APPENDIX 3

TRAFFIC IMPACT ASSESSMENT

transcore
20 years anniversary

transport planning
traffic engineering
modelling

Proposed Service Station

Lot 9065 (101) Chateau Avenue, Alkimos

PREPARED FOR:
LWP Capital Pty Ltd

November 2021

Document history and status

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1 Summary

This Transport Impact Assessment (TIA) has been prepared by Transcore with respect to the proposed 7-Eleven service station development to be located within the eastern portion of Lot 9065 (101) Chateau Avenue, Alkimos in the City of Wanneroo.

The subject lot is located at the northwest corner of the Marmion Avenue/ Hawksbill Drive/ Santorini Promenade roundabout intersection. The western portion of the site is proposed to be developed as a McDonald's restaurant with drive through facility, which does not form part of the 7-Eleven development application and is subject to a separate development application. The assessment undertaken in this report allows for the traffic generation of both proposed developments.

The subject site is currently vacant. The proposed development for the subject lot entails a full movement crossover on Hawksbill Drive between the proposed 7-Eleven site and the McDonald's restaurant site, a left turn exit only crossover from the proposed 7-Eleven service station site onto Hawksbill Drive and an exit only driveway from the McDonald's restaurant site to Carlsbad Promenade on the northern side of the site.

In accordance with the WAPC *"Transport Impact Assessment Guidelines, Volume 4 – Individual Developments (2016)"*, a Transport Impact Assessment is required for developments that generate more than 100 vehicle per hour. Accordingly, a *Transport Impact Assessment* is warranted in this case.

The proposed development layout has been assessed with respect to the traffic circulation including the fuel tanker and service vehicles. Swept path analysis confirms that the proposed entry and exit arrangements and site layout facilitate satisfactory and efficient vehicle circulation though the site.

Accordingly, the aim of this Transport Impact Assessment is to assess the traffic impact of the development proposal by estimating the traffic which will be generated by both developments and establishing the resultant traffic pattern on the surrounding road network. This assessment will include the capacity analysis of the proposed crossovers on Hawksbill Drive and the adjacent roundabout intersection of Marmion Avenue/ Hawksbill Drive/ Santorini Promenade.

2 Introduction

This Transport Impact Assessment (TIA) has been prepared by Transcore on behalf of LWP Capital Pty Ltd with regards to the proposed 7-Eleven service station to be located at Lot 9065 (101) Chateau Avenue, Alkimos in the City of Wanneroo.

The subject site is vacant land and the proposed development is located within the eastern portion of the subject site, which is located at the northwest corner of the Marmion Avenue/ Hawksbill Drive/ Santorini Promenade roundabout intersection. The western portion of the site is proposed to be developed as a McDonald's restaurant with drive through facility, which does not form part of the 7-Eleven service station development application. As shown in **Figure 1**, the subject site is bound by Carlsbad Promenade to the north, proposed McDonald's restaurant to the west, Hawksbill Drive to the south and Marmion Avenue to the east.

Figure 1: Location of the subject site

As part of the development, it is proposed to provide a full movement crossover on Hawksbill Drive between the proposed 7-Eleven service station site and the McDonald's restaurant site,

a left turn exit only crossover from the proposed 7-Eleven service station site onto Hawksbill Drive and an exit only crossover from the McDonald's restaurant site to Carlsbad Promenade on the northern side of the subject site.

This TIA will estimate the trip generation and distribution of the proposed developments and will assess the impact of the proposed developments traffic on the surrounding roads.

The key issues that will be addressed in this report include the traffic generation of the proposed developments, establishing the resultant traffic pattern on the surrounding road network and capacity analysis of the proposed developments' crossovers and the existing roundabout intersection of Marmion Avenue/ Hawksbill Drive/ Santorini Promenade.

3 Existing Situation

3.1 Existing Site Use, Access and Parking

The proposed development is located on the eastern portion of the subject site, which is located at the northwest corner of the Marmion Avenue/ Hawksbill Drive/ Santorini Promenade roundabout intersection. (Refer to **Figure 1**). The subject site is currently vacant land.

3.2 Existing Road Network

Hawksbill Drive, in the immediate vicinity of the subject site is constructed as two lanes divided carriageway with a landscaped median. Pedestrian footpaths are provided on both sides of the road in the vicinity of the subject site. Refer to **Figure 2** for more details.

Hawksbill Drive is classified as an *Access Road* in the Main Roads WA Metropolitan Functional Road Hierarchy, but is planned as Neighbourhood Connector A in the Local Structure Plan (Structure Plan No. 60), which is equivalent to a Local Distributor in the Main Roads WA road hierarchy. The default built up area speed limit of 50km/h applies on Hawksbill Drive.

According to Main Roads WA Restricted Access Vehicles (RAV) network mapping, Hawksbill Drive in this vicinity is classified as RAV Network 1 which can accommodate heavy vehicles of up to 20.0m in length with the appropriate RAV permit. (Almost all roads in Western Australia are included in RAV Network 1.) 'As of Right' vehicles including 19m semi-trailers and 12.5m rigid trucks are therefore allowed on Hawksbill Drive without requiring a permit.

There are no formal traffic counts available for this road. However, based on a traffic video survey undertaken at the Marmion Avenue/ Hawksbill Drive/ Santorini Promenade roundabout on 22 July 2021, the traffic volume on this road is estimated as approximately 3,900vpd on a regular weekday with the morning peak of 390vph between 7:45-8:45AM and the afternoon peak of 290vph between 4:30-5:30PM.

Figure 2. Westbound View along Hawksbill Drive

Carlsbad Promenade, in the vicinity of the subject site is constructed as a single carriageway, two-lane undivided road with pedestrian footpath on the northern side of the road. No classification for Carlsbad Promenade is shown in the Main Roads WA Metropolitan Functional Road Hierarchy as it is a newly built road, but this road will function as an Access Road. It operates under the default speed limit of 50km/h in the vicinity of the subject site.

There are no available traffic counts for this road at present.

Fontana Loop, in the vicinity of the subject site is also constructed as a single carriageway, two-lane undivided road with pedestrian footpath on the eastern side of the road. No classification for Fontana Loop is also shown in the Main Roads WA Metropolitan Functional Road Hierarchy as it is a newly built road, but it will function as an Access Road. It operates under the default speed limit of 50km/h in the vicinity of the subject site.

Traffic counts for this road are not available at present.

Marmion Avenue in the immediate vicinity of the subject site is constructed as a dual carriageway with four traffic lanes with a landscaped median. Pedestrian footpaths are in place on both sides of Marmion Avenue in the vicinity of the subject site. Refer to **Figure 3** for more details. Marmion Avenue is classified as a *Primary Distributor* in the Main Roads WA Functional Road Hierarchy and operates under the sign posted speed limit of 80km/h in the vicinity of the subject site.

According to Main Roads WA Restricted Access Vehicles (RAV) network mapping, Marmion Avenue in this vicinity is classified as RAV Network 1 which can accommodate heavy vehicles of up to 20.0m in length with the appropriate RAV permit. 'As of Right' vehicles including 19m semi-trailers and 12.5m rigid trucks are therefore allowed on Marmion Avenue without requiring a permit.

According to the latest available traffic count data sourced from Main Roads WA, Marmion Avenue (north of Romeo Road) carried approximately 23,100vpd on a regular weekday in 2017/18. The morning peak of 1,950vph was recorded at this location between 8:00-9:00AM while the afternoon peak of 1,940vph was recorded between 3:00-4:00PM. The traffic counts from the video survey on 22 July, 2021 indicate that the morning peak of approximately 2,170vph was recorded between 7:45-8:45AM and the afternoon peak of approximately 2,440vph was recorded between 4:30-5:30PM.

Marmion Avenue forms a four-way roundabout intersection with Hawksbill Drive and Santorini Promenade.

Figure 3. Northbound View along Marmion Avenue

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3.3 Existing Traffic Volumes on Roads

Transcore organised a traffic count video survey at the roundabout intersection of Marmion Avenue/ Hawksbill Drive and Santorini Promenade on 22 July 2021. The AM peak hour and PM peak hour traffic counts at the roundabout intersection of Marmion Avenue/ Hawksbill Drive and Santorini Promenade are shown in **Figure 4** and **Figure 5**.

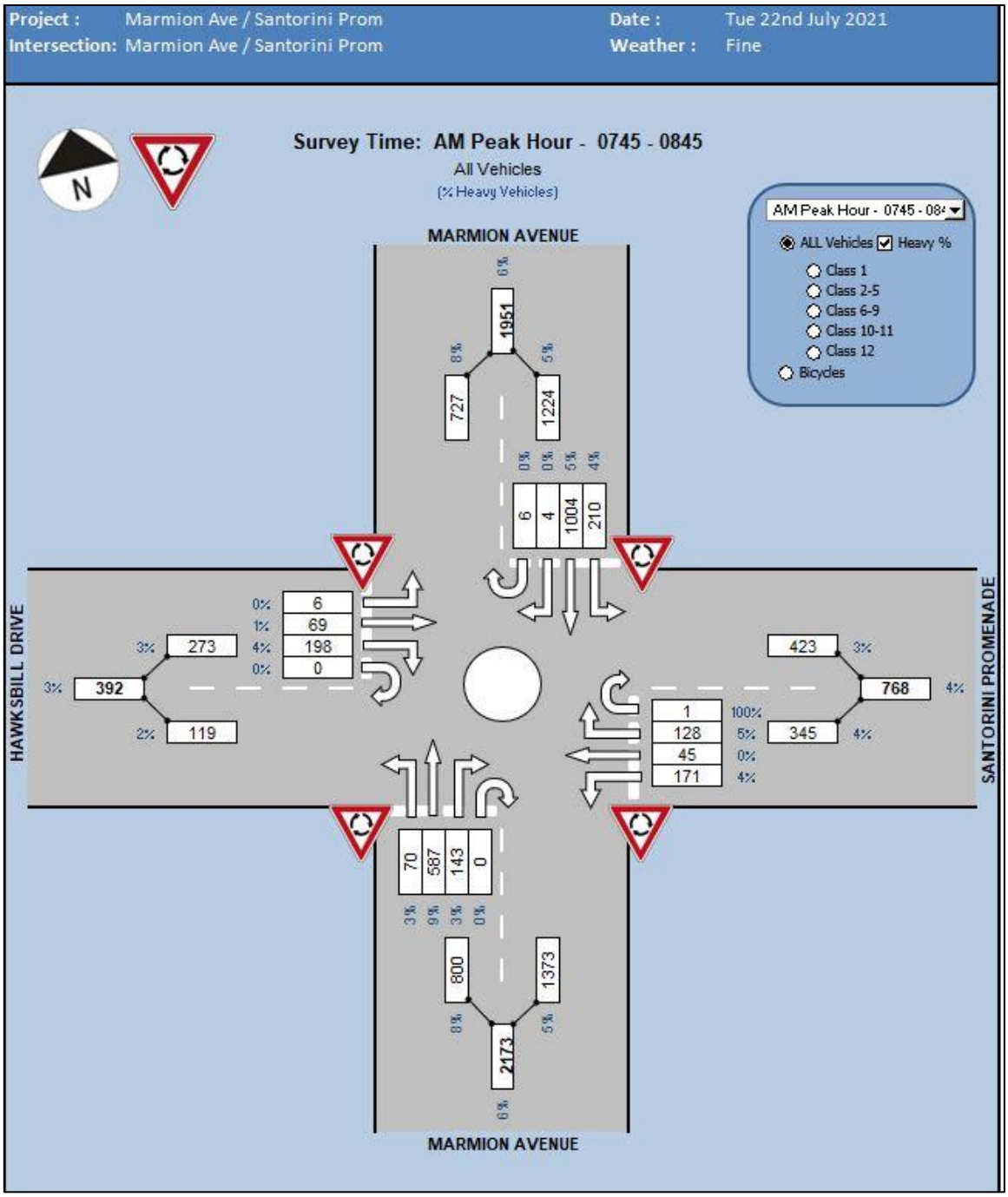


Figure 4. Existing AM peak hour traffic counts at Marmion Avenue/ Hawksbill Drive and Santorini Promenade roundabout intersection

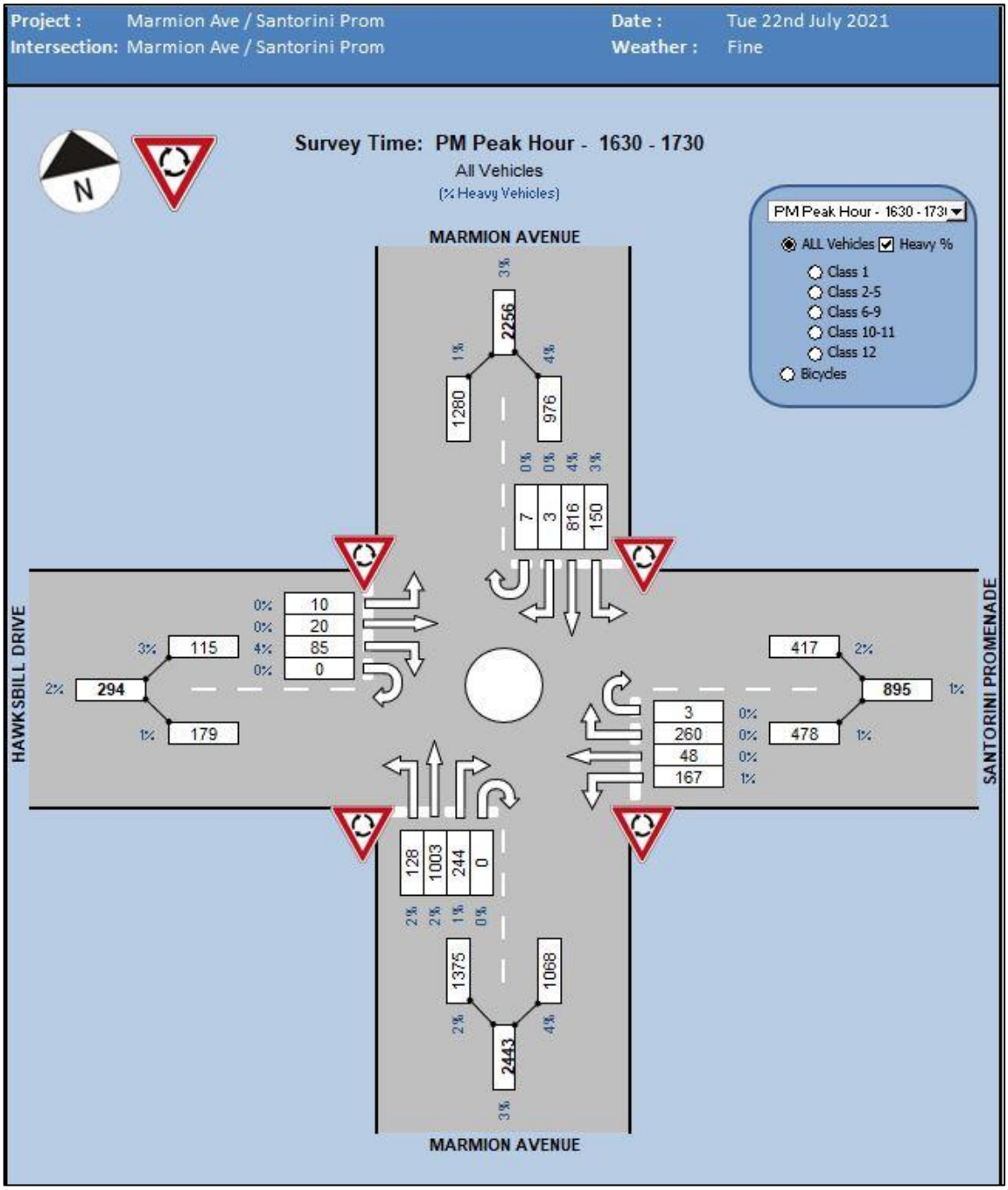


Figure 5. Existing PM peak hour traffic counts at Marmion Avenue/ Hawksbill Drive and Santorini Promenade roundabout intersection

3.4 Public Transport Access

Public transport services in the vicinity of the subject site are shown in **Figure 6**. The closest bus services to the subject site are Transperth bus routes 490 and 491, which travel along Marmion Avenue, east of the subject site. The nearest bus stop is located on Marmion Avenue approximately 190m south of the subject site which is accessible from the subject site via the existing footpath network in the locality.

Moreover, the subject site is also served by bus route 483, operating on Santorini Promenade and the nearest bus stop is located on Santorini Promenade, approximately 500m walking distance.

These bus routes provide links to Butler train station.

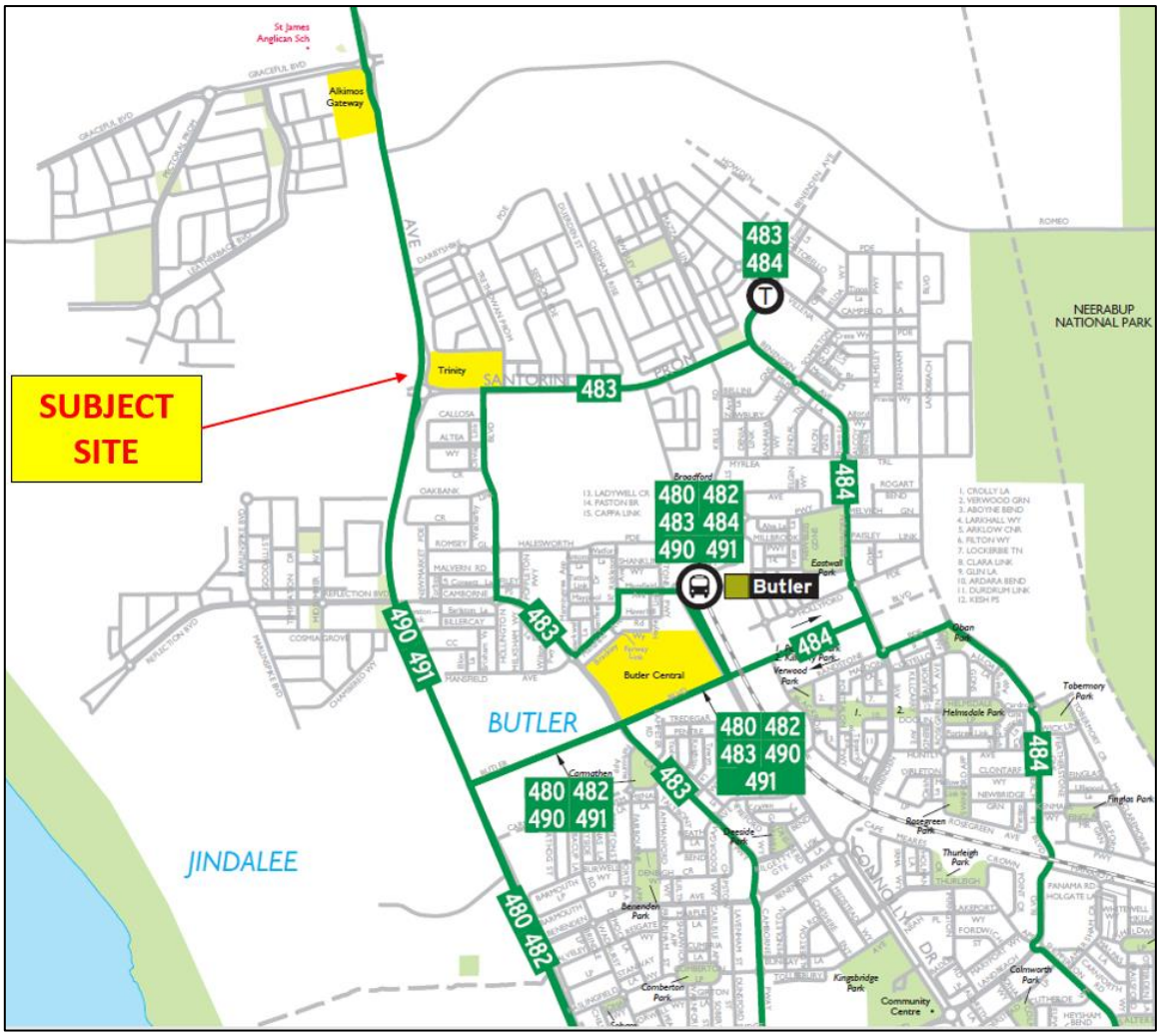


Figure 6. Existing bus routes (source: Transperth)

3.5 Pedestrian and Cyclist Facilities

Pedestrian paths in the vicinity of the subject site are provided on both sides of Marmion Avenue and Hawksbill Drive. Pedestrian crossing opportunities with refuge island are available at the Marmion Avenue/ Hawksbill Drive/ Santorini Promenade roundabout intersection.

The Department of Transport's Perth Bike Map series shows good cyclist connectivity near the subject site as shown in **Figure 7**.

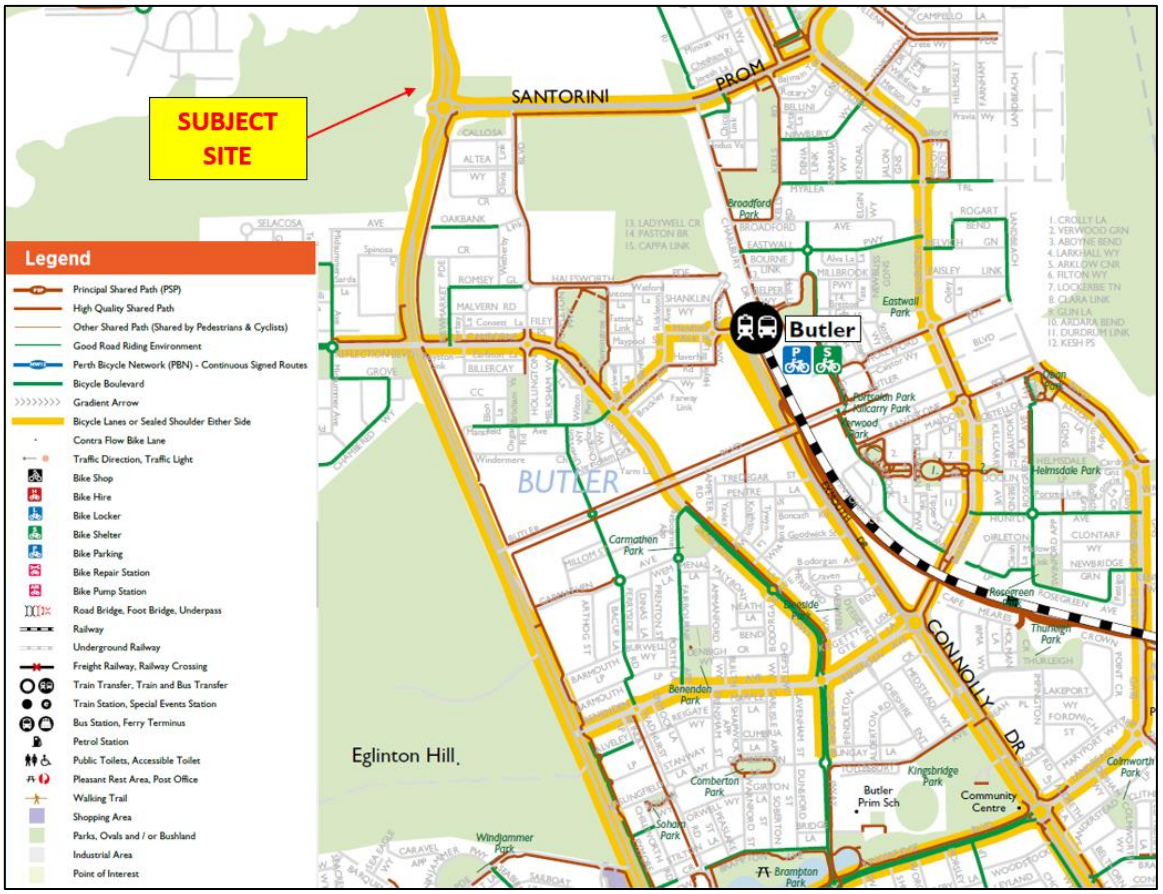


Figure 7. Bike map (source: Department of Transport)

3.6 Crash Data

Information available on the Main Roads WA website provides crash statistics for Marmion Avenue/ Hawksbill Drive/ Santorini Promenade roundabout intersection during the five-year period ending December 2020.

The crash records indicate that this intersection recorded a total of 13 road crashes with seven crashes classified as property damage only (PDO) major, four PDO minor crashes and two crashes requiring medical treatment in the last five-year period. More details on the crash records are provided in **Table 1**.

Table 1. Crash history for the Marmion Avenue/ Hawksbill Drive/ Santorini Promenade roundabout intersection

Roundabout Intersection						Total Crashes	Casualty
Marmion Avenue/ Hawksbill Drive/ Santorini Promenade						13	2
Right Turn Thru	Rear End	Hit Object	Non-Collision	Same Dir	Right Angle	Wet	Night
1	7	1	1	2	1	5	6

4 Development Proposal

4.1 Proposed Site Use

According to the proposed development plan in **Appendix A** of this report, the proposal includes a 7-Eleven service station comprising:

- A canopy with a total of 3 bowsers/ 6 fuel-filling positions for light vehicles;
- A service station retail building;
- A total of 11 on-site car parking bays including one ACROD bay and one 'air & water' bay;
- A designated fill point location for fuel tanker: and,
- A designated service vehicle loading bay.

It is Transcore's understanding that adequate parking supply is provided on site to satisfy the parking requirements for the proposed development.

The layout of the proposed development is shown in the site plan included in **Appendix A**.

4.2 Proposed Access for all Modes

The proposed access system for the development comprises one full movement crossover on Hawksbill Drive, between the proposed 7-Eleven service station site and the McDonald's restaurant site, a left turn exit only crossover from the proposed 7-Eleven service station site onto Hawksbill Drive and an exit only crossover from the McDonald's restaurant site to Carlsbad Promenade on the northern side of the site. **Figure 8** shows the locations of the proposed crossovers.

The proposed crossover system for the proposed development is in accordance with City of Wanneroo Standard Drawing TS10-5-2, which sets out the required distances from the property boundary of a distributor road to a full movement access or left in / left out access point.

Vehicles entering the site at the main driveway on Hawksbill Drive will need to have a clear path into the site so they can continue north-eastward toward the service station bowsers or turn left towards the McDonald's drive through lanes and car park. A 'Keep Clear' area is marked on the proposed development plan on the McDonald's driveway exit lane to ensure that entry movement is not obstructed. Further refinement of the internal signage and line-marking for both developments in consultation with City of Wanneroo staff is anticipated during the development approval and building licence process to ensure the internal circulation system satisfies the City's requirements.

Heavy vehicles access, egress and circulation for the proposed development is also discussed in **Section 10** of this report.

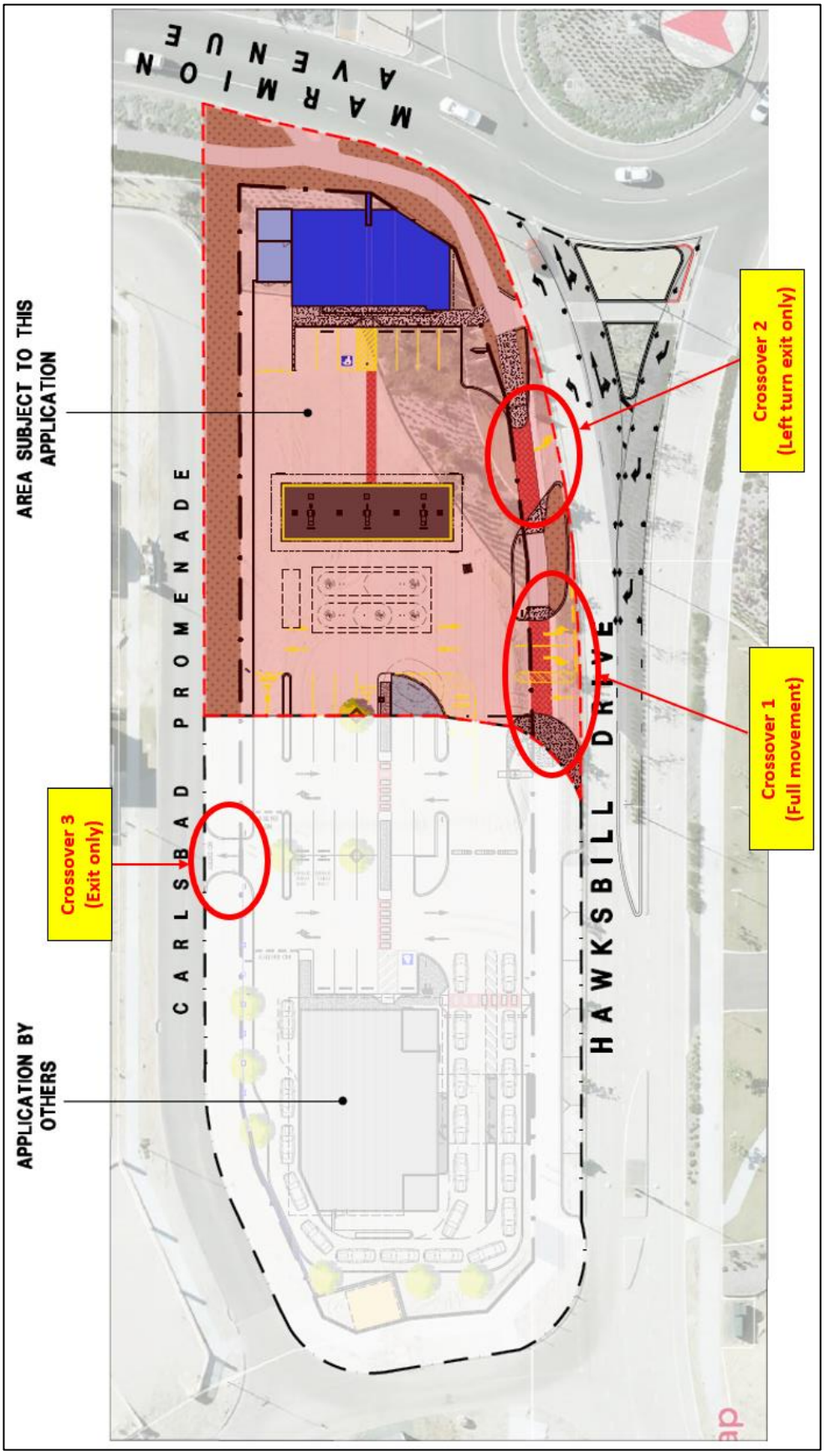


Figure 8. Proposed access arrangements

The proposed right turn access into the full movement driveway crossover (Crossover 1) on Hawksbill Drive is proposed to be provided with a new right turn lane in the median of Hawksbill Drive, as shown on **Figure 8**. The proposed right turn lane will utilise the full 3.0m width of the existing median and is approximately 55m long, including a tapered section of approximately 15m at the eastern end.

Traffic exiting from the roundabout would not be travelling at higher speeds than 50km/h as one of the key principles of roundabout design is that the deflection through the roundabout is designed to restrict speeds of vehicles travelling through the roundabout.

Austroads *Guide to Road Design Part 4A* indicates that a deceleration distance of 40m is required for comfortable deceleration from 50km/h to stop (or 30m at the maximum deceleration rate of 3.5m/s^2), so the proposed 55m right turn lane allows for that desirable deceleration distance plus at least 15m storage space, which would easily accommodate two cars or one 12.5m rigid truck. Even with a semi-trailer fuel tanker waiting to enter the site the proposed right turn lane provides more than the minimum required 30m deceleration distance.

5 Changes to Surrounding Transport Networks

The traffic analysis undertaken for this proposed development indicates that sometime in the future, the eastbound direction of Hawksbill Drive between the left turn exit only crossover and the roundabout and westbound direction of Santorini Promenade to the roundabout will need to be upgraded to two lanes standard on approach to the roundabout, because of the general traffic growth on Marmion Avenue.

It is anticipated that the timing of these changes to the surrounding road network will be confirmed during the development application approval process.

6 Integration with Surrounding Area

The proposed development comprises a service station that provides essential refuelling and incidental convenience services to the local community and travelling public, which is in line with the current zoning for the subject site, noting the LSP was recently amended to change the site's zoning to Commercial. The development is of a commercial nature and relies on good visibility / exposure, and is therefore suitably located at a key intersection with Marmion Avenue and is expected to address the existing and future demand for this type of services along Marmion Avenue, Hawksbill Drive and future surrounding land uses in the locality.

7 Hours of Operation

The proposed development is anticipated to operate 24 hours per day and 7 days per week.

8 Traffic Assessment

8.1 Assessment Period

It is anticipated that the combination of the traffic expected to be generated by the proposed developments and the peak road network traffic periods is likely to result in the greatest demand on the road network during the typical weekday morning and afternoon peak hours between 7:45-8:45AM and afternoon peak hour between 4:30-5:30PM. As such, trip generation is estimated and traffic analysis for the proposed developments is undertaken for these periods.

For the purpose of this assessment, it is assumed that the proposed developments would be fully constructed and activated by 2022. Therefore, the assessment year that has been adopted for this analysis is year 2022 which represents the assumed post-development scenario and 2032 for 10-year post development scenario.

8.2 Trip Generation and Distribution

8.2.1 Existing Traffic Generation

The subject site is presently vacant and does not generate any traffic.

8.2.2 Proposed Development Traffic Generation

Traffic generation rates for the proposed 7-Eleven service station were sourced from the *Institute of Transportation Engineers – Trip Generation Manual 10th Edition* (ITE) using *"Gasoline/Service Station with Convenience Store (945)"* land use as a reference.

The trip rates which were used to estimate the traffic generation for the proposed development are as follows:

Gasoline/Service Station with Convenient Store (945) – Regular Fuelling Points

- Weekday daily: 205.36vpd per bowser;
- Weekday AM peak hour: 12.47vph per bowser, and,
- Weekday PM peak hour: 13.99vph per bowser.

Accordingly, it is estimated that the traffic generations for the service station development are:

- Weekday daily: 205.36 x 6 = 1,232vpd;
- Weekday AM: 12.47 x 6 = 75vph;
- Weekday PM: 13.99 x 6 = 84vph.

There is typically a significant amount of cross-trade between the proposed 7-Eleven service station development and the adjacent proposed McDonald's restaurant development as they are co-located within the same site, so it has been assumed that 30% of the customers for each component will visit both land uses, so their entry and exit trips only need to be counted

once, not double-counted as traffic generated by both developments. Accordingly, 15% cross trade is applied to each trip generation of 7-Eleven service station and the McDonald's restaurant.

Therefore, the traffic generation for the proposed development with 15% cross trade are:

- Weekday daily: 1,232 x 0.85 = 1,047vpd;
- Weekday AM: 75 x 0.85 = 64vph;
- Weekday PM: 84 x 0.85 = 71vph.

Accordingly, it is estimated that the proposed service station development would generate approximately **1,047** vehicular trips per typical weekday, with about **64** trips during the typical weekday AM and about **71** trips during the typical weekday PM peak hours. These totals include both inbound and outbound vehicle movements. This level of traffic generation actually falls within the "moderate" band (10 to 100vpd) identified in the WAPC Transport Impact Assessment Guidelines and would only require a simpler Transport Impact Statement on its own, but this full Transport Impact Assessment report has been prepared due to the combined traffic generation of the two developments being over 100vpd.

Based on Table E47 and E38 and Figure E18 and E19 of the ITE Guidelines, the weekday AM peak hour passing trade is 62% and PM peak hour passing trade is 56% for land use 945 (service station with convenience store). However, for simplicity of calculation, 60% passing trade was assumed for the analysis for both AM and PM peak hours. Therefore, the net additional traffic when accounting for passing trade is +419vpd (daily), +26vph (AM peak hour) and +28vph (PM peak hour) on the surrounding road network as shown in **Table 2**.

Table 2. Estimated peak hour trips for the proposed service station development

Passing Trade	Daily Trips	AM		PM		Non-passing Trade	Daily Trips	AM		PM	
		IN	OUT	IN	OUT			IN	OUT	IN	OUT
60%	628	19	19	22	21	40%	419	13	13	14	14
	628	**19**	**19**	**22**	**21**		**419**	**13**	**13**	**14**	**14**

Traffic generation rates for the proposed McDonald's restaurant were sourced from the *Institute of Transportation Engineers – Trip Generation Manual 10th Edition* (ITE) using *"Fast-Food Restaurant with Drive-Through Window (934)"* land use as a reference.

The trip rates which were used to estimate the traffic generation for the McDonald's restaurant are as follows:

Fast-Food Restaurant with Drive-Through Window (934) – 1000 Sq. Ft. GFA

- Weekday daily: 470.95 trips per 1000 Sq. Ft. GFA/ 0.929 = 506.94vpd/ 100m^2 GFA;
- Weekday AM peak hour: 40.19 trips per 1000 Sq. Ft. GFA/ 0.929 = 43.26vph/ 100m^2 GFA; and,
- Weekday PM peak hour: 32.67 trips per 1000 Sq. Ft. GFA/ 0.929 = 35.17vph/ 100m^2 GFA.

Accordingly, it is estimated that the traffic generations for the McDonald's restaurant development are:

- Weekday daily: 506.94 x 4.2 (GFA) = 2,129vpd;
- Weekday AM: 43.26 x 4.2 (GFA) = 182vph;
- Weekday PM: 35.17 x 4.2 (GFA) = 148vph.

Therefore, the traffic generation for the McDonald's restaurant development with 15% cross trade are:

- Weekday daily: 2,129 x 0.85 = 1,810vpd;
- Weekday AM: 182 x 0.85 =155vph; and,
- Weekday PM: 148 x 0.85 = 126vph.

Accordingly, it is estimated that the McDonald's restaurant development would generate approximately **1,810** vehicular trips per typical weekday, with about **155** trips during the typical weekday AM and about **126** trips during the typical weekday PM peak hours. These totals include both inbound and outbound vehicle movements.

Fast food outlets and service stations both attract significant proportion of their customers as passing trade from traffic already passing the site on the adjacent road network. Data from the ITE Trip Generation Handbook (3rd Edition, 2017) indicates that the passing trade is typically around 50% for fast food outlets with drive through facility. The rest of the traffic attracted to the subject site (referred to as primary trips) will come from the surrounding residential areas. For this analysis, it is anticipated that 25% of primary trips will be from the west via Hawksbill Drive and the rest from east of Marmion Avenue or via Marmion Avenue from other areas to the north and south.

The resultant traffic generation calculations are shown in **Table 3**.

Table 3. Estimated peak hour trips for the proposed McDonald's restaurant development

Passing Trade	Daily Trips	AM		PM		Non-passing Trade	Daily Trips	AM		PM	
		IN	OUT	IN	OUT			IN	OUT	IN	OUT
50%	905	39	39	32	31	50%	905	39	39	32	31
	905	**39**	**39**	**32**	**31**		**905**	**39**	**39**	**32**	**31**

The directional split of inbound/outbound trips for the proposed developments is assumed to be about 50/50 for inbound/outbound trips during the peak hours.

Therefore, it is estimated that the proposed developments would generate approximately **2,857** vehicular trips per typical weekday, with about **219** trips during the typical weekday AM and about **197** trips during the typical weekday PM peak hours (allowing for the cross-trade adjustment only). These totals include both inbound and outbound vehicle movements.

8.3 Traffic Flows

The existing traffic flows used as the base for traffic assessment are presented in **Figure 9** which is the outcome of the video traffic survey organised by Transcore on 22 July, 2021.

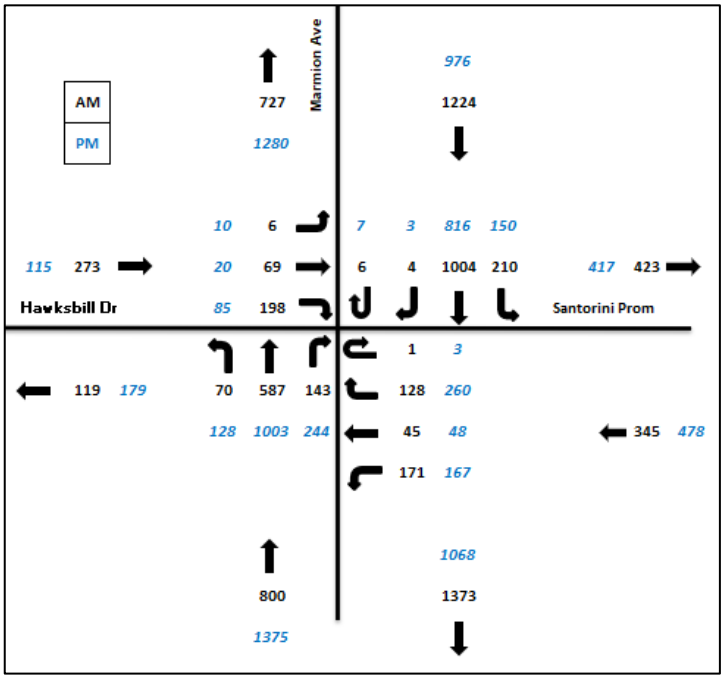


Figure 9. Existing traffic flows at the Marmion Avenue/Hawksbill Drive/Santorini Promenade roundabout – 2021 Weekday AM & PM peak hours

The combined traffic volumes of base, proposed 7-Eleven service station development and the proposed McDonald's restaurant for the post development scenario (year 2022) is presented in **Figure 10**.

In accordance with discussions at a pre-lodgement meeting with Main Roads WA on this project in September 2021, MRWA provided their latest 2021 and 2031 ROM traffic projections for Marmion Avenue north and south of Santorini Promenade. Taking the average of those modelled traffic flows north and south of this roundabout indicates a 40.5% increase in Marmion Avenue traffic over that 10-year period, which equates to an average growth rate of 4.05% per year. Accordingly, through traffic volumes on Marmion Avenue through this roundabout are calculated based on the observed through traffic flows in **Figure 9** plus growth of 4.05% per year.

The updated traffic model prepared by Transcore in April 2021 for the Trinity Alkimos LSP has been referenced for future background traffic volumes for 10-year post development (the year 2032 scenario) to determine all of the other turn movement traffic flows at this roundabout and the resulting total 10-year post development traffic volumes for the proposed developments are presented in **Figure 11**.

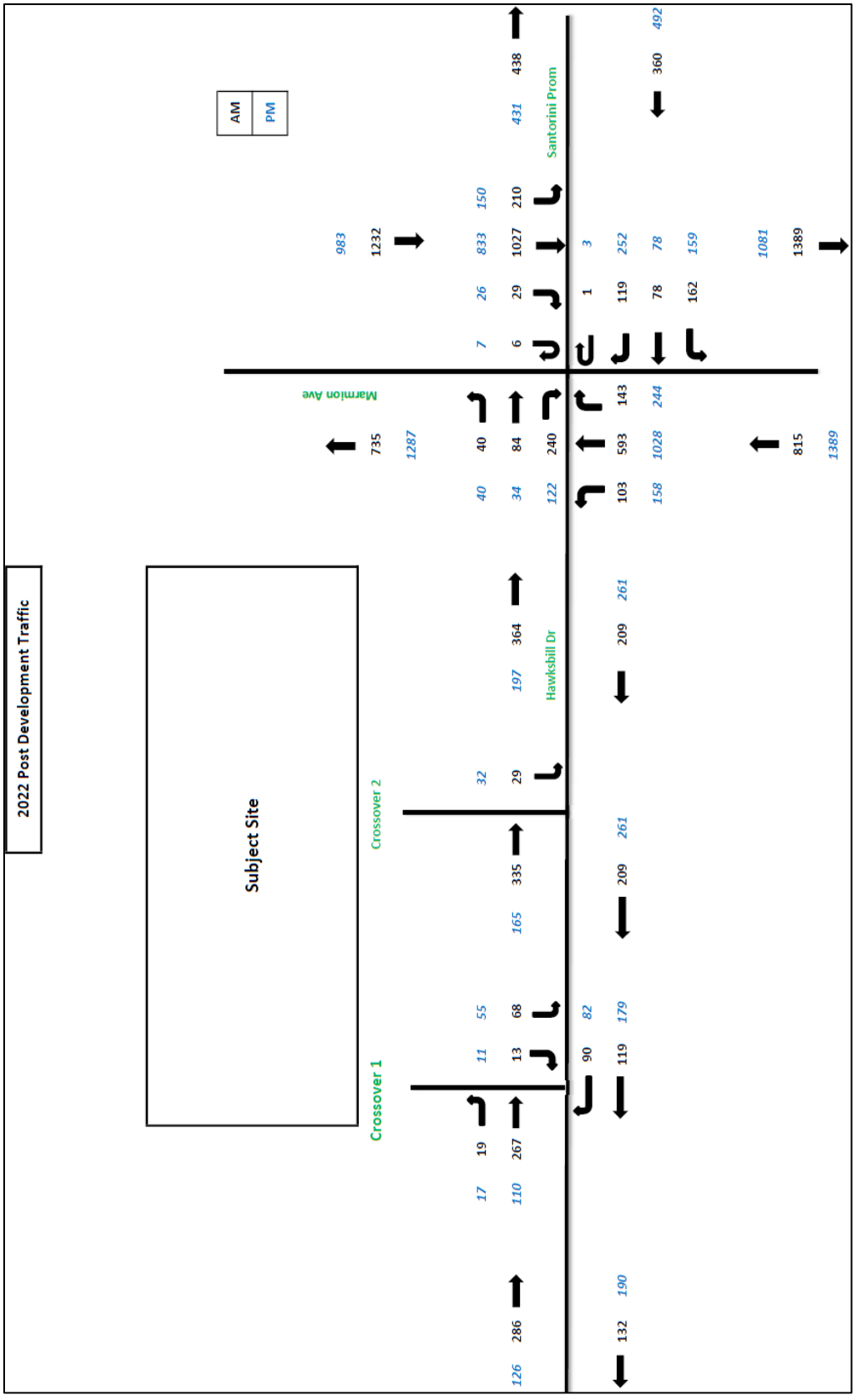


Figure 10. Post development (proposed 7-Eleven development + proposed adjacent McDonald's restaurant development) traffic flows – 2022 Weekday AM and PM peak hours

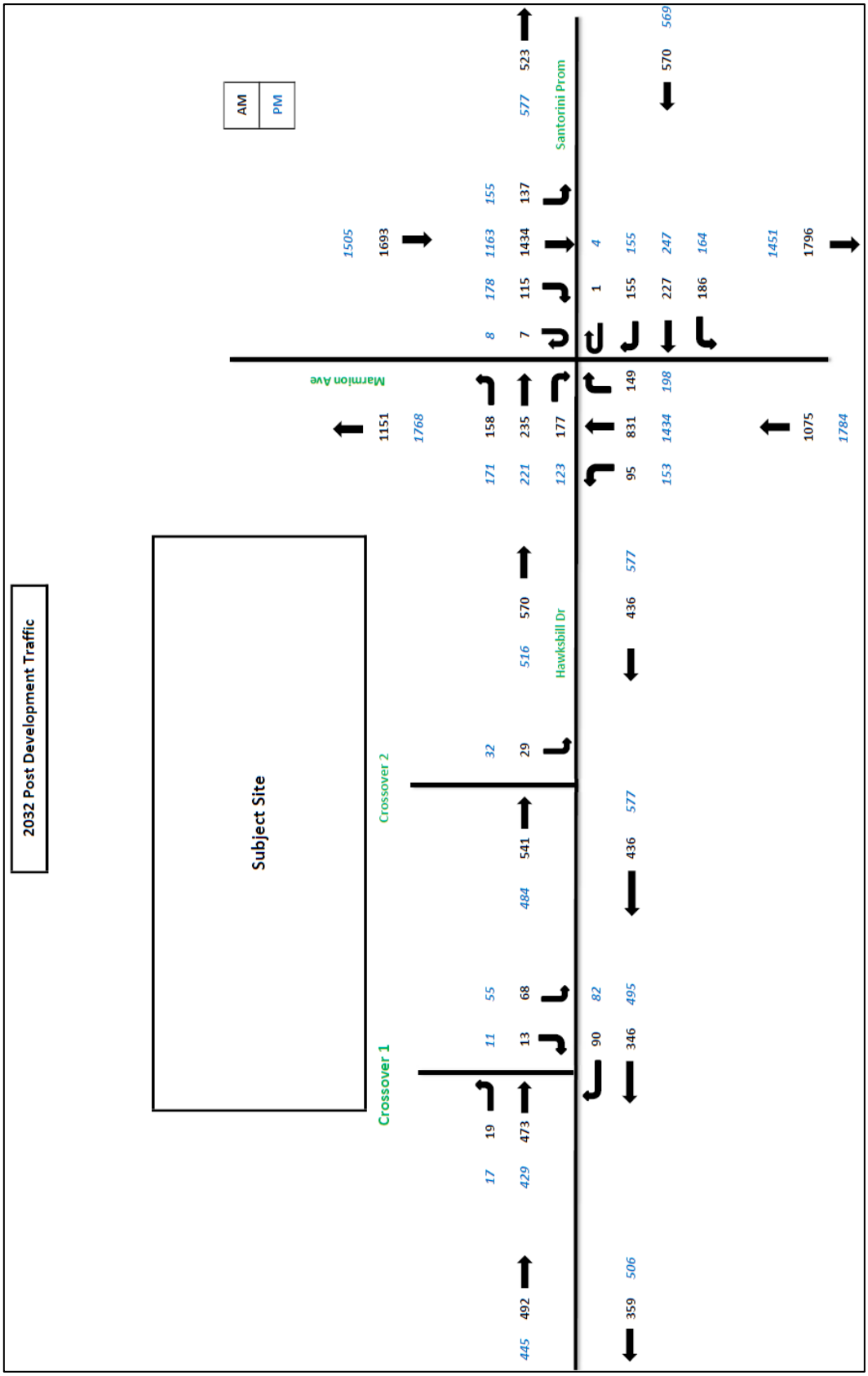


Figure 11. 10-year post development (proposed 7-Eleven development + proposed adjacent McDonald's restaurant development) traffic flows – 3032 Weekday AM and PM peak hours

8.4 Analysis of Local Intersection & Development Crossovers

SIDRA 9.0 intersection analysis has been undertaken for the subject site crossovers on Hawksbill Drive and the roundabout intersection of Marmion Avenue/ Hawksbill Drive/ Santorini Promenade in order to assess their operations in the existing and post development scenarios (2022 and 10-year post development 2032) for weekday AM and PM peak hours. It should be noted that SIDRA analysis was undertaken for combined traffic volumes of the proposed 7-Eleven service station development and the proposed adjacent McDonald's restaurant development.

For the purpose of this assessment, relevant heavy vehicle settings and parameters were updated in accordance with Main Roads WA's latest requirements.

The SIDRA package is a commonly used intersection-modelling tool by traffic engineers for all types of intersections. SIDRA outputs are presented in the form of Degree of Saturation, Level of Service, Average Delay and 95% Queue. These items are defined as follows:

- **Degree of Saturation**: is the ratio of the arrival traffic flow to the capacity of the approach during the same period. The Degree of Saturation ranges from close to zero for varied traffic flow up to one for saturated flow or capacity.
- **Level of Service**: is the qualitative measure describing operational conditions within a traffic stream and the perception by motorists and/or passengers. In general, there are 6 levels of service, designated from A to F, with Level of Service A representing the best operating condition (i.e. free flow) and Level of Service F the worst (i.e. forced or breakdown flow).
- **Average Delay**: is the average of all travel time delays for vehicles through the intersection.
- **95% Queue**: is the queue length below which 95% of all observed queue lengths fall.

The layout of the existing roundabout intersection is illustrated in **Figure 12** and the layout of the modelled network for the post development scenario and 10-year post development scenario are illustrated in **Figure 13** and **Figure 14**.

The results of SIDRA analysis of full movement crossover (crossover 1), left turn exit only crossover (crossover 2) on Hawksbill Drive and the roundabout intersection of Marmion Avenue/ Hawksbill Drive/ Santorini Promenade for the post-development scenarios (2022 and 2032) during AM and PM peak traffic periods are reported in **Table 4** to **Table 18** in **Appendix C** and discussed in the following paragraphs.

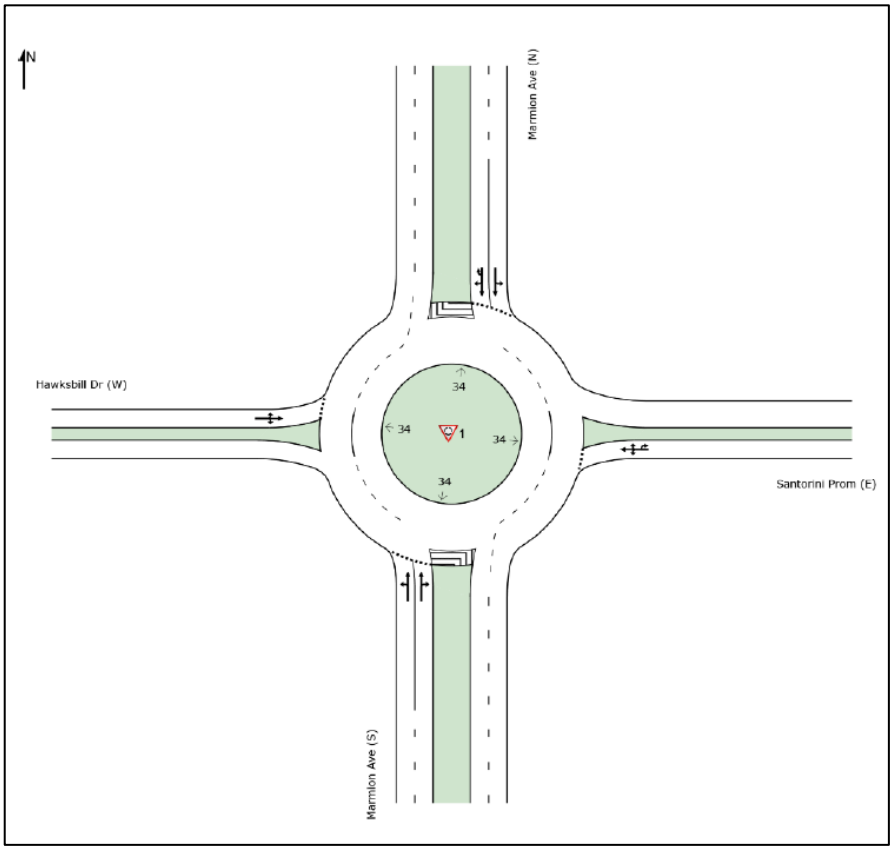


Figure 12. SIDRA layout – Existing roundabout intersection of Marmion Avenue/ Hawksbill Drive/ Santorini Promenade

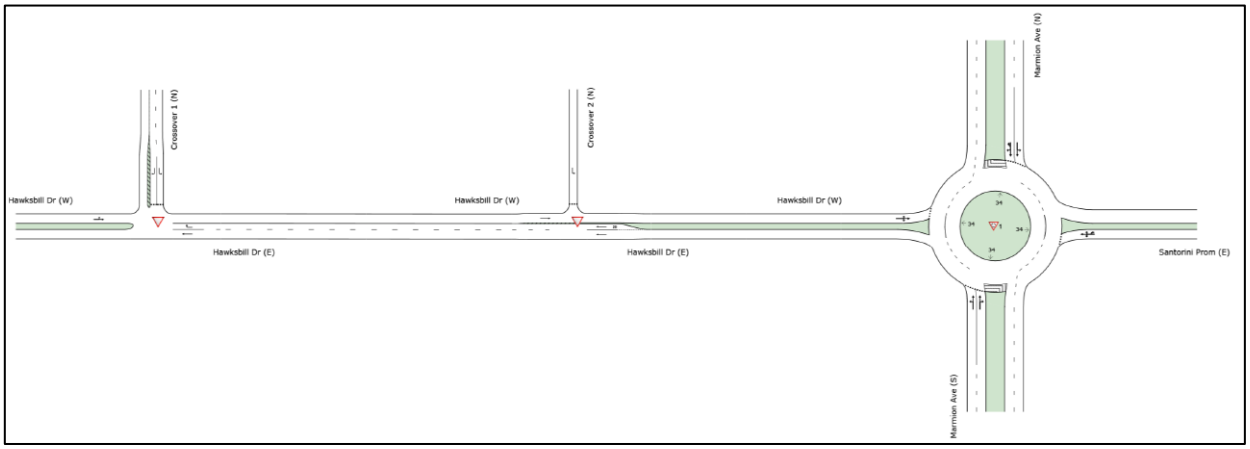


Figure 13. SIDRA Network layout for post development scenario (2022)

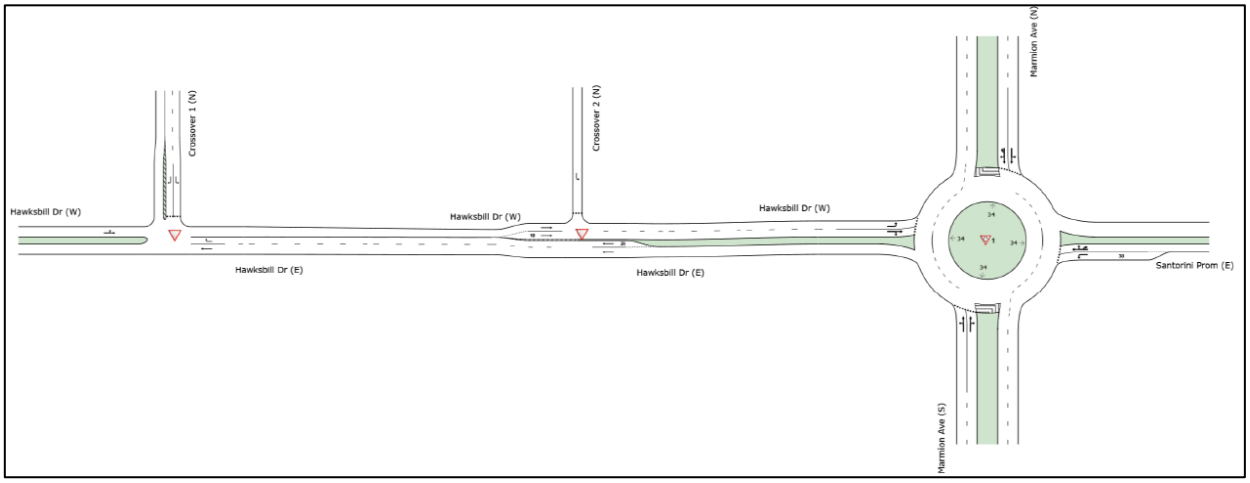


Figure 14. SIDRA Network layout for 10-year post development scenario (2032)

Hawksbill Drive full movement crossover (crossover 1)

The SIDRA results for the full movement crossover on Hawksbill Drive indicate that this crossover would operate at a very good overall Level of Service (LoS) A during typical AM and PM peak periods in the post development scenarios (both 2022 and 2032).

It should be noted that the 2032 SIDRA analysis (Table 12 AM and Table 13 PM) indicates the right turn movement has a 95the percentile queue of only 0.4 and 0.3 vehicles (2032 AM and PM peaks, respectively), so the proposed right turn lane on Hawksbill Drive provides more than sufficient storage space for vehicles turning right from Hawksbill Drive into the site.

Hawksbill Drive left turn exit only crossover (crossover 2)

The SIDRA results for left turn exit only crossover on Hawksbill Drive indicate that this crossover would also operate with overall Level of Service (LoS) A during typical AM and PM peak periods in the post development scenarios (both 2022 and 2032).

Roundabout Intersection of Marmion Avenue/ Hawksbill Drive/ Santorini Promenade

Existing and post development scenario

SIDRA results indicate that the roundabout intersection is currently operating with Level of Service A to C with approximately 2 vehicles queue back in AM peak hour and 1 vehicle queue back in PM peak hour on Hawksbill Drive eastbound.

The SIDRA results for the post development scenario confirms that the addition of traffic generated by the proposed developments will not have a material impact on the operation of this roundabout intersection which retains the current level of services and records marginal increases in queues and delays in this scenario. Importantly, the queue back on Hawksbill Drive eastbound does not extend to the development crossovers on Hawksbill Drive.

Year 2032 – 10 Year post development scenario

Based on the SIDRA results by 2032 separate left turn approach lanes will need to be provided on Hawksbill Drive eastbound and Santorini Promenade westbound and SIDRA analysis for 2032 scenario was undertaken with these anticipated upgrades. It is important to note that the need for these upgrades is as a result of the assumed traffic growth on Marmion Avenue and not the proposed developments traffic.

SIDRA results for 2032 scenario indicates that, with the assumed upgrades, the roundabout intersection will operate satisfactorily with all movements at level of service A to C except for one right turn and one U-turn at level of service D on Santorini Promenade approach in the 2032 AM peak hour.

It is reported that the 95% queue on Hawksbill Drive eastbound in PM peak hour is 58.9m which only just extends to the centre line of the full movement crossover on Hawksbill Drive. Further, it should be noted that 95% of time during the PM peak hour, the queue would be less that that reported in SIDRA (58.9m) and therefore this length of queue would occur during 5% of this peak hour which is equivalent to 3 minutes only. The reported average queue length (50% of the peak hour) on this approach is 23.7m. Please refer to the result of average queue in the year 2032 PM peak hour in **Table 18**.

Therefore, it is considered that the impact of the development traffic on this intersection is not significant and the traffic operations are satisfactory.

8.5 Impact on Surrounding Roads

The WAPC Transport Impact Assessment Guidelines (2016) provides guidance on the assessment of traffic impacts:

"As a general guide, an increase in traffic of less than 10 per cent of capacity would not normally be likely to have a material impact on any particular section of road, but increases over 10 per cent may. All sections of road with an increase greater than 10 per cent of capacity should therefore be included in the analysis. For ease of assessment, an increase of 100 vehicles per hour for any lane can be considered as equating to around 10 per cent of capacity. Therefore, any section of road where the structure plan traffic would increase flows by more than 100 vehicles per hour for any lane should be included in the analysis."

The proposed developments will not increase traffic flows near the quoted WAPC threshold to warrant further detailed analysis

8.6 Impact on Neighbouring Areas

The traffic generated by the proposed developments will have an insignificant impact on the surrounding areas.

8.7 Traffic Noise and Vibration

It generally requires a doubling of traffic volumes on a road to produce a perceptible 3dB increase in road noise. The proposed developments will not increase traffic volumes or noise on surrounding roads anywhere near this level.

9 Parking

The proposed 7-Eleven service station provides a total of 11 car parking bays (including one ACROD bay and one 'air & water' bay) for the use of customers and staff.

A dedicated loading bay for service vehicles is provided immediately on the northernmost side of the convenience store building.

It is Transcore's understanding that sufficient parking supply is provided to address the parking requirements of the proposed development.

The proposed on-street parking bays on Hawksbill Drive shown on the site plan are related to the proposed McDonalds development and are not part of the service station development application.

10 Provision for Heavy Vehicles

The largest heavy vehicle which is expected to use the subject site is a 17.25m fuel tanker for fuel deliveries. The 17.25m fuel tanker would enter the site via the full movement crossover (crossover 1) on Hawksbill Drive, access the fill point and exit the site after delivering the fuel via the left turn exit only crossover (crossover 2) on Hawksbill Drive. Turn path analysis undertaken for a 17.25m fuel tanker confirms satisfactory access, circulation and egress. In particular it can be seen from the turn path analysis at Appendix B that the proposed right turn lane on Hawksbill Drive accommodates this fuel tanker without obstructing other through traffic in the through lanes on Hawksbill Drive.

It is anticipated that fuel deliveries will be undertaken outside the peak operating hours of the service station.

Deliveries and waste collection will be accommodated within the site. Service vehicles are anticipated to enter the site via the full movement crossover (crossover 1) on Hawksbill Drive, then reverse back into the service yard adjacent to the convenience store building for loading and unloading purposes. The service vehicles will exit the site via the left turn exit only crossover (crossover 2) on Hawksbill Drive in forward gear.

Turn path analysis undertaken for a 12.5m service vehicle confirms satisfactory access, egress and circulation as presented in **Appendix B**.

11 Stacking Capacity and Queue Analysis

The stacking capacity of the service station and queue analysis at the filling points have been assessed in more detail to investigate the impacts of higher-than-average site patronage during peak weekday operational periods (i.e., "cheap fuel days"). This sensitivity analysis was undertaken in order to confirm the capacity of the service station to operate satisfactorily under amplified traffic activity conditions.

Stacking Capacity

As discussed in **Section 8.2** of this report the highest peak hour trip generation for the proposed service station is estimated to be 84 (42 inbound/42 outbound) trips during the weekday PM peak hour period (overall peak service station trip generation). It is assumed that all bowsers will be in operation during this peak period and each patron is free to choose which queuing line to join.

The 42 inbound trips during the peak hour across 6 fill points results in seven cars being serviced per fill point in one hour (42/6 = 7). This results in an average of 8.5 minutes for each car at each fill point to be serviced (60/7 = 8.5). However, practical experience indicates that the typical rate of service per fill point (time taken for a vehicle to arrive, park at a fill point, get fuel, pay for fuel and leave the fill point and service station site) is usually around three minutes during peak times. If conservatively a five-minute service time is adopted then up to 12 cars can be serviced per fill point within one hour (60/5 = 12) which in turn results in up to 72 cars in total serviced in one hour within the service station (12 cars x 6 bowsers = 72 cars/hour).

This analysis indicates that conservatively the service station can service 30 more vehicles than the highest peak hour trip rate. However, as evident from the site plan, in addition to the 6 vehicles parked at the bowsers, at least another 6 vehicles can comfortably be stacked behind the cars filling up at the bowsers without impacting the traffic circulations within the site and additional 11 vehicles can also park in the parking areas.

Therefore, it is concluded that under peak operating conditions no stacking or queue backs onto Hawksbill Drive are expected.

Queue length analysis model

As an alternative methodology to the stacking capacity analysis, Transcore has undertaken a queuing analysis. This queuing analysis, is based on Austroads guidelines, and has been undertaken by Transcore for other service station applications and uses the critical weekday peak hour (PM peak hour) traffic generation and conservative service rate of 5 minutes per bowser.

A queue length analysis was undertaken to assess the provision of storage for vehicles within the service channels. For this purpose, an M/M/1 queuing model was adopted for each bowser. The M/M/1 is a single-server queue model that can be used to approximate simple systems.

The queuing model adopts the following assumptions:

- Vehicles arrive unevenly following Poisson's probability distribution;
- Service time is exponentially distributed;
- There is one server per queue;
- The capacity of the queue in which arriving users wait before being served is infinite (for the purposes of identifying queue space requirements);
- The population of users (i.e., the pool of users) available to join the system is infinite; and,
- The queue is serviced on a first come, first served basis.

The results of the queuing analysis are detailed in **Figure 15**.

M/M/s - Car Park Queuing Analysis (Poisson Arrival and Service Rates)

M/M/s	vph	vps	
Arrival rate	42	0.011667	
Service rate	12	0.003333	
Number of servers	6	6	
Utilization	58.33%	58.33%	
P(0), probability that the system is empty	0.0290	0.0290	
Lq, expected queue length	0.2485	6.0000	(metres)
L, expected number in system	3.7485	24.0000	(metres)
Wq, expected time in queue	0.0059	21.2961	(seconds)
W, expected total time in system	0.0892	321.2961	(seconds)
Probability that a customer waits	0.1775	0.1775	
95% Queue	8.0000	48.0000	(metres)

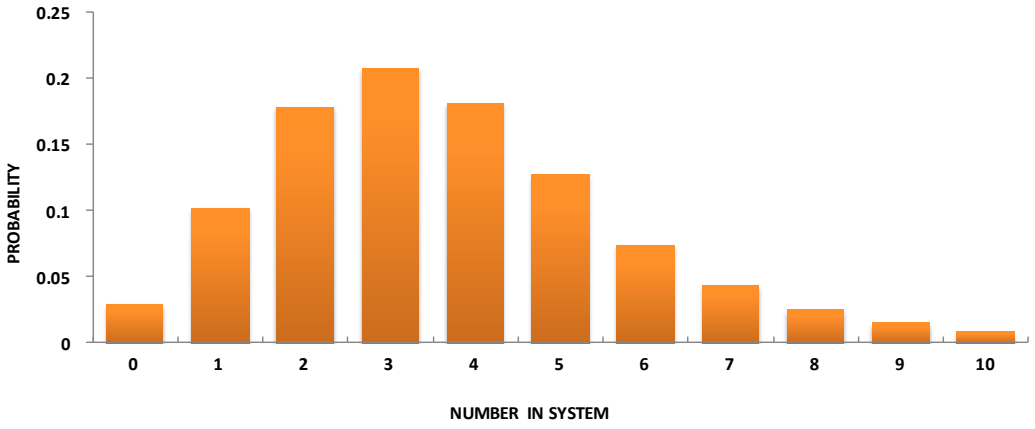


Figure 15. Peak restaurant drive-through weekday morning hour queuing analysis

In summary, critical peak hour queuing analysis of the service station established the following:

- The system utilisation rate is 58% during the PM peak hour;
- The number of fill points in the system (refuelling) is 6;
- The expected time in the queue for a vehicle to get to a fill point is 21 seconds;
- The expected total time in the system is 321 seconds; and,
- The 95th percentile queue within the whole system is 8 vehicles (6 vehicles refuelling and 2 vehicles waiting).

However, as stated earlier, at least another 6 vehicles can be stacked behind the cars filling up at the bowsers without impacting the traffic circulations within the proposed development. This is 4 vehicles more than the 95th percentile (8 vehicles) queue reported. According to the queuing analysis, this site can accommodate almost twice the typical PM peak hour queuing at the bowsers. Therefore, it is concluded that under typical peak conditions all queueing will be accommodated within the subject site and no stacking or queue backs onto Hawksbill Drive are expected.

12 Public Transport Access

The existing public transport services in the area are described in **Section 3.4** of this report.

13 Pedestrian and Cyclist Access

Pedestrian and cyclist's facilities are described in **Section 3.5** of this report.

14 Conclusions

This Transport Impact Assessment (TIA) has been prepared by Transcore on behalf of LWP Capital Pty Ltd with regards to the proposed 7-Eleven service station to be located within the eastern portion of Lot 9065 (101) Chateau Avenue, Alkimos in the City of Wanneroo. The development proposal contemplates a new service station at the subject site.

The subject lot is located at the northwest corner of the Marmion Avenue/ Hawksbill Drive/ Santorini Promenade roundabout intersection. The western portion of the site is proposed to be developed as a McDonald's restaurant with drive through facility, which does not form part of the 7-Eleven service station development application and is subject to a separate development application. The assessment undertaken in this report allows for the traffic generation of both proposed developments.

The subject site is currently vacant. The proposed development for the subject lot entails a full movement crossover on Hawksbill Drive between the proposed 7-Eleven service station site and the McDonald's restaurant site, a left turn exit only crossover from the proposed 7-Eleven service station site onto Hawksbill Drive and an exit only driveway from the McDonald's restaurant site to Carlsbad Promenade on the northern side of the site.

It is Transcore's understanding that sufficient parking supply is provided to address the parking requirement for the proposed developments.

The results of SIDRA network analysis undertaken for the combined traffic from both developments indicates that the developments crossovers operate satisfactorily with acceptable queues and delays for both post development (2022) and 10-year post development (2032) scenarios. The analysis further demonstrates that the addition of development traffic for post development scenario will have insignificant impact on the traffic operations of the roundabout intersection of Marmion Avenue/ Hawksbill Drive/ Santorini Promenade. Importantly, the queue back on Hawksbill Drive eastbound does not extend to the development crossovers on Hawksbill Drive.

SIDRA analysis for 2032 scenario was undertaken with appropriate traffic growth factor on Marmion Avenue. The SIDRA analysis indicates that by year 2032, the Hawksbill Drive eastbound and Santorini Promenade westbound approaches to the roundabout will need to entail two lanes. These upgrades are a result of the traffic growth on Marmion Avenue and are not related to the proposed developments.

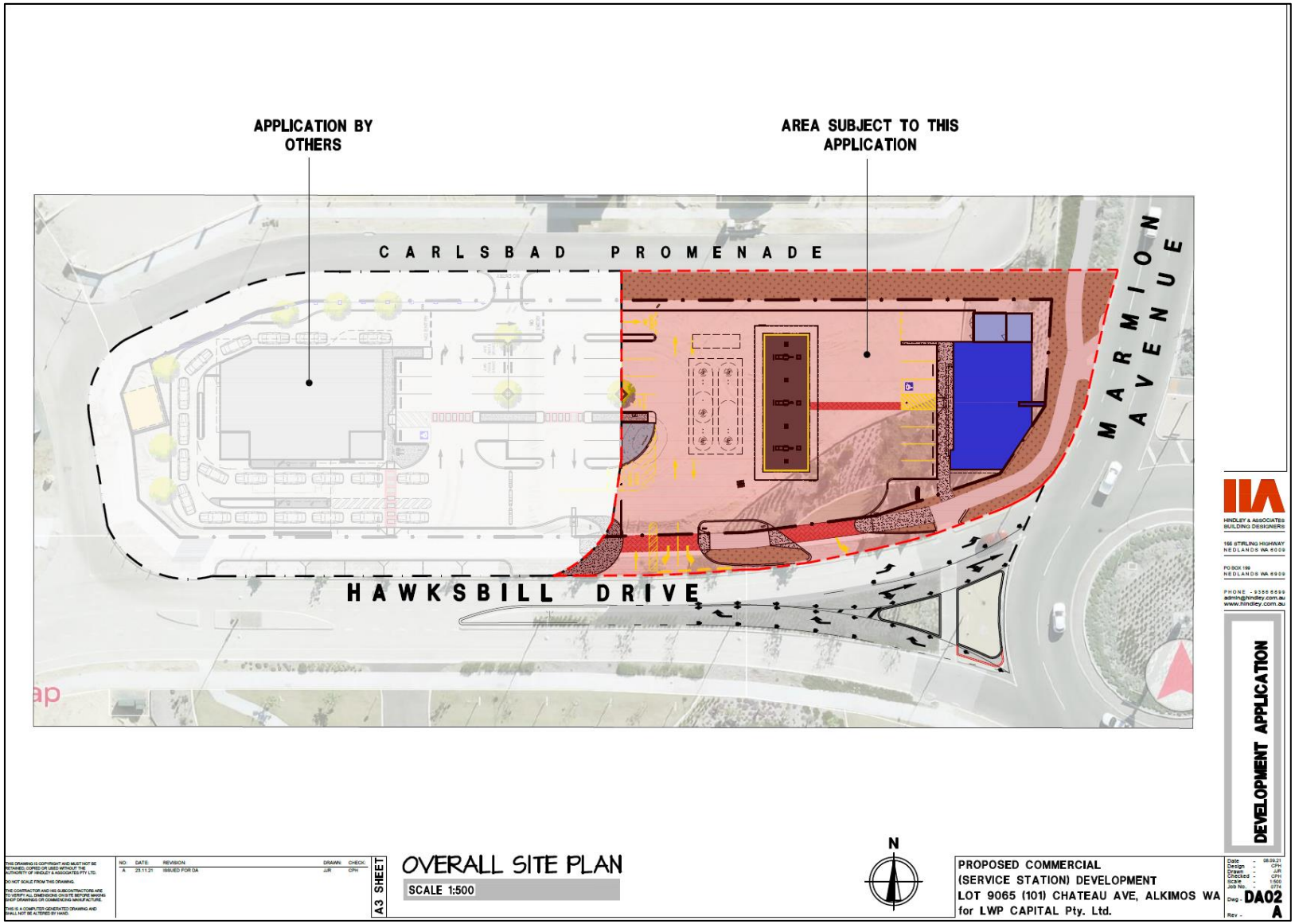
The SIDRA result with the anticipated upgrades confirms that the roundabout intersection will operate satisfactorily with acceptable level of service, queues and delays. The SIDRA result indicates that the reported 95% queue on Hawksbill Drive eastbound in the 2032 PM peak hour is 58.9m which only just extends to the centre line of the full movement crossover on Hawksbill Drive. Further, it should be noted that 95% of time during the PM peak hour, the queue would be less that that reported in SIDRA (58.9m) and therefore this length of queue would occur during 5% of this peak hour which is equivalent to 3 minutes only. The reported average queue length (50% of the peak hour time) on this approach is 23.7m.

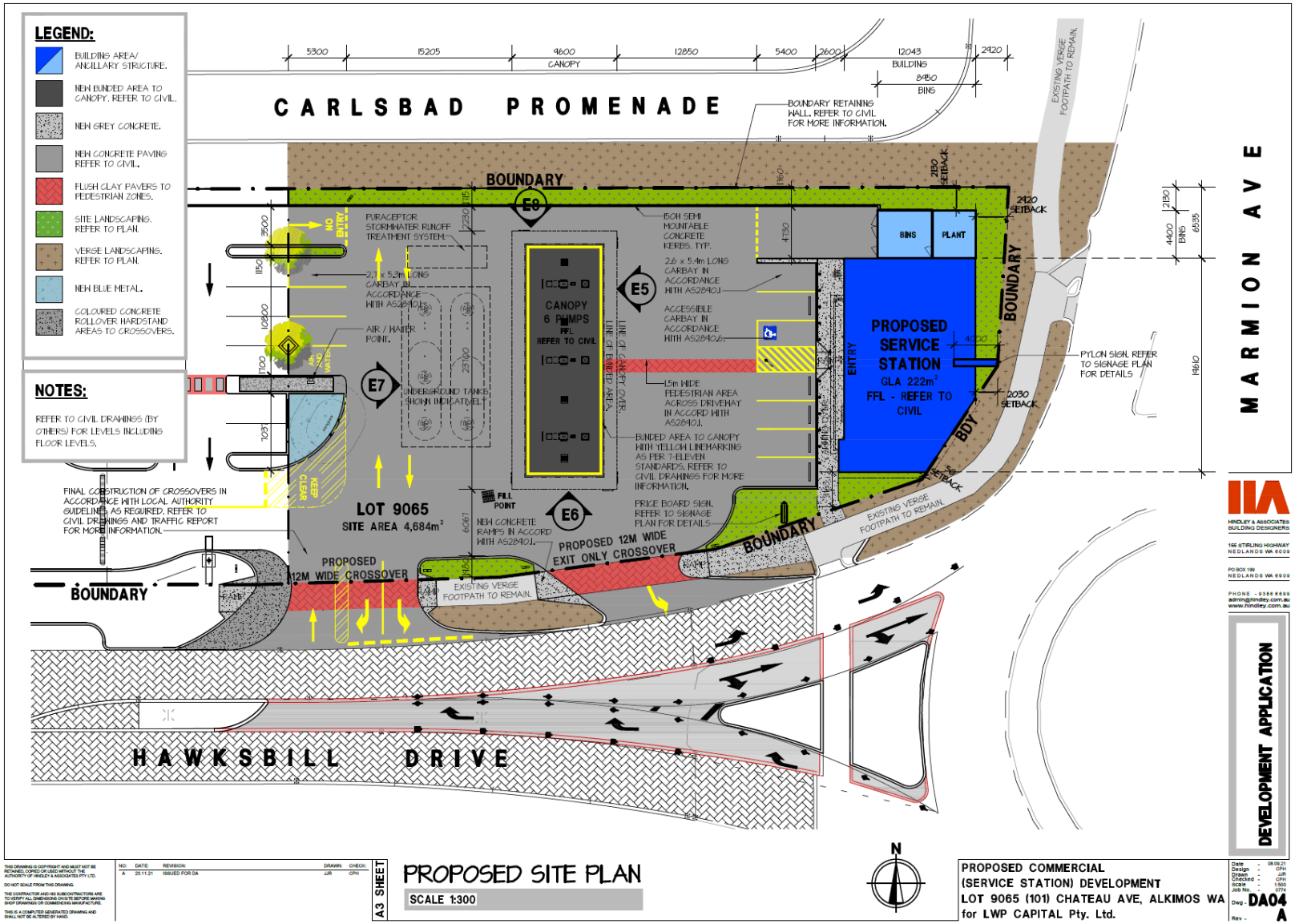
Accordingly, it is concluded that the developments traffic will not have a significant impact on the operations of the surrounding roads and intersection.

In conclusion, the findings of this Transport Impact Assessment are supportive of the proposed development.

Appendix A

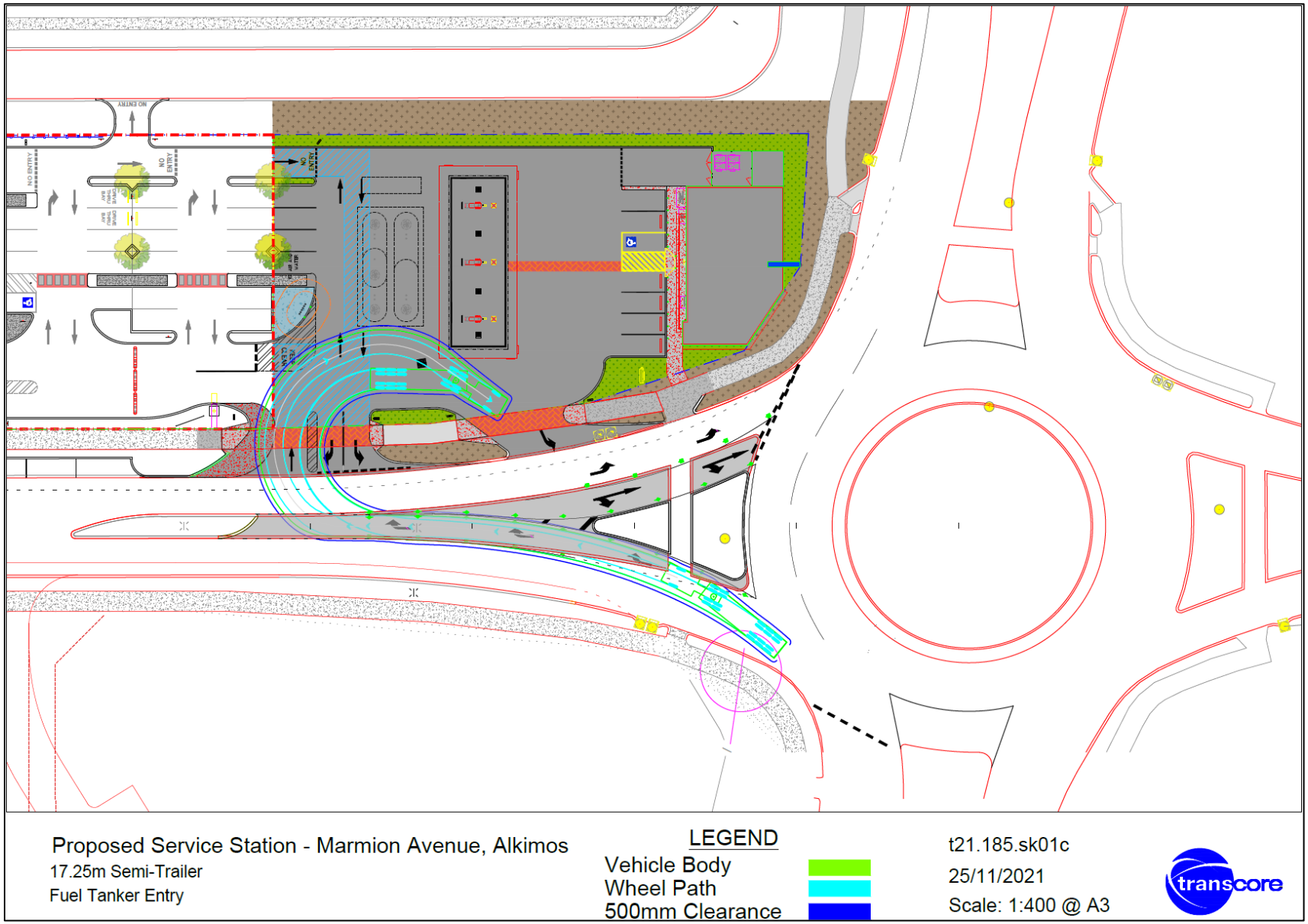
PROPOSED DEVELOPMENT PLAN

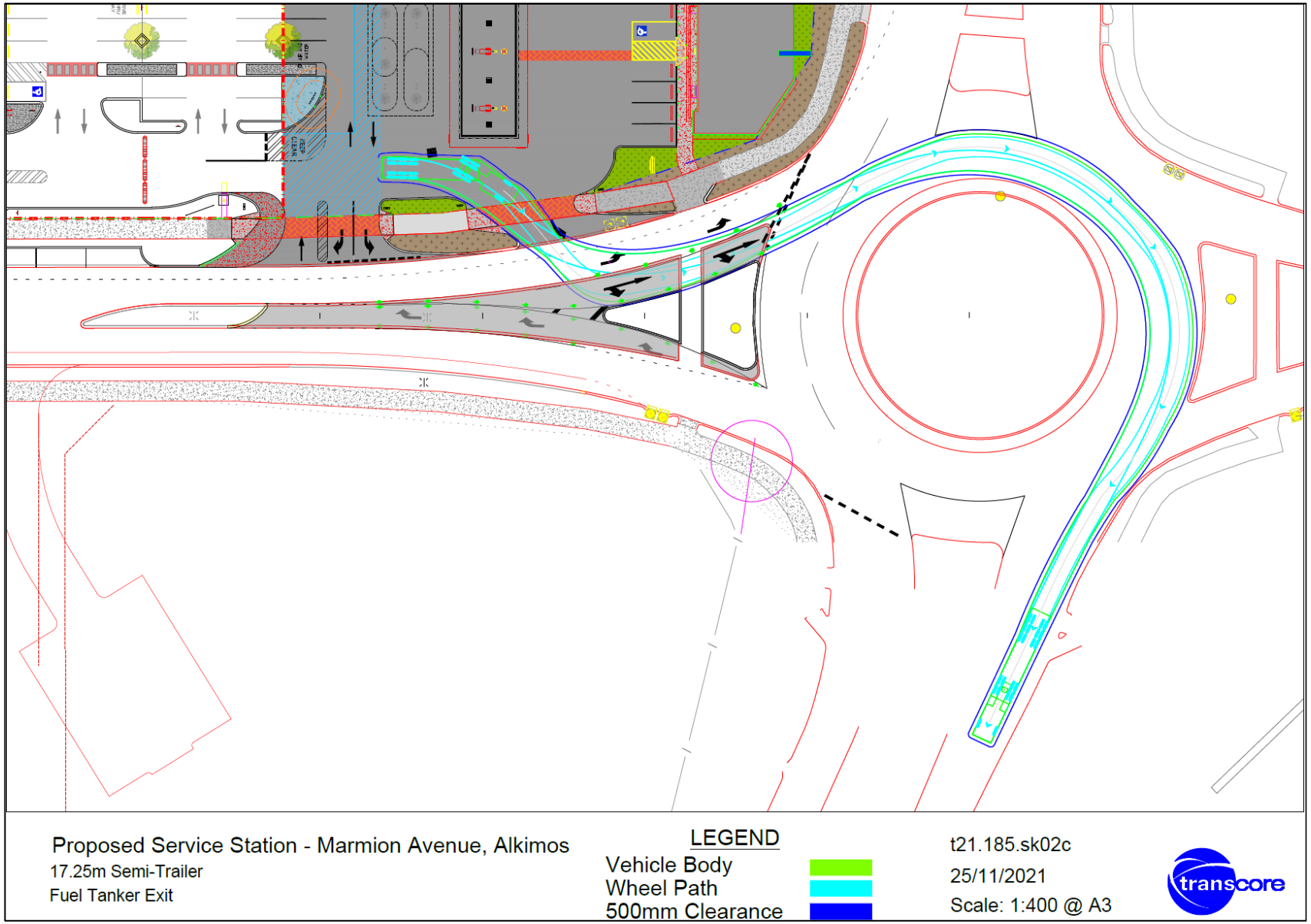

APPLICATION BY OTHERS
AREA SUBJECT TO THIS APPLICATION
CARLSBAD PROMENADE
MARMION AVENUE
HAWKSBILL DRIVE
OVERALL SITE PLAN
SCALE 1:500
A3 SHEET
N
PROPOSED COMMERCIAL
(SERVICE STATION) DEVELOPMENT
LOT 9065 (101) CHATEAU AVE, ALKIMOS WA
for LWP CAPITAL Pty. Ltd.
DEVELOPMENT APPLICATION
DA02
A


LEGEND:
BUILDING AREA/ ANCILLARY STRUCTURE.
NEW BUNDED AREA TO CANOPY. REFER TO CIVIL.
NEW GREY CONCRETE.
NEW CONCRETE PAVING REFER TO CIVIL.
FLUSH CLAY PAVERS TO PEDESTRIAN ZONES.
SITE LANDSCAPING. REFER TO PLAN.
VERGE LANDSCAPING. REFER TO PLAN.
NEW BLUE METAL.
COLOURED CONCRETE ROLLOVER HARDSTAND AREAS TO CROSSOVERS.
NOTES:
REFER TO CIVIL DRAWINGS (BY OTHERS) FOR LEVELS INCLUDING FLOOR LEVELS.
CARLSBAD PROMENADE
MARMION AVE
HAWKSBILL DRIVE
BOUNDARY
CANOPY
BUILDING
BINS
PROPOSED SERVICE STATION
GLA 222m²
FFL - REFER TO CIVIL
PYLON SIGN. REFER TO SIGNAGE PLAN FOR DETAILS
LOT 9065
SITE AREA 4,684m²
PROPOSED 12M WIDE CROSSOVER
PROPOSED 12M WIDE EXIT ONLY CROSSOVER
EXISTING VERGE FOOTPATH TO REMAIN.
PURACEPTOR STORMWATER RUNOFF TREATMENT SYSTEM
CANOPY 6 PUMPS FFL REFER TO CIVIL
UNDERGROUND TANKS SHOWN INDICATIVELY
AIR / WATER POINT.
FILL POINT
BINS
PLANT
ENTRY
NO ENTRY
KEEP CLEAR
E5
E6
E7
E8
PROPOSED SITE PLAN
SCALE 1:300
A3 SHEET
PROPOSED COMMERCIAL (SERVICE STATION) DEVELOPMENT
LOT 9065 (101) CHATEAU AVE, ALKIMOS WA
for LWP CAPITAL Pty. Ltd.
DEVELOPMENT APPLICATION
DA04
A

Appendix B

Turn Path Plans


Proposed Service Station - Marmion Avenue, Alkimos
17.25m Semi-Trailer
Fuel Tanker Entry
LEGEND
Vehicle Body
Wheel Path
500mm Clearance
t21.185.sk01c
25/11/2021
Scale: 1:400 @ A3
transcore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17.25m Semi-Trailer
Fuel Tanker Exit
LEGEND
Vehicle Body
Wheel Path
500mm Clearance
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25/11/2021
Scale: 1:400 @ A3
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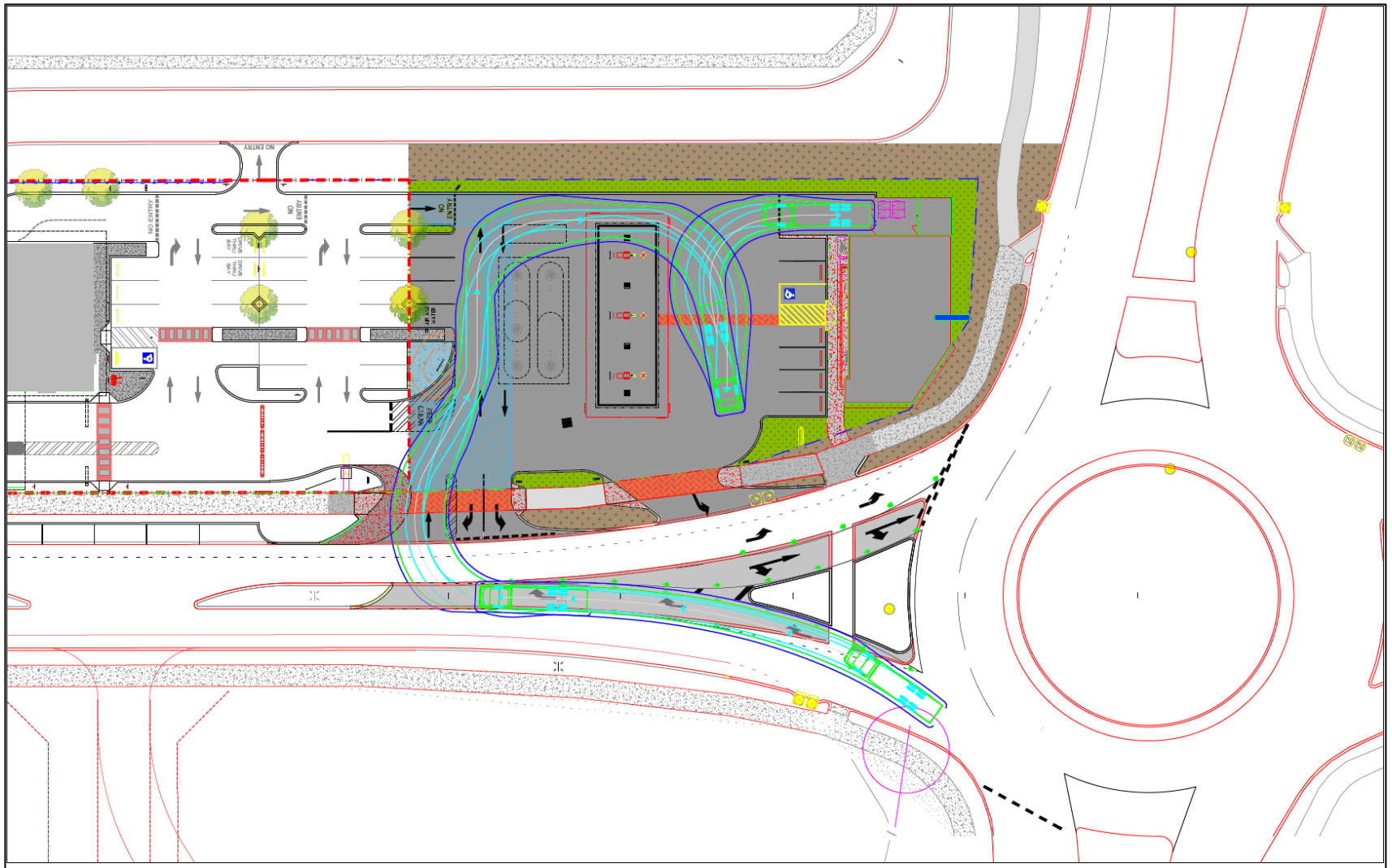
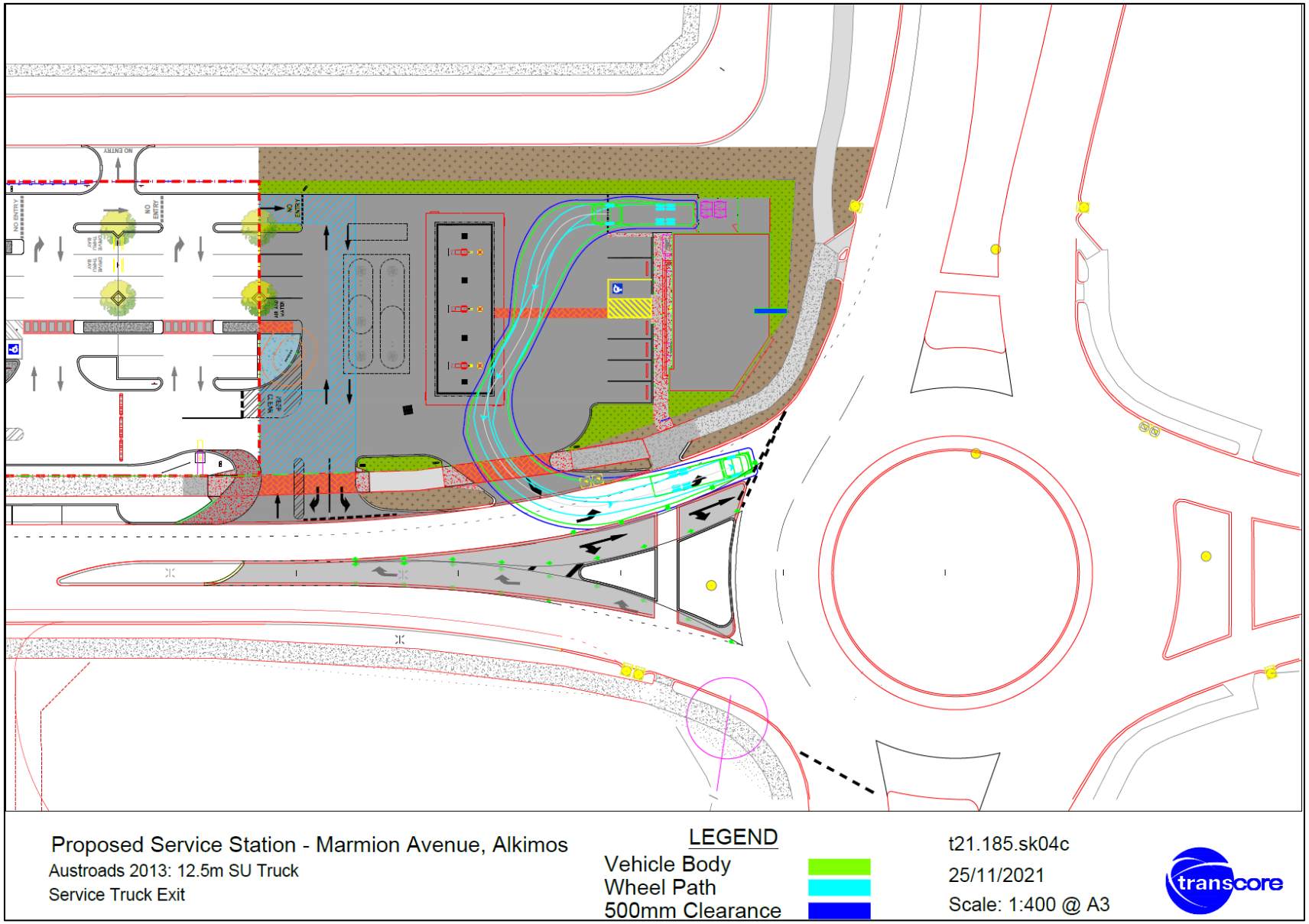
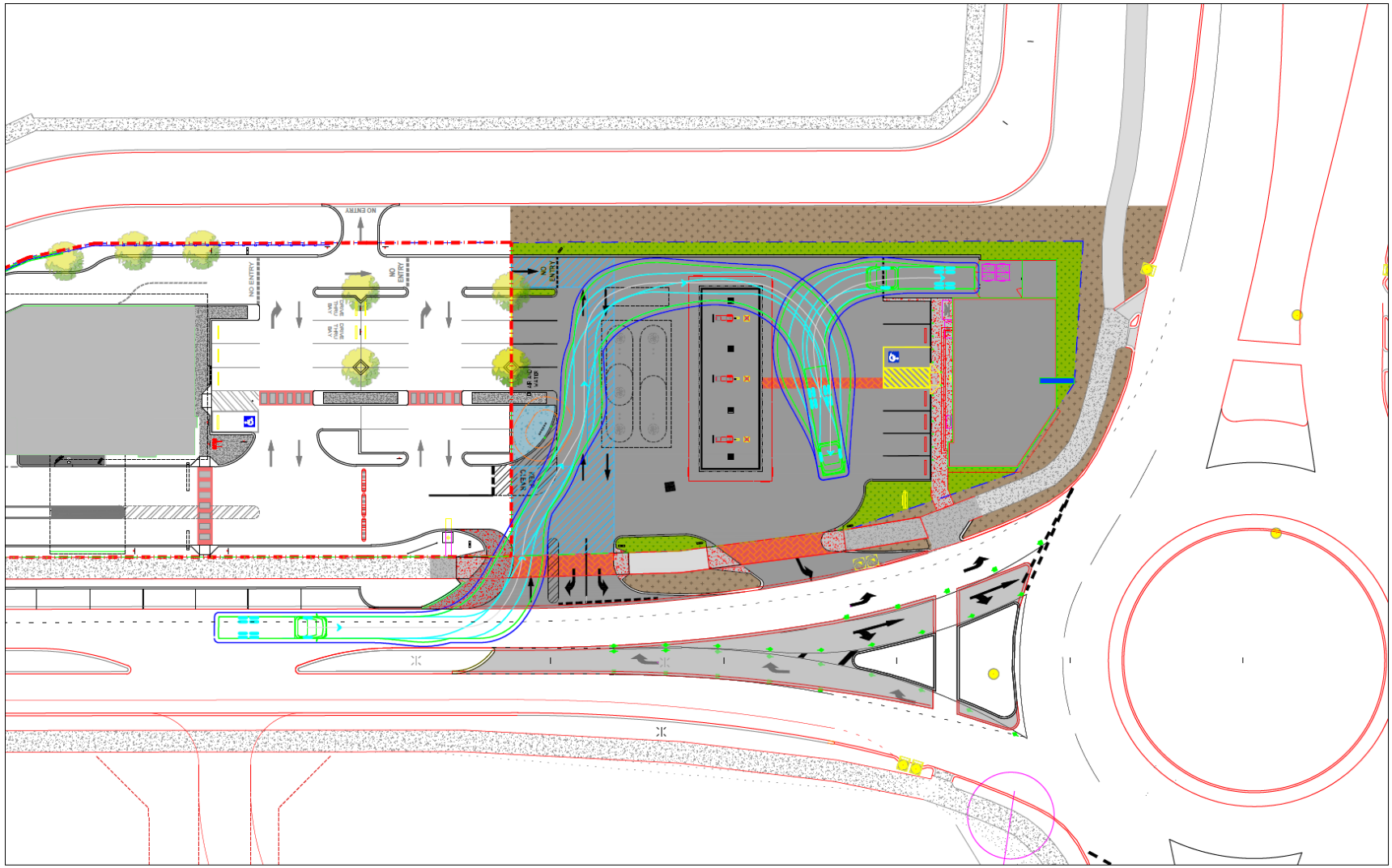

Proposed Service Station - Marmion Avenue, Alkimos
Austroads 2013: 12.5m SU Truck
Service Truck Entry - option 1
LEGEND
Vehicle Body
Wheel Path
500mm Clearance
t21.185.sk03c
25/11/2021
Scale: 1:400 @ A3
transcore


Proposed Service Station - Marmion Avenue, Alkimos
Austroads 2013: 12.5m SU Truck
Service Truck Exit
LEGEND
Vehicle Body
Wheel Path
500mm Clearance
t21.185.sk04c
25/11/2021
Scale: 1:400 @ A3
transcore



Proposed Service Station - Marmion Avenue, Alkimos
Austroads 2013: 12.5m SU Truck
Service Truck Entry - option 2

LEGEND
Vehicle Body
Wheel Path
500mm Clearance

t21.185.sk05a
25/11/2021
Scale: 1:400 @ A3

Appendix C

SIDRA Results

Table 4. SIDRA results for the roundabout intersection of Marmion Avenue/ Hawksbill Drive/ Santorini Promenade – 2021 Weekday AM peak period (Existing)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Marmion Ave (S)														
1	L2	70	2.9	74	2.9	0.303	6.1	LOS A	2.1	16.6	0.42	0.52	0.42	55.2
2	T1	587	9.2	618	9.2	0.303	6.7	LOS A	2.1	16.6	0.43	0.55	0.43	63.4
3	R2	143	2.8	151	2.8	0.303	13.0	LOS B	2.0	15.5	0.44	0.60	0.44	60.6
Approach		800	7.5	842	7.5	0.303	7.7	LOS A	2.1	16.6	0.43	0.56	0.43	62.0
East: Santorini Prom (E)														
4	L2	171	4.1	180	4.1	0.569	8.1	LOS A	3.5	27.3	0.82	0.98	1.04	50.6
5	T1	45	0.0	47	0.0	0.569	7.5	LOS A	3.5	27.3	0.82	0.98	1.04	44.3
6	R2	128	5.5	135	5.5	0.569	13.5	LOS B	3.5	27.3	0.82	0.98	1.04	48.0
6u	U	1	100.0	1	100.0	0.569	20.2	LOS C	3.5	27.3	0.82	0.98	1.04	22.6
Approach		345	4.4	363	4.4	0.569	10.1	LOS B	3.5	27.3	0.82	0.98	1.04	48.7
North: Marmion Ave (N)														
7	L2	210	3.8	221	3.8	0.527	7.5	LOS A	4.2	32.2	0.67	0.64	0.67	51.7
8	T1	1004	5.4	1057	5.4	0.527	8.4	LOS A	4.2	32.2	0.69	0.68	0.71	62.3
9	R2	4	0.0	4	0.0	0.527	14.9	LOS B	4.1	31.7	0.70	0.71	0.74	54.1
9u	U	6	0.0	6	0.0	0.527	17.9	LOS B	4.1	31.7	0.70	0.71	0.74	63.4
Approach		1224	5.1	1288	5.1	0.527	8.3	LOS A	4.2	32.2	0.69	0.67	0.70	60.9
West: Hawksbill Dr (W)														
10	L2	6	0.0	6	0.0	0.343	4.7	LOS A	1.5	11.3	0.62	0.78	0.63	49.2
11	T1	69	1.5	73	1.5	0.343	4.3	LOS A	1.5	11.3	0.62	0.78	0.63	45.1
12	R2	198	3.5	208	3.5	0.343	10.2	LOS B	1.5	11.3	0.62	0.78	0.63	52.4
Approach		273	2.9	287	2.9	0.343	8.6	LOS A	1.5	11.3	0.62	0.78	0.63	50.8
All Vehicles		2642	5.5	2781	5.5	0.569	8.4	LOS A	4.2	32.2	0.62	0.69	0.66	58.4

Table 5. SIDRA results for the roundabout intersection of Marmion Avenue/ Hawksbill Drive/ Santorini Promenade – 2021 Weekday PM peak period (Existing)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Marmion Ave (S)														
1	L2	128	1.6	135	1.6	0.558	7.0	LOS A	4.9	36.6	0.67	0.59	0.67	54.0
2	T1	1003	1.8	1056	1.8	0.558	7.5	LOS A	4.9	36.6	0.68	0.63	0.68	63.3
3	R2	244	1.2	257	1.2	0.558	14.2	LOS B	4.6	34.7	0.69	0.69	0.70	59.0
Approach		1375	1.7	1447	1.7	0.558	8.6	LOS A	4.9	36.6	0.68	0.64	0.68	61.5
East: Santorini Prom (E)														
4	L2	167	1.2	176	1.2	0.627	6.8	LOS A	4.1	30.2	0.77	0.96	0.99	51.8
5	T1	48	0.0	51	0.0	0.627	6.4	LOS A	4.1	30.2	0.77	0.96	0.99	44.5
6	R2	260	0.4	274	0.4	0.627	12.2	LOS B	4.1	30.2	0.77	0.96	0.99	49.8
6u	U	3	0.0	3	0.0	0.627	14.2	LOS B	4.1	30.2	0.77	0.96	0.99	25.6
Approach		478	0.6	503	0.6	0.627	9.7	LOS A	4.1	30.2	0.77	0.96	0.99	49.7
North: Marmion Ave (N)														
7	L2	150	2.7	158	2.7	0.404	6.9	LOS A	2.9	22.2	0.58	0.59	0.58	52.7
8	T1	816	4.3	859	4.3	0.404	7.5	LOS A	2.9	22.2	0.59	0.60	0.59	63.4
9	R2	3	0.0	3	0.0	0.404	13.9	LOS B	2.7	20.8	0.60	0.62	0.60	54.7
9u	U	7	0.0	7	0.0	0.404	16.8	LOS B	2.7	20.8	0.60	0.62	0.60	64.4
Approach		976	4.0	1027	4.0	0.404	7.5	LOS A	2.9	22.2	0.59	0.60	0.59	62.2
West: Hawksbill Dr (W)														
10	L2	10	0.0	11	0.0	0.214	6.3	LOS A	1.0	7.5	0.76	0.87	0.76	48.1
11	T1	20	0.0	21	0.0	0.214	5.9	LOS A	1.0	7.5	0.76	0.87	0.76	44.1
12	R2	85	3.5	89	3.5	0.214	11.8	LOS B	1.0	7.5	0.76	0.87	0.76	51.4
Approach		115	2.6	121	2.6	0.214	10.3	LOS B	1.0	7.5	0.76	0.87	0.76	50.1
All Vehicles		2944	2.3	3099	2.3	0.627	8.5	LOS A	4.9	36.6	0.67	0.69	0.70	59.3

Table 6. SIDRA results for full movement crossover (crossover 1) – Weekday AM peak period (Post development – Year 2022)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Hawksbill Dr (E)														
5	T1	125	3.0	125	3.0	0.062	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
6	R2	95	0.0	95	0.0	0.070	4.1	LOS A	0.3	2.3	0.39	0.55	0.39	21.5
Approach		220	1.7	220	1.7	0.070	1.7	NA	0.3	2.3	0.17	0.24	0.17	36.2
North: Crossover 1 (N)														
7	L2	72	0.0	72	0.0	0.057	0.9	LOS A	0.2	1.6	0.35	0.22	0.35	16.4
9	R2	14	0.0	14	0.0	0.021	3.6	LOS A	0.1	0.6	0.51	0.42	0.51	24.9
Approach		85	0.0	85	0.0	0.057	1.4	LOS A	0.2	1.6	0.38	0.25	0.38	18.8
West: Hawksbill Dr (W)														
10	L2	20	0.0	20	0.0	0.150	4.6	LOS A	0.0	0.0	0.00	0.04	0.00	34.1
11	T1	281	3.0	281	3.0	0.150	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	47.7
Approach		301	2.8	301	2.8	0.150	0.3	NA	0.0	0.0	0.00	0.04	0.00	46.3
All Vehicles		606	2.0	606	2.0	0.150	1.0	NA	0.3	2.3	0.11	0.14	0.11	37.9

Table 7. SIDRA results for full movement crossover (crossover 1) – Weekday PM peak period (Post development – Year 2022)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Hawksbill Dr (E)														
5	T1	188	3.0	188	3.0	0.094	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
6	R2	86	0.0	86	0.0	0.054	3.2	LOS A	0.2	1.8	0.24	0.48	0.24	21.8
Approach		275	2.1	275	2.1	0.094	1.0	NA	0.2	1.8	0.08	0.15	0.08	40.2
North: Crossover 1 (N)														
7	L2	58	0.0	58	0.0	0.039	0.3	LOS A	0.2	1.1	0.21	0.08	0.21	17.7
9	R2	12	0.0	12	0.0	0.015	2.6	LOS A	0.1	0.4	0.45	0.34	0.45	26.5
Approach		69	0.0	69	0.0	0.039	0.7	LOS A	0.2	1.1	0.25	0.13	0.25	20.3
West: Hawksbill Dr (W)														
10	L2	18	0.0	18	0.0	0.067	4.6	LOS A	0.0	0.0	0.00	0.07	0.00	34.4
11	T1	116	3.0	116	3.0	0.067	0.0	LOS A	0.0	0.0	0.00	0.07	0.00	45.7
Approach		134	2.6	134	2.6	0.067	0.6	NA	0.0	0.0	0.00	0.07	0.00	43.5
All Vehicles		478	1.9	478	1.9	0.094	0.8	NA	0.2	1.8	0.08	0.13	0.08	38.2

Table 8. SIDRA results for left turn exit only crossover (crossover 2) – Weekday AM peak period (Post development – Year 2022)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Hawksbill Dr (E)														
5	T1	220	3.0	220	3.0	0.057	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
Approach		220	3.0	220	3.0	0.057	0.0	NA	0.0	0.0	0.00	0.00	0.00	50.0
North: Crossover 2 (N)														
7	L2	31	0.0	31	0.0	0.026	1.2	LOS A	0.1	0.7	0.39	0.25	0.39	16.0
Approach		31	0.0	31	0.0	0.026	1.2	LOS A	0.1	0.7	0.39	0.25	0.39	16.0
West: Hawksbill Dr (W)														
11	T1	353	3.0	353	3.0	0.176	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.9
Approach		353	3.0	353	3.0	0.176	0.0	NA	0.0	0.0	0.00	0.00	0.00	49.9
All Vehicles		603	2.8	603	2.8	0.176	0.1	NA	0.1	0.7	0.02	0.01	0.02	45.4

Table 9. SIDRA results for left turn exit only crossover (crossover 2) – Weekday PM peak period (Post development – Year 2022)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Hawksbill Dr (E)														
5	T1	275	3.0	275	3.0	0.071	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
Approach		275	3.0	275	3.0	0.071	0.0	NA	0.0	0.0	0.00	0.00	0.00	50.0
North: Crossover 2 (N)														
7	L2	34	0.0	34	0.0	0.024	0.5	LOS A	0.1	0.7	0.26	0.12	0.26	17.2
Approach		34	0.0	34	0.0	0.024	0.5	LOS A	0.1	0.7	0.26	0.12	0.26	17.2
West: Hawksbill Dr (W)														
11	T1	174	3.0	174	3.0	0.087	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
Approach		174	3.0	174	3.0	0.087	0.0	NA	0.0	0.0	0.00	0.00	0.00	50.0
All Vehicles		482	2.8	482	2.8	0.087	0.0	NA	0.1	0.7	0.02	0.01	0.02	44.3

Table 10. SIDRA results for the roundabout intersection of Marmion Avenue/ Hawksbill Drive/ Santorini Promenade – Weekday AM peak period (Post development – Year 2022)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Marmion Ave (S)														
1	L2	108	2.9	108	2.9	0.330	6.3	LOS A	2.3	18.3	0.48	0.54	0.48	59.0
2	T1	624	9.2	624	9.2	0.330	6.9	LOS A	2.3	18.3	0.48	0.57	0.48	63.0
3	R2	151	2.8	151	2.8	0.330	13.2	LOS B	2.2	17.1	0.50	0.62	0.50	60.3
Approach		883	7.3	883	7.3	0.330	7.9	LOS A	2.3	18.3	0.49	0.57	0.49	62.2
East: Santorini Prom (E)														
4	L2	171	4.1	171	4.1	0.646	9.8	LOS A	4.4	33.6	0.87	1.04	1.18	49.2
5	T1	82	0.0	82	0.0	0.646	9.2	LOS A	4.4	33.6	0.87	1.04	1.18	27.8
6	R2	125	5.5	125	5.5	0.646	15.2	LOS B	4.4	33.6	0.87	1.04	1.18	46.4
6u	U	1	100.0	1	100.0	0.646	22.2	LOS C	4.4	33.6	0.87	1.04	1.18	22.1
Approach		379	3.9	379	3.9	0.646	11.5	LOS B	4.4	33.6	0.87	1.04	1.18	45.4
North: Marmion Ave (N)														
7	L2	221	3.8	221	3.8	0.577	8.4	LOS A	5.3	41.4	0.76	0.73	0.81	51.0
8	T1	1081	5.4	1081	5.4	0.577	9.4	LOS A	5.3	41.4	0.77	0.78	0.85	61.5
9	R2	31	0.0	31	0.0	0.577	16.1	LOS B	5.1	39.8	0.78	0.83	0.88	49.1
9u	U	6	0.0	6	0.0	0.577	19.0	LOS B	5.1	39.8	0.78	0.83	0.88	62.3
Approach		1339	5.0	1339	5.0	0.577	9.4	LOS A	5.3	41.4	0.76	0.77	0.84	60.0
West: Hawksbill Dr (W)														
10	L2	42	0.0	42	0.0	0.464	4.5	LOS A	2.4	18.2	0.67	0.89	0.77	50.2
11	T1	88	1.5	88	1.5	0.464	4.5	LOS A	2.4	18.2	0.67	0.89	0.77	40.0
12	R2	253	3.5	253	3.5	0.464	9.4	LOS A	2.4	18.2	0.67	0.89	0.77	56.3
Approach		383	2.6	383	2.6	0.464	7.8	LOS A	2.4	18.2	0.67	0.89	0.77	53.2
All Vehicles		2984	5.2	2984	5.2	0.646	9.0	LOS A	5.3	41.4	0.68	0.76	0.77	58.3

Table 11. SIDRA results for the roundabout intersection of Marmion Avenue/ Hawksbill Drive/ Santorini Promenade – Weekday PM peak period (Post development – Year 2022)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Marmion Ave (S)														
1	L2	166	1.6	166	1.6	0.601	7.5	LOS A	5.7	42.7	0.73	0.64	0.75	56.2
2	T1	1082	1.8	1082	1.8	0.601	8.2	LOS A	5.7	42.7	0.74	0.69	0.78	62.7
3	R2	257	1.2	257	1.2	0.601	15.1	LOS B	5.6	42.0	0.76	0.76	0.82	58.3
Approach		1505	1.7	1505	1.7	0.601	9.3	LOS A	5.7	42.7	0.74	0.70	0.78	61.5
East: Santorini Prom (E)														
4	L2	167	1.8	167	1.8	0.682	7.9	LOS A	4.8	35.8	0.82	1.02	1.11	50.8
5	T1	82	0.0	82	0.0	0.682	7.4	LOS A	4.8	35.8	0.82	1.02	1.11	29.3
6	R2	265	0.4	265	0.4	0.682	13.2	LOS B	4.8	35.8	0.82	1.02	1.11	48.9
6u	U	3	0.0	3	0.0	0.682	15.2	LOS B	4.8	35.8	0.82	1.02	1.11	25.2
Approach		518	0.8	518	0.8	0.682	10.6	LOS B	4.8	35.8	0.82	1.02	1.11	47.5
North: Marmion Ave (N)														
7	L2	158	2.7	158	2.7	0.436	7.2	LOS A	3.2	24.8	0.63	0.62	0.63	52.2
8	T1	877	4.3	877	4.3	0.436	7.9	LOS A	3.2	24.8	0.64	0.63	0.64	62.9
9	R2	27	0.0	27	0.0	0.436	14.3	LOS B	3.0	22.9	0.65	0.65	0.65	50.6
9u	U	7	0.0	7	0.0	0.436	17.2	LOS B	3.0	22.9	0.65	0.65	0.65	63.5
Approach		1069	3.9	1069	3.9	0.436	8.0	LOS A	3.2	24.8	0.64	0.63	0.64	61.5
West: Hawksbill Dr (W)														
10	L2	42	0.0	42	0.0	0.380	6.5	LOS A	2.0	15.1	0.81	0.95	0.90	47.5
11	T1	36	0.0	36	0.0	0.380	6.5	LOS A	2.0	15.1	0.81	0.95	0.90	37.0
12	R2	128	3.5	128	3.5	0.380	11.4	LOS B	2.0	15.1	0.81	0.95	0.90	53.8
Approach		206	2.2	206	2.2	0.380	9.6	LOS A	2.0	15.1	0.81	0.95	0.90	50.7
All Vehicles		3299	2.3	3299	2.3	0.682	9.1	LOS A	5.7	42.7	0.72	0.74	0.79	59.0

Table 12. SIDRA results for full movement crossover (crossover 1) – Weekday AM peak period (10-Year Post development – Year 2032)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Hawksbill Dr (E)														
5	T1	364	3.0	364	3.0	0.181	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.9
6	R2	95	0.0	95	0.0	0.091	5.2	LOS A	0.4	2.8	0.52	0.67	0.52	19.7
Approach		459	2.4	459	2.4	0.181	1.1	NA	0.4	2.8	0.11	0.14	0.11	42.1
North: Crossover 1 (N)														
7	L2	72	0.0	72	0.0	0.072	2.0	LOS A	0.3	2.0	0.48	0.39	0.48	15.2
9	R2	14	0.0	14	0.0	0.043	10.2	LOS B	0.1	1.1	0.74	0.76	0.74	17.7
Approach		85	0.0	85	0.0	0.072	3.3	LOS A	0.3	2.0	0.52	0.45	0.52	16.1
West: Hawksbill Dr (W)														
10	L2	20	0.0	20	0.0	0.258	4.6	LOS A	0.0	0.0	0.00	0.02	0.00	34.4
11	T1	498	3.0	498	3.0	0.258	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	48.6
Approach		518	2.9	518	2.9	0.258	0.2	NA	0.0	0.0	0.00	0.02	0.00	47.7
All Vehicles		1062	2.4	1062	2.4	0.258	0.8	NA	0.4	2.8	0.09	0.11	0.09	41.7

Table 13. SIDRA results for full movement crossover (crossover 1) – Weekday PM peak period (10-Year Post development – Year 2032)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Hawksbill Dr (E)														
5	T1	521	3.0	521	3.0	0.260	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.9
6	R2	86	0.0	86	0.0	0.078	4.9	LOS A	0.3	2.4	0.49	0.63	0.49	20.2
Approach		607	2.6	607	2.6	0.260	0.7	NA	0.3	2.4	0.07	0.09	0.07	44.6
North: Crossover 1 (N)														
7	L2	58	2.0	58	2.0	0.056	1.8	LOS A	0.2	1.6	0.46	0.35	0.46	15.5
9	R2	12	2.0	12	2.0	0.044	12.7	LOS B	0.1	1.1	0.79	0.80	0.79	15.9
Approach		69	2.0	69	2.0	0.056	3.6	LOS A	0.2	1.6	0.51	0.42	0.51	15.7
West: Hawksbill Dr (W)														
10	L2	18	0.0	18	0.0	0.234	4.6	LOS A	0.0	0.0	0.00	0.02	0.00	34.4
11	T1	452	3.0	452	3.0	0.234	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	48.6
Approach		469	2.9	469	2.9	0.234	0.2	NA	0.0	0.0	0.00	0.02	0.00	47.7
All Vehicles		1146	2.7	1146	2.7	0.260	0.7	NA	0.3	2.4	0.07	0.08	0.07	43.4

Table 14. SIDRA results for left turn exit only crossover (crossover 2) – Weekday AM peak period (10-Year Post development – Year 2032)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Hawksbill Dr (E)														
5	T1	459	3.0	459	3.0	0.119	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
Approach		459	3.0	459	3.0	0.119	0.0	NA	0.0	0.0	0.00	0.00	0.00	50.0
North: Crossover 2 (N)														
7	L2	31	0.0	31	0.0	0.031	1.3	LOS A	0.1	0.8	0.37	0.24	0.37	16.2
Approach		31	0.0	31	0.0	0.031	1.3	LOS A	0.1	0.8	0.37	0.24	0.37	16.2
West: Hawksbill Dr (W)														
11	T1	569	3.0	569	3.0	0.162	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.9
Approach		569	3.0	569	3.0	0.162	0.0	NA	0.0	0.0	0.00	0.00	0.00	49.9
All Vehicles		1059	2.9	1059	2.9	0.162	0.0	NA	0.1	0.8	0.01	0.01	0.01	47.3

Table 15. SIDRA results for left turn exit only crossover (crossover 2) – Weekday PM peak period (10-Year Post development – Year 2032)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Hawksbill Dr (E)														
5	T1	607	3.0	607	3.0	0.157	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.9
Approach		607	3.0	607	3.0	0.157	0.0	NA	0.0	0.0	0.00	0.00	0.00	49.9
North: Crossover 2 (N)														
7	L2	34	0.0	34	0.0	0.038	1.4	LOS A	0.1	0.9	0.37	0.25	0.37	16.2
Approach		34	0.0	34	0.0	0.038	1.4	LOS A	0.1	0.9	0.37	0.25	0.37	16.2
West: Hawksbill Dr (W)														
11	T1	509	3.0	509	3.0	0.182	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.9
Approach		509	3.0	509	3.0	0.182	0.0	NA	0.0	0.0	0.00	0.00	0.00	49.9
All Vehicles		1151	2.9	1151	2.9	0.182	0.0	NA	0.1	0.9	0.01	0.01	0.01	47.2

Table 16. SIDRA results for the roundabout intersection of Marmion Avenue/ Hawksbill Drive/ Santorini Promenade – Weekday AM peak period (10-Year Post development – Year 2032)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Marmion Ave (S)														
1	L2	100	3.1	100	3.1	0.540	8.3	LOS A	5.0	40.1	0.81	0.72	0.85	55.3
2	T1	875	9.3	875	9.3	0.540	9.3	LOS A	5.0	40.1	0.82	0.77	0.87	60.4
3	R2	157	2.8	157	2.8	0.540	16.2	LOS B	4.7	37.3	0.82	0.85	0.91	57.4
Approach		1132	7.8	1132	7.8	0.540	10.2	LOS B	5.0	40.1	0.82	0.77	0.88	59.7
East: Santorini Prom (E)														
4	L2	196	4.1	196	4.1	0.653	19.0	LOS B	4.2	32.2	0.94	1.09	1.30	42.6
5	T1	239	3.0	239	3.0	0.904	33.3	LOS C	10.7	83.0	1.00	1.50	2.25	15.1
6	R2	163	5.5	163	5.5	0.904	39.3	LOS D	10.7	83.0	1.00	1.50	2.25	29.9
6u	U	1	100.0	1	100.0	0.904	48.7	LOS D	10.7	83.0	1.00	1.50	2.25	19.5
Approach		599	4.2	599	4.2	0.904	30.3	LOS C	10.7	83.0	0.98	1.37	1.94	28.7
North: Marmion Ave (N)														
7	L2	144	4.0	144	4.0	0.865	17.3	LOS B	18.1	141.2	1.00	1.14	1.67	43.1
8	T1	1509	5.5	1509	5.5	0.865	19.0	LOS B	18.1	141.2	1.00	1.18	1.72	53.1
9	R2	121	3.0	121	3.0	0.865	27.0	LOS C	16.1	125.7	1.00	1.23	1.78	36.5
9u	U	7	0.0	7	0.0	0.865	29.8	LOS C	16.1	125.7	1.00	1.23	1.78	50.4
Approach		1782	5.2	1782	5.2	0.865	19.5	LOS B	18.1	141.2	1.00	1.18	1.72	51.6
West: Hawksbill Dr (W)														
10	L2	166	3.0	166	3.0	0.343	6.9	LOS A	1.8	13.5	0.81	0.88	0.86	50.5
11	T1	247	1.7	247	1.7	0.611	7.4	LOS A	4.6	35.0	0.90	1.05	1.16	36.8
12	R2	186	3.5	186	3.5	0.611	12.4	LOS B	4.6	35.0	0.90	1.05	1.16	53.8
Approach		600	2.6	600	2.6	0.611	8.8	LOS A	4.6	35.0	0.87	1.01	1.08	47.4
All Vehicles		4113	5.4	4113	5.4	0.904	16.9	LOS B	18.1	141.2	0.93	1.07	1.43	49.8

Table 17. SIDRA results for the roundabout intersection of Marmion Avenue/ Hawksbill Drive/ Santorini Promenade – Weekday PM peak period (10-Year Post development – Year 2032)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Marmion Ave (S)														
1	L2	161	1.8	161	1.8	0.923	23.9	LOS C	25.8	194.3	1.00	1.31	2.13	40.4
2	T1	1509	2.1	1509	2.1	0.923	25.9	LOS C	25.8	194.3	1.00	1.35	2.18	48.3
3	R2	208	1.2	208	1.2	0.923	34.7	LOS C	22.5	169.6	1.00	1.40	2.27	41.6
Approach		1879	2.0	1879	2.0	0.923	26.7	LOS C	25.8	194.3	1.00	1.35	2.19	47.1
East: Santorini Prom (E)														
4	L2	173	1.4	173	1.4	0.459	10.9	LOS B	2.6	19.7	0.89	0.98	1.04	50.5
5	T1	260	3.0	260	3.0	0.781	15.2	LOS B	7.1	53.3	0.99	1.22	1.55	23.4
6	R2	163	0.4	163	0.4	0.781	20.9	LOS C	7.1	53.3	0.99	1.22	1.55	41.9
6u	U	4	0.0	4	0.0	0.781	22.9	LOS C	7.1	53.3	0.99	1.22	1.55	30.1
Approach		600	1.8	600	1.8	0.781	15.6	LOS B	7.1	53.3	0.96	1.15	1.41	38.3
North: Marmion Ave (N)														
7	L2	163	2.9	163	2.9	0.748	12.0	LOS B	10.8	83.4	0.94	0.95	1.24	48.8
8	T1	1224	4.3	1224	4.3	0.748	13.2	LOS B	10.8	83.4	0.95	0.99	1.28	58.7
9	R2	187	3.0	187	3.0	0.748	20.6	LOS C	9.8	75.7	0.96	1.05	1.33	42.7
9u	U	8	0.0	8	0.0	0.748	23.4	LOS C	9.8	75.7	0.96	1.05	1.33	56.3
Approach		1583	4.0	1583	4.0	0.748	14.0	LOS B	10.8	83.4	0.95	0.99	1.28	56.6
West: Hawksbill Dr (W)														
10	L2	180	3.0	180	3.0	0.611	17.0	LOS B	3.8	28.8	0.93	1.07	1.24	37.2
11	T1	233	3.0	233	3.0	0.820	22.7	LOS C	7.8	58.9	1.00	1.30	1.74	22.3
12	R2	129	3.0	129	3.0	0.820	27.5	LOS C	7.8	58.9	1.00	1.30	1.74	39.1
Approach		542	3.0	542	3.0	0.820	21.9	LOS C	7.8	58.9	0.98	1.22	1.58	32.0
All Vehicles		4604	2.8	4604	2.8	0.923	20.3	LOS C	25.8	194.3	0.97	1.19	1.70	47.9

Table 18. SIDRA average queue results for the roundabout intersection of Marmion Avenue/ Hawksbill Drive/ Santorini Promenade – Weekday PM peak period (10-Year Post development – Year 2032)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Marmion Ave (S)														
1	L2	161	1.8	161	1.8	0.923	23.9	LOS C	10.4	78.1	1.00	1.31	2.13	40.4
2	T1	1509	2.1	1509	2.1	0.923	25.9	LOS C	10.4	78.1	1.00	1.35	2.18	48.3
3	R2	208	1.2	208	1.2	0.923	34.7	LOS C	9.1	68.2	1.00	1.40	2.27	41.6
Approach		1879	2.0	1879	2.0	0.923	26.7	LOS C	10.4	78.1	1.00	1.35	2.19	47.1
East: Santorini Prom (E)														
4	L2	173	1.4	173	1.4	0.459	10.9	LOS B	1.1	7.9	0.89	0.98	1.04	50.5
5	T1	260	3.0	260	3.0	0.781	15.2	LOS B	2.9	21.4	0.99	1.22	1.55	23.4
6	R2	163	0.4	163	0.4	0.781	20.9	LOS C	2.9	21.4	0.99	1.22	1.55	41.9
6u	U	4	0.0	4	0.0	0.781	22.9	LOS C	2.9	21.4	0.99	1.22	1.55	30.1
Approach		600	1.8	600	1.8	0.781	15.6	LOS B	2.9	21.4	0.96	1.15	1.41	38.3
North: Marmion Ave (N)														
7	L2	163	2.9	163	2.9	0.748	12.0	LOS B	4.3	33.5	0.94	0.95	1.24	48.8
8	T1	1224	4.3	1224	4.3	0.748	13.2	LOS B	4.3	33.5	0.95	0.99	1.28	58.7
9	R2	187	3.0	187	3.0	0.748	20.6	LOS C	3.9	30.4	0.96	1.05	1.33	42.7
9u	U	8	0.0	8	0.0	0.748	23.4	LOS C	3.9	30.4	0.96	1.05	1.33	56.3
Approach		1583	4.0	1583	4.0	0.748	14.0	LOS B	4.3	33.5	0.95	0.99	1.28	56.6
West: Hawksbill Dr (W)														
10	L2	180	3.0	180	3.0	0.611	17.0	LOS B	1.5	11.6	0.93	1.07	1.24	37.2
11	T1	233	3.0	233	3.0	0.820	22.7	LOS C	3.1	23.7	1.00	1.30	1.74	22.3
12	R2	129	3.0	129	3.0	0.820	27.5	LOS C	3.1	23.7	1.00	1.30	1.74	39.1
Approach		542	3.0	542	3.0	0.820	21.9	LOS C	3.1	23.7	0.98	1.22	1.58	32.0
All Vehicles		4604	2.8	4604	2.8	0.923	20.3	LOS C	10.4	78.1	0.97	1.19	1.70	47.9