7. Shortlist option development and assessment

7.1 Shortlist option development

For those corridor options that passed through the longlist filter, they were then subject to further testing and refinement including:

- Different traffic access/ intersection configuration options
- Different LRT alignment options (within the selected corridor)
- Different station location options (within the applicable investigation areas)

Through this refinement stage, the team were able to identify technical risks/issues associated with certain designs which led to the development of sub options (further explained in the following chapters). The lane configurations and layouts at major intersections located in Bilinga, Kirra and the Airport were designed based on inputs from the Jacobs traffic team.

As the Bilinga and Kirra options involved changes to the Gold Coast Highway including modifications to side road access and rationalisation of certain movements, microsimulation modelling was undertaken to assess and refine options. The Aimsun mesoscopic model developed for the previous Burleigh Heads to Tugun Multi Modal Corridor Study (GCSAM_2041_20_400dz) was used to develop a high level 2041 microsimulation model. Refer to *IH140900-TP21-CT-RPT-0001* (Jacobs, 2020) for the original mesoscopic model assumptions. A detailed overview of the microsimulation modelling is located within the relevant corridor segment chapters throughout this report.

7.1.1 Bilinga shortlist option development

Alignment options within this section were refined based on a design/geometrical review of the Bilinga corridor and subsequent traffic modelling to undertake comparative assessments for the MCA. These refinements are described in the following sections of this report.

7.1.1.1 Route option development – geometric review

This process involved developing options regarding the connectivity between Gold Coast Highway and the parallel service roads of Golden Four Drive and Coolangatta Road noting that in either option B1 or B2, all currently uncontrolled movements across the Gold Coast Highway would need to be signal controlled.

High-level line diagrams were first developed to test different options for how sides roads could be connected to the Gold Coast Highway in order to balance intersection spacing, complexity, local access and circulation. It is noted that the designs include the shortlisted concept for LRT at Terminal Drive (as per the Airport section). The sub options developed within the Bilinga section included:

Parallel Lane Option (relevant to B1 only)

- Three unsignalised T-intersections between Boyd Street and Kirribin Street. Includes three access point from Golden Four Drive and two access points from Coolangatta Road.
- Two signalised T-intersections at Loongana Avenue. Proposed separated parallel lane from Golden Four Drive that at intersection allows traffic to u-turn or to merge with Gold Coast Highway.

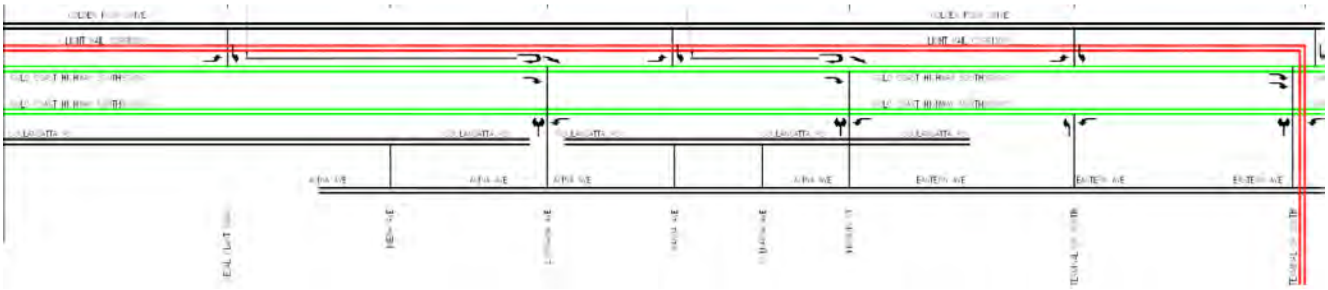

Figure 7-1: Parallel Lane option

Consolidated intersection option (refer Figure 7-2)

- Full signalised intersection at Loongana Avenue – with all movement access from Loongana Avenue and Golden Four Drive.
- Limited access to Coolangatta Road to/from Loongana Avenue due to geometric constraints created by signalised intersection and allowing for left turn from Gold Coast Highway to Loongana Avenue.
- Emergency access only at Kirribin Street.
- Addition of left turn only from Golden Four Drive to Gold Coast Highway at Terminal Drive South.
- Removal of access from remaining side roads connected to Gold Coast Highway.

Staggered T intersections option (Figure 7-3):

- Alternative option designed to avoid a complex signalised intersection with five phases and to retain full movement access along Coolangatta Road.
- Staggered T- intersections at the at Gold Coast Highway with Golden Four Drive (requiring removal of access from Loongana Avenue) and a T-intersection at Kirribin Street with Coolangatta Road (requiring the removal of access from Golden Four Drive although emergency access would be allowed).
- Addition of left turn only from Golden Four Drive to Gold Coast Highway at Terminal Drive South.
- Removal of access from remaining side roads connected to Gold Coast Highway.

The high-level line diagrams of these options were presented to TMR at Progress Meeting #12 - *IW251600-0000-ZM-MIN-0017* and of these the second and third sub options were selected to be taken forward for traffic modelling. The basis of this decision was to avoid significant delays on the Gold Coast Highway, by rationalising side road access to the main road and to minimise traffic re-routing through the local road network.

7.1.1.2 Traffic modelling - side road

The Consolidated Intersection option and the Staggered T-intersection option were modelled in a microsimulation model using the most recent version of the GCSAM 2041 model. The aim of this analysis was to understand, at a high level, the transport performance of the alternative side road designs and how they compare to each other. It was assumed for the purposes of this comparative analysis that the performance for the B1 alignment (eastern corridor) would be comparable as the B2 alignment (centre corridor) and therefore only B1 was modelled. It is noted that as part of this work, an indicative airport alignment option was adopted.

Figure 7-2 and Figure 7-3 illustrate the Aimsun interpretation of the options and detail any additional operational assumptions.

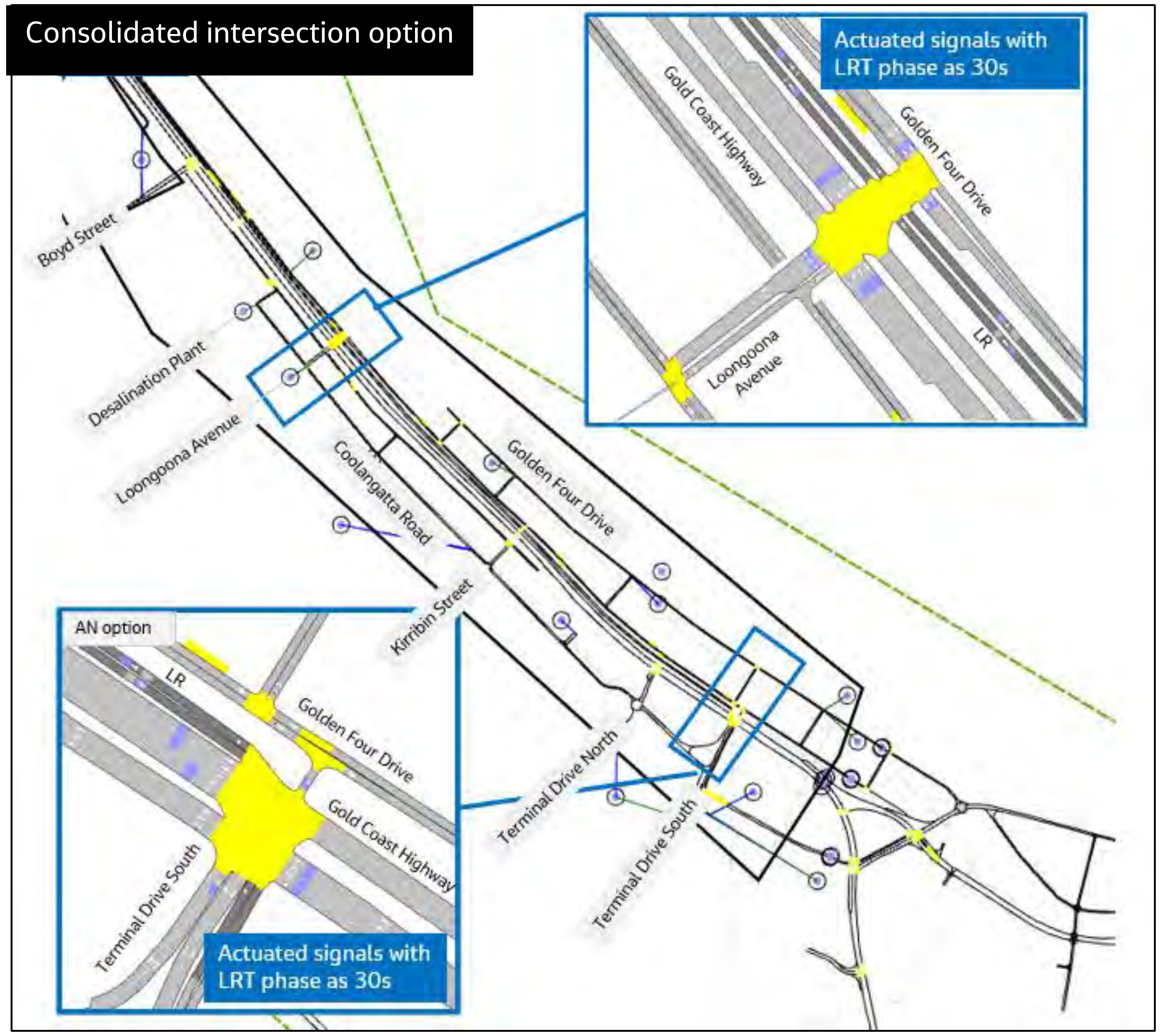

Figure 7-2: Modelled layout for consolidated intersection option (Source model - GCSAM,2019)

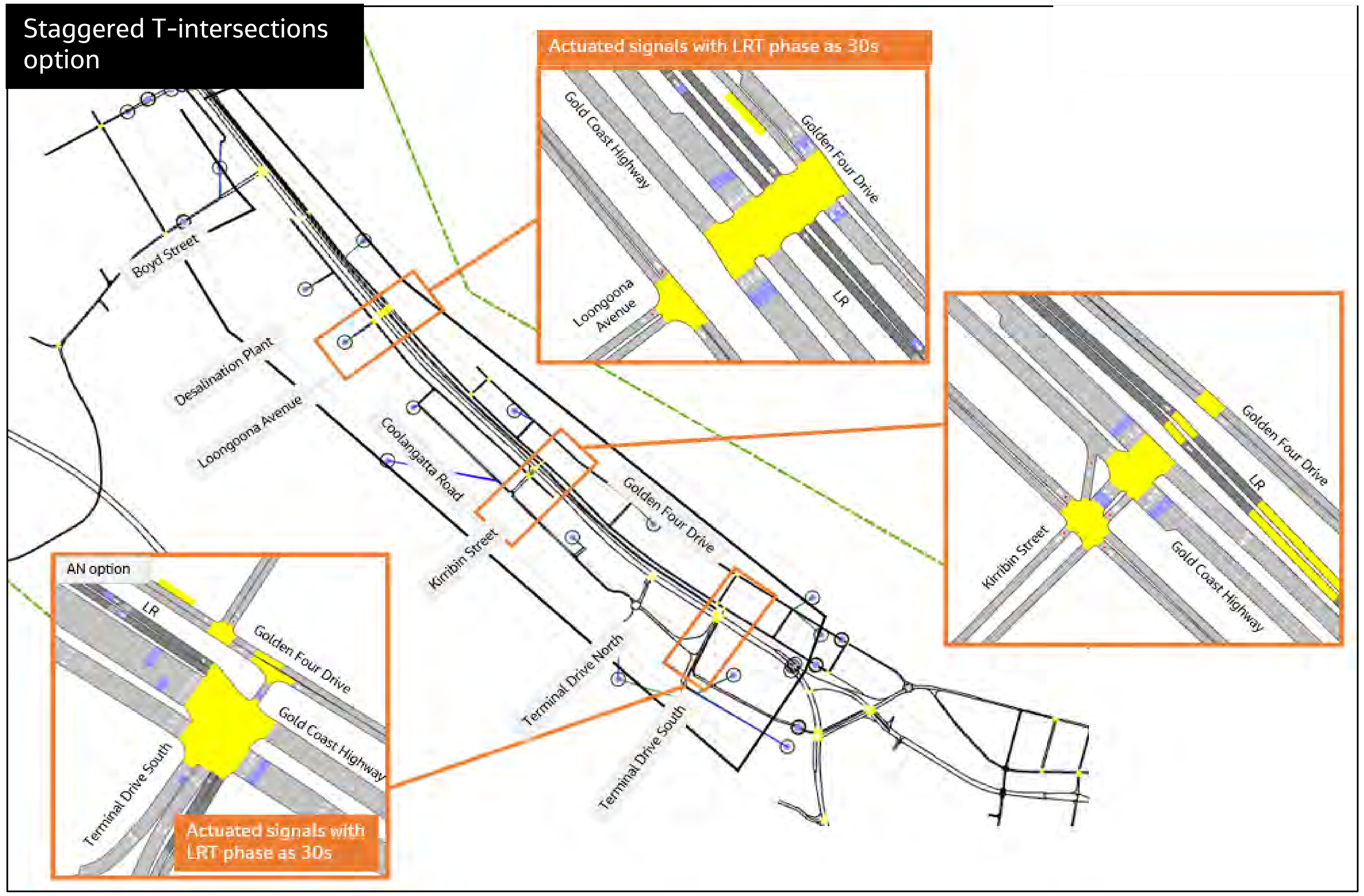

Figure 7-3: Modelled layout for Staggered T intersections options (Source model - GCSAM, 2019)

In determining the preferred sub-option, three transport metrics were analysed from the models and compared:

- Subnetwork density in both peak periods: In both peaks, the densities between the two options are comparable. There is approximately a maximum difference of 0.5veh/km between the options in both peak periods.
- Subnetwork speed: In the AM peak, average speeds range between 40km/hr to 48km/hr, with a maximum speed difference between options of approximately 2km/hr. In the PM peak, the Staggered T Intersections Option records a faster average speed for the majority of the peak period where speeds range between 25km/h to 47km/h.
- Gold Coast Highway mainline travel times (between Boyd Street to Terminal Drive South): In both peak periods, travel times along Gold Coast Highway is comparable between options with maximum travel time difference of approximately 1.5 minutes (with the Consolidated Intersection option performing better).

The travel time and speed results are expected given that with the Consolidated Intersection Option, the Gold Coast Highway traffic would only be stopped once at the Loongana Avenue intersection, compared to having to stop twice at both Loongana Avenue and Kirribin Street intersection with the alternate option. This however impedes the travel times for vehicles travelling to/from side roads and hence why, in the PM peak, the Staggered T Intersections Option performs better in terms of overall network speed. Therefore, as the results are comparable and Staggered T Intersections Option provides a better transport solution for both the mainline and side roads, and was chosen as the preferred side road access concept for both the B1 and B2 alignments. The refined shortlisted Bilinga alignment options (as B1-3 and B2-3), inclusive of the above access arrangements, were then taken forward to MCA.

7.1.1.3 Shortlisted alignment options

The figures on the following pages illustrate the shortlisted alignment options B1 and B2 used for this comparative MCA assessment.

7.1.1.4 Alignment Option B1-3 – east of Gold Coast Highway.

Figure 7-4 and Figure 7.4 illustrate the concept designs of B1-3.

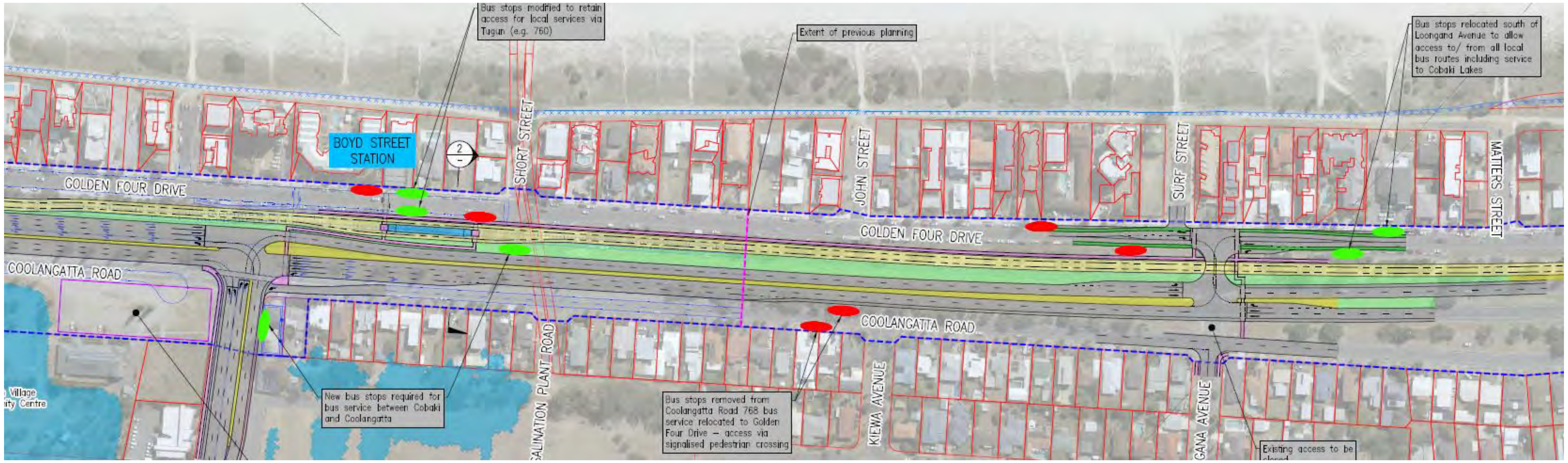

Figure 7-4: Alignment Option B1-3 design (between and including Boyd Street and Loongana Avenue)

Figure 7-5: Alignment Option B1-3 design (between Loongana Avenue and Terminal Drive)

7.1.1.5 Alignment Option B2-3 - centre of Gold Coast Highway

Figure 7-6 and Figure 7.6 illustrate the design of B2-3.

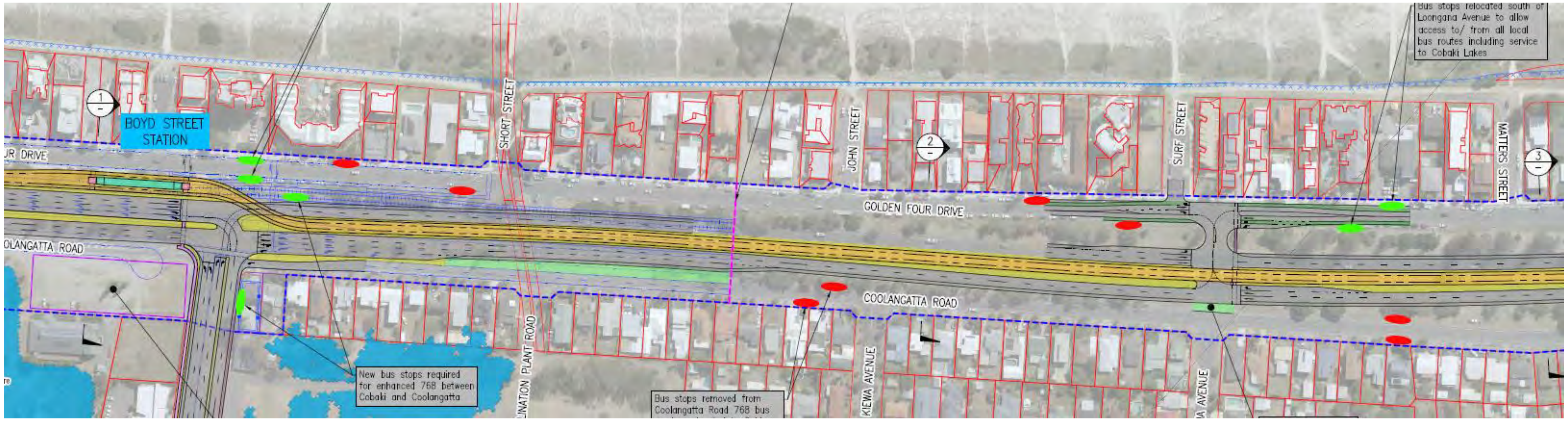

Figure 7-6: Alignment Option B2-3 design (between and including Boyd Street and Loongana Avenue)

Figure 7-7: Alignment Option B2-3 design (between and including Loongana Avenue and Terminal Drive)

7.1.2 Airport shortlisted options development

The intersection design proposed for Alignment Option AN1 was developed and tested in a microsimulation model as part of the traffic analysis undertaken for the Bilinga sub-options. Therefore, for the purposes of developing the shortlist alignment designs, the boundary between Bilinga and Airport zones was moved so that the airport alignment options now sit fully within the Gold Coast Airport land only. In addition, the boundary between Airport and Kirra was also moved so that the airport alignment options remain on airport land which means the alignment options for the Gold Coast Highway/ Coolangatta Highway/Musgrave Street are included in the Kirra section (see Section 7.1.3.1).

Therefore, only the LRT alignments within the airport, i.e., including Airport South (AS) along with the corresponding heavy rail alignment (R1/R2) were included in the design of the shortlisted airport alignment options. A high-level concept sketch of the shortlisted alignment options is illustrated in Figure 7-8. Please note that during this shortlist refinement, the airport alignment options were renamed, for simplicity, to the following:

- AS3+R2 became A1
- AS2+R1 became A2

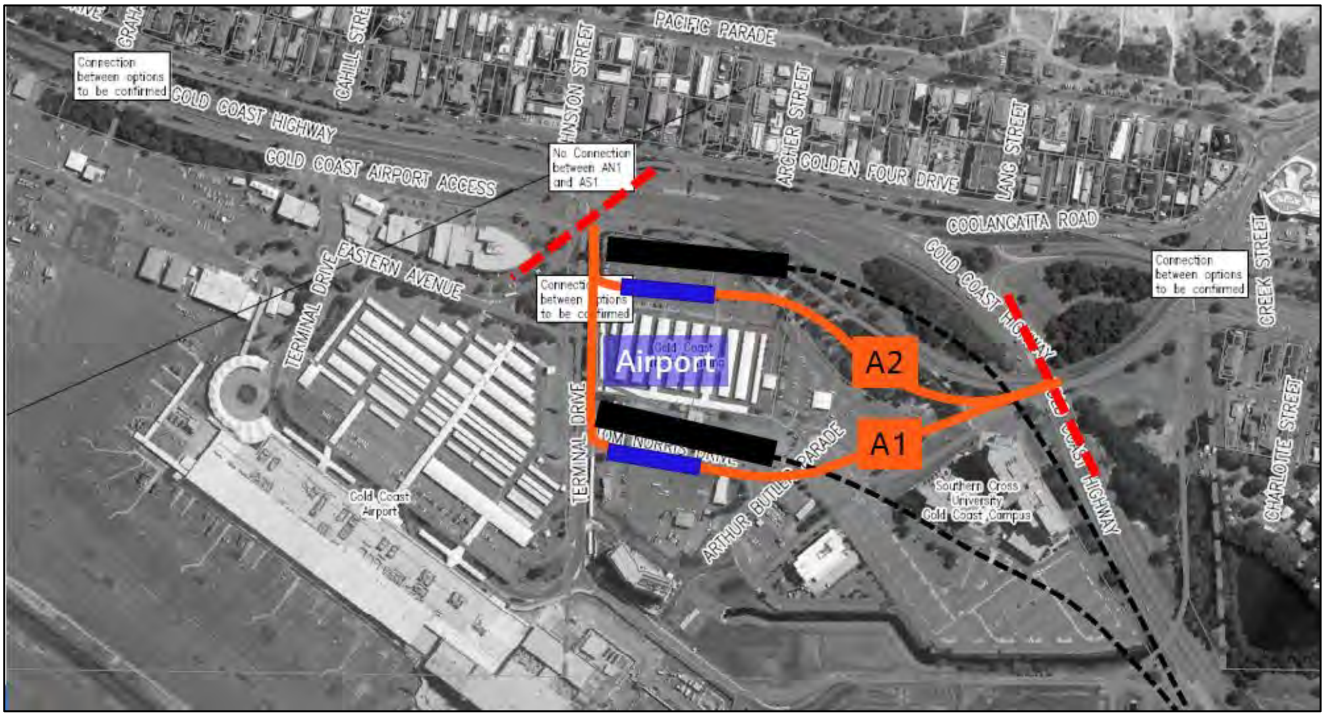

Figure 7-8: Airport short list alignment and station options – high level design (Aerial image: Metromap, 2020)

The following figures, Figure 7-9 and Figure 7-10 show the shortlisted alignment options A1 and A2 used for the comparative MCA assessment.

7.1.2.1 Alignment Option A1 (closer to Airport)

Figure 7-9 illustrates the concept design of A1-3.

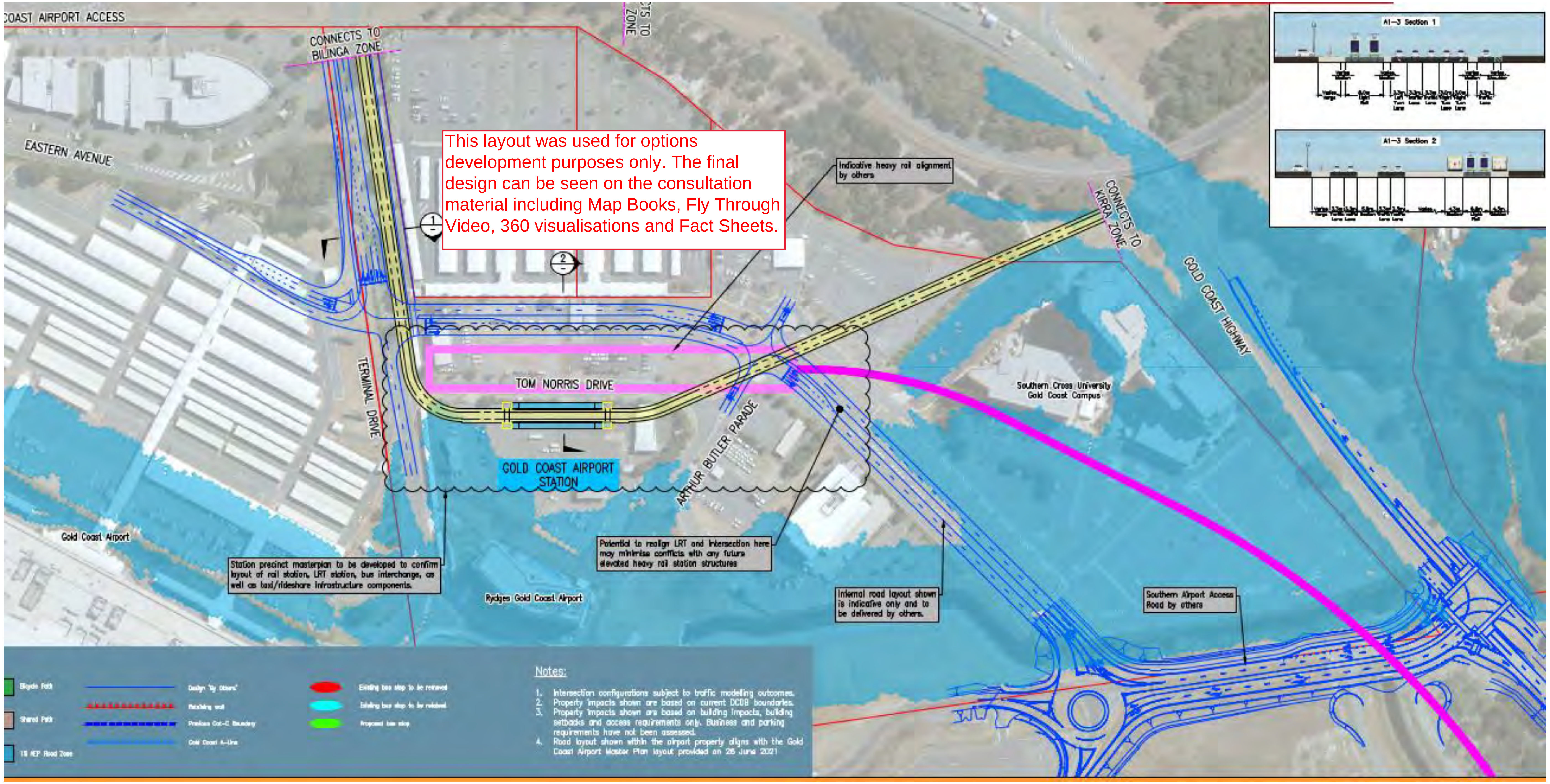

Figure 7-9: Alignment Option A1-3 design

7.1.2.2 Alignment Option A2 (closer to Gold Coast Highway)

Figure 7-10 illustrates the concept design of A2-3.

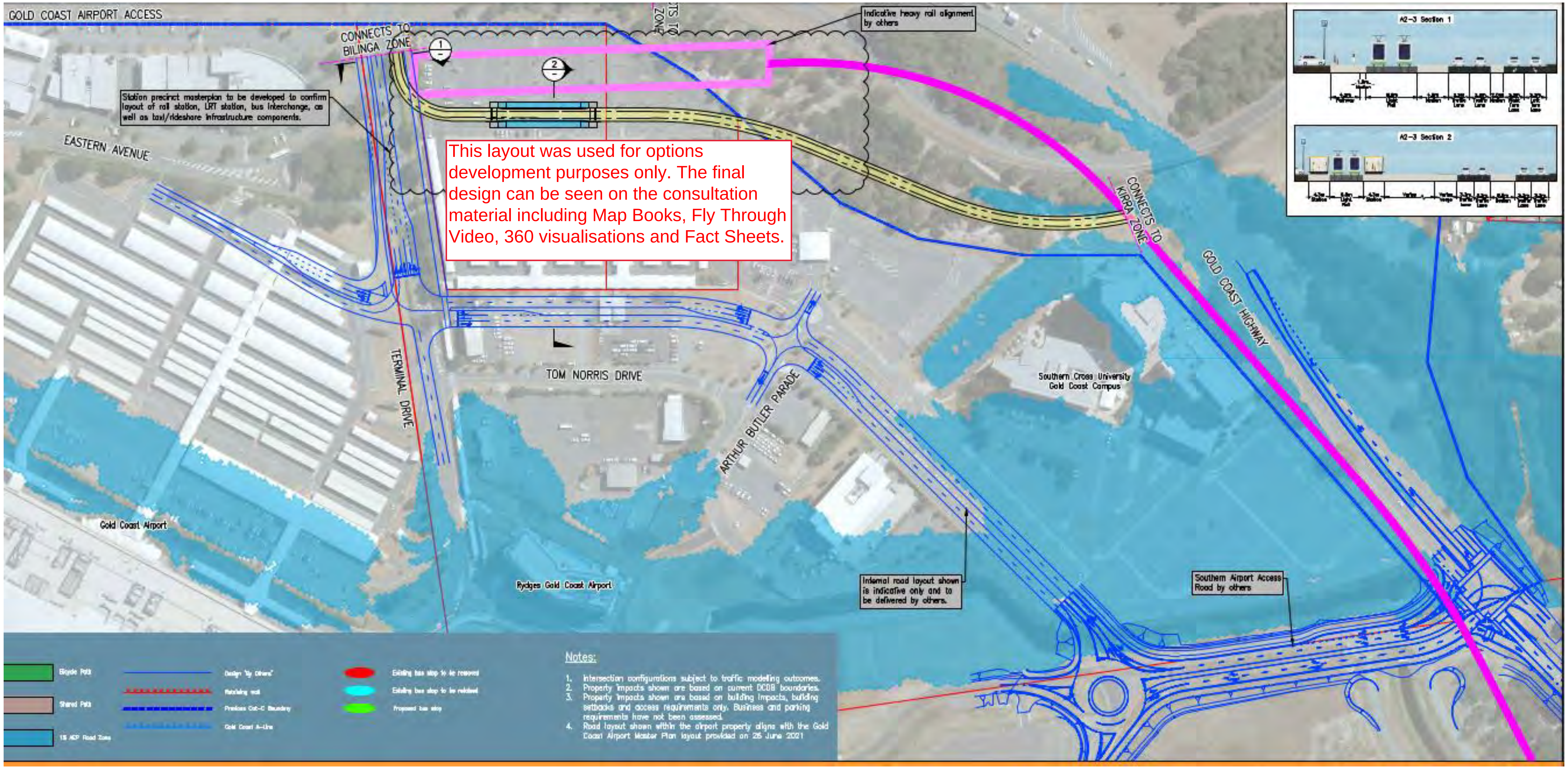

Figure 7-10: Alignment Option A2-3 design

7.1.3 Kirra shortlisted option development

As detailed above, the Kirra section was extended to include the intersections of Gold Coast Highway/ Musgrave Street / Coolangatta Road.

Options within this section were refined based on traffic modelling and a geotechnical structural review. These refinements are described in the following sections of this report.

7.1.3.1 Traffic modelling

Based on a high-level review a range of potential intersection configuration options for Gold Coast Highway / Musgrave Street / Coolangatta Road were identified with the primary aim to reduce delays, minimise footprint and improve safety. From this process, two intersection options were taken forward for a more detailed traffic analysis:

- Intersection Option 1 – Two T- intersections with the Gold Coast Highway with LRT located at the northern most intersection
- Intersection Option 2 - Single consolidated T-intersection with Gold Coast Highway enabling Coolangatta Road to connect directly with Golden Four Drive

These two options were modelled in a microsimulation model using the most recent version of the Gold Coast Southern Aimsun Model (GCSAM) 2041 model. The aim of this analysis was to understand, at a high level, the transport performance of potential options and how they compare to each other. The Aimsun layouts for the options are illustrated from Figure 7-11 to Figure 7-12. The same assumptions as the Bilinga analysis were adopted regarding Light Rail phasing and timing. For the purpose of this analysis, the GCSAM design of Light Rail connecting to Coolangatta Road was retained to create a like-for-like comparison.

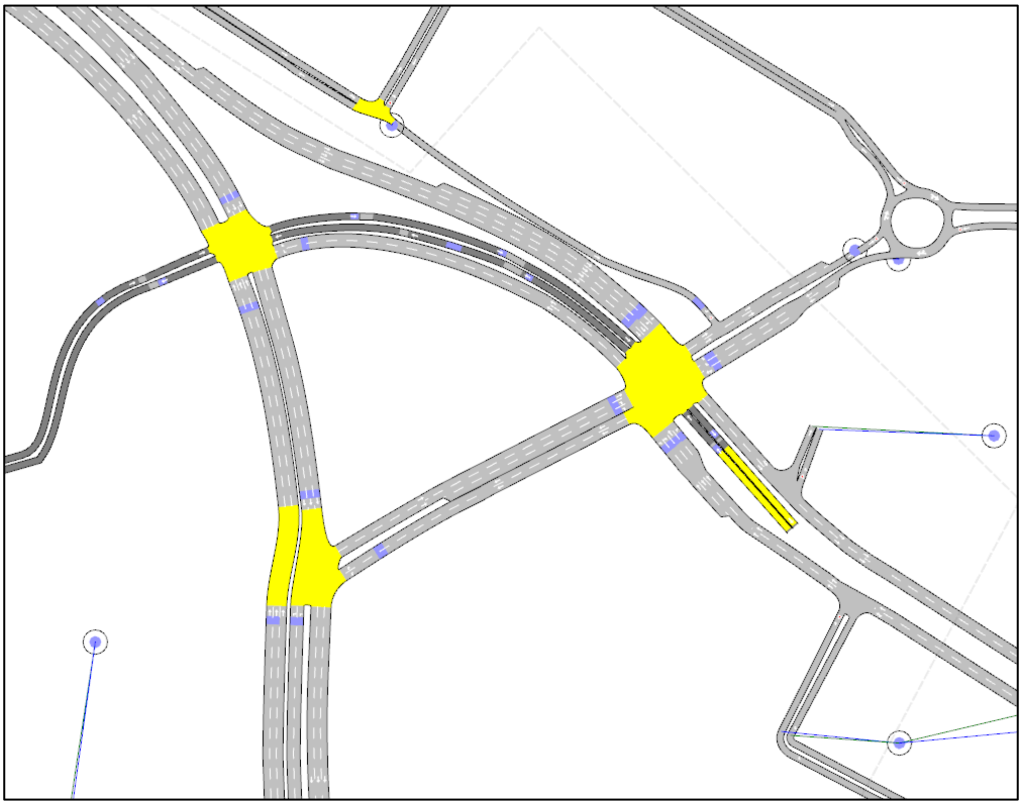

Figure 7-11: Intersection design option 1 - Aimsun layout

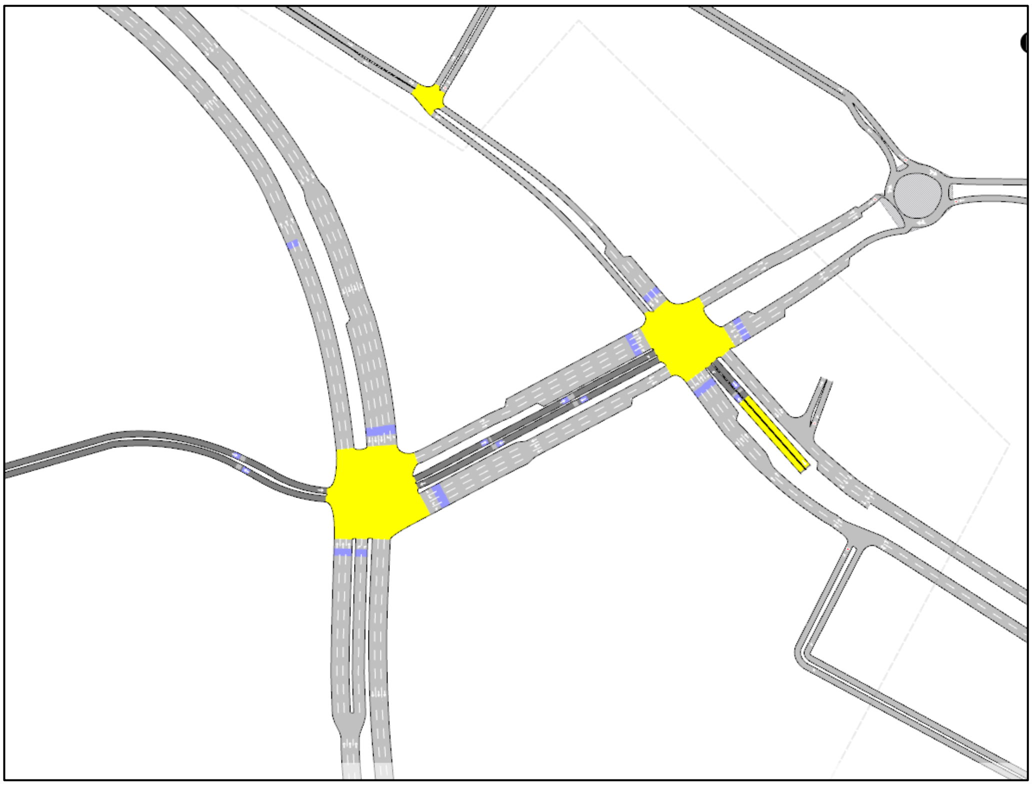

Figure 7-12: Intersection design option 2 - Aimsun layout

In determining the preferred intersection design, two transport metrics were analysed from the models and compared:

- Subnetwork density. In both peaks, the densities between intersection design option 1 and intersection design option 2 are comparable. There is approximately a maximum difference of 3 veh/km between sub options 1 and 2 in both peak periods.
- Subnetwork speed. In both peak periods, intersection design option 1 speeds are marginally faster than intersection design option 2, with a greater difference observed in the AM peak (maximum of a 7 veh/hr difference). Speeds range between 35km/hr to 45km/hr. This is due to the significant movement from Gold Coast Highway southbound turning left to Musgrave Street having to only pass one intersection in intersection design option 1 compared to two intersections in intersection design option 2. It was identified that there are opportunities to improve intersection design option 2 performance through signal coordination.

It was determined that the two intersection design options do not significantly differ in terms of traffic performance (with opportunities to improve intersection design option 2 performance even further). As such, a wider range of factors were considered including geometric design, local access, constructability, safety, cost and active transport provision. Overall, intersection design option 2 was identified as preferred as it provided better cycle lane and local traffic connectivity, created more residual space for potential Light Rail stabling and was likely to have lower cost due to smaller construction footprint. This design was then applied to both Kirra options (K2 and K3).

7.1.3.2 Geotechnical and structural review

The tunnel proposed as part of K2 was reviewed from a geotechnical and constructability perspective. The section of the route along Musgrave Street between Churchill Street in Kirra to McLean Street in Coolangatta traverses a steep highland area of coastline that includes unsuitable grades (exceeds max grade of 5%) for Light Rail on surface, therefore mined tunnel, cut-and-cover tunnel and retained cut sub-options were investigated.

Refer to Figure 7-13 for an overview of the alignment. The assessment of the corridor was undertaken through visual assessment of existing cuttings in the area and available background information.

Figure 7-13: Aerial plan layout of K2 (Aerial image: Metromap, 2020)

Key assumptions made and issues identified in this review are summarised below:

- The depth below existing road level to meet a desirable maximum 4.5 % grade (adopted based on slow approach from station stopped status noting that absolute maximum grades of 6% to 8% can be achieved for short lengths when entered at speed). To meet the requirement, Light Rail would require a depth of cut or tunnel alignment up to 14m below ground level
- The Light Rail is dual track and would require a base dimension of in the order of 8m wide excluding provision for emergency egress of between 2 to 4m
- Construction options must take into consideration how to maintain access to the existing residential properties which includes some multistorey apartment blocks that directly access Musgrave Street
- Access to associated intersecting roads (e.g., Garrick Street) should be maintained
- Any construction is to limit impacts to existing infrastructure (street furniture, above or below ground utilities, buildings, retaining walls) and impacts to the existing road formation should be minimised to ensure no major adverse effects in consideration of their present state
- Any construction impacts are to be offset through appropriate temporary or permanent measures
- Adverse community aspects of the construction (apart from access) should be minimised as far as practically possible (e.g., noise, dust, fumes etc.)

Important information that needs to be considered in assessing construction options include:

- Musgrave Street corridor is relatively narrow (typically 15-20m between property boundaries) so there are a number of difficulties with available space to cater for all the assumptions above.
- Musgrave Street traverses a steep hill (19% grade), and no subsurface information is currently available however a steep hill suggests that competent rock may be relatively close to the existing ground surface
- A review of Street View of Google Maps suggests some of the lot boundary boulder retaining walls have significant signs of instability, plus there are some notable cracks in the existing road surface.

As a result of the above high level site analysis, two clear option themes have emerged, namely a driven/ bored tunnel option and a retained cut (with optional 'cover') option.

7.1.3.2.1 Construction option 1: tunnel

The tunnel option involves development of a tunnel portal, tunnel entrance, and subsequently driving a tunnel under the surface using a tunnel boring machine (TBM) or road header type. By comparison, cut and cover construction (refer Option 2) involves using excavation equipment to dig a large trench in the ground that is then covered by a deck and in this situation road access.

Tunnelling options under this option theme include:

- Driven and Boring: The tunnel drive is short at approximately 300m long and would have significant construction costs. Construction would require a large tunnel envelope that is not viable for a tunnel boring machine (TBM) due to the lack of drive length and available space.
- Drill and blast: this technique is not viable based on the medium to high probability of risk of damage to nearby properties, utilities, street furniture and public perception of noise and vibration impacts.
- Roadheader: may be restricted to using a roadheader, but uncertainty exists on availability of good rock cover to tunnel crown. i.e., if insufficient competent rock exists then stability of tunnel is a potential issue and may result in crown hole or trough development at the surface (possibly instantaneously with the result that the road drops into the tunnel &/or the buildings are badly damaged creating a risk to life etc.). If the rock cover is sufficient, then the rock could be too strong for excavation. If the rock strength is >100 MPa, the rock becomes uneconomic to mine at an acceptable rate of progress.

Spoil management

Tunnel spoil management would be extremely problematic with traffic management at either end in high activity areas or may have to be transported to landfill

Constructability requirements

Tunnel portals could be in Musgrave Street or adjacent properties with a tunnel running parallel to Musgrave Street. The width of Musgrave St will require acquisition of multiple commercial/residential properties adjacent to the tunnel to space proof for portals, storage and to maintain property access.

There is insufficient space in Musgrave Street at present to fit in tunnel portals and maintain access to residential properties

Potential advantages

The tunnel option could potentially allow minimisation of future issues for road and community access, that is, once constructed the space over the tunnel could be available for access.

7.1.3.2.2 Construction option 2: cut-and-cover or retaining wall

Cut and cover construction involves using excavation equipment to dig a large trench (approx. 12 m wide at base to allow rail, emergency/maintenance access, excluding structural side supports, soil nails/rock bolts or anchors beyond this zone) in the ground that is then covered by a deck and in this situation possibly reinstated road access. The retaining wall option is included as it is a similar excavation but has no deck or roof and remains open.

Construction options include:

Cut-and-cover: A 10-12 m wide base dimension cut with up to a 14m deep cut is a substantial hole in the ground with high safety risk to constructors and the public. Width of excavation even with a vertical retaining structure system could be extremely difficult to achieve without detrimental effects to adjacent roads, residential properties and utilities. Potentially a red flag, i.e. as for the tunnelling option this could require acquisition of residential properties on one side of the road for space requirements

Retaining wall: would be extremely expensive to install a retaining structure that would guarantee no adverse impacts during construction and operation of the Light Rail to the directly adjacent properties and utilities. A likely option would be bored pile wall (contiguous, soldier pile with panel or secant, diaphragm walls would be more expensive) and high noise and limited space issues for construction would be difficult to manage.

Spoil management

Retaining structure and associated excavations to form the rail corridor will have greater spoil volumes than tunnelling, so spoil management handling, transfer and disposal would be worse than the tunnel option.

Constructability requirements

Even though the excavation could be staged (by chainage) with perhaps the use of temporary soldier piles with a steel deck to provide access onto Musgrave Street from the residential properties, it would be extremely expensive and have severe impacts on construction productivity and in terms of construction progress (i.e. would take a long time to construct and accordingly would be expensive).

Potential advantages

It is considered that a cut and cover approach as identified above would be technically simpler and therefore more desirable than a tunnel, based on the short 600m section and at this level, the lack of detailed geotechnical or construction methodology information.

7.1.3.2.3 Assessment findings

Overall, this review found that both options for delivering a suitably graded LRT alignment on the Musgrave Street corridor between Churchill Street, Kirra and McLean Street, Coolangatta would result in significant physical and social impacts. Due to the spatial requirements for construction, there would be significant property acquisition and issues around impacts to existing infrastructure, being utilities and retaining walls, and maintaining property access. The section of Musgrave Street includes multiple multi-storey apartment dwellings and mid-block access to Rutledge Street and Robinson Lane.

Without further detailed investigations, the exact impacts cannot be known. However, this assessment has identified prohibitively high costs, significant disruptions to the local area and access impacts to a large number of properties.

It is recommended that alternative route be considered. Based on this assessment, and in agreement with TMR, K2 was amended east of Miles Street to follow the same alignment as K3 (i.e., with both options travelling via the former heavy rail alignment through the cutting between Miles Street, Kirra and McLean Street, Coolangatta).

7.1.3.3 Shortlisted alignment options

A high-level concept sketch of the Kirra shortlisted alignment options is illustrated in Figure 7-14. Existing bus stops on Musgrave Street/ Marine Parade are assumed to be used by tram replacement bus services under all Kirra options.

Figure 7-14: Kirra short list alignment and station options – high level design (Aerial image: Metromap, 2020)

The following figures, Figure 7-15 and Figure 7-16 show the shortlisted alignment options K2 and K3 used for the comparative MCA assessment.

7.1.3.3.1 Alignment Option K2 – Musgrave Street / cutting

Figure 7-15 illustrates the concept design of K2-2.

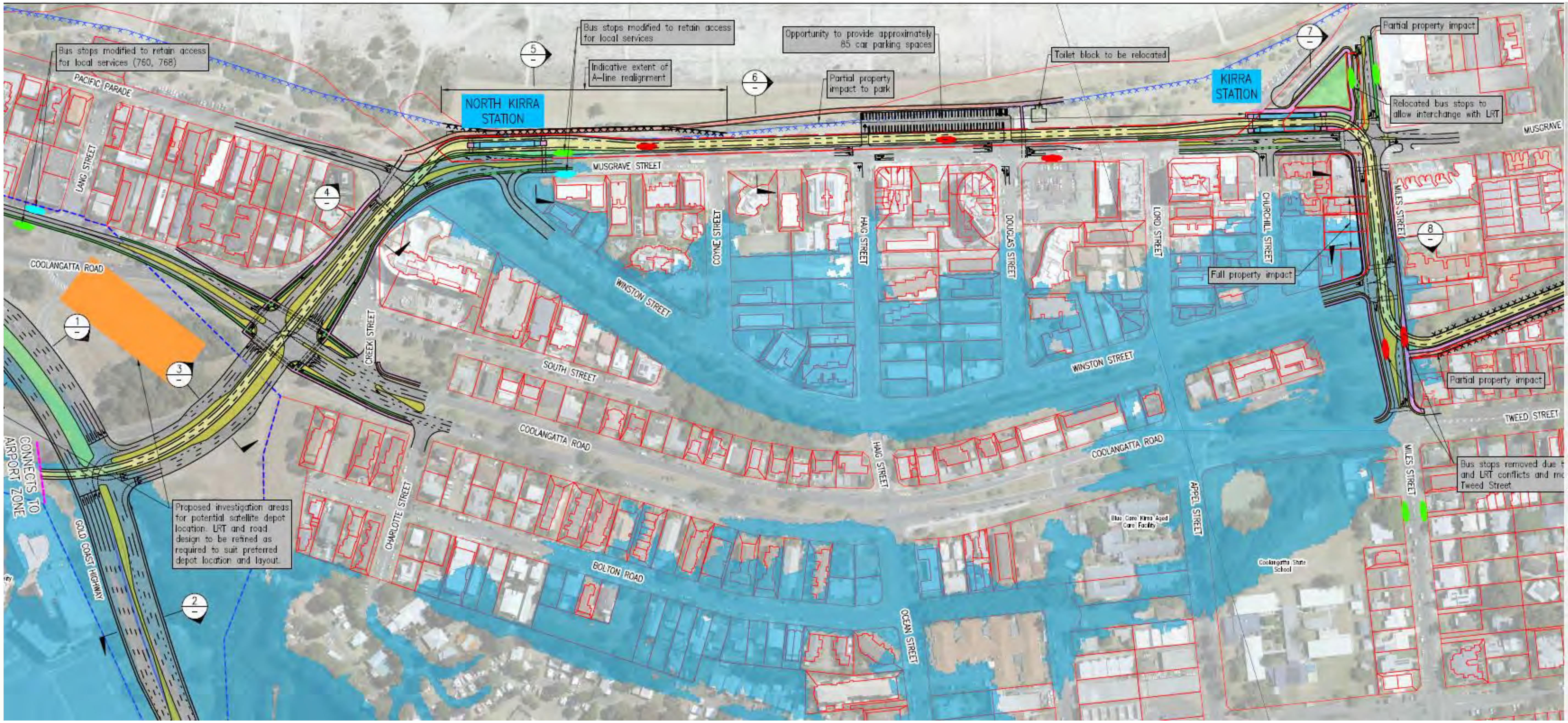

Figure 7-15: Alignment Option K2-2 design

7.1.3.3.2 Alignment Option K3 – Coolangatta Road / cutting

Figure 7-16 illustrates the concept design of K3-2.

Figure 7-16: Alignment Option K3-2 design

7.1.4 Coolangatta shortlist option development

McLean Street / Lanham Street/ Chalk Street / Griffith Street intersections were refined based on a review of existing count data and 2041 volumes from the Gold Coast Highway (Burleigh to Tugun) MMCS Aimsun 2041 Model. These volumes were used to understand the magnitude of intersection volumes and dominant movements. This initial traffic and geometric analysis informed the following major changes to the existing situation that is consistent with both shortlisted alignment options, however, it is intended to be reviewed once the preferred alignment option is identified:

With both Light Rail options travelling through the rail cutting to McLean Street, the signalisation of McLean Street and the LRT crossing was required. Due to the number of intersections in close proximity to the Light Rail, the following design changes were undertaken:

- C2 - to reduce intersection complexity and improve capacity was to convert Lanham Street (west) to a cul-de-sac. Access from McLean Street (south), Lanham Street (east), Musgrave Street and McLean Street north were retained.
- C3 – with LRT travelling along Chalk Street, the left turn from McLean Street to Chalk Street was signalised, and McLean Street (south) and Lanham Street (east) access was removed from the signalised intersection.
- Signalisation of the Griffith Street / McLean Street roundabout. This was adopted due to the close proximity of the Light Rail intersection and the potential risk of vehicles queueing at the roundabout, extending back to the Light Rail intersection, creating significant safety concerns.

A high-level concept sketch of the Coolangatta shortlisted alignment options is illustrated in Figure 7-17.

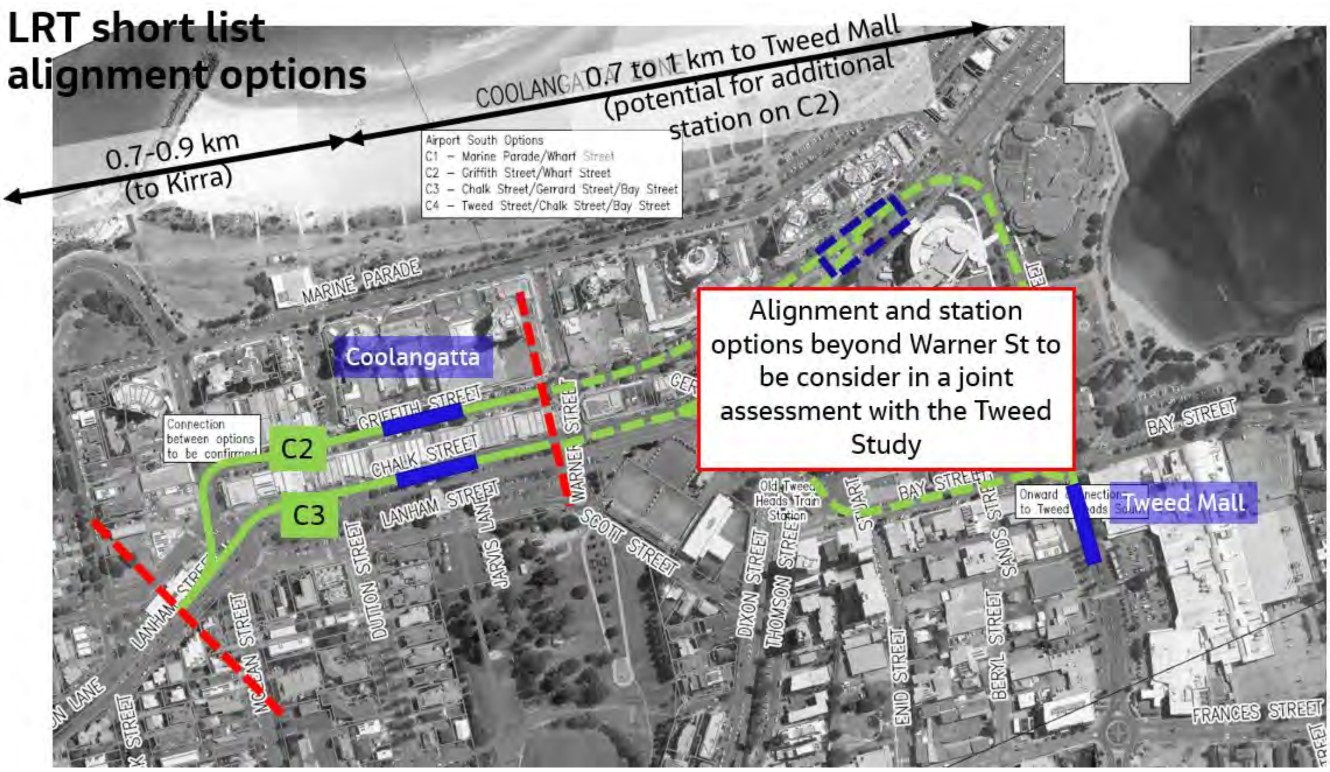

Figure 7-17: Coolangatta short list alignment and station options – high level design (Aerial image: Metromap, 2020)

The following figures, Figure 7-18 and Figure 7-19 show the shortlisted alignment options K2 and K3 used for the comparative MCA assessment.

7.1.4.1 Alignment Option C2 – Griffith Street

Figure 7-18 illustrates the concept design of C2-2.

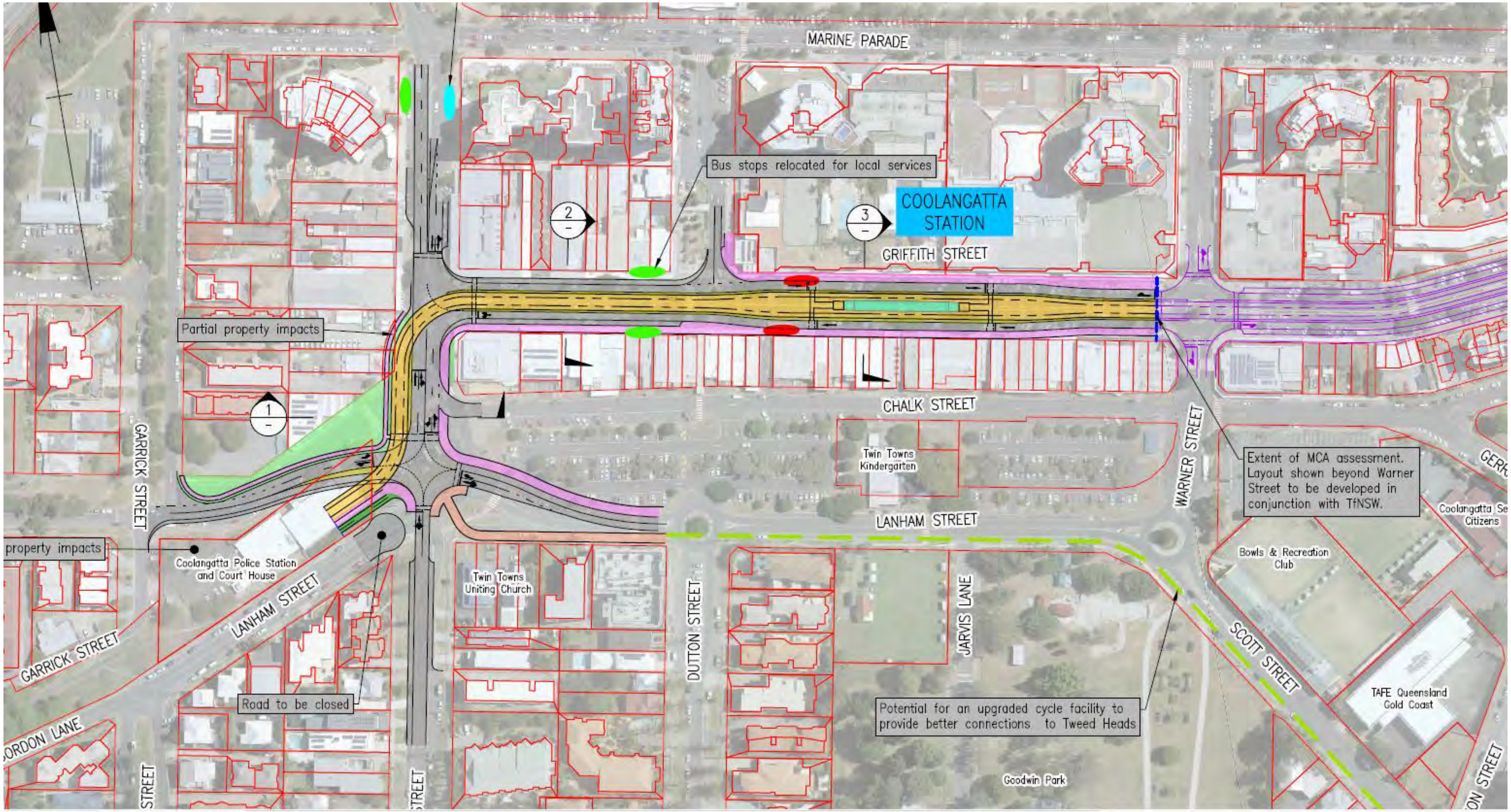

Figure 7-18: Alignment Option C2-2 design

7.1.4.2 Alignment Option C3 – Chalk Street

Figure 7-19 illustrates the concept design of C3-1.

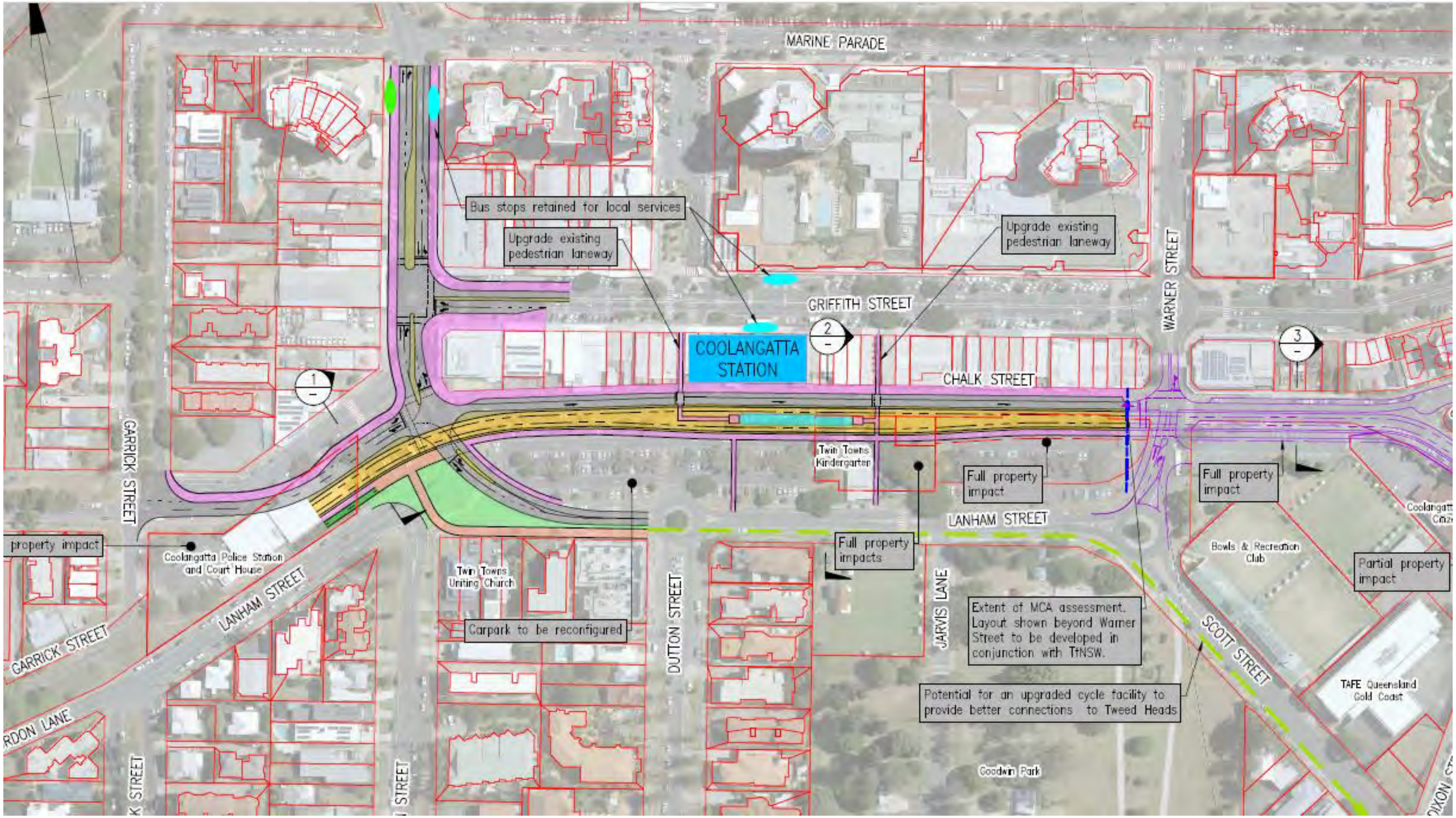

Figure 7-19: Alignment Option C3-1 design

7.2 Assessment framework

To determine the preferred corridor alignment for further investigation and refinement, comparable assessments of the short-listed alignment options using a multi-criteria analysis (MCA) was undertaken. The concept alignment options represent indicative options only and are subject to change with further analysis and feedback from key stakeholders.

Each alignment option provides a reasonable level of confidence to make comparative assessment between each option to determine their likely performance and outcomes with some flexibility. Station locations are also indicative only. All options assessed are flexible, however the concept option intent will remain.

The MCA framework has been developed in conjunction with TMR and City of Gold Coast and included the following inputs:

- TMR smarter solutions MCA guide that includes the following categories:
    1. Economic Data
    2. Transport Performance and Logistics
    3. Construction and Constructability
    4. Environmental Impact
    5. Social factors
- Infrastructure Australia (IA) MCA guide
- Project corridor vision

7.2.1 TMR smarter solutions MCA guide

The following table identifies all of the potential criteria suggested in the TMR Smarter Solutions MCA Guide, noting why certain criteria were adopted and why others are not considered suitable for this particular assessment and were therefore excluded from the MCA.

Criterion	Indicator	Rational for inclusion/ rejection in this MCA
Economic Data		
Implementation Costs	Estimated cost of construction and procurement (outturn estimate)	Construction costs to be assessed.
Whole-of-life operation and maintenance	Estimated cost of whole of-life asset operation and maintenance	At this stage of the project (alignment options) – would not produce any quantifiable differences in scores as too early to measure – not adopted.
End-to-end cost	Impact on direct end-to - end cost or price of travel (incl. amenity)	At this stage of the project (alignment options) – would not produce any quantifiable differences in scores as too early to measure – not adopted.
Road User vehicle operating costs	Estimated change in vehicle operating costs (Vehicle/Bus operating costs: fuel, tyre wear, lubricants, repairs, maintenance)	High level assessment of PT operating cost adopted – assessing kilometres travelled.
BCR	Rapid Benefit Cost Ratio	Not adopted – too early to measure
Traffic Performance and Integration		

Criterion	Indicator	Rational for inclusion/ rejection in this MCA
Network connectivity	Impact on the directness of links and the density of connections in the network	Adopted. Density plots to be reviewed to understand the traffic performance of each option.
Operating conditions	Change in the efficiency of operating conditions	Initial assessment did not produce any quantifiable differences in scores
Travel time reliability	Impact on time travel reliability, measured by the percent variation in travel time	Adopted. PT accessibility and connectivity measured.
LOS	Impact on transport network performance as captured by the level of service rating	Initial assessment did not produce any quantifiable differences in scores
Intersection delay	Change in intersection delay	Initial assessment did not produce any quantifiable differences in scores
Public transport patronage	Change in user behaviour to increase public transport patronage	To be adopted. Reflected in the assessment of understanding access to frequent and reliable public transport to support population growth.
Active transport	Impact on active transport users	Adopted. Reflected in the assessment of degree of active transport implemented, safety, comfort and access.
Performance horizon	Performance of the option over time, as measured by the duration of benefits	Too early to measure.
Amenity of travel	Change in the perceived quality or amenity of travel	Adopted for amenity of travel for active transport and public transport users.
Safety		
Safety	Impact on safety incl. accidents, injuries, casualties and property damage	Adopted criteria – to use SSA scoring
Freight		
Freight volume	Impact on freight volume	Does not produce any quantifiable differences in scores – not adopted
Freight vehicle operating costs	Estimated change in freight vehicle operating costs (Vehicle operating costs: fuel, wear, lubricants, repairs, maintenance)	Does not produce any quantifiable differences in scores – not adopted
Frequency of service	Impact on the frequency of freight services	Does not produce any quantifiable differences in scores – not adopted
Construction and Constructability		
Traffic Management	Impact on traffic management during construction/implementation	Adopted
Community disruption	Impact of construction on the local community including visual amenity, safety risk, increased traffic and additional parking demand.	Adopted. Construction vibration and noise excluded from assessment unable to create differentiated scores between the two options.
Engineering/ constructability	Potential engineering or construction challenges- during construction or across lifecycle	Two criterion adopted based on review of study area: PUP risks Construction risks (geotechnical, hydrological, etc)

Criterion	Indicator	Rational for inclusion/ rejection in this MCA
Geotechnical Risk	Level of risk attributed to the geotechnical conditions at construction site	Included in construction risks criterion.
Ease of construction	Level of political and construction risk resulting in delays and disruptions during construction	Too early to measure – not adopted.
Stageability	Ability for the option to be implemented in discrete stages over time	At this stage of the project (alignment options) – would not produce any quantifiable differences in scores – not adopted.
Environmental impact		
Noise and air quality	Impact on noise and air quality	Adopted. Air quality measured with vehicle emissions & noise measured with severance.
Vehicle emissions	Impact on vehicle emissions	Adopted - change in number of private vehicles travelling through corridor (increase or decrease in vehicle emissions).
Flora and fauna	Impact on vegetation and / or sites of environmental importance	Adopted.
Social factors		
Barriers to development	Are there any significant barriers to development? E.g., existing land use or cultural significance	Heritage and iconic landscapes considered at this stage of the project.
Future land use	Degree of alignment to strategic land use and planning objectives	Adopted. Reflected in assessment of urban amenity and liveability.
Mode Shift	Impact on user behaviour and influence on mode shift	Reflected in the improved urban amenity and liveability criteria and PT accessibility and connectivity.
Impact on property owners	Impact to local land, property and businesses resulting from disruption during construction and operation	Property impact adopted
Visual amenity and urban quality	Impact on visual amenity and urban quality as a result of changes in bikeways, walking paths, noise during construction and design/aesthetic	Adopted and reflected in assessing the improved urban amenity and liveability.
Severance	Impact on community severance	Adopted
Regional development	Change in the economic and social impact of the transport system on regional development	Adopted. Reflected in the improved urban amenity and liveability criteria.

7.2.2 Infrastructure Australia (IA) MCA guide

Key themes for multi criteria assessment as identified in the Infrastructure Australia (IA) guide are shown in Figure 7-20. Table 7-1 details how the proposed MCA framework, aligns to the themes of this IA guidance.

Figure 7-20: Infrastructure Australia MCA themes (Source: Infrastructure Australia, 2021)

Table 7-1: MCA framework – mapped to Infrastructure Australia (IA) guidance

MCA Category		MCA Criteria		Alignment with IA guide
1	Cost	1.1	Construction costs (inc. property)	Aligns with the "deliverability" theme in IA guide
		1.2	Operating cost (PT network)	
2	Land use planning	2.1	Enhanced access to frequent and reliable public transport to support population growth	These criteria closely relate to the overall project objectives and the corridor vision – this aligns with the "strategic fit" theme in the IA guide.
		2.2	Improved urban amenity and liveability	
3	Transport outcomes	3.1	PT accessibility and connectivity	
		3.2	Degree of active transport infrastructure implemented - safety, comfort and access.	
		3.3	Traffic performance	
		3.4	Road safety	
4	Construction and constructability	4.1	Traffic management risks (during construction)	Aligns with the "deliverability" them in IA guide
		4.2	Community disruption risks (during construction)	
		4.3	PUP risks (during construction)	
		4.4	Other construction risks (geotechnical, hydrological, etc)	
5	Environmental impact	5.1	Transport emissions (air quality)	These criteria align with the "societal impact" theme in IA guide.
		5.2	Ecological and natural hazard risks	
6	Social factors	6.1	Heritage and iconic landscapes	
		6.2	Noise and severance (to local land uses, property and businesses) during operation	
		6.3	Property impacts	

7.2.3 MCA categories, criteria and scoring

This section details how each MCA category is broken down to a criterion and how it is scored. Table 7-2 details the MCA category, criterion and performance measures with the detailed of the method of assessment contained in Appendix E.

Table 7-3 details the high-level range in scoring applied to the MCA criteria where the scoring is based on an 11-point system (from -5 to +5). The range in scoring differs for each criteria dependent on whether the criteria is inherently worsening the current situation (can only score between 0 and -5) or is improving the current situation (0 to +5), this is explained in detail for each criteria in detail in Appendix E.

Table 7-2: MCA criteria and performance measures

MCA Category		MCA Criteria		MCA Performance Measure
1	Cost	1.1	Construction costs (inc. property)	High level capital cost - based on Project Cost Estimate
		1.2	Operating cost (PT network)	High level operating cost - based on total daily bus and LRT operating km.
2	Land use planning	2.1	Enhanced access to frequent and reliable public transport to support population growth	Jobs served within 800m of an LRT station (2041) and Residents within 800m of an LRT station (2041)
		2.2	Improved urban amenity and liveability	Extent of opportunities for local precinct enhancements/ placemaking (micro scale)
3	Transport outcomes	3.1	PT accessibility and connectivity	Measure of accessibility: In vehicle travel time by Public Transport between Tugun and Coolangatta
		3.2	Degree of active transport infrastructure implemented - safety, comfort and access.	Pedestrian Safety Score (using SSA) Cycle Safety Score (using SSA) and additional safety observations
		3.3	Traffic performance	Transport operations based on density plots and travel time / volume metric extraction from Aimsun.
		3.4	Road safety	Safe System Assessment (overall score) - lower SSA score means more alignment with SSA principles. High level safety review of components captured in the SSA.
4	Construction and constructability	4.1	Traffic management risks (during construction)	Qualitative assessment based on traffic engineering assessment of likely lane closure requirements
		4.2	Community disruption risks (during construction)	Qualitative assessment around likely impacts to businesses and residents (inc parking removal/ relocation)
		4.3	PUP risks (during construction)	Qualitative assessment around number of potential high-risk obstacles (inc impact on any major plant)
		4.4	Other construction risks (geotechnical, hydrological, etc)	Qualitative assessment (number of geotechnical risk features e.g., Kirra hill, wetlands)
5	Environmental impact	5.1	Transport emissions (air quality)	Change in number of private vehicles travelling through corridor (increase or decrease in vehicle emissions).
		5.2	Ecological and natural hazard risks	Area of flora and fauna impacted; Inc number water bodies impacted, erosion and other natural hazard risks

MCA Category		MCA Criteria		MCA Performance Measure
6	Social factors	6.1	Heritage and iconic landscapes	Number heritage listed properties or iconic landscape features; parklands impacted
		6.2	Noise and severance (to local land uses, property and businesses) during operation	Number of properties potentially affected by noise impacts or urban separation. Include commentary on sensitive land uses, any notable increases on traffic and/or specific geometric differences (tight corners) which introduce new noise issues (wheel squeal)
		6.3	Property impacts	Number of properties impacts (full/ part) and whether residential/ business

Table 7-3: MCA general scoring

Score	
5	Substantial benefits and a high degree of confidence of benefits being realized and/or long term / permanent benefits
4	High extent of benefits and confidence of benefit being realized and/or medium - long term benefits
3	Good benefits and/or medium term
2	Low or localised benefits and/or short term
1	Very low benefits and/or very short term
0	No change in benefits, impacts or difficulties from current situation
-1	Few difficulties, very low cost or low impact on some resources/values and/or very short term
-2	Minor difficulties, low cost or minor impacts on resources/values and/or short term
-3	Some difficulties, moderate cost or some impact on resources/values and/or medium term
-4	Clear difficulties, high cost or high impact on resources/values and/or medium - long term
-5	Substantial difficulties, very high cost or substantial impact on resources/values and/or long term / permanent

7.2.4 Weightings

At the end of the MCA workshop, a link to an online form was distributed to participants asking them to rank the MCA categories from 1 to 6 for three different zones (Bilinga, Airport and Kirra/Coolangatta). Kirra and Coolangatta were combined due to similarities in transport context and as well as urban growth and catchment opportunities. 14 responses were received from TWG participants in total.

The combined ranking results were then used to identify whether there were different priorities within each section of the corridor and the relative importance of the decision criteria (against other criteria under consideration). Statistical methods were used to convert the rankings to weightings as the mixed nature (qualitative and quantitative) of the MCA criteria tends to make it difficult for participants to directly attribute percentage weights to individual criteria.

Two statistical methods were tested for deriving weightings for the MCA tool namely:

- Rank Sum
- Rank Order Centroid

Each of these proposed weighting methodologies are explained below.

7.2.4.1 Rank Sum

As detailed in the Smarter Solutions – MCA Tool user guide, “the rank sum weighting method assigns weightings by first ranking each criteria in order by preference; the most preferred option is selected as the first rank.” The relative weightings are then calculated by applying the formula detailed in Figure 7-21. The rank sum methodology derives weightings that are more narrowly distributed relative to alternative ranking methodologies

$$wt_i = \frac{K - r_i + 1}{\sum_{j=1}^{K} K - r_j + 1}$$

Where:

- r_i is the rank of the *i*th objective
- K is the total number of objectives

Figure 7-21: Rank sum formula

7.2.4.2 Rank Order Centroid

As detailed in the Smarter Solutions – MCA Tool user guide, “the rank order centroid weighting method aims to minimise the maximum error of each weight by identifying the centroid of all possible weights relative to the assigned ranking of alternatives. Similar to the other rank methods, the criteria must first be ranked by preference then the relative weightings are then calculated by applying the formula detailed in Figure 7-22. The rank order centroid methodology returns weights that are more dispersed than the rank sum methodology. The result being that the first rank achieves a higher weighting compared to the Rank Sum method. For this reason, the Rank Order Centroid method was adopted for this study.

$$wt_i = \left(\frac{1}{K}\right)\sum_{j=1}^{K}\left(\frac{1}{r_j}\right)$$

$$wt_1 = \left(1 + \frac{1}{2} + \frac{1}{3} + \ldots \frac{1}{K}\right) / K$$

$$wt_K = \left(0 + 0 + 0 + \ldots \frac{1}{K}\right) / K$$

Where:

- r_j is the rank of the *j*th objective
- K is the total number of objectives

Figure 7-22: Rank order centroid formula

Refer to Figure 7-23 for a comparison of the weighting methodologies.

Criterion	Straight Rank	Rank Sum	
		Weight	Normalised Weight
A	4	2	13.3%
B	2	4	26.7%
C	5	1	6.7%
D	1	5	33.3%
E	3	3	20.0%
Total		15	100.0%

Criterion	Straight Rank	Rand Order Centroid	
		Reciprocal Weight	Normalised Weight
A	4	0.250	9.0%
B	2	0.500	25.7%
C	5	0.200	4.0%
D	1	1.000	45.6%
E	3	0.333	15.7%
Total		2.283	100.0%

Figure 7-23: Weighting methodology comparison (Appendix 1, TMR Smarter Solutions) – note only the Rank Order Centroid method was taken forward

7.3 MCA workshop and results

A Technical Working Group (TWG) workshop was held on 10 September 2021 with relevant stakeholders including City of Gold Coast (CoGC), various TMR divisions and TfNSW. Participants reviewed the draft assessment findings and proposed scores for each options in each section in accordance with the scoring guideline and methodology outlined above. Inputs from participants including changes to scores and comments have been reflected within the following sections.

7.3.1 Bilinga

This section summarises the MCA scoring and subsequent weighting of the shortlisted Bilinga alignment options with the detailed commentary contained in Appendix E. The purpose of the MCA scoring is to undertake a comparison assessment of the shortlisted alignment options to arrive at a preferred LRT alignment within the corridor for further investigation and refinement.

7.3.1.1 Bilinga MCA scores

Table 7-4 summarises the raw and unweighted scores from the workshop. These scores have been reviewed and approved by TMR and stakeholders from the TWG.

Table 7-4: Final scoring of Bilinga option (unweighted)

MCA Category		MCA Criteria		BILINGA	
				B1-3 Eastern LRT corridor	B2-3 Median LRT corridor
1	Cost	1.1	Construction costs (inc. property)	-2	-4
		1.2	Operating cost (PT network)	5	5
2	Land use planning	2.1	Enhanced access to frequent and reliable public transport to support population growth	4	2
		2.2	Improved urban amenity and liveability	2	2
3	Transport outcomes	3.1	PT accessibility and connectivity	5	4
		3.2	Degree of active transport infrastructure implemented - safety, comfort and access.	3	2
		3.3	Traffic performance	5	4
		3.4	Road safety	3	4
4	Construction and constructability	4.1	Traffic management risks (during construction)	-3	-5
		4.2	Community disruption risks (during construction)	-4	-2
		4.3	PUP risks (during construction)	-4	-2
		4.4	Other (geotechnical, hydrological, etc) during construction	0	0
5	Environmental impact	5.1	Transport emissions (air quality)	4	4
		5.2	Ecological and natural hazard risks	0	0
6	Social factors	6.1	Minimise impacts on heritage and iconic landscapes	-3	-1
		6.2	Noise and severance impact to local land uses, property and businesses during operation	-2	-1
		6.3	Property impacts	0	0

7.3.1.2 Bilinga weightings and sensitivity tests

As part of the TWG Workshop 3 held on 10 September 2021, stakeholders were asked to rank the MCA categories for Bilinga (1 = highest priority and 6 = lowest priority) to inform on the weightings of the MCA category. Using the survey results as an input, three weighting scenarios were developed:

- Scenario 1: reflects the exact order of first preferences from the survey (with Transport Performance ranked 1)

- Scenario 2: Elevated the second ranked category (Land Use) to number 1 to test if this would alter the results
- Scenario 3: Same as Scenario 1 but with 'Cost" removed noting that the two options were only 11% apart, to see if this would alter the result

After applying the different rankings and their corresponding weightings (refer Appendix E for more detail), B1-3 was identified as the preferred option, even prior to any mitigation for tree loss (refer to Table 7-5).

Table 7-5: MCA results with rank order weightings applied.

Scenario	B1-3 Eastern LRT corridor	B2-3 Median LRT corridor
Scenario 1	2.33	1.85
Scenario 2	2.16	1.60
Scenario 3	2.19	1.90

7.3.1.3 Emerging preferred Bilinga recommendation

The findings from the MCA indicate that:

- **B1-3** performs better in terms of cost, catchment/ serving growth as well as slightly better LRT travel times and general traffic performance. B1 is also consistent with the proposed east-side LRT running for the section north to Tugun Village
- **B2-3** performs slightly better in terms of impacts on landscape/ trees and impacts to residents and businesses
- **B1-3** is marked down due to the LRT requiring removal of mature trees and vegetated buffer between Golden Four Drive and GCH. Therefore, a revised version of B1-3 is proposed to be re-designed to include a wider buffer where possible which would likely outperform B2-3 overall and could offer:
  - Enhanced opportunities for placemaking and legibility with retention of more of the current avenue of trees as part of an arrival gateway
  - Enhanced opportunities for active transport
  - Reduced visual amenity and noise impacts
  - Reduced impacts on PUP and road drainage on Golden Four Drive but a higher cost (assumed to be comparable with B2-3)

Nevertheless, even prior to mitigation, B1-3 achieves the highest weighted score under all 3 ranking scenarios and as such was the recommended emerging preferred option for Bilinga.

7.3.2 Airport

This section summarises the MCA scoring and subsequent weighting of the shortlisted Airport alignment options with the detailed commentary contained in Appendix E. The purpose of the MCA scoring is to undertake a comparison assessment of the shortlisted alignment options to arrive at a preferred LRT alignment within the corridor for further investigation and refinement.

7.3.2.1 Airport MCA scores

Table 7-6 summarises the raw and unweighted scores. These scores have been reviewed and approved by TMR and relevant stakeholders.

Table 7-6: Final scoring of Airport option (unweighted)

MCA Category		MCA Criteria		AIRPORT	
				A1-3 Closer to Airport Terminal	A2-3 Closer to Gold Coast Highway
1	Cost	1.1	Construction costs (inc. property)	-5	-2
		1.2	Operating cost (PT network)	-5	-4
2	Land use planning	2.1	Enhanced access to frequent and reliable public transport to support population growth	4	1
		2.2	Improved urban amenity and liveability	4	2
3	Transport outcomes	3.1	PT accessibility and connectivity	4	5
		3.2	Degree of active transport infrastructure implemented - safety, comfort and access.	2	-1
		3.3	Traffic performance	0	2
		3.4	Road safety	-1	0
4	Construction and constructability	4.1	Traffic management risks (during construction)	-2	-1
		4.2	Community disruption risks (during construction)	-2	-1
		4.3	PUP risks (during construction)	-1	-1
		4.4	Other (geotechnical, hydrological, etc) during construction	-2	-1
5	Environmental impact	5.1	Transport emissions (air quality)	4	4
		5.2	Ecological and natural hazard risks	0	-1
6	Social factors	6.1	Minimise impacts on heritage and iconic landscapes	-1	-1
		6.2	Noise and severance impact to local land uses, property and businesses during operation	0	0
		6.3	Property impacts	-3	-1

7.3.2.2 Airport weightings and sensitivity tests

As part of the TWG Workshop 3 held on 10 September, stakeholders were asked to rank the MCA categories for Airport (1 = highest priority and 6 = lowest priority) to inform on the weightings of the MCA category. Using the survey results as an input, three weighting scenarios were developed:

- Scenario 1: reflects the exact order of first preferences from the survey (with Transport Performance ranked 1)

- Scenario 2: Elevated the second ranked category (Land Use) to number 1 to test if this would alter the results
- Scenario 3: Same as Scenario 1 but with 'Cost" removed to see if this would alter the result

After applying the different rankings and their corresponding weightings (refer Appendix E), A1-3 was identified as the preferred option (refer to Table 7-7).

Table 7-7: MCA results with rank order weightings applied.

Scenario	A1-3 Closer to Airport Terminal	A2-3 Closer to Gold Coast Highway
Scenario 1	0.47	0.40
Scenario 2	0.93	0.40
Scenario 3	1.27	0.91

7.3.2.3 Emerging preferred Airport recommendation

The findings from the MCA indicate that:

- **A1 (terminal)** performances significantly better in terms of supporting growth and enhancing access to frequent and reliable public transport for key regional destinations (airport university). It also delivers better urban amenity and placemaking outcomes.
- **A2 (Gold Coast Highway)** is slightly shorter and therefore cheaper with marginally faster travel times for through passengers. A2 also scores better from road safety and traffic performance perspective although these are marginal.

A1-3 achieves the highest weighted score under all 3 ranking scenarios and as such is the recommended emerging preferred option for the Airport.

7.3.3 Kirra

This section summarises the MCA scoring and subsequent weighting of the shortlisted Kirra alignment options with the detailed commentary contained in Appendix E. The purpose of the MCA scoring is to undertake a comparison assessment of the shortlisted alignment options to arrive at a preferred LRT alignment within the corridor for further investigation and refinement.

7.3.3.1 Kirra MCA scores

Table 7-8 summarises the raw and unweighted scores. These scores have been reviewed and approved by TMR and relevant stakeholders.

Table 7-8: Final scoring of Kirra option (unweighted)

MCA Category		MCA Criteria		KIRRA	
				K2-2 Musgrave Street & Miles Street	K3-2 Coolangatta Road
1	Cost	1.1	Construction costs (inc. property)	-4	-3
		1.2	Operating cost (PT network)	2	4
2	Land use planning	2.1	Enhanced access to frequent and reliable public transport to support population growth	-2	4
		2.2	Improved urban amenity and liveability	3	4
3	Transport outcomes	3.1	PT accessibility and connectivity	3	5
		3.2	Degree of active transport infrastructure implemented - safety, comfort and access.	-1	3
		3.3	Traffic performance	-2	3
		3.4	Road safety	-1	3
4	Construction and constructability	4.1	Traffic management risks (during construction)	-3	-3
		4.2	Community disruption risks (during construction)	-4	-2
		4.3	PUP risks (during construction)	-3	-4
		4.4	Other (geotechnical, hydrological, etc) during construction	-3	-2
5	Environmental impact	5.1	Transport emissions (air quality)	2	4
		5.2	Ecological and natural hazard risks	-3	-1
6	Social factors	6.1	Minimise impacts on heritage and iconic landscapes	-5	-2
		6.2	Noise and severance impact to local land uses, property and businesses during operation	-5	-3
		6.3	Property impacts	-3	-1

7.3.3.2 Kirra weightings and sensitivity tests

As part of the TWG Workshop 3 held on 10 September, stakeholders were asked to rank the MCA categories for Kirra and Coolangatta (1 = highest priority and 6 = lowest priority) to inform on the weightings of the MCA category. Using the survey results as an input, three weighting scenarios were developed:

- Scenario 1: reflects the exact order of first preferences from the survey (with Transport Performance ranked 1)

- Scenario 2: Elevated the second ranked category (Land Use) to number 1 to test if this would alter the results
- Scenario 3: Same as Scenario 1 but with 'Cost" removed to see if this would alter the result

After applying the different rankings and their corresponding weightings (refer Appendix E for more details), K3-2 was identified as the preferred option (refer to Table 7-9).

Table 7-9: MCA results with weightings applied.

Scenario	K2-2 Musgrave Street & Miles Street	K3-2 Coolangatta Road
Scenario 1	-0.74	2.25
Scenario 2	-0.87	2.16
Scenario 3	-0.67	2.45

7.3.3.3 Emerging preferred Kirra recommendation

The findings from the MCA indicate that:

- **K2 (Musgrave Road and Miles Street)** would provide a unique beachside transport experience for passengers serving the current highest trip generating uses within this part of the study area. But K2 comes at an increased cost, longer journey time, and with major impacts to parkland/ visual amenity
- **K3 (Coolangatta Rd)** offers a shorter, faster, cheaper route. It is more centrally located to the wider catchment and may help support population growth more equitably. While it has construction challenges due to lots of frontage stakeholders, the corridor is wide and could become a green boulevard
- Overall, K3 significantly outperforms K2. Due to the scale of scoring differences, K3 is likely to be the emerging preferred option regardless of the application of weightings

K3-2 achieves the highest weighted score under all 3 ranking scenarios and as such is the recommended emerging preferred option for Kirra.

7.3.4 Coolangatta

This section summarises the MCA scoring and subsequent weighting of the shortlisted Coolangatta alignment options with the detailed commentary contained in Appendix E. The purpose of the MCA scoring is to undertake a comparison assessment of the shortlisted alignment options to arrive at a preferred LRT alignment within the corridor for further investigation and refinement.

7.3.4.1 Coolangatta MCA scores

Table 7-10 summarises the raw and unweighted scores. These scores have been reviewed and approved by TMR and relevant stakeholders.

Table 7-10: Final scoring of Coolangatta option (unweighted)

MCA Category		MCA Criteria		COOLANGATTA	
				C2-2 Griffith Street	C3-1 Chalk Street
1	Cost	1.1	Construction costs (inc. property)	-4	-3
		1.2	Operating cost (PT network)	2	4
2	Land use planning	2.1	Enhanced access to frequent and reliable public transport to support population growth	3	3
		2.2	Improved urban amenity and liveability	2	4
3	Transport outcomes	3.1	PT accessibility and connectivity	3	4
		3.2	Degree of active transport infrastructure implemented - safety, comfort and access.	1	2
		3.3	Traffic performance	-1	4
		3.4	Road safety	-2	-1
4	Construction and constructability	4.1	Traffic management risks (during construction)	-5	-1
		4.2	Community disruption risks (during construction)	-5	-1
		4.3	PUP risks (during construction)	-3	-3
		4.4	Other (geotechnical, hydrological, etc) during construction	0	0
5	Environmental impact	5.1	Transport emissions (air quality)	5	5
		5.2	Ecological and natural hazard risks	0	0
6	Social factors	6.1	Minimise impacts on heritage and iconic landscapes	-2	-1
		6.2	Noise and severance impact to local land uses, property and businesses during operation	-3	-2
		6.3	Property impacts	-2	-3

7.3.4.2 Weightings and sensitivity tests

As part of the TWG Workshop 3 held on 10 September 2021, stakeholders were asked to rank the MCA categories for Kirra and Coolangatta (1 = highest priority and 6 = lowest priority) to inform on the weightings of the MCA category. Using the survey results as an input, three weighting scenarios were developed:

- Scenario 1: reflects the exact order of first preferences from the survey (with Transport Performance ranked 1)

- Scenario 2: Elevated the second ranked category (Land Use) to number 1 to test if this would alter the results
- Scenario 3: Same as Scenario 1 but with 'Cost" removed to see if this would alter the result

After applying the different rankings and their corresponding weightings (refer Appendix E for more details), C3-1 was identified as the preferred option (refer to Table 7-11).

Table 7-11: MCA results with weightings applied.

Scenario	C2-2 Griffith Street	C3-1 Chalk Street
Scenario 1	0.68	1.81
Scenario 2	0.30	1.60
Scenario 3	0.94	2.02

7.3.4.3 Emerging preferred Coolangatta recommendation

The findings from the MCA include:

- **C2 (Griffith Street)** reflects the existing road and transport hierarchy with public transport serving the original 'high street' but comes with higher costs and significant construction impacts to business due to major construction including utilities diversions within a constrained road corridor. It will also result in the permanent loss of most on-street car parking, is more disruptive to local vehicle access and circulation and significantly reduces pedestrian oriented public realm.
- **C3 (Chalk Street)** offers a more transformative opportunity for Coolangatta and could help shape a more balanced town centre anchored by LRT and a new civic precinct to the south (if enabled/ encouraged through redevelopment opportunities). It also offers a more direct/ shorter/ cheaper/ easier to construct route towards Kirra and good onward extension options towards Tweed Heads.

C3-1 achieves the highest weighted score under all 3 ranking scenarios and as such is the recommended emerging preferred option for Coolangatta.

7.4 Conclusions from shortlist assessment (MCA)

Following a detailed, multi-faceted and multi-stage option development and assessment process, the following emerging preferred alignment options were recommended to proceed to Stage 4 (Option refinement). Key elements to be further resolved are noted under each section heading.

7.4.1 Bilinga:

Option B1-3 was the recommended preferred alignment however is subject to re-design to provide a wider buffer between the LRT corridor and Golden Four Drive to create greater visual separation, retain mature trees wherever possible and to deliver a road corridor that creates an entry/gateway statement to the Gold Coast from the Airport.

- Investigate modifications to the cross section of the option to provide a wider buffer between the LRT tracks and Golden Four Drive for greater visual separation to retain mature trees (Norfolk Pines) and to deliver a road corridor that helps make an entry/ gateway statement to the Gold Coast from the airport
- Identify opportunities for enhanced cycle facilities on Golden Four Drive as noted in the SSA

- Identify opportunities for traffic and urban realm treatments in the vicinity of the two stations fronting Golden Four Drive (including options for formalised pedestrian crossing facilities of Golden Four Drive at both ends of station platforms)
- Investigate bus stop and/or bus priority facility options at both the Boyd Street intersection and the Terminal Drive intersection to cater for existing (retained) and new local bus routes
- Include enhanced pedestrian crossing facilities at all signalised intersections in line with QLD road safety policy

7.4.2 Airport:

Option A1-3 was the recommended preferred concept for a consolidated multi-modal (LRT, heavy rail and bus) public transport facility located between the airport terminal and the proposed new internal airport distributor road (approx. 150-180m from the airport terminal building). However heavy rail alignment constraints need to be investigated further to confirm viability of this location.

- Critically, this option relies on the feasibility of a future heavy rail station in this (or a substantially similar) location. A key early task in further option development is the reconfirmation of the feasibility (and risks/ impacts) of such a heavy rail station arrangement and related main line alignment. Should this not be deemed feasible, alternative heavy rail alignment and station arrangements which deliver heavy rail as close as possible to the terminal building, in line with the intent of A1-3, should be explored as a fallback.
- Identify the functional requirements for scheduled urban bus services that may serve the future multi modal airport station including local TransLink services and possible future TfNSW (Tweed) services in order to determine an appropriate bus station footprint (and access/ egress strategy)
- Confirm requirements for and incorporate infrastructure provision for other motorised access modes including taxi and kiss n ride
- Confirm the preferred pedestrian and cycle access strategy, which may depend on the exact station location and extent of roads/ barriers between the PT hub and the airport terminal. Pedestrian access options may include a combination of at grade and grade separated facilities.
- Identify opportunities for the airport multi modal passenger facility to be integrated into a public space creating a benefit to the airport precinct including adjacent hotel and university precincts
- Identify options and a preferred approach to satellite depot and stabling facilities in or immediately adjacent to the airport precinct.

7.4.3 Kirra:

Option K3-2B was the recommended preferred concept to take forward, with LRT located within the Coolangatta Road corridor

- Reconfirm the number and optimal location of station(s) in this corridor segment, in conjunction with the final station location in the airport precinct relative to the North Kirra catchment. If a two-station solution remains preferred, investigate moving Kirra station closer to Miles Street (a clear north-south axis and potential ‘feeder’ route for both active transport and bus users)
- Confirm requirements for active transport both on/ adjacent to Coolangatta Rd and on Miles Street – both in terms of principal level cycle facilities and cross corridor pedestrian connections, particularly those also used by students at the adjacent Coolangatta State School.
- Review the required number and configuration of traffic lanes on Coolangatta Road as well as on street parking requirements and opportunities
- Undertake sufficient hydraulic analysis to determine a suitable infrastructure or operational solution for the current flood immunity deficiencies identified on Coolangatta Rd and Miles Street
- Undertake sufficient structural analysis to confirm the preferred approach to retaining walls within the ‘cutting’, between Miles Street and McLean Street

7.4.4 Coolangatta:

Option C3-2B was the recommended preferred concept to be taken forward, with LRT located immediately south of Chalk Street

- Early consultation and coordination with key affected stakeholders are recommended, including Queensland Police, Magistrates Court and Twin Towns Kindergarten.
- Inter-related to the above required consultation and coordination is the need to undertake sufficient 'precinct planning' to confirm key option components (including exact station location and pedestrian connection strategy). This planning would be intended to identify the key changes required to support the implementation of LRT, mitigate its direct impacts, or help maximise its benefits. This includes the potential reconfiguration of car park land post construction as well as the potential for new civic buildings and plazas/ public spaces, maximising as well as enhancing north south pedestrian connections from south of Lanham Street to North of Griffith Street.
- Confirm requirements for active transport enhancements on or parallel to the LRT alignment to provide a high-quality principal level connection between Tweed Heads and Coolangatta (civic and retail precinct) complementing recreational facilities along the foreshore (Oceanway)
- Continue to work collaboratively with TfNSW to determine feasible onward extension options into Tweed Shire
- In parallel with the above, confirm requirements for bus stop and interchange facilities in and around the Coolangatta LRT station in particular to serve Tweed Shire bus services.

Figure 7-24: Emerging preferred Light Rail alignment and station locations post MCA