approach to the Gold Coast Highway / Burleigh Street / James Street intersection. These changes will improve the efficiency of this intersection, better manage queues and provide an improved environment for pedestrian and cyclist movements.

The assessment has also revealed that the construction of the 'missing' Tabilban Street link between Ocean Parade and Reserve Street would be very steep and expensive to construct. It's travel time benefits would be minimal and there is no basis to further consider this option.

7.2 Recommendations

It is recommended that Council:

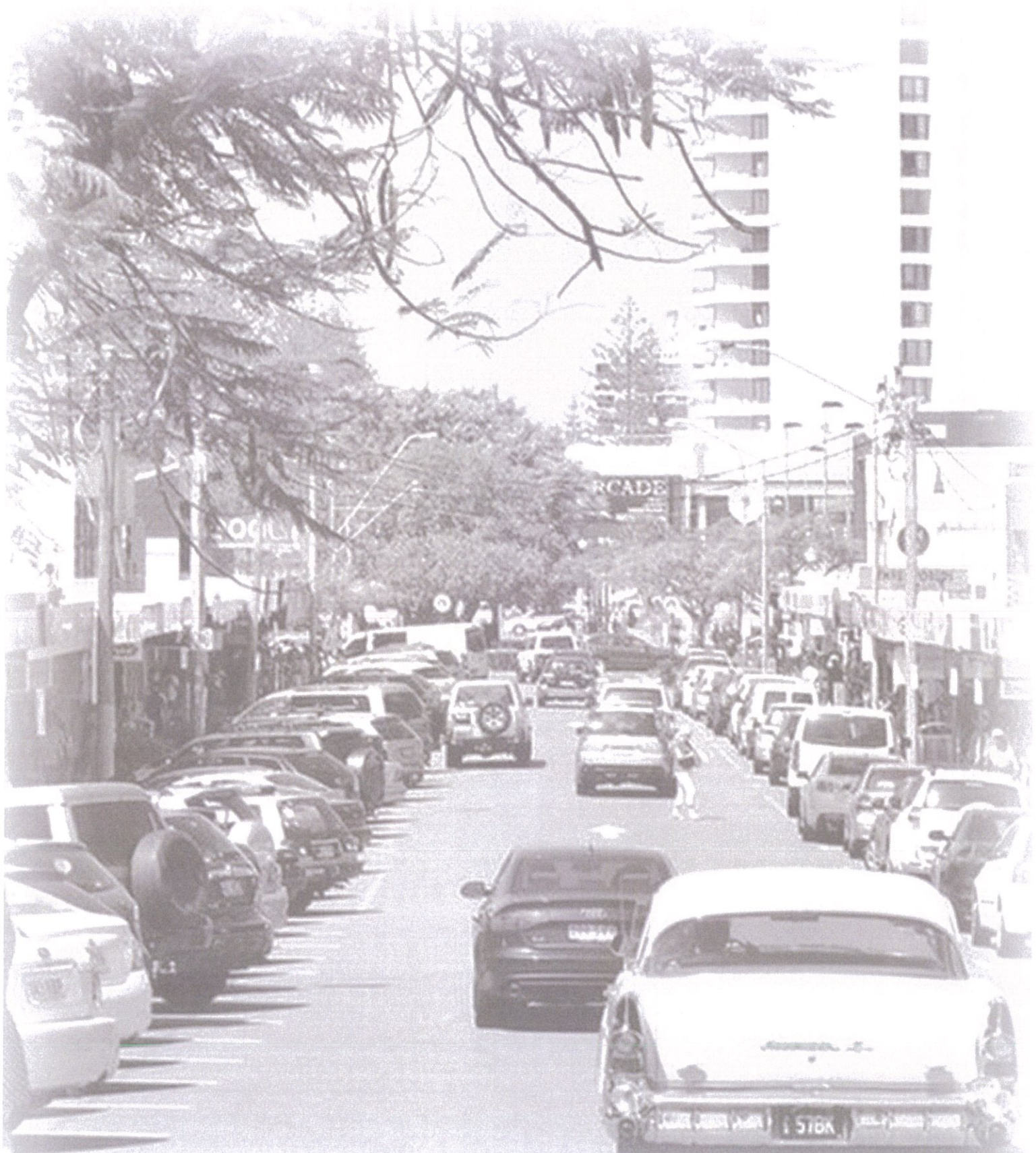
- Further investigate the geometry, cost and construction timeframes for the extension of Stanley Street to intersect with West Street including determining the preferred intersection orientation at the Stanley Street / West Street intersection to cater for the steep grades at this location
- Further assess (using current traffic data), design and implement the works to remove the right turn out of George Street East and consult with TMR on the introduction of a U-turn facility in the northern approach of the Gold Coast Highway / Ikkina Road intersection
- Assess (with current traffic data) the intersection of Ocean Parade / Reserve Street, assess sight lines and design and implement a re-orientated intersection configuration to align through movement priority with the dominant east-west movements at the intersection
- Develop a traffic management scheme for Acanthus Avenue between Starling Street and Sandpiper Drive that preserves local traffic accessibility to / from side streets and manages speed conflicts between vehicles, parking movements, pedestrians and cyclists
- Assess (with current traffic data) the intersection of Hayle Street / George Street East, assess sight lines and design and implement a re-orientated intersection configuration to align through movement priority with the dominant north-west movements at the intersection
- Develop a traffic management scheme for Tabilban Street and Park Avenue that manages speed conflicts between vehicles, parking movements, pedestrians and cyclists
- Further investigate the removal of on-street parking along the eastern side of Hayle Street south of Nathan Street, line marking the parking lane / bays on the western side and the creation of 90 degree bays along the western side of Hayle Street between Goodwin Terrace and Nathan Street to offset the parking loss further south
- Assess the benefits and impacts of options generally involving signalling the Stanley Street / West Burleigh Road intersection as a full movement intersection and removing the James Street approach to the Gold Coast Highway / Burleigh Street / James Street intersection (including associated works at James Street / West Street). The assessment should be based on current traffic data using a localised model of West Burleigh Road between the Gold Coast Highway and Stanley Street and including West Street and its intersections with James Street, Park Avenue and Stanley Street (proposed)
- Consult with TMR on all identified works at state-controlled intersections.

7.3 Further Studies

In addition to the above, it is recommended that Council:

- Undertake a traffic and transport study for the Burleigh Heads centre which considers multi-modal effects and needs associated with GCLR3 and any associated redevelopment expected in the centre. The study should include updated traffic modelling, and in an integrated way, develop a traffic, parking, public transport and active transport strategy for the centre to maximise the opportunities and minimise the risks associated with GCLR3
- Complete a broader network modelling assessment using the GCSCAM or the GCSTM-MM to assess the broader route choice influences GCLR3 beyond the localised impacts / needs determined in this study.

Appendix A: Model Development Technical Note



Issue History

File Name	Prepared	Reviewed	Issued by	Date	Issued to
P4413.001T GCLR3A Construction Modelling – Base Model Development	M. Kimmins	D. Bitzios	M. Kimmins	01/09/2020	Anette Cinthio Morse ACINTHIOMORSE@goldcoast.qld.gov.au

GCLR3A Construction Modelling

Base Model Development

1. Introduction

This Technical Note details the development of the 2020 Base microsimulation models being used to assess the light rail construction period traffic impacts and mitigation options in and around Burleigh Heads. The study area / modelling extents is shown in Figure 1.1.

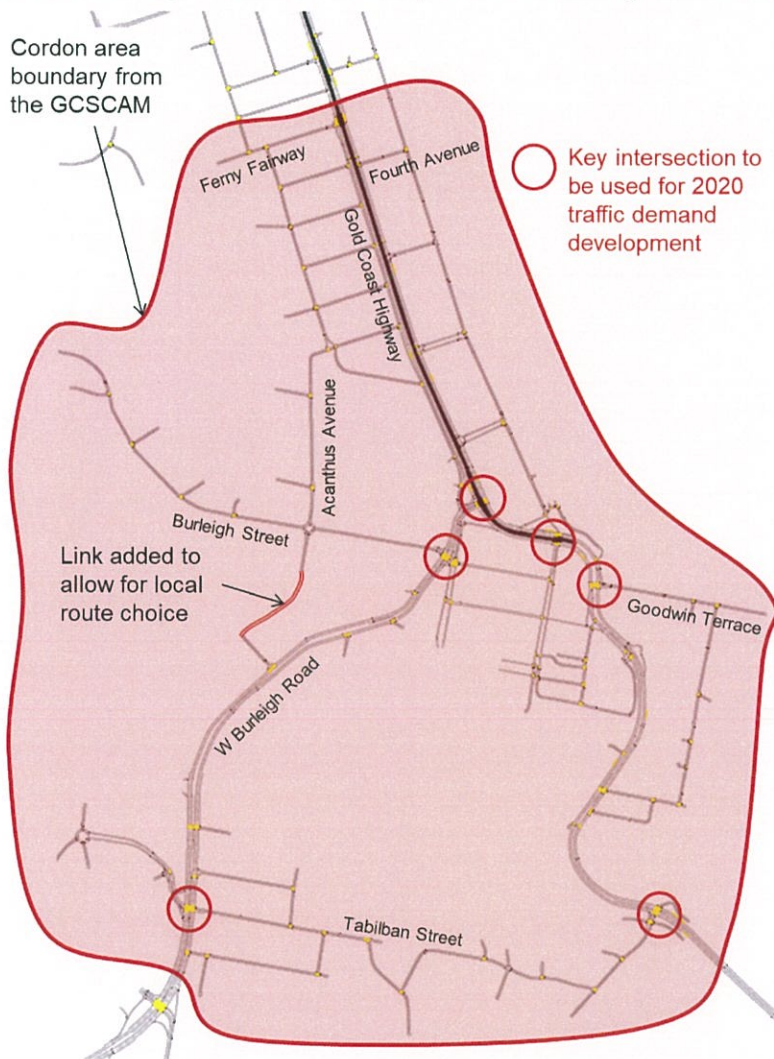


Figure 1.1: Study Area and Model Boundary

The study area was defined to enable the impacts of localised route choice changes to be identified with the expected Gold Coast Light Rail Stage 3A (GCLR3A) construction period traffic conditions in place. The modelling did not account for the potential route choice changes outside of the above boundary as time was not available to consider broader route choice modelling. The results presented in this Technical Note should be interpreted with this context.

2. Model Development

2.1 Methodology and Limitations

The model development methodology was customised to meet Council's 4-week program. Due to these time constraints, conventional model calibration and validation could not be undertaken, so an alternative approach was used. A cordon (or 'cut out') of Council's base year 2016 Gold Coast Southern and Central Aimsun Model (GCSCAM) was used along with traffic count and signal phasing data made available by Council.

Aimsun Next 20 was used to estimate Base (existing conditions) microsimulation models for the following periods:

- 2020 AM Base: 7:00am to 9:00am
- 2020 PM Base: 4:00pm to 6:00pm
- 2020 Saturday Base: 10:00am to 11:00am.

The following sections detail how these models were developed using the available data.

2.2 Traffic Demands

The cordon area of the 2016 GCSCAM provided initial weekday AM and PM 2-hour peak traffic demands. These demands were then mathematically adjusted within Aimsun aiming to match the model's assigned traffic volumes to the provided year 2020 intersections turning counts. Data was available at the following key intersections within the study area:

- West Burleigh Road / Burleigh Street / James Street (Wednesday, 12/02/2020)
- Gold Coast Highway / West Burleigh Road (Wednesday, 12/02/2020)
- Gold Coast Highway / Connor Street / The Esplanade (Wednesday, 12/02/2020)
- Gold Coast Highway / Goodwin Terrace (Wednesday, 12/02/2020)
- West Burleigh Road / Dunlin Drive / Tabilban Street (Wednesday, 30/11/2016)
- Gold Coast Highway / Ikkina Road (Thursday, 01/12/2016).

The 2016 intersection surveys for the West Burleigh Road / Burleigh Street / James Street intersection and the Gold Coast Highway / Goodwin Terrace intersection were used to determine growth rates from 2016 to 2020. These growth rates were then used to estimate 2020 intersection volumes at the West Burleigh Road / Dunlin Drive / Tabilban Street intersection and the Gold Coast Highway / Ikkina Road intersection for use in the demand estimation.

For the Saturday peak demands, data from Saturday 4 January 2020 was compared to the weekday peak data. What was revealed from this comparison was that the turning flows at key intersections were similar. This led to the conclusion to estimate the 2020 Saturday peak traffic demand using the weekday PM peak as its starting position.

The Saturday demands were then estimated in Aimsun using Council-provided loop count data from the following signalised intersections:

- West Burleigh Road / Burleigh Street / James Street (Saturday, 04/01/2020)
- Gold Coast Highway / West Burleigh Road (Saturday, 04/01/2020)
- Gold Coast Highway / Connor Street / The Esplanade (Saturday, 04/01/2020)
- Gold Coast Highway / Goodwin Terrace (Saturday, 04/01/2020).

Section 3 of this Technical Note details the demand estimation results.

2.3 Traffic Signals

Signal data was provided for the six (6) intersections included in the demand development. The signal data was analysed and incorporated into the Base models. Actuated signals have been implemented to allow for phases and times to vary based on traffic flow and demand. This is relevant for the 'with construction' condition where demands for specific movements, and hence the balance of green time needs, will change.

2.4 Model Parameters

The majority of network and model parameters, such as vehicle types, road types, speeds, etc. have been retained from the GCSCAM. Localised network verification was undertaken for key movements where obvious coding anomalies were visualised in the simulation.

2.5 Traffic Assignment

Dynamic User Equilibrium (DUE) assignment using the Weighted Method of Successive Averages (MSA) method has been used. The MSA procedure reassigns traffic flows among the available paths in an iterative procedure until the convergence criteria are met. Path assignment files which record the paths taken by all vehicles are produced and then incorporated in the simulation replications.

This assignment method was used for demand estimation and then replicated for all tested scenarios to ensure consistency of model outputs.

3. Model Calibration (Matrix Estimation)

The models have been calibrated to the observed vehicle movement data sourced from the intersection turn counts at six intersections within the study area. This number of counts would ordinarily be considered insufficient for the size of the study area in order to achieve high confidence in the calibration but was the best that could be achieved in the time available. Model calibration criteria were based on the *RMS Traffic Modelling Guidelines 2013* as follows:

- A minimum of 85% of turn volumes with a GEH < 5
- No volumes with a GEH > 10

The Geoffrey E. Havers (GEH) Statistic is an industry standard measure of variance between the observed count and modelled count, expressed by the following:

$$GEH = \sqrt{\frac{2(M - C)^2}{M + C}}$$

Where *M* is the Modelled Volume and *C* is the Observed Volume

The following table summarise the GEH summaries for the three (3) Base model scenarios. Detailed observed and modelled calibration statistics are provided in Attachment A.

Table 3.1: Turn Count Calibration – GEH Statistics

Measure	2020 AM Base		2020 PM Base		2020 Saturday Base
	7:00 to 8:00	8:00 to 9:00	4:00 to 5:00	5:00 to 6:00	10:00am to 11:00am
% of GEH > 10	0%	0%	0%	0%	0%
% of GEH < 5	97%	91%	88%	89%	89%

As shown in the table above, more than 85% of the turn volumes in all models have a GEH below 5 and no GEH values are over 10, which meets the target criteria.

4. Model Validation

Model validation was based on local knowledge of the queuing extents and patterns in the area. This was the only validation method that could be used in the absence of survey data.

Figure 4.1 shows the typical queues in the AM peak at the Gold Coast Highway / West Burleigh Road intersection. Queues for the right turn from Gold Coast Highway to West Burleigh Road occasionally extend beyond the turn pocket, slightly impacting through traffic flow. The northbound queue on the Gold Coast Highway at this intersection can also extend southwards almost as far as Connor Street at times, impeding the left turn movement from the Gold Coast Highway to West Burleigh Road.



Figure 4.1: AM Queues – Gold Coast Highway / West Burleigh Road Intersection

Also, in the AM peak, the queues on the northern (westbound) West Burleigh Road approach to James Street can extend past the left turn slip lane from the Gold Coast Highway and the queues on the Burleigh Street approach to West Burleigh Road can also extend up to 100m, as shown in Figure 4.2 and evidenced from local experience.

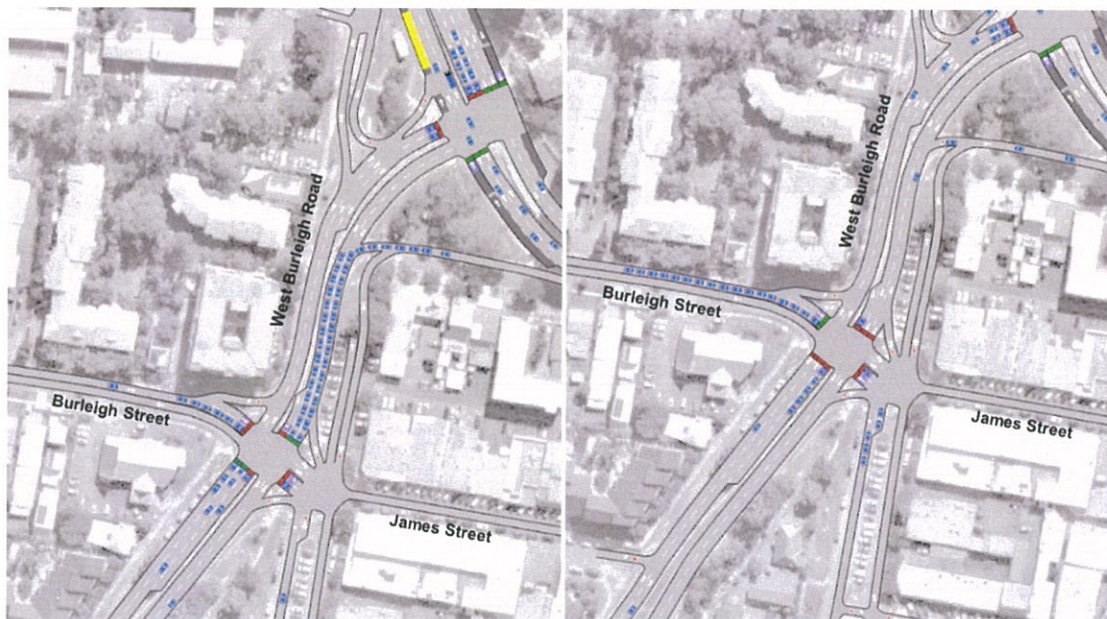


Figure 4.2: AM Queues – West Burleigh Road / Burleigh Street / James Street

In the PM peak, queuing occurs northbound on West Burleigh Road, as shown in Figure 4.3. The queuing and weaving on the West Burleigh Road approach to the Gold Coast Highway can impact the northbound throughput at the West Burleigh Road / Burleigh Street / James Street intersection.

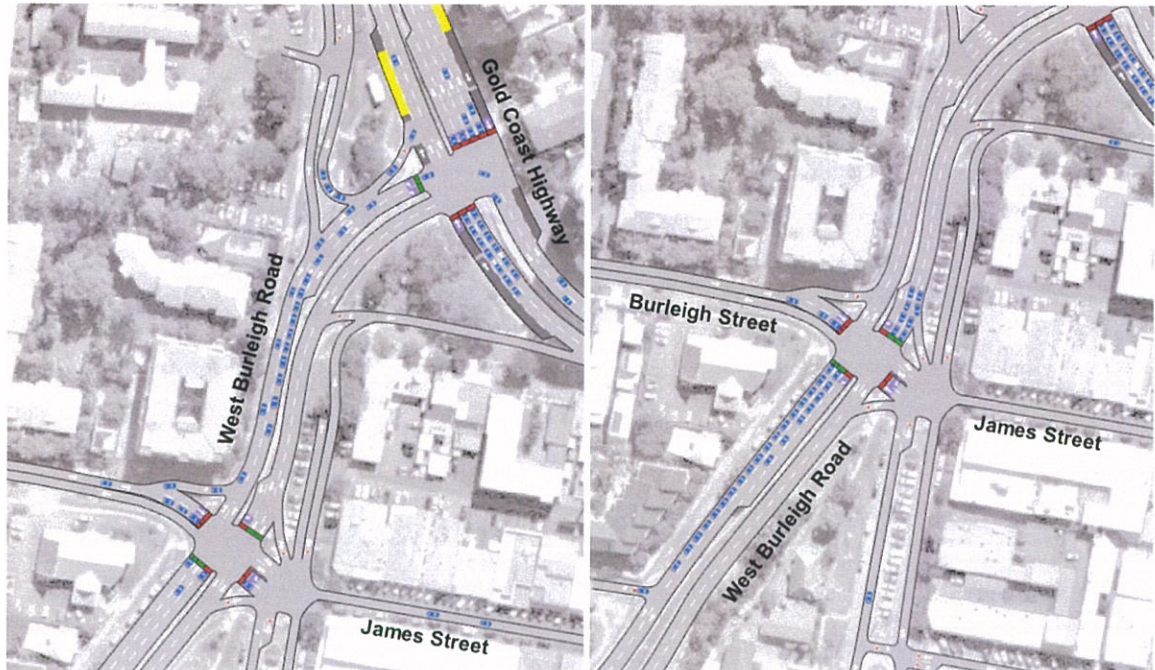


Figure 4.3: PM Queues – West Burleigh Road Northbound

Peak Saturday queues on approach to the Gold Coast Highway / West Burleigh Road intersection are shown in Figure 4.4. Similar to the PM peak, northbound queues on the West Burleigh Road approach to the Gold Coast Highway are quite significant. Queuing also occasionally extends beyond the right turn pocket for the Gold Coast Highway to West Burleigh Road movement.

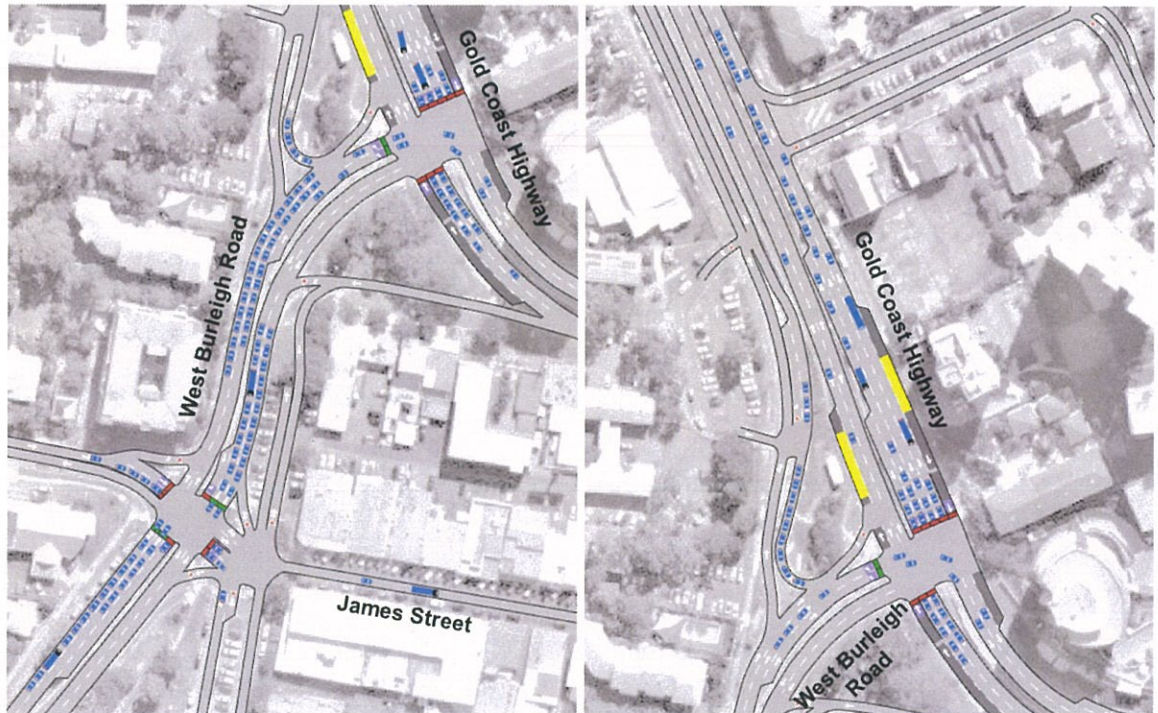


Figure 4.4: Saturday Queues – Gold Coast Highway / West Burleigh Road

Figure 4.5 shows the Saturday peak queues at the West Burleigh Road / Burleigh Street / James Street intersection. Queues on the western Burleigh Street approach can extend up to 100m. On the southern West Burleigh Road approach, the right turn to James Street occasional extends beyond the pocket and through traffic queues can extend beyond Stevens Street.

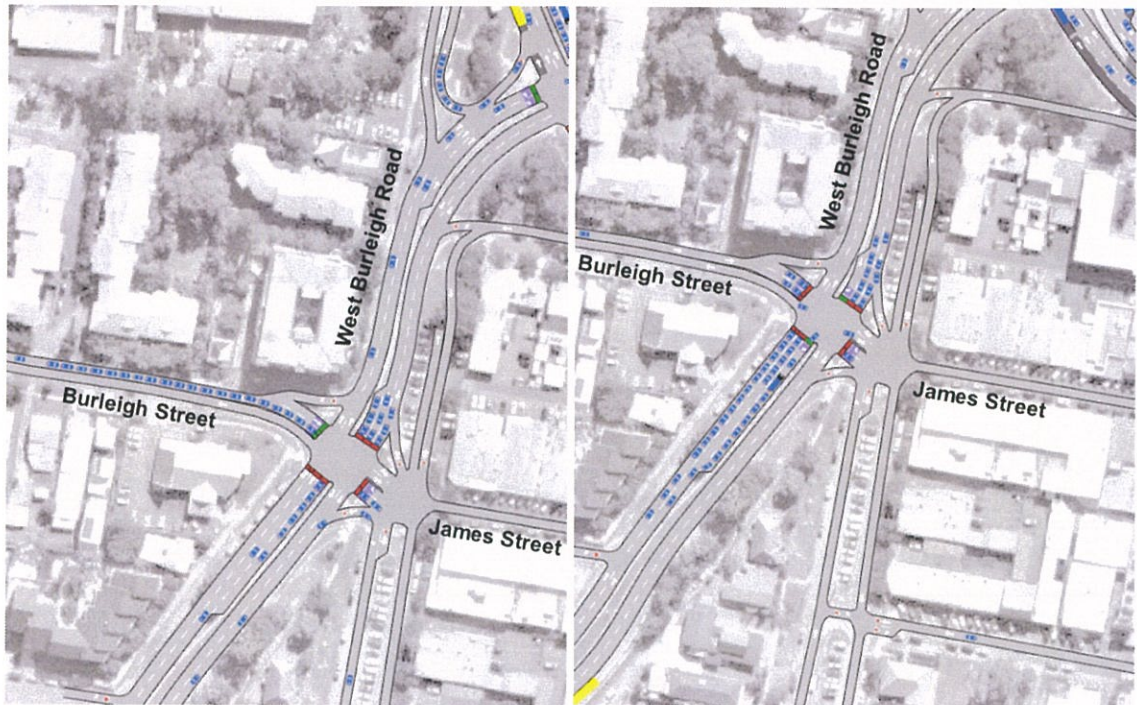


Figure 4.5: Saturday Queues – West Burleigh Road / Burleigh Street / James Street

Overall, the modelled queues are similar to typical peak period conditions and queuing patterns.

5. Implications for Model Usage

The models have been developed using a limited amount of data and still rely heavily on the previous modelling undertaken (for the GCSCAM). Confidence in the Saturday Base model is further limited due to its reliance on signal detector data (i.e. loop counts) and no initial demand from GCSCAM due to it being a weekday only model. The AM and PM peak turn count calibration at the six key intersections is still considered to be sufficient for the purposes of this study, with the modelling primarily being used to confirm traffic pattern implications of construction works and expected congestion consequences.

Relevant key movements and times where the estimation of volumes should be considered when interpreting the reviewing the model outputs include:

- James Street right turn into West Burleigh Road in the AM peak being 49 vph low compared to the count. Congestion and queueing would be slightly worse than the model shows
- The West Burleigh Road left turn into James Street being 28 – 50 vph low in the PM peak compared to the count, possibly underestimating the queue in West Burleigh Road
- The left turn from Ikkinia Road into the Gold Coast Highway being 49-78 vph high in the PM peak suggesting slightly longer queues in Ikkinia Road than in reality
- The right turn from West Burleigh Road into the Gold Coast Highway being 106 vph low in the PM peak suggesting that queues on this approach would be about 25% longer than shown in the model.

Outside of the key routes, there are intersections and routes throughout the modelled network that have not been incorporated in the model calibration, including:

- Intersections along the north/south travel route on the Lower Gold Coast Highway
- Intersections along the north/south travel route on Acanthus Avenue and Symonds Road
- Intersection along the north/south travel route on The Esplanade as well as east/west traffic between The Esplanade and the Gold Coast Highway
- Intersections along the east/west travel route on Park Avenue
- Circulating traffic and impacts within the Burleigh central business area
- The Gold Coast Highway / George Street East intersection.

The implications of the above are that the model should only be used as a guide in the assessment of light rail construction impacts and the identification/assessment of options to mitigate these impacts. Further modelling and assessment should be undertaken during the development of any business cases or detailed designs for any works identified.

6. Conclusion

The Burleigh Heads Aimsun model is calibration to conventional GEH criteria but should not be considered to be a fully calibrated and validated model given the limited data upon which it was based. The model is considered to be sufficient to guide the assessment of GCLR3A construction period impacts and the merits of potential upgrade options in terms of their worthiness for more detailed assessment.

Attachment A: Turn Count Calibration – GEH Statistics

P4413 GCLR 3A
 AMSUN Turn Calibration
 AM Peak 0700-0800

GEH Turn Summary 0700-0800		
>10	0	0%
>5, <=10	2	3%
<=5	56	97%

ID	Intersection	Turn	From	To	Turn	Observed	Modelled	Abs. Diff (Mod - obs)	% Diff (Mod-Obs)	GEH
1	W Burleigh Road Tabilban Street W Burleigh Road Dunlin Dr	6356	W Burleigh Road (N)	Dunlin Dr (W)	R	82	92	10	12.8%	1.1
		6358		W Burleigh Road (S)	T	958	980	22	2.3%	0.7
		6359		Tabilban Street (E)	L	13	2	11	84.9%	4.1
		6364	Tabilban Street (E)	W Burleigh Road (N)	R	35	27	8	21.8%	1.4
		6366		Dunlin Dr (W)	T	80	62	18	22.5%	2.1
		6367		W Burleigh Road (S)	L	87	73	14	16.1%	1.6
		6363	W Burleigh Road (S)	Tabilban Street (E)	R	66	81	15	23.2%	1.8
		6360		W Burleigh Road (N)	T	589	608	19	3.1%	0.8
		6381		Dunlin Dr (W)	L	54	71	17	30.9%	2.1
		6351	Dunlin Dr (W)	W Burleigh Road (S)	R	174	240	66	37.8%	4.6
		6355		Tabilban Street (E)	T	29	28	1	3.4%	0.2
6391		W Burleigh Road (N)	L	54	67	13	23.5%	1.6		
All						2221	2331	214		
2	W Burleigh Road James Street W Burleigh Road Burleigh St	5446	W Burleigh Road (N)	Burleigh St (W)	R	47	31	16	34.0%	2.6
		5448		W Burleigh Road (S)	T	539	641	102	18.9%	4.2
		5468		James Street (E)	L	72	69	3	4.2%	0.4
		5451	James Street (E)	W Burleigh Road (N)	R	54	28	26	48.1%	4.1
		5449		Burleigh St (W)	T	51	30	21	41.2%	3.3
		5703		W Burleigh Road (S)	L	202	198	4	2.0%	0.3
		5440	W Burleigh Road (S)	James Street (E)	R	121	175	54	44.6%	4.4
		5438		W Burleigh Road (N)	T	383	346	37	9.7%	1.9
		5434		Burleigh St (W)	L	9	1	8	88.9%	3.6
		5444	Burleigh St (W)	W Burleigh Road (S)	R	167	214	47	28.1%	3.4
		5442		James Street (E)	T	54	52	2	3.7%	0.3
5471		W Burleigh Road (N)	L	59	47	12	20.3%	1.6		
All						1758	1832	332		
3	GC Highway GC Highway Burleigh St	5323	GC Highway (N)	GC Highway (N)	U	17	26	9	52.9%	1.9
		5319		Burleigh St (W)	R	442	556	114	25.8%	5.1
		5322		GC Highway (S)	T	668	679	11	1.6%	0.4
		5313	GC Highway (S)	GC Highway (N)	T	1337	1442	105	7.9%	2.8
		5516		Burleigh St (W)	L	224	198	26	11.6%	1.8
		5317	Burleigh St (W)	GC Highway (S)	R	232	163	69	29.7%	4.9
5339		GC Highway (N)	L	233	256	23	9.9%	1.5		
All						3153	3320	357		
4	The Esplanade GC Highway Connor Street GC Highway	5490	GC Highway (E)	The Esplanade	R	60	30	30	50.0%	4.5
		5493		GC Highway (W)	T	1504	1573	69	4.6%	1.8
		5492		Connor Street (S)	L	26	23	3	11.5%	0.6
		5497	Connor Street (S)	GC Highway (E)	R	82	106	24	29.3%	2.5
		5495		The Esplanade	T	38	52	14	36.8%	2.1
		5496		GC Highway (W)	L	65	70	5	7.7%	0.6
		5499	GC Highway (W)	Connor Street (S)	R	39	6	33	84.6%	7.0
		5500		GC Highway (E)	T	807	751	56	6.9%	2.0
5384		The Esplanade	L	108	89	19	17.6%	1.9		
All						2729	2700	253		
5	GC Highway Goodwin Terrace GC Highway	5630	GC Highway (N)	GC Highway (S)	T	745	681	64	8.6%	2.4
		5644		Goodwin Terrace (E)	L	195	180	15	7.7%	1.1
		5625	Goodwin Terrace (E)	GC Highway (N)	R	238	315	77	32.4%	4.6
		5628		GC Highway (S)	L	31	27	4	12.9%	0.7
		5632	GC Highway (S)	Goodwin Terrace (E)	R	24	5	19	79.2%	5.0
		5634		GC Highway (N)	T	1380	1286	94	6.8%	2.6
All						2613	2494	273		
6	Jellurgal Centre Access GC Highway Ikkin Road GC Highway	6314	Jellurgal Centre Access (N)	GC Highway (W)	R	4	2	2	49.0%	1.1
		6315		Ikkin Road (S)	T	2	3	1	47.3%	0.6
		6312		GC Highway (E)	L	8	1	7	87.7%	3.3
		6316	GC Highway (E)	Jellurgal Centre Access (N)	R	10	2	8	79.6%	3.2
		6317		GC Highway (W)	T	1443	1407	36	2.5%	1.0
		6318		Ikkin Road (S)	L	396	490	94	23.8%	4.5
		6323	Ikkin Road (S)	GC Highway (E)	R	120	131	11	9.0%	1.0
		6322		Jellurgal Centre Access (N)	T	1	3	2	200.0%	1.4
		6337		GC Highway (W)	L	44	60	16	36.1%	2.2
		6321	GC Highway (W)	Ikkin Road (S)	R	27	14	13	49.1%	3.0
		6320		GC Highway (E)	T	737	690	47	6.4%	1.8
		6319		Jellurgal Centre Access (N)	L	9	3	6	67.3%	2.5
All						2802	2806	244		

P4413 GCLR 3A
 AIMSUN Turn Calibration
 AM Peak 0800-0900

GEH Turn Summary 0800-0900		
>10	0	0%
>5, <=10	5	9%
<=5	53	91%

ID	Intersection	Turn	From	To	Turn	Observed	Modelled	Abs. Diff (Mod - obs)	% Diff (Mod-Obs)	GEH
1	W Burleigh Road Tabilban Street W Burleigh Road Dunlin Dr	6356	W Burleigh Road (N)	Dunlin Dr (W)	R	175	236	61	34.7%	4.2
		6358		W Burleigh Road (S)	T	1020	1072	52	5.1%	1.6
		6359		Tabilban Street (E)	L	17	2	15	88.4%	4.9
		6364	Tabilban Street (E)	W Burleigh Road (N)	R	45	23	22	49.0%	3.8
		6366		Dunlin Dr (W)	T	112	106	6	5.4%	0.6
		6367		W Burleigh Road (S)	L	140	184	44	31.9%	3.5
		6363	W Burleigh Road (S)	Tabilban Street (E)	R	99	125	26	26.0%	2.4
		6360		W Burleigh Road (N)	T	761	754	7	0.9%	0.3
		6381		Dunlin Dr (W)	L	92	79	13	13.8%	1.4
		6351	Dunlin Dr (W)	W Burleigh Road (S)	R	212	182	30	14.2%	2.1
6355		Tabilban Street (E)	T	51	32	19	37.3%	2.9		
6391		W Burleigh Road (N)	L	100	136	36	36.1%	3.3		
All						2824	2931	331		
2	W Burleigh Road James Street W Burleigh Road Burleigh St	5446	W Burleigh Road (N)	Burleigh St (W)	R	44	52	8	18.2%	1.2
		5448		W Burleigh Road (S)	T	630	622	8	1.3%	0.3
		5468		James Street (E)	L	81	46	35	43.2%	4.4
		5451	James Street (E)	W Burleigh Road (N)	R	105	56	49	46.7%	5.5
		5449		Burleigh St (W)	T	85	69	16	18.8%	1.8
		5703		W Burleigh Road (S)	L	290	322	32	11.0%	1.8
		5440	W Burleigh Road (S)	James Street (E)	R	145	192	47	32.4%	3.6
		5438		W Burleigh Road (N)	T	479	453	26	5.4%	1.2
		5434		Burleigh St (W)	L	20	2	18	90.0%	5.4
		5444	Burleigh St (W)	W Burleigh Road (S)	R	271	339	68	25.1%	3.9
		5442		James Street (E)	T	87	90	3	3.4%	0.3
5471		W Burleigh Road (N)	L	70	43	27	38.6%	3.6		
All						2307	2286	337		
3	GC Highway GC Highway Burleigh St	5323	GC Highway (N)	GC Highway (N)	U	17	14	3	17.6%	0.8
		5319		Burleigh St (W)	R	498	568	70	14.1%	3.0
		5322		GC Highway (S)	T	831	861	30	3.6%	1.0
		5313	GC Highway (S)	GC Highway (N)	T	1338	1331	7	0.5%	0.2
		5516		Burleigh St (W)	L	231	141	90	39.0%	6.6
		5317	Burleigh St (W)	GC Highway (S)	R	261	223	38	14.6%	2.4
5339		GC Highway (N)	L	294	313	19	6.5%	1.1		
All						3470	3451	257		
4	The Esplanade GC Highway Connor Street GC Highway	5490	GC Highway (E)	The Esplanade	R	106	51	55	51.9%	6.2
		5493		GC Highway (W)	T	1503	1425	78	5.2%	2.0
		5492		Connor Street (S)	L	22	15	7	31.8%	1.6
		5497	Connor Street (S)	GC Highway (E)	R	103	127	24	23.3%	2.2
		5495		The Esplanade	T	35	97	62	177.1%	7.6
		5496		GC Highway (W)	L	89	83	6	6.7%	0.6
		5499	GC Highway (W)	Connor Street (S)	R	45	33	12	26.7%	1.9
		5500		GC Highway (E)	T	941	897	44	4.7%	1.5
5384		The Esplanade	L	118	150	32	27.1%	2.8		
All						2962	2878	320		
5	GC Highway Goodwin Terrace GC Highway	5630	GC Highway (N)	GC Highway (S)	T	922	828	94	10.2%	3.2
		5644		Goodwin Terrace (E)	L	218	204	14	6.4%	1.0
		5625	Goodwin Terrace (E)	GC Highway (N)	R	208	229	21	10.1%	1.4
		5628		GC Highway (S)	L	34	34	0	0.0%	0.0
		5632	GC Highway (S)	Goodwin Terrace (E)	R	11	8	3	27.3%	1.0
5634		GC Highway (N)	T	1362	1256	106	7.8%	2.9		
All						2755	2559	238		
6	Jellurgal Centre Access GC Highway Ikkin Road GC Highway	6314	Jellurgal Centre Access (N)	GC Highway (W)	R	4	4	0	7.7%	0.2
		6315		Ikkin Road (S)	T	3	2	1	33.3%	0.6
		6312		GC Highway (E)	L	6	3	3	50.5%	1.4
		6316	GC Highway (E)	Jellurgal Centre Access (N)	R	9	2	7	76.9%	2.9
		6317		GC Highway (W)	T	1488	1489	1	0.0%	0.0
		6318		Ikkin Road (S)	L	487	555	68	13.9%	3.0
		6323	Ikkin Road (S)	GC Highway (E)	R	164	218	54	33.2%	3.9
		6322		Jellurgal Centre Access (N)	T	4	3	1	25.0%	0.5
		6337		GC Highway (W)	L	49	44	5	9.4%	0.7
		6321	GC Highway (W)	Ikkin Road (S)	R	49	30	19	38.2%	3.0
		6320		GC Highway (E)	T	917	819	98	10.6%	3.3
6319		Jellurgal Centre Access (N)	L	9	3	6	67.0%	2.5		
All						3188	3172	262		

P4413 GCLR 3A
 AIMSUN Turn Calibration
 PM Peak 1600-1700

GEH Turn Summary 1600-1700		
>10	0	0%
>5, <=10	7	12%
<=5	50	88%

ID	Intersection	Turn	From	To	Turn	Observed	Modelled	Abs. Diff (Mod - obs)	% Diff (Mod - Obs)	GEH
1	W Burleigh Road Tabilban Street W Burleigh Road Dunlin Dr	6356	W Burleigh Road (N)	Dunlin Dr (W)	R	159	141	18	11.1%	1.4
		6358		W Burleigh Road (S)	T	614	628	14	2.3%	0.6
		6359		Tabilban Street (E)	L	22	4	18	81.5%	4.9
		6364	Tabilban Street (E)	W Burleigh Road (N)	R	25	8	17	67.8%	4.2
		6366		Dunlin Dr (W)	T	69	30	39	56.5%	5.5
		6367		W Burleigh Road (S)	L	59	50	9	14.7%	1.2
		6363	W Burleigh Road (S)	Tabilban Street (E)	R	329	329	0	0.1%	0.0
		6360		W Burleigh Road (N)	T	887	831	56	6.3%	1.9
		6381		Dunlin Dr (W)	L	142	152	10	7.3%	0.9
		6351	Dunlin Dr (W)	W Burleigh Road (S)	R	99	103	4	3.9%	0.4
		6355		Tabilban Street (E)	T	108	63	45	41.7%	4.9
6391		W Burleigh Road (N)	L	169	183	14	8.1%	1.0		
All						2681	2522	243		
2	W Burleigh Road James Street W Burleigh Road Burleigh St	5446	W Burleigh Road (N)	Burleigh St (W)	R	77	73	4	5.2%	0.5
		5448		W Burleigh Road (S)	T	413	452	39	9.4%	1.9
		5468		James Street (E)	L	96	42	54	56.3%	6.5
		5451	James Street (E)	W Burleigh Road (N)	R	72	44	28	38.9%	3.7
		5449		Burleigh St (W)	T	61	41	20	32.8%	2.8
		5703		W Burleigh Road (S)	L	121	151	30	24.8%	2.6
		5440	W Burleigh Road (S)	James Street (E)	R	182	131	51	28.0%	4.1
		5438		W Burleigh Road (N)	T	636	559	77	12.1%	3.2
		5434		Burleigh St (W)	L	21	3	18	85.7%	5.2
		5444	Burleigh St (W)	W Burleigh Road (S)	R	133	137	4	3.0%	0.3
		5442		James Street (E)	T	73	66	7	9.6%	0.8
5471		W Burleigh Road (N)	L	71	97	26	36.6%	2.8		
All						1956	1796	358		
3	GC Highway GC Highway Burleigh St	5323	GC Highway (N)	GC Highway (N)	U	11	25	14	127.3%	3.3
		5319		Burleigh St (W)	R	361	365	4	1.1%	0.2
		5322		GC Highway (S)	T	1089	1075	14	1.3%	0.4
		5313	GC Highway (S)	GC Highway (N)	T	898	974	76	8.5%	2.5
		5516		Burleigh St (W)	L	211	206	5	2.4%	0.3
		5317	Burleigh St (W)	GC Highway (S)	R	429	427	2	0.5%	0.1
5339		GC Highway (N)	L	322	317	5	1.6%	0.3		
All						3321	3389	120		
4	The Esplanade GC Highway Connor Street GC Highway	5490	GC Highway (E)	The Esplanade	R	93	70	23	24.7%	2.5
		5493		GC Highway (W)	T	1044	1013	31	3.0%	1.0
		5492		Connor Street (S)	L	15	9	6	40.0%	1.7
		5497	Connor Street (S)	GC Highway (E)	R	117	96	21	17.9%	2.0
		5495		The Esplanade	T	43	48	5	11.6%	0.7
		5496		GC Highway (W)	L	107	166	59	55.1%	5.0
		5499	GC Highway (W)	Connor Street (S)	R	30	8	22	73.3%	5.0
		5500		GC Highway (E)	T	1403	1415	12	0.9%	0.3
		5384		The Esplanade	L	93	85	8	8.6%	0.8
All						2945	2910	187		
5	GC Highway Goodwin Terrace GC Highway	5630	GC Highway (N)	GC Highway (S)	T	1362	1344	18	1.3%	0.5
		5644		Goodwin Terrace (E)	L	241	196	45	18.7%	3.0
		5625	Goodwin Terrace (E)	GC Highway (N)	R	205	250	45	22.0%	3.0
		5628		GC Highway (S)	L	46	24	22	47.8%	3.7
		5632	GC Highway (S)	Goodwin Terrace (E)	R	34	1	33	97.1%	7.9
		5634		GC Highway (N)	T	940	829	111	11.8%	3.7
All						2828	2644	274		
6	Jellurgal Centre Access GC Highway Ikkina Road GC Highway	6314	Jellurgal Centre Access (N)	GC Highway (W)	R	10	0	10	100.0%	4.5
		6315		Ikkina Road (S)	T	1	0	1	100.0%	1.4
		6312		GC Highway (E)	L	6	0	6	100.0%	3.6
		6316	GC Highway (E)	Jellurgal Centre Access (N)	R	2	0	2	100.0%	1.8
		6317		GC Highway (W)	T	1041	954	87	8.4%	2.8
		6318		Ikkina Road (S)	L	203	244	41	20.3%	2.8
		6323	Ikkina Road (S)	GC Highway (E)	R	364	326	38	10.5%	2.1
		6322		Jellurgal Centre Access (N)	T	2	2	0	0.0%	0.0
		6337		GC Highway (W)	L	32	110	78	245.3%	9.3
		6321	GC Highway (W)	Ikkina Road (S)	R	33	32	1	1.7%	0.1
		6320		GC Highway (E)	T	1349	1354	5	0.4%	0.1
6319		Jellurgal Centre Access (N)	L	0	0	0	0.0%	0.0		
All						3043	3022	269		

P4413 GCLR 3A
 AIMSUN Turn Calibration
 PM Peak 1700-1800

GEH Turn Summary 1700-1800		
>10	0	0%
>5, <=10	6	11%
<=5	51	89%

ID	Intersection	Turn	From	To	Turn	Observed	Modelled	Abs. Diff (Mod - obs)	% Diff (Mod - Obs)	GEH
1	W Burleigh Road Tabilban Street W Burleigh Road Dunlin Dr	6356	W Burleigh Road (N)	Dunlin Dr (W)	R	101	129	28	27.6%	2.6
		6358	W Burleigh Road (S)	W Burleigh Road (S)	T	557	518	39	7.0%	1.7
		6359	Tabilban Street (E)	Tabilban Street (E)	L	30	7	23	76.5%	5.3
		6364	W Burleigh Road (N)	W Burleigh Road (N)	R	25	12	13	52.4%	3.1
		6366	Dunlin Dr (W)	Dunlin Dr (W)	T	63	64	1	1.6%	0.1
		6367	W Burleigh Road (S)	W Burleigh Road (S)	L	44	89	45	101.3%	5.5
		6363	Tabilban Street (E)	Tabilban Street (E)	R	331	285	46	14.0%	2.6
		6360	W Burleigh Road (N)	W Burleigh Road (N)	T	893	845	48	5.4%	1.6
		6381	Dunlin Dr (W)	Dunlin Dr (W)	L	124	121	3	2.5%	0.3
		6351	W Burleigh Road (S)	W Burleigh Road (S)	R	83	76	7	8.4%	0.8
6355	Tabilban Street (E)	Tabilban Street (E)	T	101	89	12	11.9%	1.2		
6391	W Burleigh Road (N)	W Burleigh Road (N)	L	170	171	1	0.6%	0.1		
All						2523	2406	267		
2	W Burleigh Road James Street W Burleigh Road Burleigh St	5446	W Burleigh Road (N)	Burleigh St (W)	R	52	85	33	63.5%	4.0
		5448	W Burleigh Road (S)	W Burleigh Road (S)	T	350	442	92	26.3%	4.6
		5468	James Street (E)	James Street (E)	L	118	68	50	42.4%	5.2
		5451	W Burleigh Road (N)	W Burleigh Road (N)	R	58	57	1	1.7%	0.1
		5449	Burleigh St (W)	Burleigh St (W)	T	78	45	33	42.3%	4.2
		5703	W Burleigh Road (S)	W Burleigh Road (S)	L	107	117	10	9.3%	0.9
		5440	James Street (E)	James Street (E)	R	187	131	56	29.9%	4.4
		5438	W Burleigh Road (N)	W Burleigh Road (N)	T	660	597	63	9.5%	2.5
		5434	Burleigh St (W)	Burleigh St (W)	L	24	5	19	79.2%	5.0
		5444	W Burleigh Road (S)	W Burleigh Road (S)	R	88	86	2	2.3%	0.2
		5442	James Street (E)	James Street (E)	T	101	111	10	9.9%	1.0
5471	W Burleigh Road (N)	W Burleigh Road (N)	L	76	76	0	0.0%	0.0		
All						1899	1820	369		
3	GC Highway GC Highway Burleigh St	5323	GC Highway (N)	GC Highway (N)	U	8	18	10	125.0%	2.8
		5319	Burleigh St (W)	Burleigh St (W)	R	349	414	65	18.6%	3.3
		5322	GC Highway (S)	GC Highway (S)	T	1154	1120	34	2.9%	1.0
		5313	GC Highway (N)	GC Highway (N)	T	851	876	25	2.9%	0.9
		5516	Burleigh St (W)	Burleigh St (W)	L	168	192	24	14.3%	1.8
		5317	GC Highway (S)	GC Highway (S)	R	463	384	79	17.1%	3.8
5339	GC Highway (N)	GC Highway (N)	L	329	365	36	10.9%	1.9		
All						3322	3369	273		
4	The Esplanade GC Highway Connor Street GC Highway	5490	GC Highway (E)	The Esplanade	R	75	73	2	2.7%	0.2
		5493	GC Highway (W)	GC Highway (W)	T	897	990	93	10.4%	3.0
		5492	Connor Street (S)	Connor Street (S)	L	27	3	24	88.9%	6.2
		5497	GC Highway (E)	GC Highway (E)	R	144	128	16	11.1%	1.4
		5495	The Esplanade	The Esplanade	T	37	20	17	45.9%	3.2
		5496	GC Highway (W)	GC Highway (W)	L	96	94	2	2.1%	0.2
		5499	Connor Street (S)	Connor Street (S)	R	46	3	43	93.5%	8.7
		5500	GC Highway (E)	GC Highway (E)	T	1473	1376	97	6.6%	2.6
5384	The Esplanade	The Esplanade	L	111	125	14	12.6%	1.3		
All						2906	2812	308		
5	GC Highway Goodwin Terrace GC Highway	5630	GC Highway (N)	GC Highway (S)	T	1439	1324	115	8.0%	3.1
		5644	Goodwin Terrace (E)	Goodwin Terrace (E)	L	248	207	41	16.5%	2.7
		5625	GC Highway (N)	GC Highway (N)	R	175	237	62	35.4%	4.3
		5628	GC Highway (S)	GC Highway (S)	L	41	22	19	46.3%	3.4
		5632	Goodwin Terrace (E)	Goodwin Terrace (E)	R	29	9	20	69.0%	4.6
5634	GC Highway (N)	GC Highway (N)	T	859	816	43	5.0%	1.5		
All						2791	2615	300		
6	Jellurgal Centre Access GC Highway Ikkinia Road GC Highway	6314	Jellurgal Centre Access (N)	GC Highway (W)	R	2	0	2	100.0%	1.9
		6315	Ikkinia Road (S)	Ikkinia Road (S)	T	4	0	4	100.0%	2.8
		6312	GC Highway (E)	GC Highway (E)	L	6	0	6	100.0%	3.5
		6316	Jellurgal Centre Access (N)	Jellurgal Centre Access (N)	R	1	0	1	100.0%	1.4
		6317	GC Highway (W)	GC Highway (W)	T	923	886	37	4.0%	1.2
		6318	Ikkinia Road (S)	Ikkinia Road (S)	L	188	248	60	32.0%	4.1
		6323	GC Highway (E)	GC Highway (E)	R	412	330	82	20.0%	4.3
		6322	Jellurgal Centre Access (N)	Jellurgal Centre Access (N)	T	1	2	1	100.0%	0.8
		6337	GC Highway (W)	GC Highway (W)	L	35	84	49	141.6%	6.4
		6321	Ikkinia Road (S)	Ikkinia Road (S)	R	41	51	10	24.6%	1.5
		6320	GC Highway (E)	GC Highway (E)	T	1461	1296	165	11.3%	4.4
6319	Jellurgal Centre Access (N)	Jellurgal Centre Access (N)	L	0	0	0	0.0%	0.0		
All						3074	2897	417		

P4413 GCLR 3A
 AIMSUN Turn Calibration
 Saturday Peak 1000-1100

GEH Turn Summary 0700-0800		
>10	0	0%
>5, <=10	2	11%
<=5	17	89%

ID	Intersection	Turn	From	To	Turn	Observed	Modelled	Abs. Diff (Mod - obs)	% Diff (Mod - Obs)	GEH		
5045	W Burleigh Road	5446	5448	5468	W Burleigh Road (N)	W Burleigh Road (S) & James Street (E) & Burleigh St (W)	All	807	741	66	8.2%	2.4
	James Street	5451	5449		James Street (E)	Burleigh St (W) & W Burleigh Road (N)	T & R	100	102	2	2.0%	0.2
	W Burleigh Road	5440			W Burleigh Road (S)	James Street (E)	R	213	266	53	24.9%	3.4
	Burleigh St	5438	5434			Burleigh St (W) & W Burleigh Road (N)	T & L	680	600	80	11.8%	3.2
		5444	5442			Burleigh St (W)	W Burleigh Road (S) & James Street (E)	T & R	370	393	23	6.2%
						All	2170	2102	224			
5101	GC Highway	5323	5319		GC Highway (N)	GC Highway (N) & W Burleigh Rd (W)	U & R	520	611	91	17.5%	3.8
	GC Highway	5322				GC Highway (S)	T	1228	1193	35	2.9%	1.0
	W Burleigh Rd	5313			GC Highway (S)	GC Highway (N)	T	1100	1209	109	9.9%	3.2
		5317			W Burleigh Rd (W)	GC Highway (S)	R	468	362	106	22.6%	5.2
						All	3316	3375	341			
5102	The Esplanade	5490			GC Highway (E)	The Esplanade	R	129	145	16	12.4%	1.4
	GC Highway	5493	5492			Connor Street (S) & GC Highway (W)	T & L	1348	1295	53	3.9%	1.5
	Connor Street	5497	5495		Connor Street (S)	GC Highway (E) & The Esplanade	T & R	185	199	14	7.6%	1.0
	GC Highway	5496				GC Highway (W)	L	118	59	59	50.0%	6.3
		5499			GC Highway (W)	Connor Street (S)	R	60	30	30	50.0%	4.5
		5500				GC Highway (E)	T	1485	1391	94	6.3%	2.5
						All	3325	3119	266			
5103	GC Highway	5630			GC Highway (N)	GC Highway (S)	T	1450	1383	67	4.6%	1.8
	Goodwin Terrace	5625			Goodwin Terrace (E)	GC Highway (N)	R	238	220	18	7.6%	1.2
	GC Highway	5628				GC Highway (S)	L	77	65	12	15.6%	1.4
		5632	5634		GC Highway (S)	GC Highway (N) & Goodwin Terrace (E)	T & R	1129	1223	94	8.3%	2.7
						All	2894	2891	191			

