APPENDIX A – AMENDED AGREED STRUCTURE PLAN

N

MARMION

SOUNDING AVENUE

BROADSIDE AVENUE

CHESSTREE AVENUE

KYLE AVENUE

MITCHELL

FREEWAY

ALKIMOS DRIVE

AVENUE

(RMD25-R60)

(RMD30-R80)

HS

PS

A

B

C

D

E

GWTP

WWTP

BUS/ RAIL INTERCHANGE

RAIL STATION

LEGEND

Structure Plan Boundary

Zones

- Mixed Use
- Residential
- Business
- Commercial

Reserves

- Regional Open Space
- Education & Recreation
  - HS High School
  - PS Primary School
- Railway Reserve
- Strategic POS

Other

- Primary Distributor Road
- District Distributor Integrator A (No Direct Frontage Access Permitted
- District Distributor Integrator B
- Neighbourhood Connector
- Social/ Pedestrian/ Cycle Linkage
- District Open Space (DCP Item)
- No Subdivision or Development within this area until such time as the Metropolitan Region Scheme is amended to transfer the land to the Urban Zone

- (A) Strategic Local Open Space Refer to Table 1 of Part 1
- (A) Strategic Regional Open Space Refer to Table 2 of Part 1

LANDCORP

lendlease

robertsday.com.au
planning·design·place

CADASTRAL INFORMATION
SOURCE: LANDGATE
YYMMDD: 101101
DWG REF: 0845cad
PROJECTION: PCG94

AERIAL PHOTOGRAPHY
SOURCE: NA
YYMMDD: NA

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1:10,000

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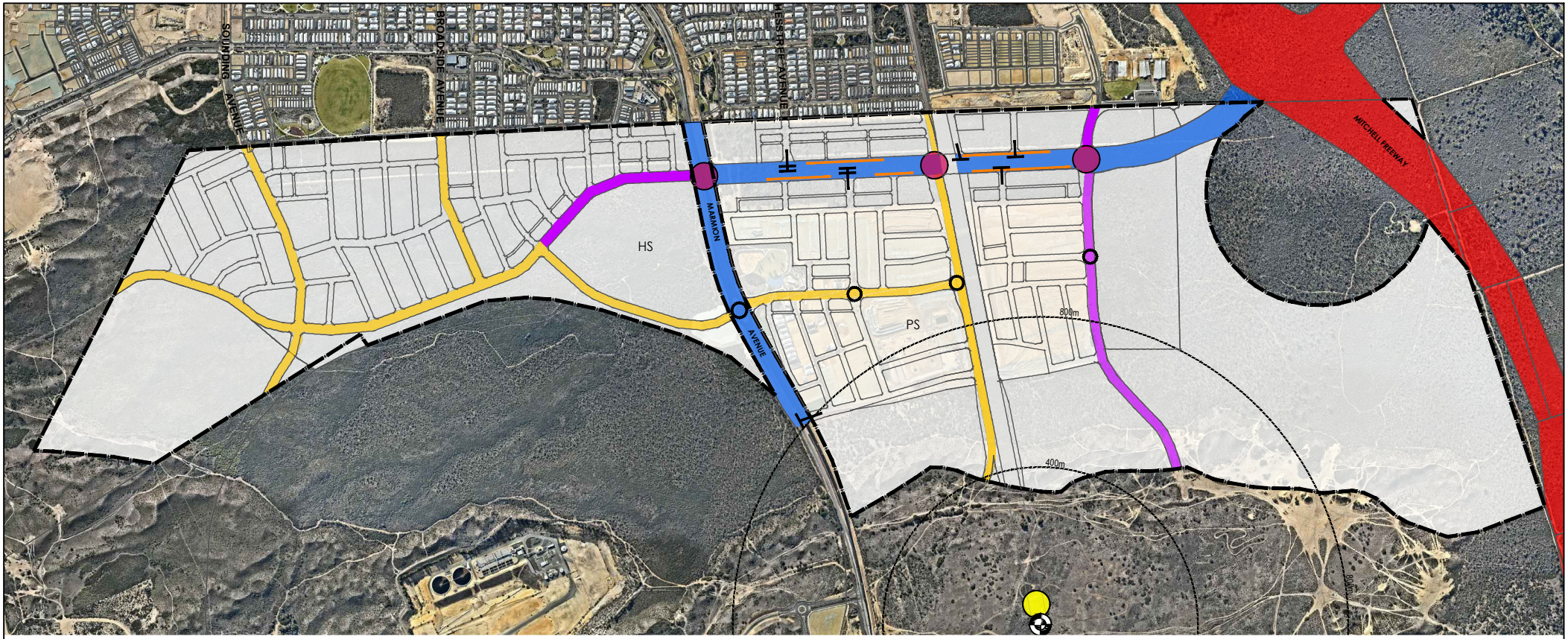
X	UPDATED FROM RD1 102 C	190121	HH	RD
W	POS A UPDATE	171005	SB	RD
V	POS A UPDATE	170904	HH	HH
U	UPDATE EAST OF MARMION	170614	SB	EH
T	MINOR EDIT	161124	HH	RD
S	VARIOUS MODS	161116	HH	RD

LOCAL STRUCTURE PLAN
Central Alkimos
City of Wanneroo

REF NO.	DRAW NO.	REV.
DLL CEN	**RD1 001**	**X**

APPENDIX B – AMENDED FIGURE 18: MOVEMENT NETWORK



LEGEND

- STRUCTURE PLAN AREA
- PRIMARY DISTRIBUTOR
- DISTRICT DISTRIBUTOR A
- DISTRICT DISTRIBUTOR B (2-LANES)
- NEIGHBOURHOOD CONNECTOR
- RAIL STATION
- SIGNALISED INTERSECTION
- BUS/ RAIL INTERCHANGE
- RAILWAY CORRIDOR
- FULL ACCESS T-INTERSECTION
- LEFT IN/ LEFT OUT T-JUNCTION
- CAP ROADS
- ROUNDABOUT
- WALKABLE CATCHMENT 400M/800M

N

LANDCORP lendlease

CADASTRAL INFORMATION
SOURCE: MAPS+ROBERTSDAY
YYMMDD: VARIES
DWG REF: VARIES
PROJECTION: PCG94

AERIAL PHOTOGRAPHY
SOURCE: NEARMAP
YYMMDD: 190525

RD great places

SIZE A4_1:15,000

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H	INCLUDE FULL-ACCESS T	200520	SB	RD
G	UPDATE VISTA EAST	200428	SB	RD
F	UPDATED FROM RD1 102 C	190121	HH	RD
E	NORTH ALKIMOS DR UPDATE	180716	MT	RD
D	UPDATE SKETCH & POS ALPHABET	180713	II	RD

PROPOSED ROAD HIERARCHY
Alkimos Central, Alkimos
City of Wanneroo

JOBE CODE	DRAW NO.	REV.
DLL CEN	**RD1 010**	**H**

APPENDIX C – TRAFFIC IMPACT ANALYSIS (GTA, 2019)

TECHNICAL NOTE

Traffic Engineering

Project Code:	W122764	**Project Name:**	Alkimos Vista - Further Work - Removal of the Bridge
Date:	11 May 2020	**Version No.**	5
Author:	Gary Soo/Tanya Moran		
SUBJECT:	**Alkimos Vista Local Structure Plan Amendment – Removal of the Bridge over the Railway Reserve**		
Page 1 of	21 plus two Attachments		

Dear Laura

A Local Structure Plan (LSP) has been prepared for Alkimos Vista (formerly called Central Alkimos) located in the City of Wanneroo. As part of the initial works completed with the LSP preparation, a *"Traffic and Movement Network"* report was prepared by Bruce Aulabaugh Traffic Engineering and Transport Planning[1] in 2013 (referred herein as the Aulabaugh Report). Since the completion of the Aulabaugh Report, the future intersection arrangement on Marmion Avenue adjacent Alkimos Vista has been updated to better suit land use planning which was subsequently been approved by Main Roads WA and the City of Wanneroo in 2017. This Technical Note incorporates these adopted changes on Marmion Avenue adjacent Alkimos Vista.

The objective of this April 2020 Technical Note is to document the analysis findings of removing the secondary Bridge over the railway reserve within Alkimos Vista (located approximately 300m south of Alkimos Drive Bridge) ("The Amendment"). This Bridge previously connected road corridors NS 1 and NS 2 in the Aulabaugh Report. The Alkimos Drive Bridge further north will provide east-west connectivity and it is understood this will be constructed as part of the state METRONET project prior to the Yanchep Rail Line extension opening in 2022.

The Amendment also proposes a minor modification to realign the primary school site located within Alkimos Vista, just west of NS 1. The Amendment also proposes a modification to the LSP cell east of the railway, with a POS shifted further east. CAP Roads are also proposed for the viability of the mixed-use developments along Alkimos Drive (on both sides) and have been shown to fit well within the Alkimos Drive road reserve and within the ultimate dual carriageway cross-section between Marmion Avenue and the Mitchell Freeway. A plan showing the network changes is shown in Figure 1 on the next page.

In light of the above bridge removal proposal, GTA has been reengaged by Lendlease to prepare an Addendum Report to the Aulabaugh Report to address the Amendment, and in particular, define any impacts to the proposed local road hierarchy and movement network. This Technical Note provides supplementary information on the Amendment, within the context of the broader LSP and the Aulabaugh Report.

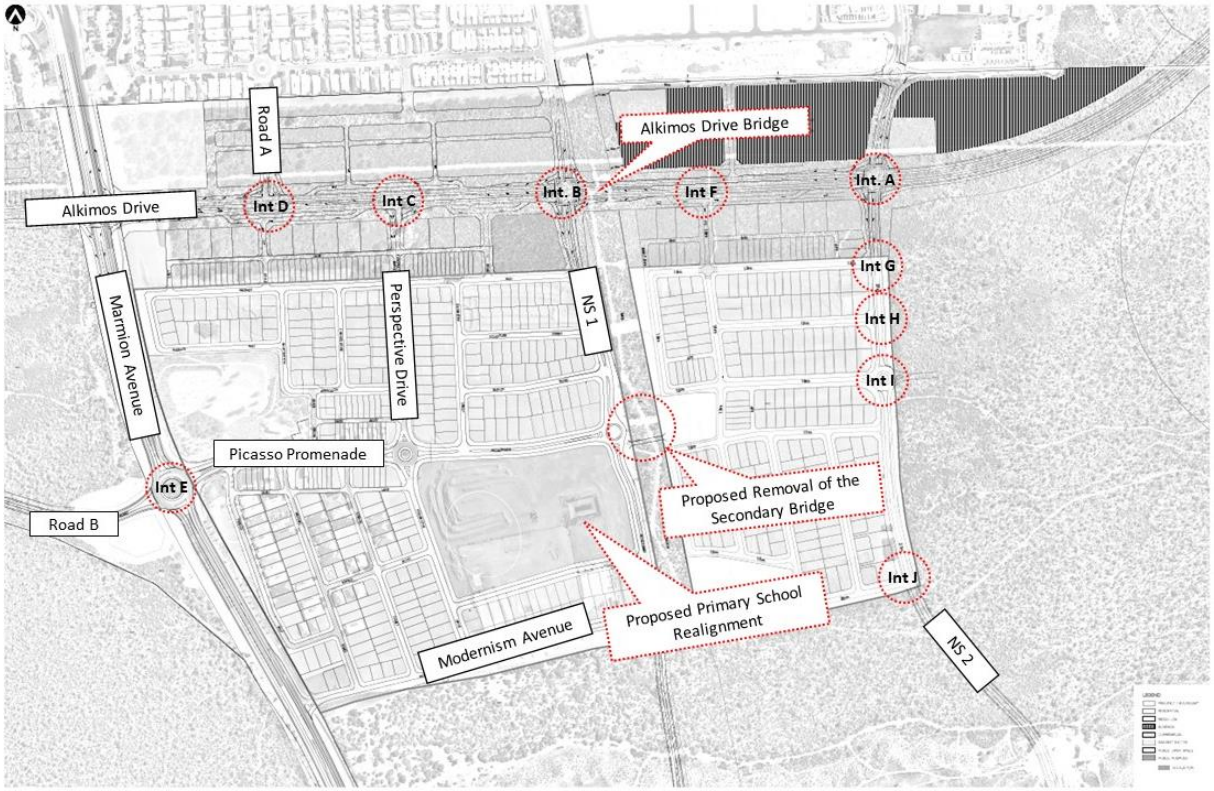
Cossill & Webley Engineers have prepared preliminary layouts of the intersections along Alkimos Drive to determine the land take requirements and to ensure compatibility with the METRONET bridge design on Alkimos Drive. These intersections are shown on Figure 1 as:

- Intersection A; Alkimos Drive / NS 2 intersection
- Intersection B; Alkimos Drive / NS 1 intersection

[1] Central Alkimos, Traffic and Movement Network, Final Report, Bruce Aulabaugh, Rev 1 – May 9, 2013

- Intersection C; full movement priority-controlled intersection at Alkimos Drive / Perspective Drive, west of NS 1.
- Intersection D; full movement priority-controlled intersection at Alkimos Drive / Road A (west of Intersection C).

Figure 1 "The Amendment" Plan for Alkimos Vista



The objectives of this April 2020 Technical Note are to determine:

1. Daily flows along the links within Alkimos Vista east of Marmion Avenue following the removal of the bridge;
2. Assessment of the impacts on the removal of the bridge on the surrounding road network;
3. SIDRA analysis of the four intersections on Alkimos Drive (A, B, C, and D) and four intersections on NS 2 (G, H, I, and J) to determine ultimate design requirements (post 2031 – assuming Alkimos Drive connects Marmion Avenue to the Freeway);
4. SIDRA analysis of the two intersections on Alkimos Drive (A and B) pre-2031 – assuming No Alkimos Drive and Freeway extensions north of Romeo Road;
5. Sensitivity SIDRA analysis of Intersection E to determine at which Year/Stage of Alkimos Vista the intersection will fail, assuming No Alkimos Drive and Freeway extensions;
6. Sensitivity SIDRA analysis of Intersection F as a full access T intersection to ensure it operates acceptably until such time that Alkimos Drive, NS 2 and Intersection A are constructed (and it reverts to a Left-in/Left-out);
7. Commentary on traffic speeds along NS 1 adjacent to the rail corridor and more importantly, the Primary School;
8. Commentary on suitability of CAP roads with the Alkimos Drive reserve; and
9. Commentary on traffic speeds and NS 2 adjacent to the District Open Space.

Previous Marmion Avenue Traffic Analysis

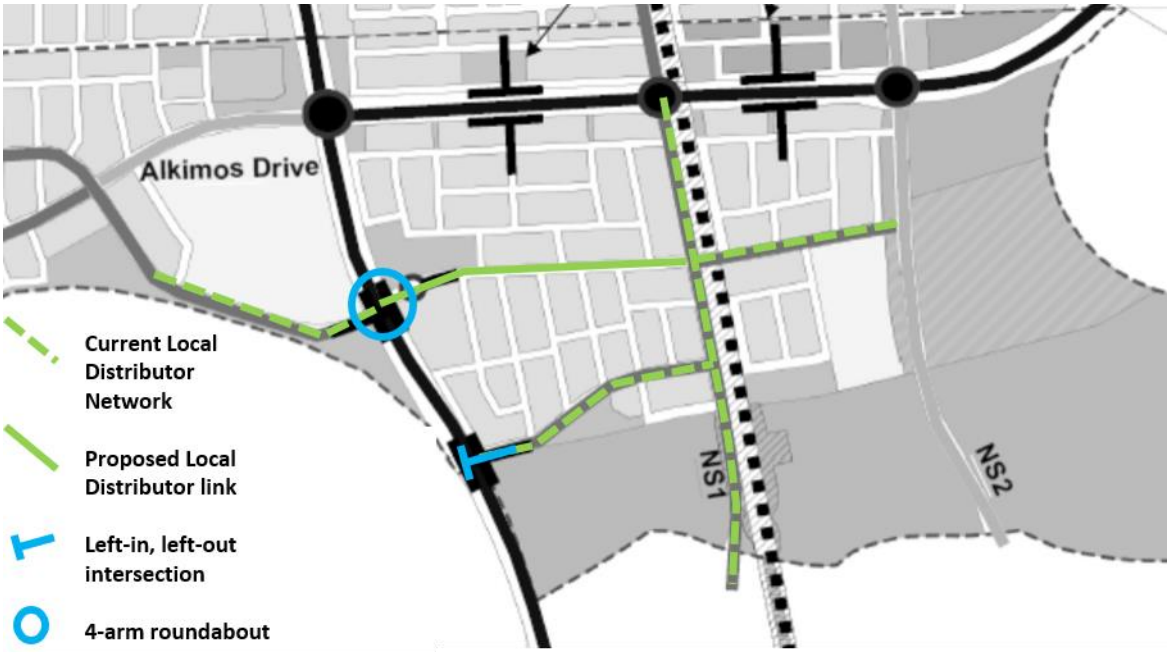
GTA has previously been involved in the transport planning for Alkimos Vista approved LSP area (ASP 95) having contributed to a 2017 Transport Assessment to support a Subdivision Application for Stage 1 of development. Further, GTA prepared a high level Traffic Assessment to support the provision of a revised access arrangement on Marmion Avenue to aid and facilitate the access to the first stages of development.

Prior to the planned Alkimos Drive and the Freeway extension being constructed (expected to be after 2031), Marmion Avenue will continue to act as the sole access for vehicles to travel to and through the northern corridor of Wanneroo, and as a result, all traffic associated with the Alkimos Vista will travel on Marmion Avenue. In this context, GTA developed vehicle demand scenarios and undertook intersection capacity tests to determine suitable access arrangements along Marmion Avenue.

It was determined that of the number of options tested, a left-in/left-out (LILO) intersection plus a Roundabout (with dual lane approaches on Marmion Avenue and single lane approaches on the LSP arms) would provide sufficient capacity to provide access for the LSP during the first stages of development. As such, GTA has considered the provision of these two access arrangements on Marmion Avenue as a permanent solution to provide access for the LSP.

The road network changes with the original 2013 Aulabaugh LSP movement network as base map layout are highlighted in Figure 2.

Figure 2 NW Corridor Traffic Model Network Extension (Bruce Aulabaugh, 2013)



The above Marmion Avenue intersection arrangements were accepted by Main Roads WA and the City of Wanneroo, subsequently constructed and so the traffic analysis for The Amendment is undertaken in line with the above accessibility arrangements.

Adopted Trip Rates

The Alkimos Vista will include a mix of residential and education land uses. The traffic generation and distribution estimates contained within the Aulabaugh Report were produced using the EMME modelling software package. Access to this model was not provided for the preparation of The Amendment, and as such GTA has estimated traffic generation impacts using conventional methods and standard trip generation rates.

The trip generation rates and arrival/departure proportions adopted for these land uses for the analysis are set out in Table 1 and have been extracted from *Western Australian Planning Commission Transport Impact Assessment Guidelines (2016)* (WAPC Guidelines).

Table 1 Adopted Trip Generation Rates for Alkimos Vista (Eastern Portion)

Land Use	Trip Rate (VPD)	Morning Peak		Evening Peak	
		IN	OUT	IN	OUT
Residential	8.0 per dwelling	25%	75%	67%	33%
School	1.0 per child	50%	50%	50%	50%

The assessed traffic generation for the eastern portion of Alkimos Vista is shown in Table 2.

Table 2 Assessed Daily Trip Generation for Alkimos Vista (Eastern Portion)

Proposed Land Use	Assumed Area/Number of Lots/Students	Daily Trip Generation Rate	Daily Trips (VPD)
Residential	Approx. 564 (lots)	8 trips per lot per day	4,512
School	650 (Students)	1.0 per child	650
			5,162 vpd Total

Vehicle Traffic Distribution and Assignment

A bespoke spreadsheet model was developed considering the eastern portion of Alkimos Vista where The Amendment occurs. Inputs to the model include the forecast background traffic on the adjacent network and the trip generation associated with the Alkimos Vista's full development.

The redistribution of traffic associated with the removal of the secondary Bridge over the railway is based upon the previous approved traffic modelling assumptions and results derived from the Aulabaugh Report Northwest Corridor Traffic Model for 2031 (NW Corridor Traffic Model). This traffic model covers an area from Hester Avenue (South) to Wilbinga Reserve in Two Rocks (North), and from the coast (West) to Old Yanchep Road located to the east of Wanneroo Road. Figure 3 shows the extent of the modelled road network in the NW Corridor Traffic Model.

The trips calculated in the trip generation exercise above were distributed onto the road network using the following method and assumptions:

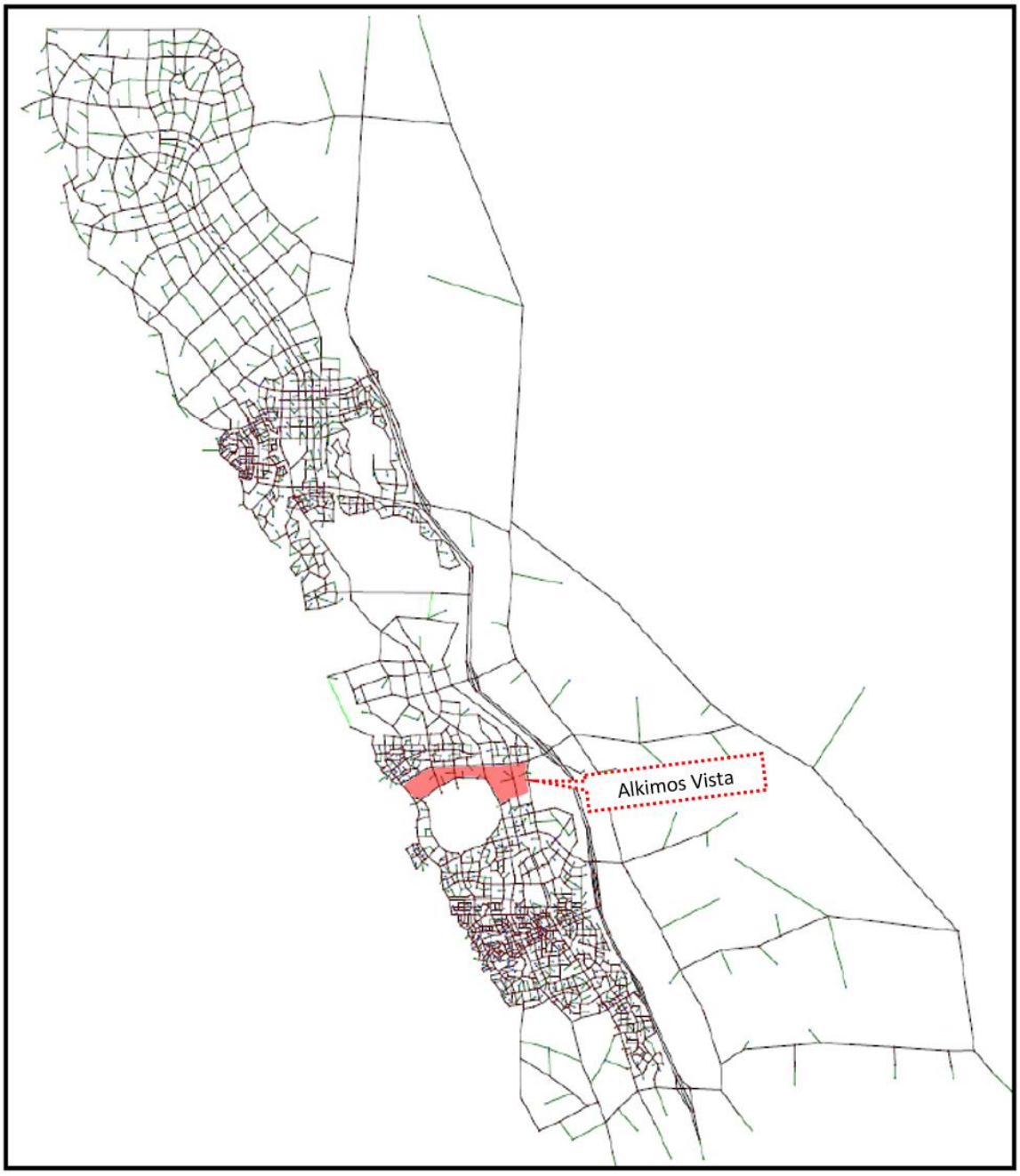
- Full development of the Alkimos Vista LSP (east of Marmion Avenue) is expected to be completed by 2027, based off recent market conditions and advice from Lendlease.
- GTA has modelled a post-2031 scenario where:
    - Alkimos Vista is fully developed
    - Alkimos Drive is connected to Marmion Avenue as a signalised intersection
    - Freeway extension occurs north of Romeo Road and connects to Alkimos Drive.
- GTA has modelled an interim pre-2031 scenario where:
    - Alkimos Drive has NOT been connected to Marmion Avenue. Only the Alkimos Drive Bridge exists.
    - Freeway / Alkimos Drive interchange does not exist
    - This scenario has been tested to determine at which development stage/lots the Picasso/Marmion Avenue will fail, prior to Alkimos Drive connecting Marmion Avenue to the Freeway.
- The traffic modelling divides the LSP into smaller internal sub-zones. This zone structure divided the project area into key traffic sub-areas within the development to provide and appropriate bespoke traffic model.

The external trip attraction patterns surrounding the site were analysed in accordance with ultimate demand forecasts sourced from the NW Corridor Traffic Model. These external distribution percentages are outlined in

- Table 3.

- Apart from primary school related trips, zero internal trips are assumed for the internal residential zones travelling within the LSP.
- For each internal zone within the LSP travelling to/from another zone, it was assumed that the vehicle making the trip would be following the shortest or the path of least resistance to get to their destination. An extract of the modelled network is shown in Figure 4.

Figure 3 NW Corridor Traffic Model Network Extension (Bruce Aulabaugh, 2013)

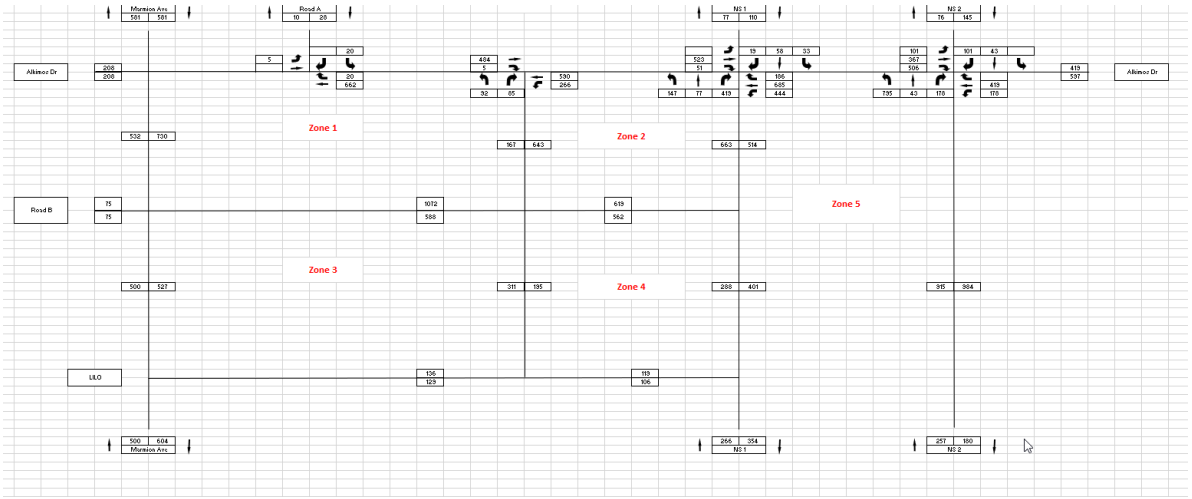


Source: Central Alkimos, Traffic and Movement Network, Final Report, Bruce Aulabaugh, Rev 1 – May 9, 2013

Table 3 Adopted External Traffic Distributions

To/From	Distribution Percentage (%) Inbound/Outbound
Marmion Avenue (North)	21.5%
Marmion Avenue (South)	22.2%
Alkimos Drive (West)	7.6%
Road B south of Alkimos Drive (West)	2.8%
Mitchel Freeway (East)	21.9%
NS 1 (North)	4.0%
NS 1 (South)	4.3%
NS 2 (North)	5.3%
NS 2 (South)	9.4%
Road A west of NS 1 (North)	1.0%
Total	100%

Figure 4 Overview of the Alkimos Drive Traffic Demand Model Network



Traffic Flows and Road Hierarchy

The traffic generated within the eastern portion of Alkimos Vista was reassigned onto the adjacent road network taking into account the removal of the Bridge and using the methods and assumptions noted above. Future demands for each internal and external zone, in addition to background traffic from key strategic links and connections adjacent to the site, were then added together resulting in the daily demands set out in Figure 5.

Figure 5 Estimated Daily Vehicle Demands (post-2031)

Based on the information and analysis detailed above, the changes to the traffic generation characteristics of the eastern portion of the LSP have been evaluated and are shown in Figure 6.

*Figure 6: Forecast Traffic Volumes Differences from the Original LSP (2013)**

*Flow difference information is not available along Perspective Drive and Picasso Promenade as these links were not reported in the original NW Corridor Model

As can be seen, following the removal of the secondary bridge over the railway line, there has been an increase in the two-way daily volumes estimated along **NS 1 approaching Alkimos Drive (6,200vpd**; previously 5,000vpd in the Aulabaugh Report) as more trips are choosing this short section of route to access Alkimos Drive. It is also noted that flows along **NS 2 (12,600vpd)** have decreased as a result of the bridge removal (previously 15,000vpd in the Aulabaugh Report). The daily flows also decreased along Modernism Avenue as a result of the preference in routing through Picasso Promenade which provides a more direct link and roundabout controlled to the eastern portion of Alkimos Vista to/from Marmion Avenue.

The total future volumes overall and as shown in Figure 5 are still within what has been considered within the Aulabaugh Report. The proposed internal road hierarchy for the eastern portion of Alkimos Vista is shown in The cross-section for Alkimos Drive prepared by Cossill & Webley (dated December 2019) is included at Appendix B.

Figure 7. This road hierarchy has been verified using the guidelines and indicative daily traffic volume limits set out in *Liveable Neighbourhoods*, together with the overall design principles and aims for the LSP development.

The road reserve widths proposed for each class of road are in line with the *Liveable Neighbourhoods* guidance (indicative), as set out below:

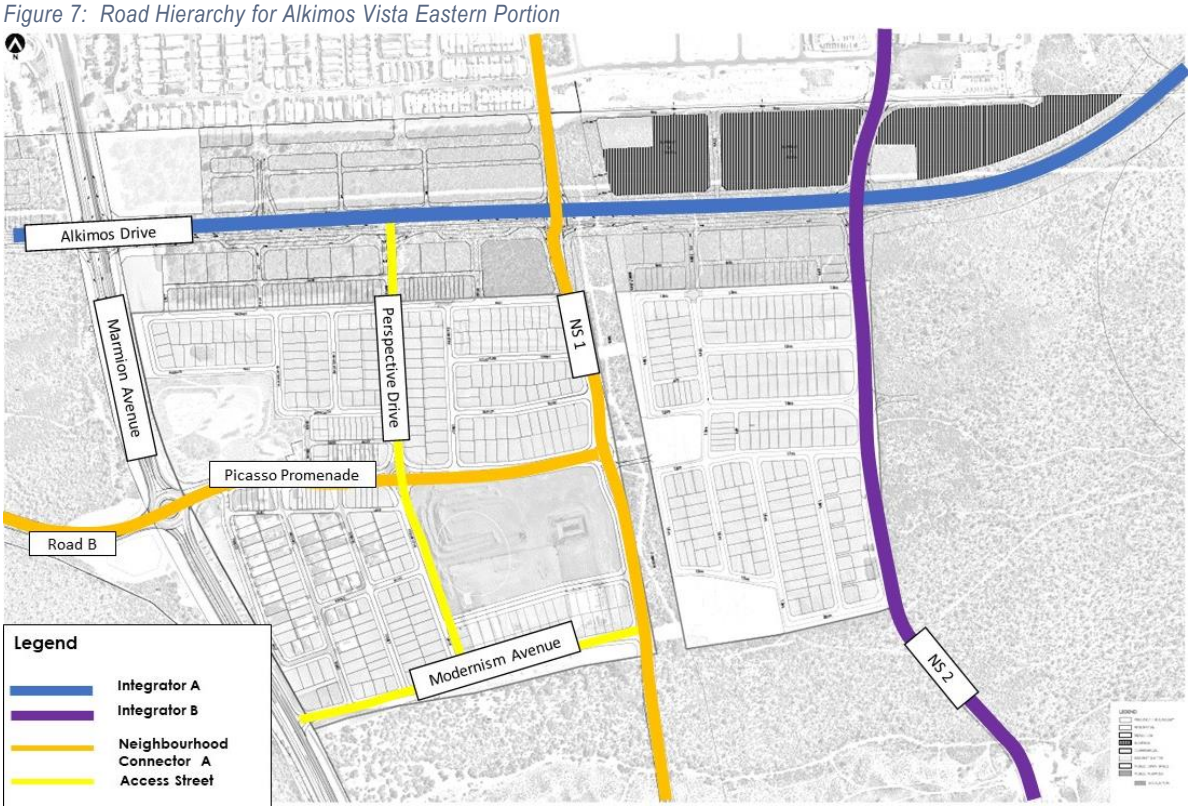
- Integrator A = 50.6m – 52.6m, 2x8.2m including bike lane and 2x5.5 service roads with parking. The section of Alkimos Drive between Marmion Avenue and the freeway is recommended as an Integrator A.
- Integrator B = 27.0m, 2x7.5m including a bike lane and excluding on-street parking (5.5m verge width). NS 2 is recommended as an Integrator B (2-lanes).
- Neighbourhood Connector A = 22.5m - 24.4m (These are 'special' streets and their design needs to have regard to context, function and adjacent land uses). As indicated in the daily demands set out in Figure 5, NS 1 to the west of the railway corridor is expected to carry in the order of (7,950vpd to 5,075vpd) and accordingly is recommended to be constructed as a two-lane divided street to accommodate higher Neighbourhood Connector volumes. Road B is also expected to carry in the order of 5,000vpd and is also recommended to be constructed to this standard.

The remainder of the local road network is classified as Access Street B, C, and D with 16.5m – 14.2m road reserve width as follows:

- Access Street B = 16.5m – 18m. The access streets adjoining the primary school are recommended to be constructed to this standard in order to allow for on-street parking on both sides of the street.
- Access Street C = 15.4m – 16m.
- Access Street D = 14.2m (narrower access streets (5.5 to 6m pavement width) may be appropriate in locations further away from centres and activity where traffic flows are less than 1,000vpd and a low on-street parking demand exists).

Removing the secondary bridge will also remove the previously planned pedestrian/cycle connections over the railway corridor in Vista. To ensure adequate walk/cycle connections are present, Cossill & Webley's preliminary Alkimos Drive cross-section layout proposes a dual carriageway of 3.5m wide lanes and 2m wide on-road cycle lanes (both sides), a 6m median, shared path in one verge and a dual use path/footpath in the opposite verge. All Access Streets are also proposed to have a footpath on at least one side. The cross-section for Alkimos Drive prepared by Cossill & Webley (dated December 2019) is included at Appendix B.

Figure 7: Road Hierarchy for Alkimos Vista Eastern Portion



Local Traffic Management

Given the predominantly residential land use within Alkimos Vista, and their weighted one-directional peak hour flows within the internal road network, it is not expected any capacity issues will occur at junctions internal to the LSP and that uncontrolled priority and roundabout intersections will be sufficient to accommodate the expected demand.

The proposed road hierarchy detailed in The cross-section for Alkimos Drive prepared by Cossill & Webley (dated December 2019) is included at Appendix B.

Figure 7 assumes a Neighbourhood Connector A standard for Picasso Promenade along its full length. It is noted that the section of this road immediately to the west of NS 1 is estimated to carry some 3,450vpd which suggests that direct full movement access is still feasible for the lots fronting this section of road.

The default speed limit within built up areas is 50km/hr along Neighbourhood Connectors and Access Streets as per current *Liveable Neighbourhoods* guidance, however, a push to lower local road speeds to below the Killed or Serious Injured threshold speeds should be considered as per the Safe Systems Engineering designs adopted by State Government. It is recommended to have a School Speed Zone along the portion of NS 1 immediately to the east of the primary school as shown in Figure 8. Roundabouts are suggested along the northern corners of the primary school to maintain safe speeds and facilitate traffic turning movements with priority-controlled intersections recommended to be adequate at the other two corners of the school. Suggested speed limits within the portion of the LSP east of Marmion Avenue (in line with the *Liveable Neighbourhoods* guidance) are presented in Table 4.

Traffic management measures should be further confirmed at the time that the school is planned in detail to ensure appropriate treatments are provided at convenient locations for safe pedestrian, cyclists movement and school pick-up / set down.

Table 4 Suggested Speed Limits within Alkimos Vista Eastern Portion (Liveable Neighbourhoods Guidelines)

Road	Suggested Speed Limit (km/hr)
Perspective Drive	50/40km/hr
Picasso Promenade	50km/hr
Modernism Avenue	50/40km/hr
NS 1	Within school zone hours, 40km/hr immediately to the east of the primary school and 50km/hr along north of Road B Outside school zone hours, 50km/hr along its full length
NS 2	50/40km/hr
Alkimos Drive	60km/hr

CAP Roads along Alkimos Drive are proposed as an essential need for the viability of the mixed-use developments along Alkimos Drive (on both sides) and provides a suitable access solution to these land uses between Marmion Avenue and the Mitchell Freeway. The CAP roads have been shown to fit well within the Alkimos Drive road reserve and within the ultimate dual carriageway cross-section (refer Cossill & Webley plans at Appendix B). Passing traffic along this strategic east-west Alkimos Drive will have good exposure to the commercial land uses planned along Alkimos Drive and the CAP roads enable a direct access solution that also does not detrimentally impact the through flow. The CAP roads also remove undue pressure on just one all-movement intersection and the undesired re-routing of traffic to other supplementary local intersections. As an example, considering the section between the railway and Marmion Avenue, the provision of two left-only in slip lanes and 2 left-only out slip lanes distributes the traffic demands across 5 intersections in a non-imposing operational manner, as opposed to just one imposing all movement intersection. The same applies for the section between the railway corridor and NS 2.

The viability of the neighbourhood centre and mixed-use developments along Alkimos Drive fronting Alkimos Vista and abutting Shorehaven are greatly dependent on the CAP roads being in place. Without these, the amenity of the residential roads within Shorehaven and the Vista are expected to suffer and carry in excess of what they are intended to (above 3,000vpd).

Figure 8 Traffic Management for Alkimos Vista Eastern Portion

Assessment of Intersection Operations

The operation of the key intersections along Alkimos Drive for access to the eastern portion of Alkimos Vista has been assessed using SIDRA Intersection[2] (SIDRA) in 2031. SIDRA is a computer-based modelling package which calculates intersection performance. As detailed in the WAPC Guidelines, the critical measure of intersection performance is average delay per vehicle. Table 5 sets out the thresholds for intersection delays considered to provide an adequate Level of Service (LoS) within the WAPC Guidelines for priority-controlled intersections.

Table 5 WAPC Guideline Thresholds for Intersection Adequate Operations

Delay Component	Priority-Controlled Intersection Threshold	Signalised Intersection Threshold
Average delay for all vehicles passing through the intersection	<35 seconds	<55 seconds
Average delay for any individual vehicle, pedestrian or cyclist movement	<45 seconds	<65 seconds

SIDRA outputs are presented in the form of Degree of Saturation, Level of Service, Average Delay and 95% Queue. These characteristics are defined as follows:

- **Degree of Saturation (DoS)**; 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 (LoS)**; 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 Length**; is the queue length below which 95% of all observed queue lengths fall.

The general layouts of intersections A and B along Alkimos Drive have been tested as signalised intersections in line with the recommendations presented in the Aulabaugh Report. Layouts are shown in Figure 9 and Figure 10, though this may also be in the form of roundabouts (subject to further analysis and stakeholder approval).

Figure 11 and Figure 12 demonstrate the **two-stage crossing** layouts suggested for **intersections C and D**. Outputs of the intersection performance assessment are summarised in Table 6 to Table 9 with full results presented at Appendix A.

[2] Program used under licence from Akcelik & Associates Pty Ltd

Figure 9 Alkimos Drive / NS 2 - Intersection A (Post 2031 Scenario)

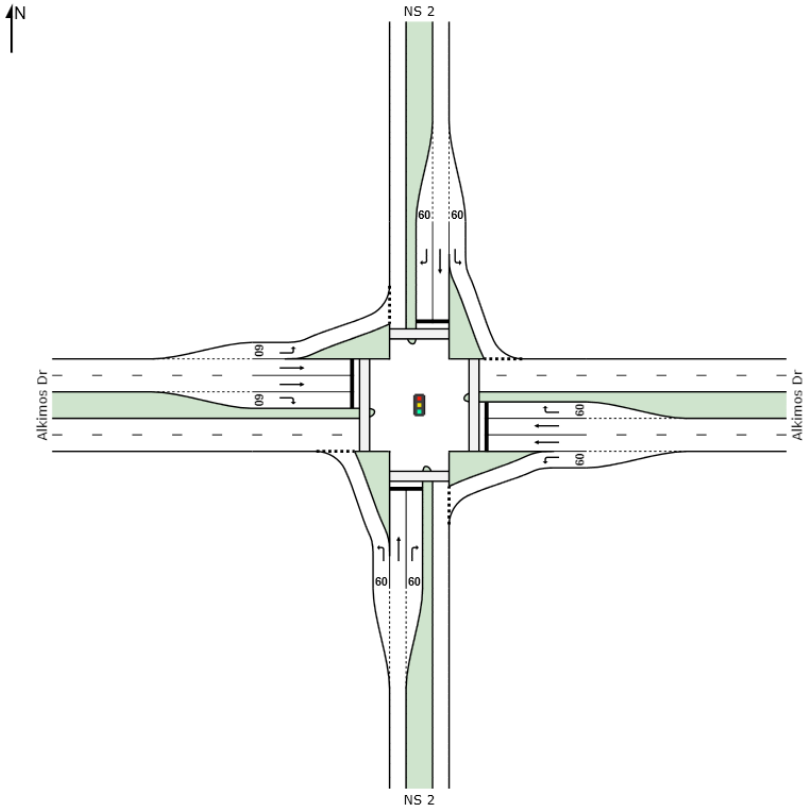


Figure 10:Alkimos Drive / NS 1 - Intersection B (Post 2031 Scenario)

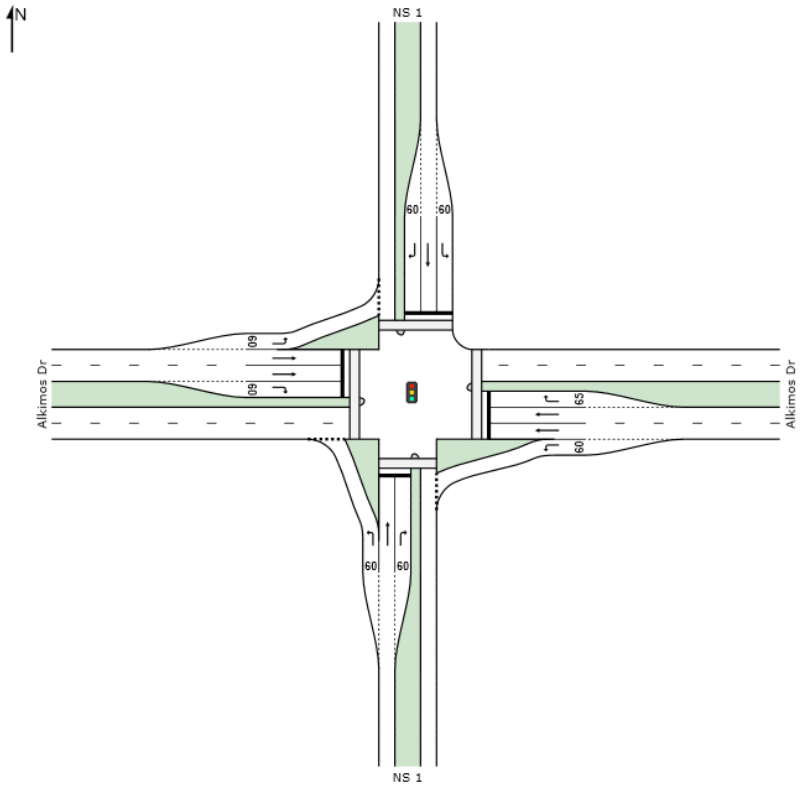


Figure 11:Alkimos Drive / Perspective Drive - Intersection C (Post 2031 Scenario)

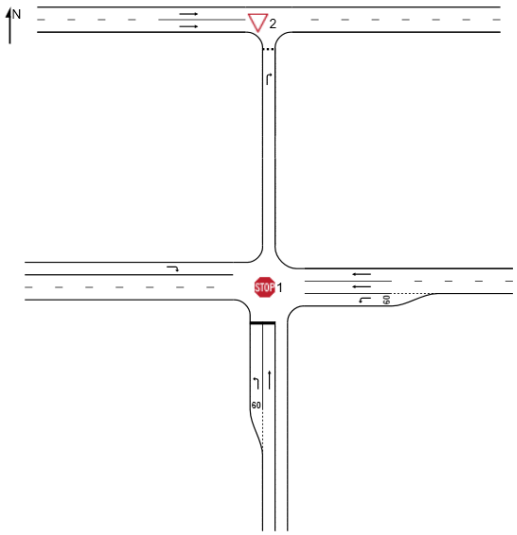


Figure 12:Alkimos Drive / Road A - Intersection D (Post 2031 Scenario)

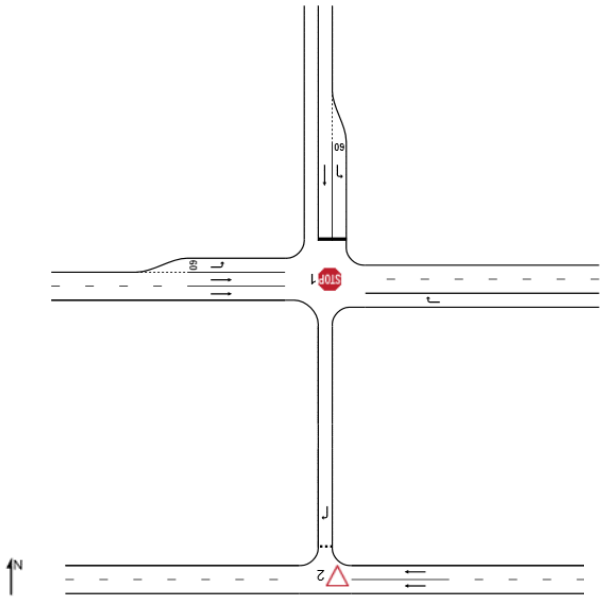


Table 6 Intersection A - Alkimos Drive/NS 2 Intersection Performance (Post 2031 Scenario)

Intersection	Arm	DOS	LOS	Avrg Delay	95th %ile Q
Intersection A Alkimos Drive / NS 2 AM	NS2 (south)	0.650	C	26.0	99.0
	Alkimos Drive (east)	0.890	C	32.1	104.6
	NS2 (north)	0.870	D	40.8	93.6
	Alkimos Drive (west)	0.878	D	40.9	226.2
	Intersection	**0.890**	**D**	**35.2**	**226.2**
Intersection A Alkimos Drive / NS 2 PM	NS2 (south)	0.509	C	20.7	40.5
	Alkimos Drive (east)	0.875	C	26.5	121.5
	NS2 (north)	0.885	C	32.9	60.2
	Alkimos Drive (west)	0.854	D	36.4	115.8
	Intersection	**0.885**	**C**	**29.4**	**121.5**

Table 7 Intersection B - Alkimos Drive/NS 1 Intersection Performance (Post 2031 Scenario)

Intersection	Arm	DOS	LOS	Avrg Delay	95th %ile Q
Intersection B Alkimos Drive / NS 1 AM	NS1 (south)	0.810	D	35.4	51.9
	Alkimos Drive (east)	0.861	C	32.8	132.0
	NS1 (north)	0.738	C	29.8	46.0
	Alkimos Drive (west)	0.872	C	34.2	110.0
	Intersection	**0.872**	**C**	**32.9**	**132.0**
Intersection B Alkimos Drive / NS 1 PM	NS1 (south)	0.735	C	34.3	35.7
	Alkimos Drive (east)	0.789	C	25.4	105.6
	NS1 (north)	0.753	C	29.1	36.8
	Alkimos Drive (west)	0.755	C	27.1	82.7
	Intersection	**0.789**	C	**27.1**	**105.6**

Table 8 Intersection C - Alkimos Drive/Perspective Drive Intersection Performance (Post 2031 Scenario)

Intersection	Arm	DOS	LOS	Avrg Delay	95th %ile Q
Intersection C Alkimos Drive / Perspective Drive AM	Perspective Drive (south)	0.167	C	17.3	3.9
	Alkimos Drive (east)	0.258	N/A	0.8	0.0
	Alkimos Drive (west)	0.223	N/A	22.3	1.2
	Intersection	**0.258**	**N/A**	**2.2**	**3.9**
Intersection C Alkimos Drive / Perspective Drive PM	Perspective Drive (south)	0.109	C	15.1	2.6
	Alkimos Drive (east)	0.232	N/A	1.0	0.0
	Alkimos Drive (west)	0.207	N/A	19.4	1.0
	Intersection	**0.232**	**N/A**	**2.0**	**2.6**

Table 9 Intersection D - Alkimos Drive/Road A Intersection Performance (Post 2031 Scenario)

Intersection	Arm	DOS	LOS	Avrg Delay	95th %ile Q
Intersection D Alkimos Drive / Road A AM	Alkimos Drive (east)	0.264	N/A	14.4	2.5
	Road A (north)	0.051	B	11.6	1.3
	Alkimos Drive (west)	0.208	N/A	0.2	0.0
	Intersection	**0.264**	**N/A**	**1.3**	**2.5**
Intersection C Alkimos Drive / Road A PM	Alkimos Drive (east)	0.235	N/A	12.5	2.1
	Road A (north)	0.050	B	11.2	1.3
	Alkimos Drive (west)	0.180	N/A	0.3	0.0
	Intersection	**0.235**	**N/A**	**1.5**	**2.1**

Analysis results demonstrate that the three intersections are expected to operate acceptably upon full development of the site in 2031.

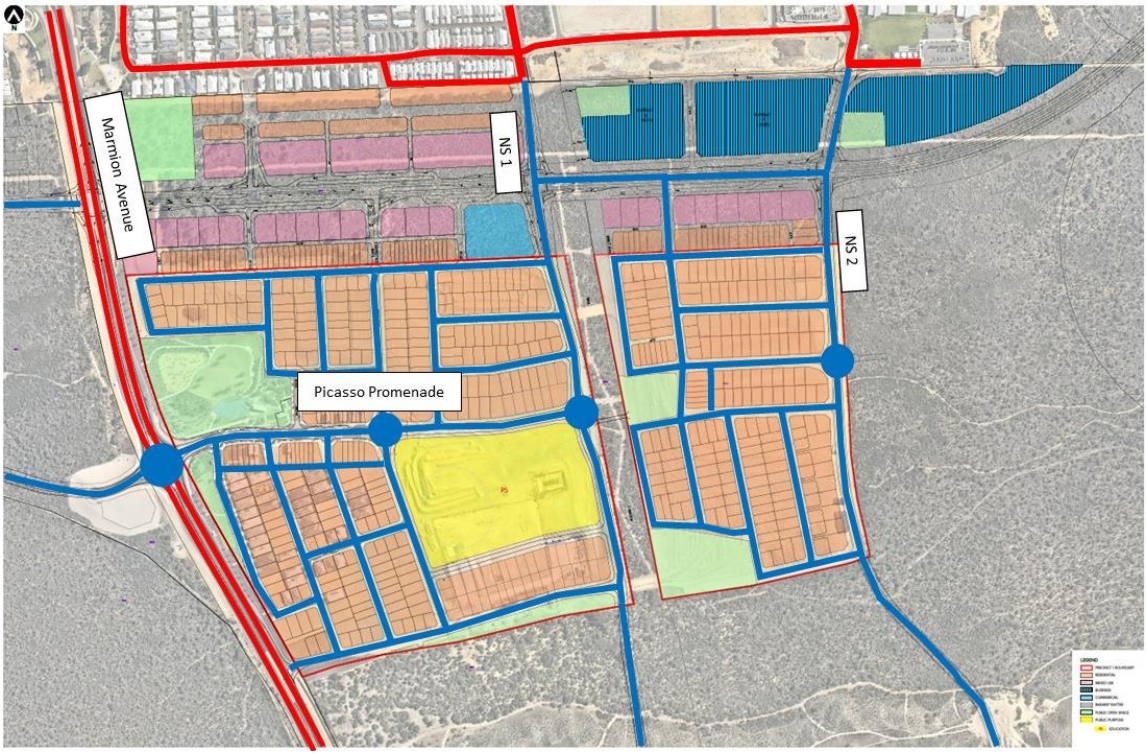
Further, the analysis results in Appendix A demonstrate that the four intersections (G, H, I and J along NS 2) are expected to operate acceptably upon full development of the site post 2031.

Interim Scenario Modelling (Pre 2031)

GTA has modelled an interim pre-2031 scenario where:

- Alkimos Drive has NOT been connected to Marmion Avenue. Only the Alkimos Drive Bridge exists.
- Freeway / Alkimos Drive interchange does not exist.

Figure 13 Alkimos Vista Road Network (Pre-2031 Interim Scenario)



The operation of the Marmion Avenue / Picasso Promenade intersection has been modelled to test the performance of the intersection without an Alkimos Drive and a Freeway extension at 2031. In this scenario, Marmion Avenue is carrying 25,000 vehicles per day in 2031, consistent with estimates undertaken for the Marmion Avenue Duplication Project by City of Wanneroo and Alkimos Central City Centre modelling by Development WA.

Figure 14 Marmion Avenue / Picasso Promenade Roundabout Intersection – Intersection E

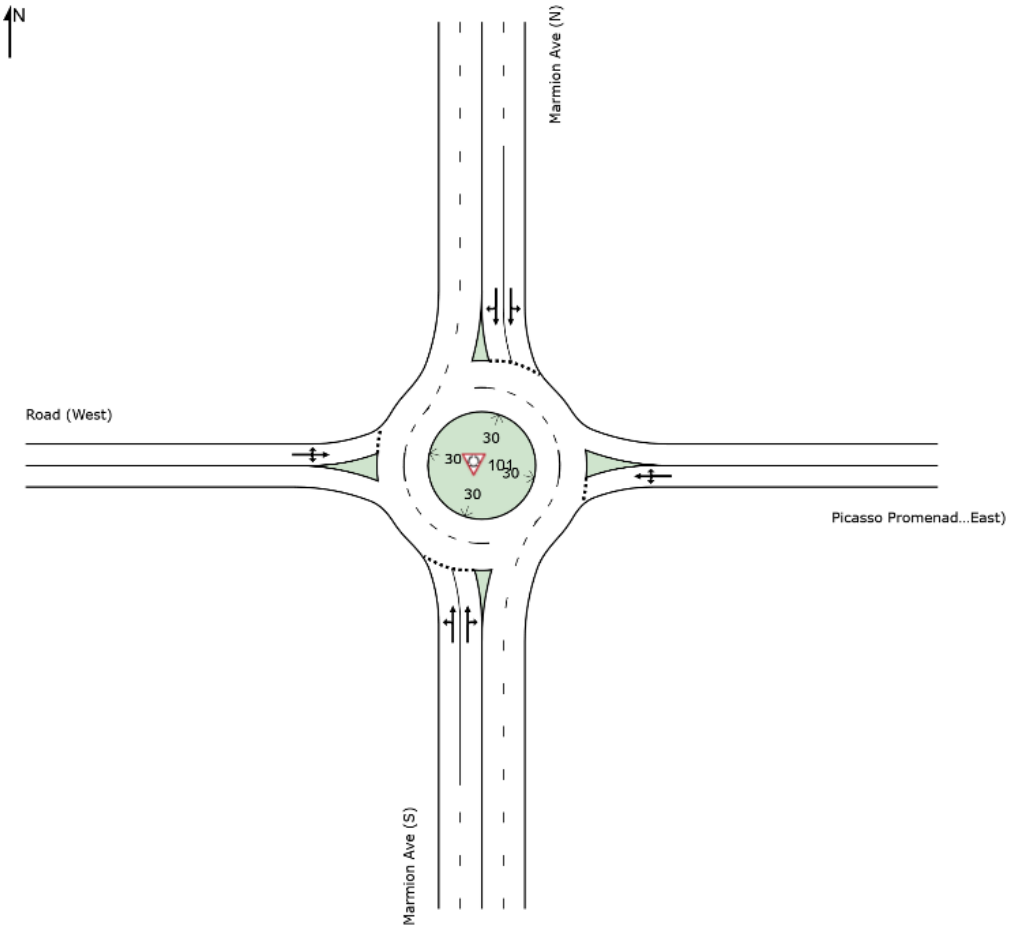


Table 10 Marmion Avenue / Picasso Promenade (Pre-2031 Interim Scenario)

Location	Arm	DOS	LOS	Avrg Delay	95th %ile Q
Marmion Avenue / Picasso Promenade – Precinct West of Railway AM	Marmion Ave (S)	0.59	B	10s	42m
	Picasso Promenade (East)	0.90	C	24s	84m
	Marmion Ave (N)	0.50	A	7s	27m
	Road (West)	0.28	B	11s	11m
	Intersection	0.90	B	12s	84m
Marmion Avenue / Picasso Promenade - Stage 16 AM	Marmion Ave (S)	0.62	B	11s	47m
	Picasso Promenade (East)	0.99	D	43s	162m
	Marmion Ave (N)	0.50	A	7s	27m
	Road (West)	0.27	B	11s	10m
	Intersection	0.99	B	16s	162m
Marmion Avenue / Picasso Promenade - Full Development AM	Marmion Ave (S)	0.62	B	11s	47m
	Picasso Promenade (East)	1.02	E	58s	219m
	Marmion Ave (N)	0.50	A	7s	28m
	Road (West)	0.27	B	11s	10m
	Intersection	1.02	B	20s	219m

Location	Arm	DOS	LOS	Avrg Delay	95th %ile Q
Marmion Avenue / Picasso Promenade - Precinct West of Railway PM	Marmion Ave (S)	0.54	A	9s	33m
	Picasso Promenade (East)	0.74	B	16s	45m
	Marmion Ave (N)	0.56	A	8s	33m
	Road (West)	0.24	A	10s	9m
	Intersection	0.74	A	10s	45m
Marmion Avenue / Picasso Promenade - Stage 16 PM	Marmion Ave (S)	0.56	A	9s	36m
	Picasso Promenade (East)	0.80	B	18s	53m
	Marmion Ave (N)	0.58	A	8s	36m
	Road (West)	0.25	B	10s	9m
	Intersection	0.80	B	10s	53m
Marmion Avenue / Picasso Promenade - Full Development PM	Marmion Ave (S)	0.60	B	10s	43m
	Picasso Promenade (East)	0.93	C	29s	97m
	Marmion Ave (N)	0.61	A	9s	42m
	Road (West)	0.28	B	10s	11m
	Intersection	0.93	B	13s	97m

Figure 15 NS 1 / Alkimos Drive T-Junction Intersection – Intersection B (Pre-2031 Interim Scenario)

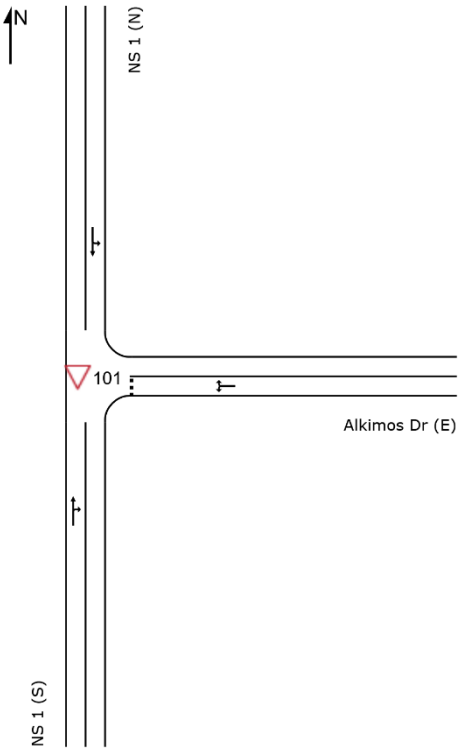


Table 11 NS 1 / Alkimos Drive Intersection (Pre-2031 Interim Scenario)

Location	Arm	DOS	LOS	Avrg Delay	95th %ile Q
NS 1 / Alkimos Drive AM	NS 1 (S)	0.18	-	4s	7m
	Alkimos Dr (E)	0.39	A	7s	15m

Location	Arm	DOS	LOS	Avrg Delay	95th %ile Q
	NS 1 (N)	0.11	-	2s	0m
	Intersection	0.39	-	5s	15m
NS 1 / Alkimos Drive PM	NS 1 (S)	0.22	-	5s	9m
	Alkimos Dr (E)	0.34	A	7s	11m
	NS 1 (N)	0.15	-	3s	0m
	Intersection	0.34	-	5s	11m

Figure 16 NS 2 / Alkimos Drive T-Junction Intersection – Intersection A (Pre-2031 Interim Scenario)

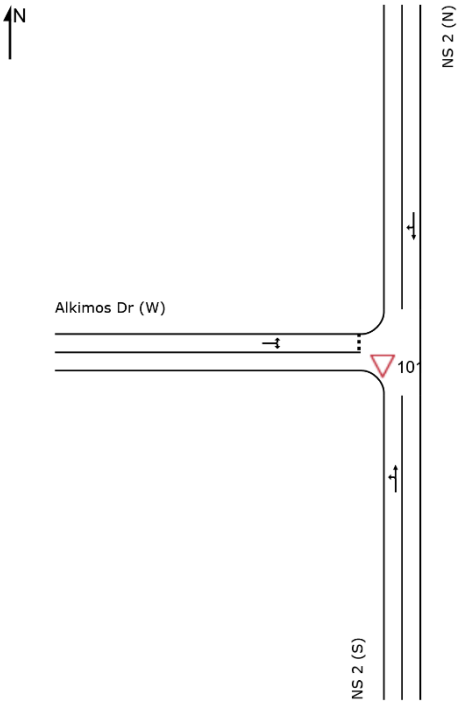


Table 12 NS 2 / Alkimos Drive Intersection Performance (Pre-2031 Interim Scenario)

Location	Arm	DOS	LOS	Avrg Delay	95th %ile Q
NS 2 / Alkimos Drive AM	NS 2 (S)	0.16	-	5s	0m
	NS 2 (N)	0.14	-	6s	5m
	Alkimos Dr (W)	0.23	A	7s	7m
	Intersection	0.23	-	6s	7m
NS 2 / Alkimos Drive PM	NS 2 (S)	0.14	-	4s	0m
	NS 2 (N)	0.13	-	5s	5m
	Alkimos Dr (W)	0.34	A	7s	11m
	Intersection	0.34	-	6s	11m

Figure 17 Alkimos Drive / Alkimos Vista T-Junction – Intersection F (Pre-2031 Interim Scenario)

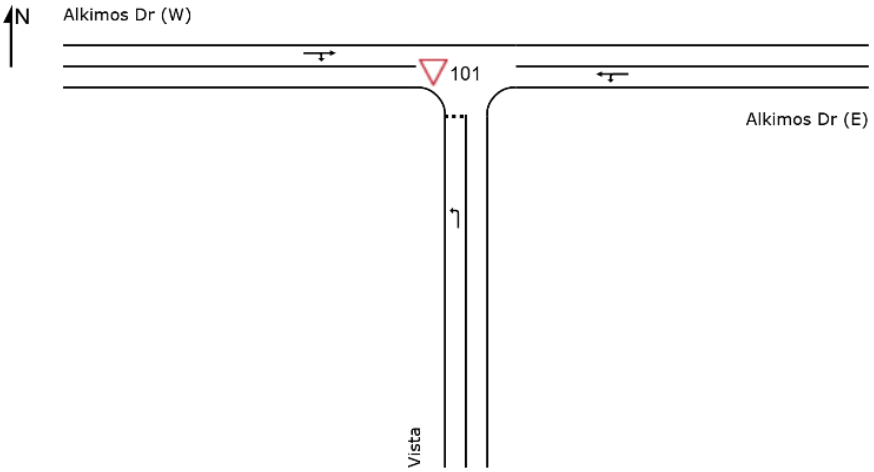


Table 13 Alkimos Drive / Alkimos Vista T-Junction (Pre-2031 Interim Scenario)

Location	Arm	DOS	LOS	Avrg Delay	95th %ile Q
Alkimos Dr / Vista Access AM	Vista	0.04	A	7s	1m
	Alkimos Dr (E)	0.21	-	0s	0m
	Alkimos Dr (W)	0.15	-	1s	3m
	Intersection	0.21	-	1s	3m
Alkimos Dr / Vista Access PM	Vista	0.01	A	7s	0m
	Alkimos Dr (E)	0.19	-	0s	0m
	Alkimos Dr (W)	0.22	-	2s	6m
	Intersection	0.22	-	1s	6m

Based on the above, the following key development staging milestones arise:

All lots between Marmion Avenue and the Railway Corridor (Stages 1 - 11, **361 lots and school**)

- Picasso Promenade / Marmion Avenue
    - AM Peak – 89.8%, LOS C
    - PM Peak – 74.2%, LOS B

    Acceptable operation in both peaks.

91% of full development (Stages 1 – 16, **514 lots and school**)

- Picasso Promenade / Marmion Avenue
    - AM Peak – 98.6%, LOS D
    - PM Peak – 79.5%, LOS B

    Acceptable Operation in both peaks given LOS D (average delay <45s/veh) or better per WAPC Guidelines.

100% development of Alkimos Vista approximately **564 lots** (anticipated 2027 Ultimate Development)

- Picasso Promenade / Marmion Avenue
- Acceptable Operation in both peaks in 2027 with DOS below 100%

- Just prior to 2031, Picasso Promenade reaches capacity at DOS of 101.8% / 93% with LOS E/C (AM/PM) but Marmion Avenue (both approaches) will be operating well with a DOS of 65% in both peaks.

The above highlights that with Alkimos Vista's Ultimately Developed in 2027, the Picasso Promenade / Marmion Avenue roundabout intersection will be operating acceptably. However, just prior to 2031, the Picasso Promenade approach to Marmion Avenue will begin to reach capacity and an Alkimos Drive signalised intersection at Marmion Avenue (or another access) is expected to be needed at 2031.

Summary and Conclusion

An LSP has been previously prepared for Alkimos Vista (formerly called Central Alkimos) located in the City of Wanneroo. As part of the initial works completed with the LSP preparation, a full *"Traffic and Movement Network"* report was prepared by Bruce Aulabaugh in 2013. A new Amendment ("The Amendment") is necessitated due to Lendlease's recent proposal to remove the secondary bridge located over the rail corridor which joined the North-South corridors NS 1 and NS 2 south of future Alkimos Drive. It is also proposed to realign the primary school site located west of NS 1 and shift the POS east of the railway corridor slightly further east as part of The Amendment. This does not result in any changes to the LSP yields or to the overall road network.

On this basis, GTA has been engaged by Lendlease to prepare an Addendum to the Aulabaugh Report to address the revised LSP and define any impacts to the proposed local road hierarchy and movement network. This Technical Note provides supplementary information on The Amendment, within the context of the broader context of the 2013 Aulabaugh Report.

Based on the findings presented within this addendum, the following conclusions are made:

- Following the removal of the secondary bridge, there has been an increase in the two-way daily volumes estimated along NS 1 northern portion approaching Alkimos Drive and a decrease in the daily flows along NS 2. The daily flows also decrease along Modernism Avenue as a result of the preference of Picasso Promenade which provides a more direct link and roundabout control to/from Marmion Avenue.
- Future traffic volumes on individual road links within the LSP are expected to be accommodated within the proposed road reserves and cross-sections.
- The proposed internal road network layout has been designed in accordance with *Liveable Neighbourhoods* design principles, and revised volumes are shown to still be within what was considered within the Aulabaugh Report.
- CAP Roads along Alkimos Drive fit well into the road reserve and the ultimate road cross section. They are proposed as an essential need for the viability of the mixed-use developments along Alkimos Drive (on both sides) and provides a suitable access solution to the land uses between Marmion Avenue and the Mitchell Freeway without detrimentally impacting the through flow.
- Without the CAP Roads, the amenity of the residential roads within Shorehaven and the Vista are expected to suffer and carry in excess of what they are intended to (above 3,000vpd).
- The default speed limit within built up areas is 50km/hr as per current Neighbourhood Connectors and Access Streets as per *Liveable Neighbourhoods* guidance.
- Internal traffic management treatments have been considered and are expected to be reviewed and agreed upon during the subdivision phase of development.
- Removing the secondary bridge also removes the pedestrian/cycle connectivity over the railway, this resulting in a higher emphasis for attractive pedestrian and cyclist facilities to be provided along the future Alkimos Drive.
- To ensure adequate walk/cycle connections are present, Cossill & Webley's preliminary Alkimos Drive layout proposes a dual carriageway 3.5m wide lanes and 2m wide on-road cycle lanes (both sides) with a 6m median. A shared path in one verge and a dual use path/footpath in the other verge are also proposed to cater for adequate walk/cycle infrastructure provisions for Alkimos Vista.

- Intersection capacity analysis at key intersections along Alkimos Drive demonstrate that these intersections are expected to operate acceptably upon full development of the site post 2031 when the Freeway and Alkimos Drive connections are in place.
- The Interim Scenario modelling highlights that with Alkimos Vista's ultimate development expected by 2027, the Picasso Promenade / Marmion Avenue roundabout intersection will be operating acceptably. However, just prior to 2031, the Picasso Promenade approach to Marmion Avenue will begin to reach capacity and an Alkimos Drive signalised intersection at Marmion Avenue (or another access) is expected to be needed at 2031.

Naturally, should you have any questions or require any further information, please do not hesitate to contact me or Gary Soo in our Perth office on (08) 6169 1000.

Yours sincerely

GTA CONSULTANTS

Tanya Moran
Director
encl. Attachment A; Detailed Outputs from the SIDRA Analysis

Attachment A - Detailed Outputs from the SIDRA Analysis

USER REPORT FOR SITE

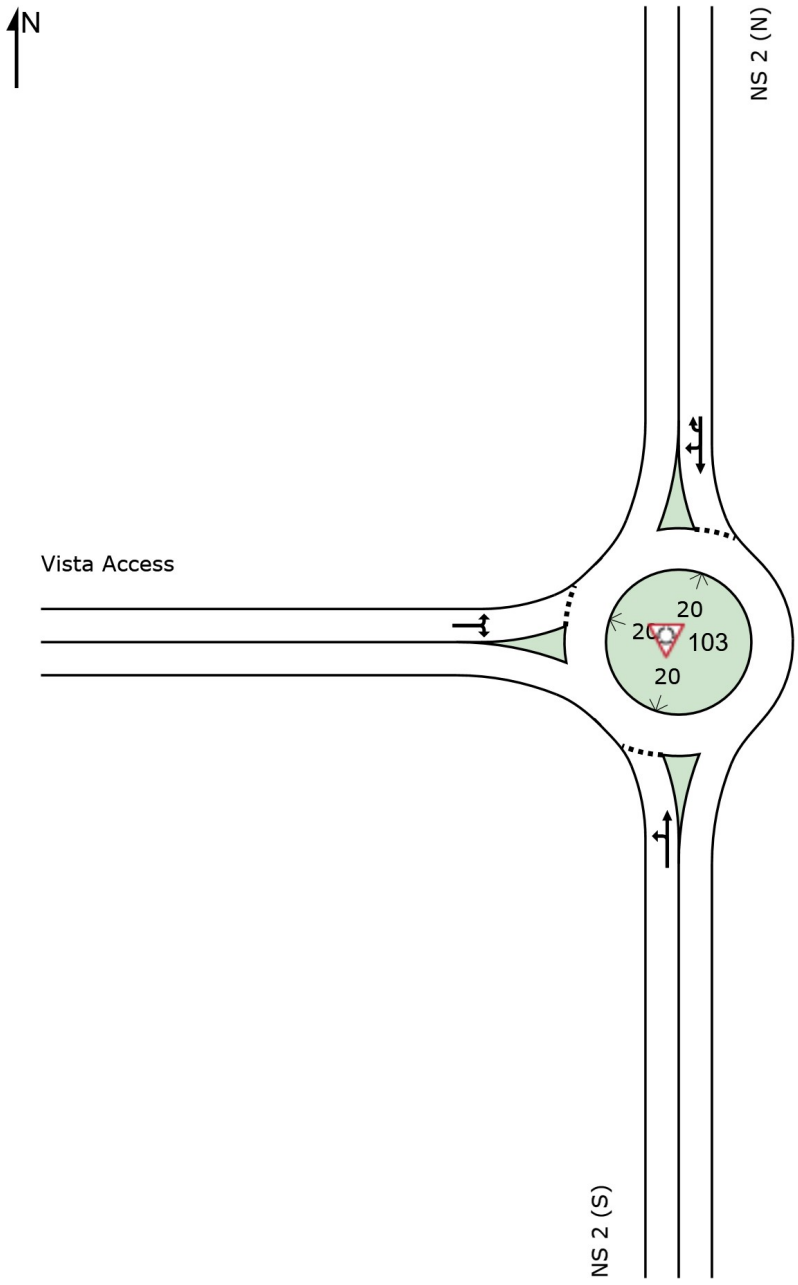
Project: Alkimos Vista

Template: GTA Appendix Report (Non Signalised)

Site: 103 [NS 2/Vista Access (With Dev) - AM Peak - 2031]

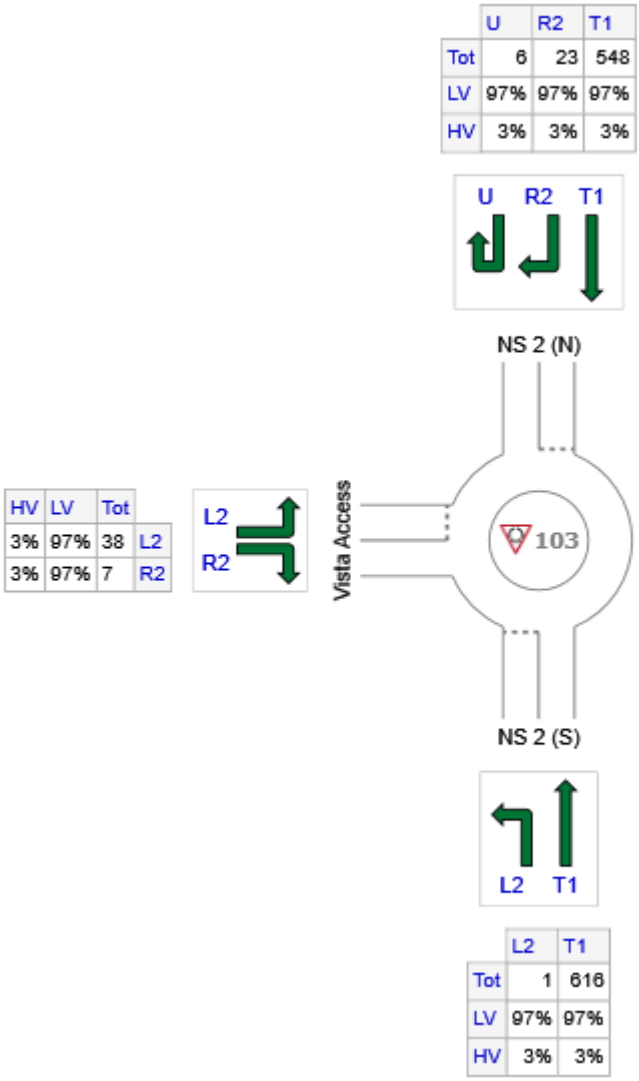
Alkimos Vista
Site Category: (None)
Roundabout

Site Layout


N
NS 2 (N)
Vista Access
20
20
103
20
NS 2 (S)

Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: NS 2 (S)	617	598	19
N: NS 2 (N)	577	560	17
W: Vista Access	45	44	1
Total	1239	1202	37

Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: NS 2 (S)													
Lane 1[d]	649	3.0	1562	0.416	100	4.3	LOS A	2.9	22.2	Full	500	0.0	0.0
Approach	649	3.0		0.416		4.3	LOS A	2.9	22.2				
North: NS 2 (N)													
Lane 1[d]	607	3.0	1675	0.363	100	4.4	LOS A	2.9	22.3	Full	500	0.0	0.0
Approach	607	3.0		0.363		4.4	LOS A	2.9	22.3				
West: Vista Access													
Lane 1[d]	47	3.0	824	0.057	100	8.3	LOS A	0.3	2.4	Full	500	0.0	0.0
Approach	47	3.0		0.057		8.3	LOS A	0.3	2.4				
Intersection	1304	3.0		0.416		4.5	LOS A	2.9	22.3				

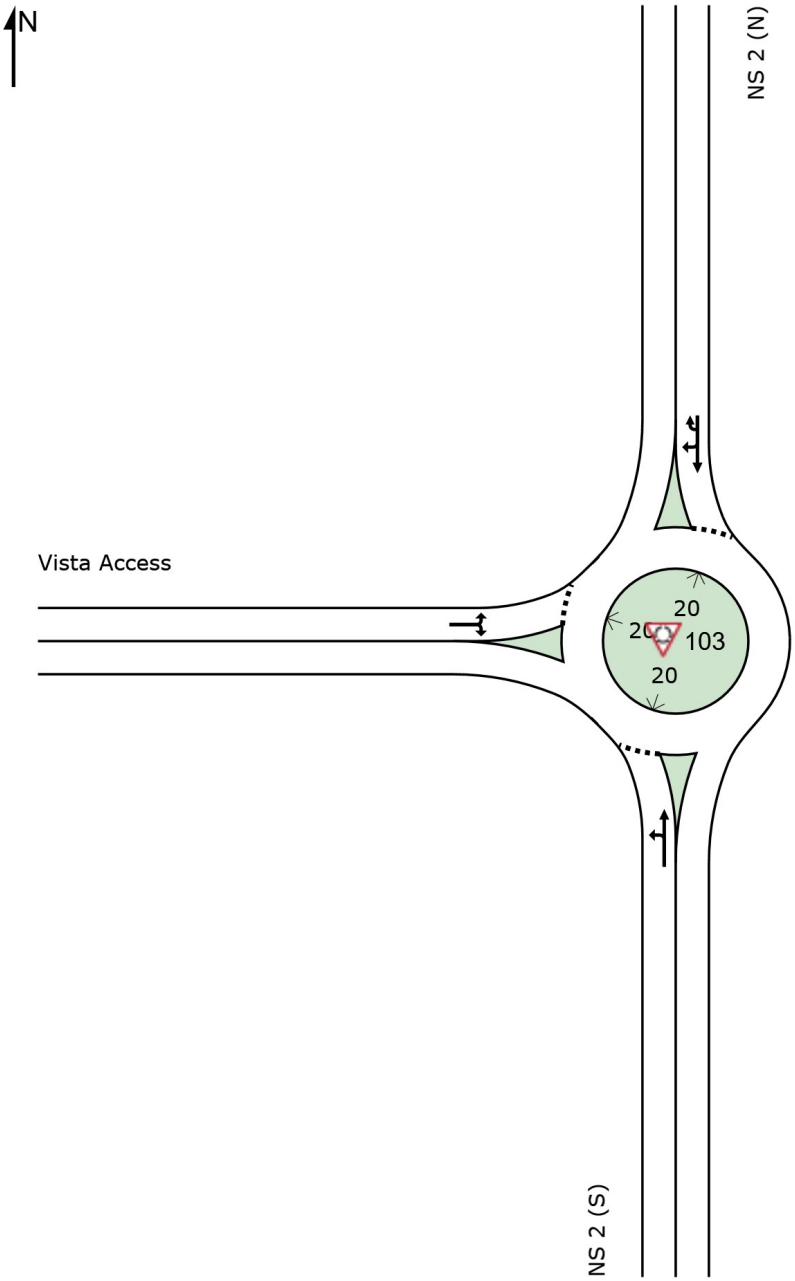
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

Site: 103 [NS 2/Vista Access (With Dev) - PM Peak - 2031]

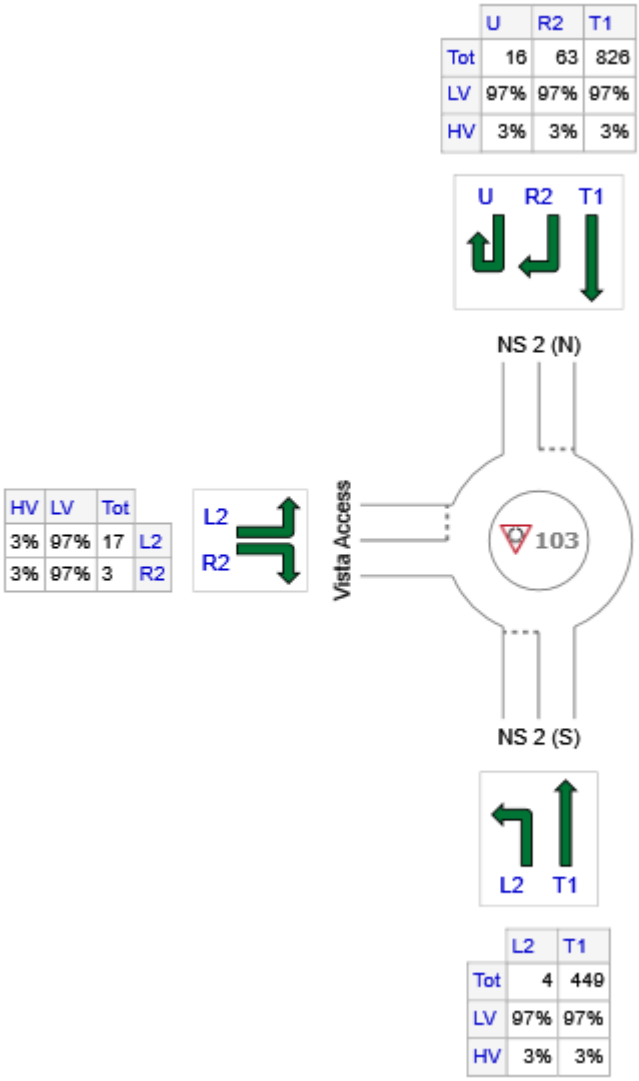
Alkimos Vista
Site Category: (None)
Roundabout

Site Layout



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: NS 2 (S)	453	439	14
N: NS 2 (N)	905	878	27
W: Vista Access	20	19	1
Total	1378	1337	41

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: NS 2 (S)													
Lane 1[d]	477	3.0	1394	0.342	100	4.6	LOS A	2.1	16.3	Full	500	0.0	0.0
Approach	477	3.0		0.342		4.6	LOS A	2.1	16.3				
North: NS 2 (N)													
Lane 1[d]	953	3.0	1714	0.556	100	4.6	LOS A	5.9	44.8	Full	500	0.0	0.0
Approach	953	3.0		0.556		4.6	LOS A	5.9	44.8				
West: Vista Access													
Lane 1[d]	21	3.0	926	0.023	100	7.0	LOS A	0.1	0.9	Full	500	0.0	0.0
Approach	21	3.0		0.023		7.0	LOS A	0.1	0.9				
Intersection	1451	3.0		0.556		4.6	LOS A	5.9	44.8				

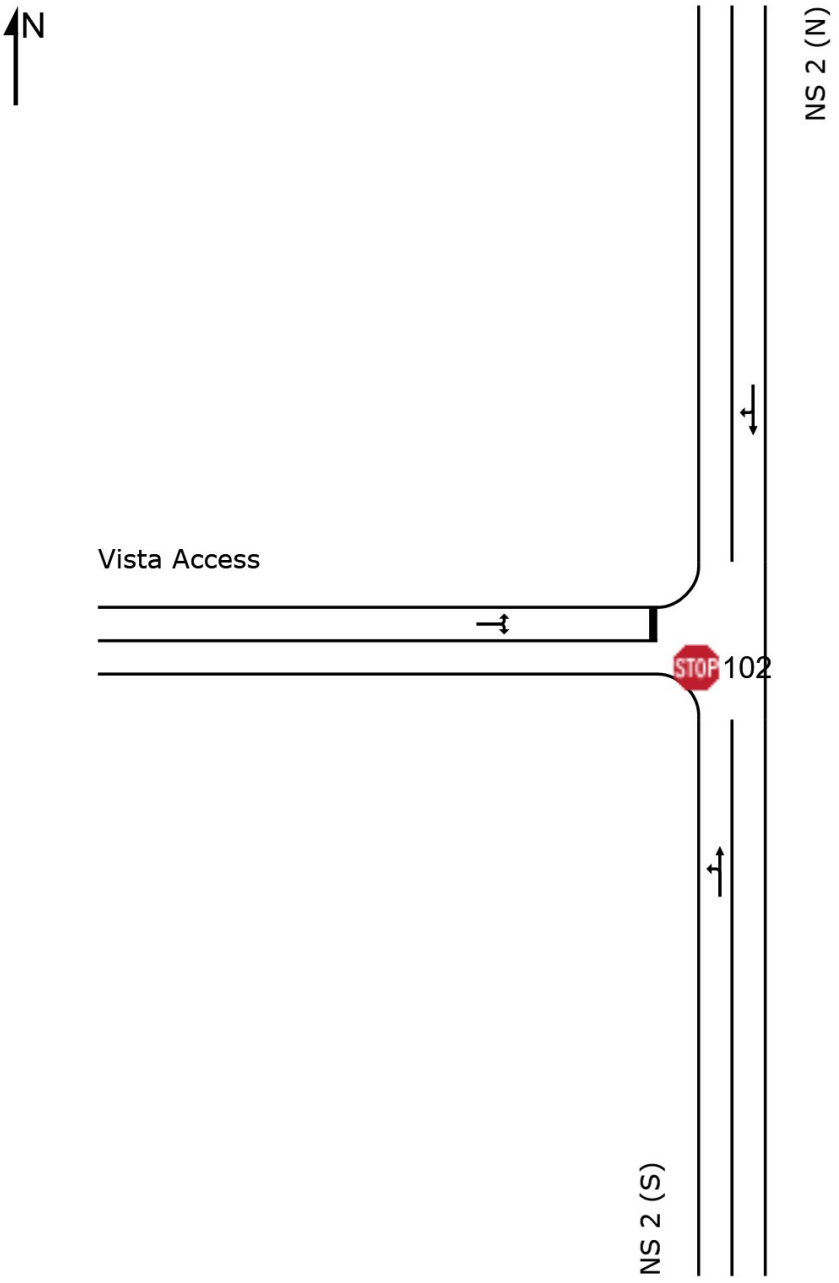
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

Site: 102 [NS 2/Vista South Access (With Dev) - AM Peak - 2031]

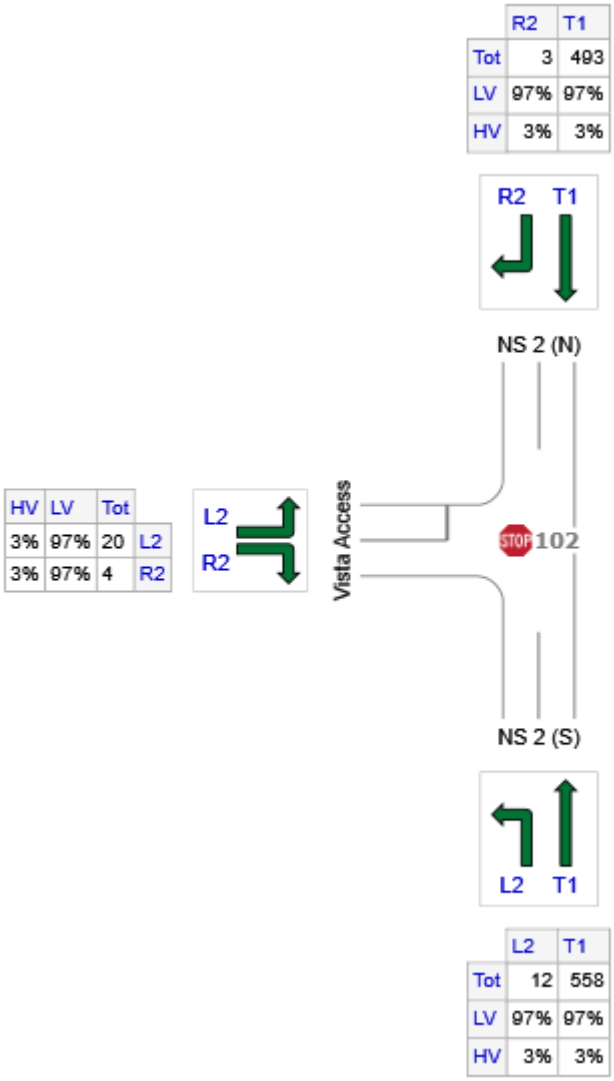
Alkimos Vista
Site Category: (None)
Stop (Two-Way)

Site Layout



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: NS 2 (S)	570	553	17
N: NS 2 (N)	496	481	15
W: Vista Access	24	23	1
Total	1090	1057	33

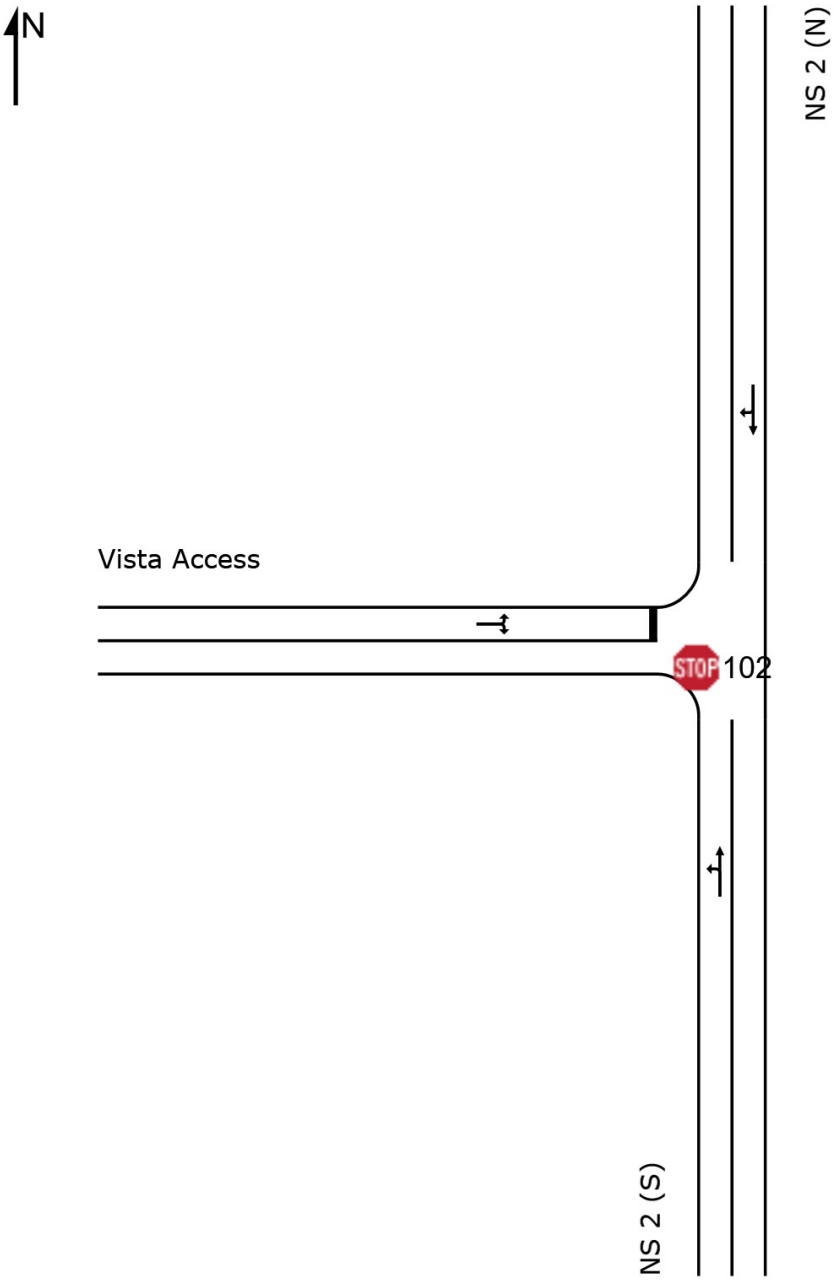
Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: NS 2 (S)													
Lane 1	600	3.0	1891	0.317	100	0.2	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	600	3.0		0.317		0.2	NA	0.0	0.0				
North: NS 2 (N)													
Lane 1	522	3.0	1880	0.278	100	0.1	LOS A	0.1	0.4	Full	500	0.0	0.0
Approach	522	3.0		0.278		0.1	NA	0.1	0.4				
West: Vista Access													
Lane 1	25	3.0	546	0.046	100	12.9	LOS B	0.2	1.2	Full	500	0.0	0.0
Approach	25	3.0		0.046		12.9	LOS B	0.2	1.2				
Intersection	1147	3.0		0.317		0.4	NA	0.2	1.2				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Site: 102 [NS 2/Vista South Access (With Dev) - PM Peak - 2031]

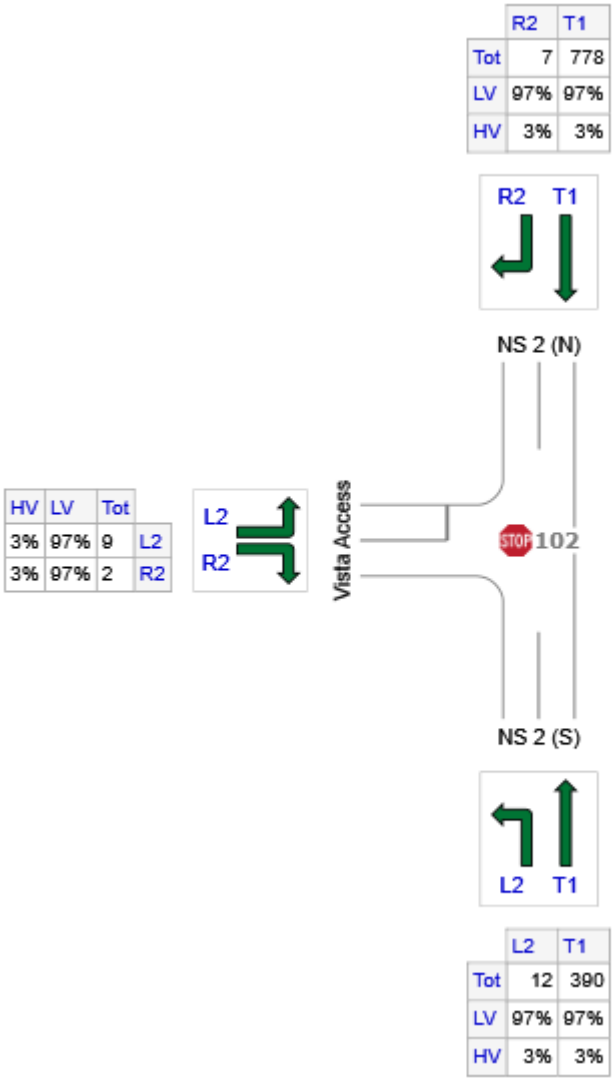
Alkimos Vista
Site Category: (None)
Stop (Two-Way)

Site Layout



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: NS 2 (S)	402	390	12
N: NS 2 (N)	785	761	24
W: Vista Access	11	11	0
Total	1198	1162	36

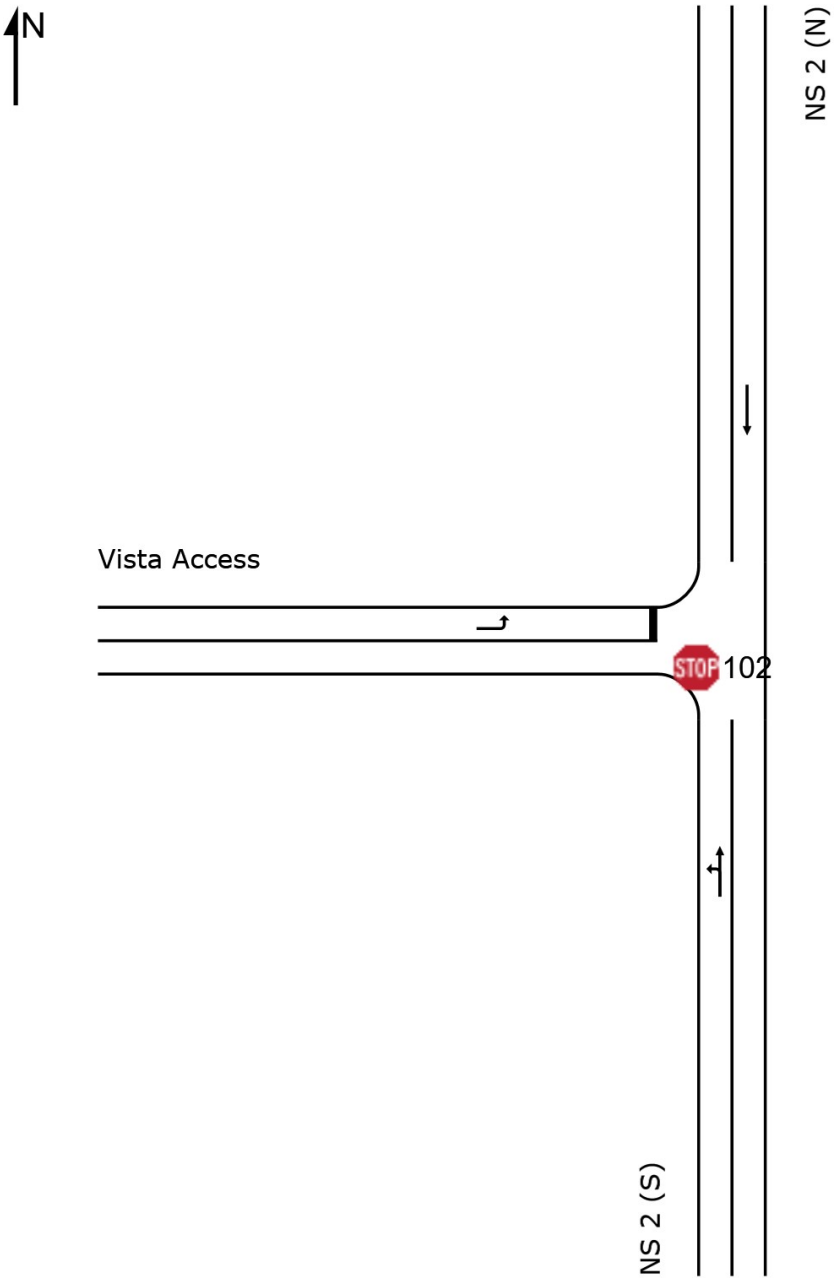
Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: NS 2 (S)													
Lane 1	423	3.0	1890	0.224	100	0.2	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	423	3.0		0.224		0.2	NA	0.0	0.0				
North: NS 2 (N)													
Lane 1	826	3.0	1882	0.439	100	0.1	LOS A	0.1	1.1	Full	500	0.0	0.0
Approach	826	3.0		0.439		0.1	NA	0.1	1.1				
West: Vista Access													
Lane 1	12	3.0	528	0.022	100	12.8	LOS B	0.1	0.5	Full	500	0.0	0.0
Approach	12	3.0		0.022		12.8	LOS B	0.1	0.5				
Intersection	1261	3.0		0.439		0.3	NA	0.1	1.1				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Site: 102 [Int G @ NS 2 (With Dev) - AM Peak - 2031]

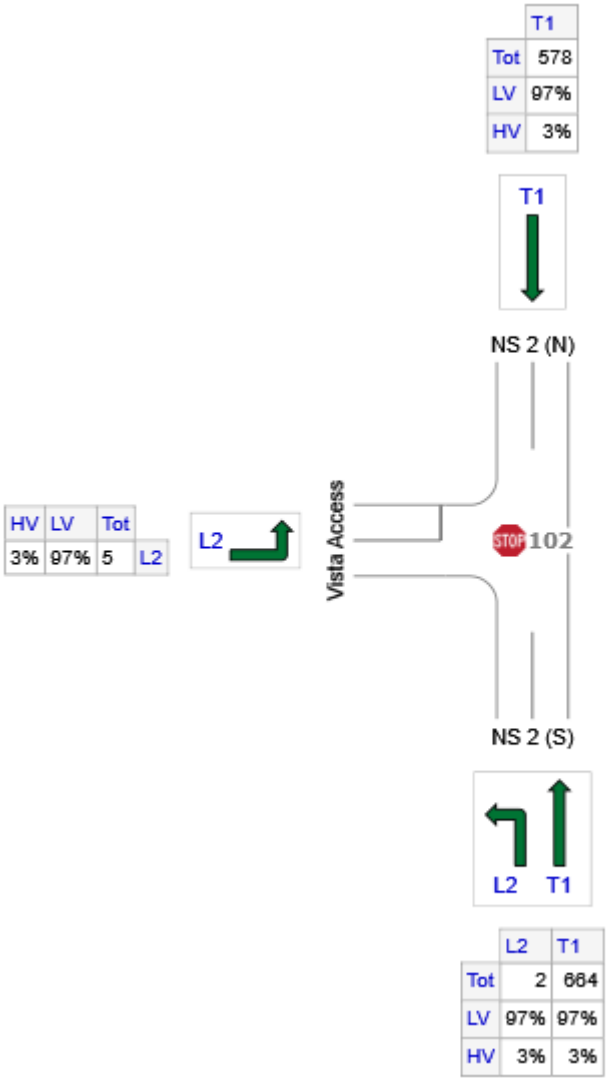
Alkimos Vista
Site Category: (None)
Stop (Two-Way)

Site Layout



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: NS 2 (S)	666	646	20
N: NS 2 (N)	578	561	17
W: Vista Access	5	5	0
Total	1249	1212	37

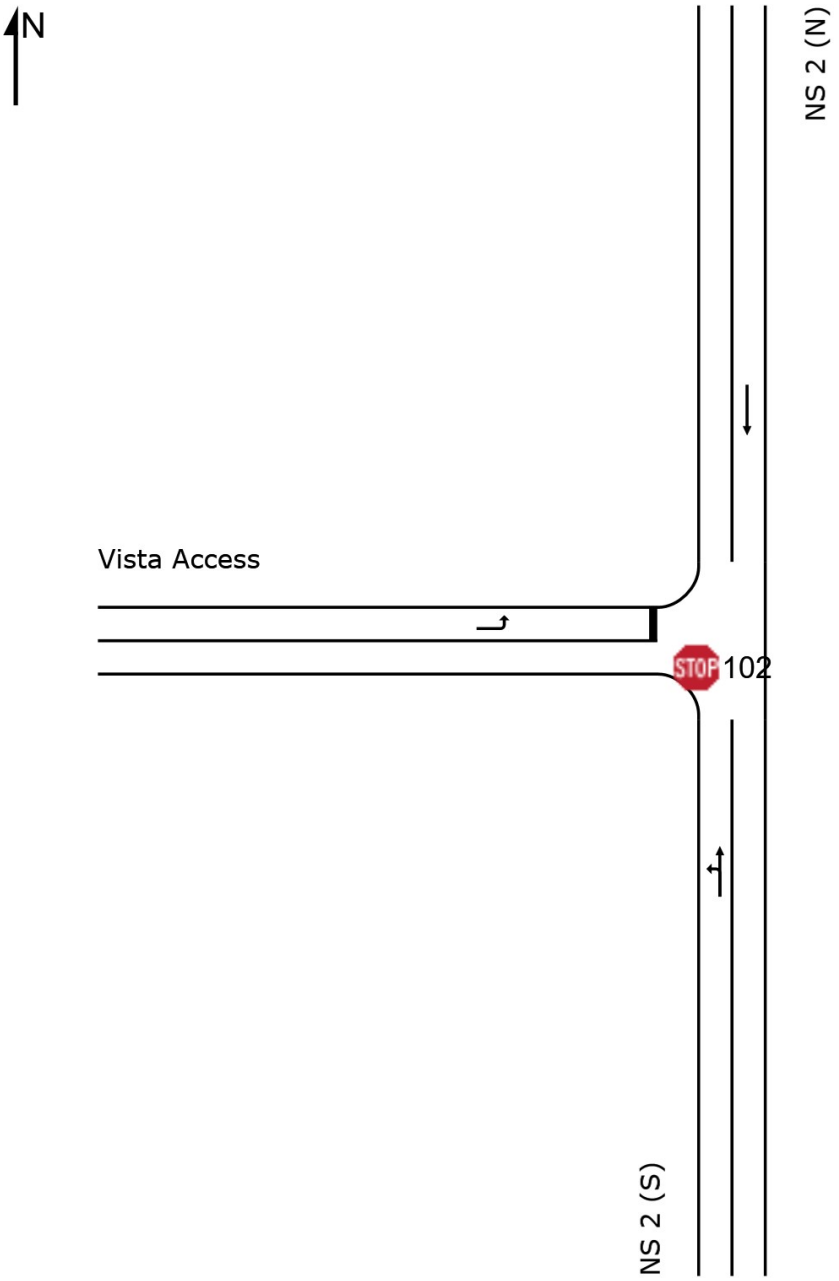
Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: NS 2 (S)													
Lane 1	701	3.0	1893	0.370	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	701	3.0		0.370		0.1	NA	0.0	0.0				
North: NS 2 (N)													
Lane 1	608	3.0	1893	0.321	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	608	3.0		0.321		0.0	NA	0.0	0.0				
West: Vista Access													
Lane 1	5	3.0	577	0.009	100	12.7	LOS B	0.0	0.2	Full	500	0.0	0.0
Approach	5	3.0		0.009		12.7	LOS B	0.0	0.2				
Intersection	1315	3.0		0.370		0.1	NA	0.0	0.2				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Site: 102 [Int G @ NS 2 (With Dev) - PM Peak - 2031]

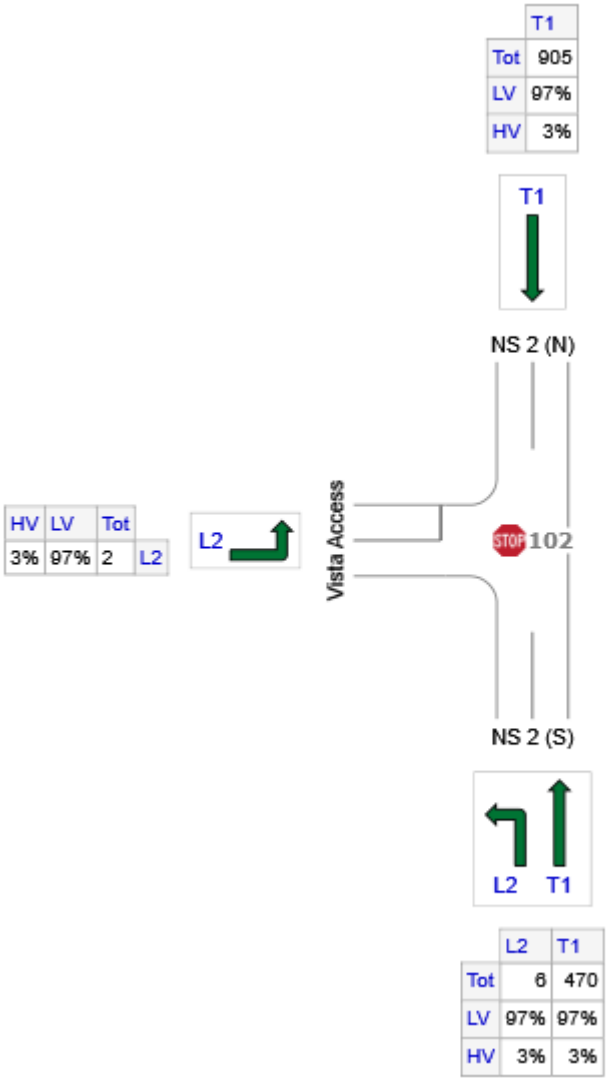
Alkimos Vista
Site Category: (None)
Stop (Two-Way)

Site Layout



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: NS 2 (S)	476	462	14
N: NS 2 (N)	905	878	27
W: Vista Access	2	2	0
Total	1383	1342	41

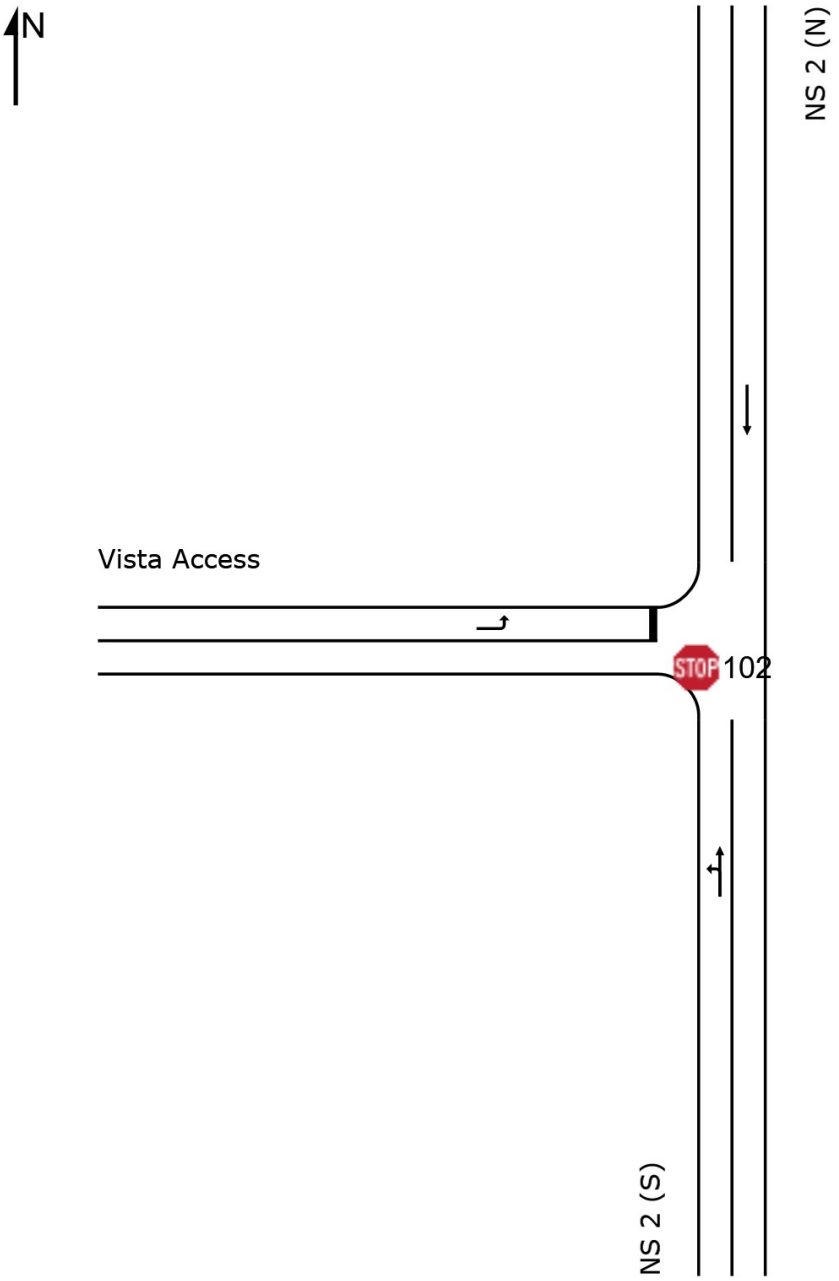
Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: NS 2 (S)													
Lane 1	501	3.0	1892	0.265	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	501	3.0		0.265		0.1	NA	0.0	0.0				
North: NS 2 (N)													
Lane 1	953	3.0	1893	0.503	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	953	3.0		0.503		0.1	NA	0.0	0.0				
West: Vista Access													
Lane 1	2	3.0	801	0.003	100	10.6	LOS B	0.0	0.1	Full	500	0.0	0.0
Approach	2	3.0		0.003		10.6	LOS B	0.0	0.1				
Intersection	1456	3.0		0.503		0.1	NA	0.0	0.1				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Site: 102 [Int H @ NS 2 (With Dev) - AM Peak - 2031]

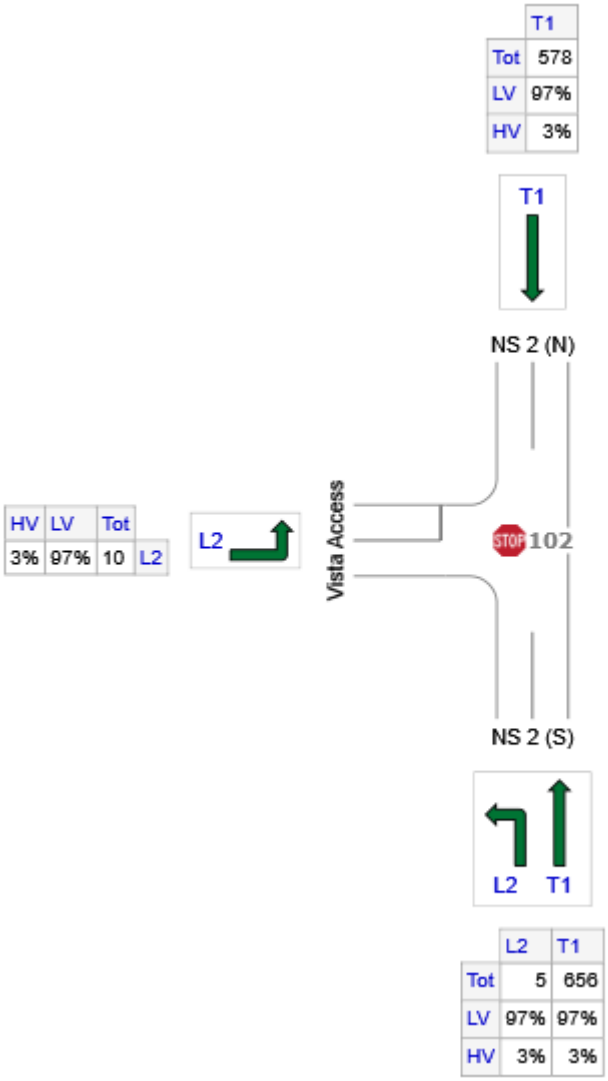
Alkimos Vista
Site Category: (None)
Stop (Two-Way)

Site Layout



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: NS 2 (S)	661	641	20
N: NS 2 (N)	578	561	17
W: Vista Access	10	10	0
Total	1249	1212	37

Lane Use and Performance

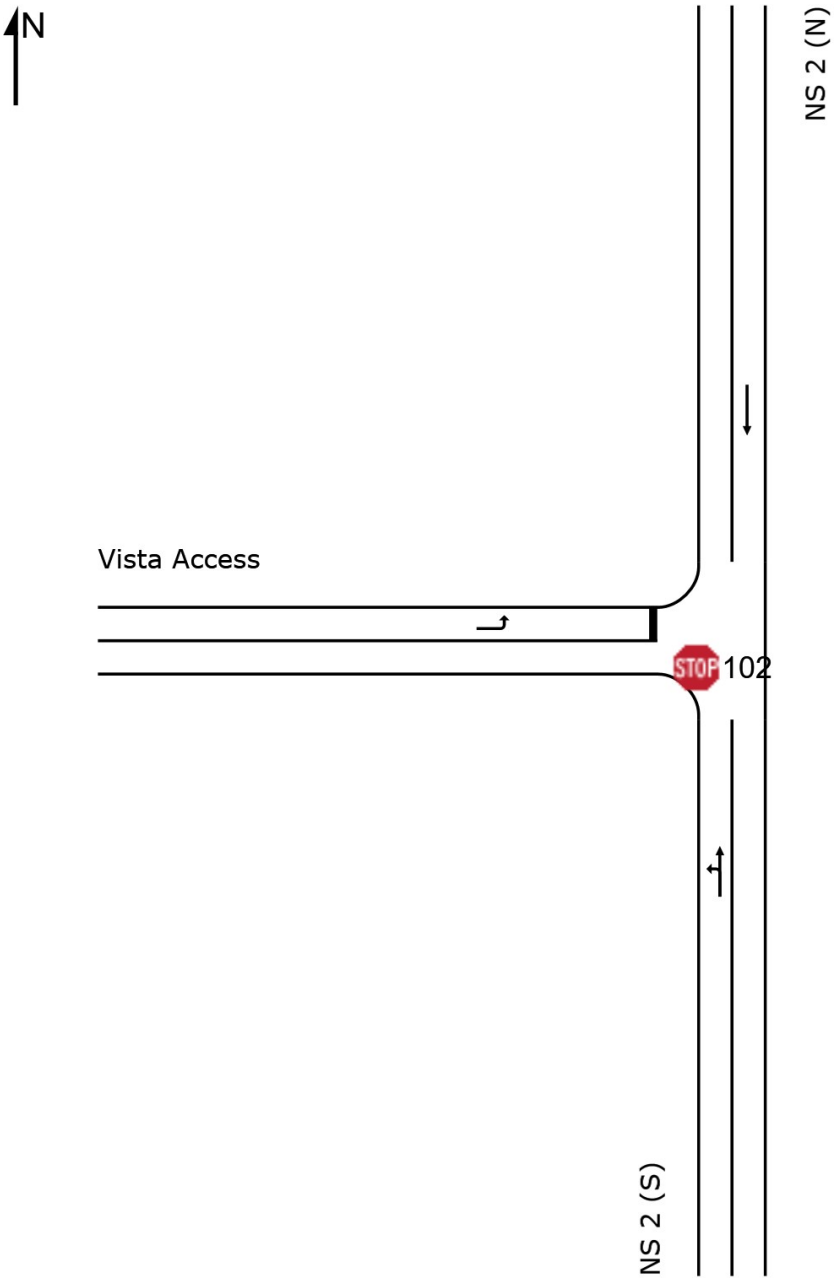
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: NS 2 (S)													
Lane 1	696	3.0	1892	0.368	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	696	3.0		0.368		0.1	NA	0.0	0.0				
North: NS 2 (N)													
Lane 1	608	3.0	1893	0.321	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	608	3.0		0.321		0.0	NA	0.0	0.0				
West: Vista Access													
Lane 1	11	3.0	585	0.018	100	12.6	LOS B	0.1	0.5	Full	500	0.0	0.0
Approach	11	3.0		0.018		12.6	LOS B	0.1	0.5				
Intersection	1315	3.0		0.368		0.2	NA	0.1	0.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Site: 102 [Int H @ NS 2 (With Dev) - PM Peak - 2031]

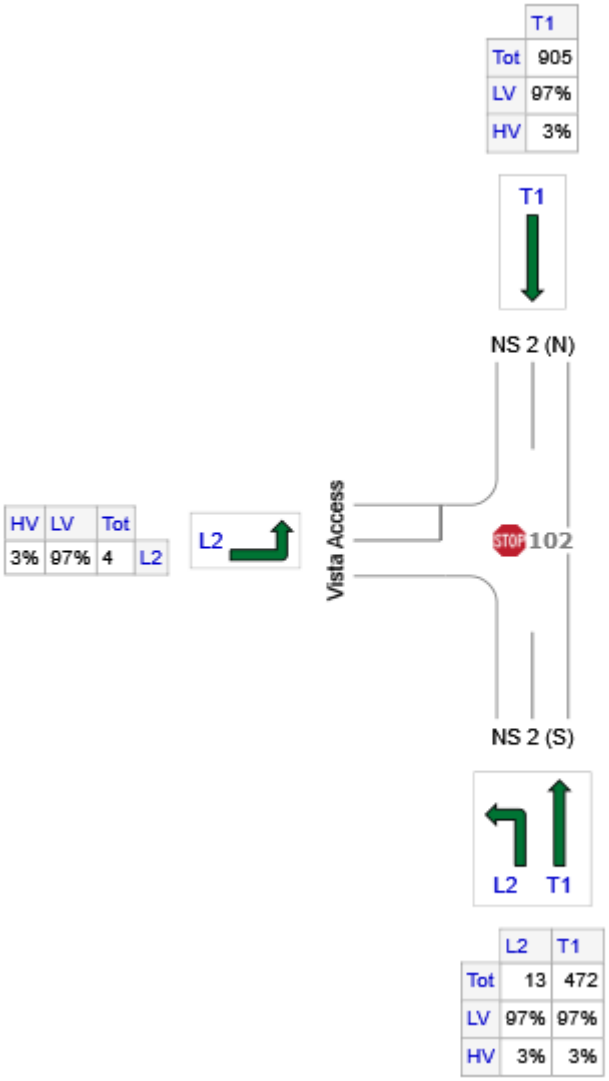
Alkimos Vista
Site Category: (None)
Stop (Two-Way)

Site Layout



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: NS 2 (S)	485	470	15
N: NS 2 (N)	905	878	27
W: Vista Access	4	4	0
Total	1394	1352	42

Lane Use and Performance

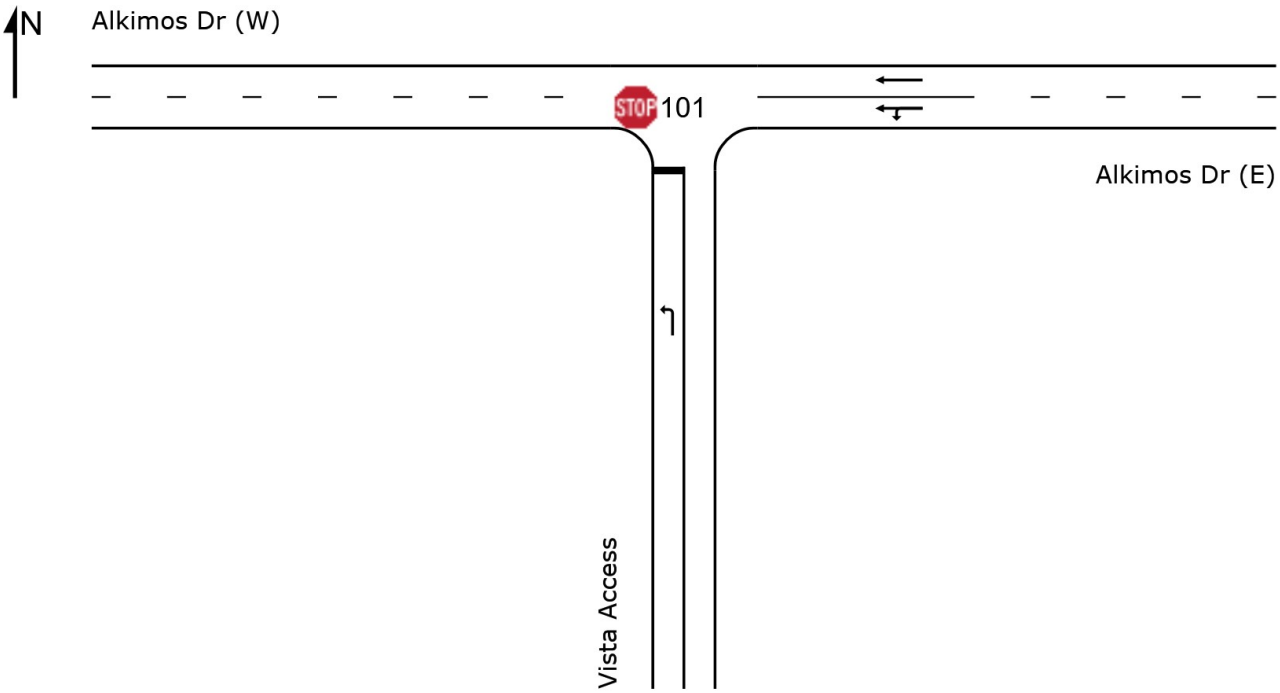
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: NS 2 (S)													
Lane 1	511	3.0	1891	0.270	100	0.2	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	511	3.0		0.270		0.2	NA	0.0	0.0				
North: NS 2 (N)													
Lane 1	953	3.0	1893	0.503	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	953	3.0		0.503		0.1	NA	0.0	0.0				
West: Vista Access													
Lane 1	4	3.0	798	0.005	100	10.7	LOS B	0.0	0.1	Full	500	0.0	0.0
Approach	4	3.0		0.005		10.7	LOS B	0.0	0.1				
Intersection	1467	3.0		0.503		0.1	NA	0.0	0.1				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Site: 101 [Alkimos Dr/LILO Access (With Dev) - AM Peak - 2031]

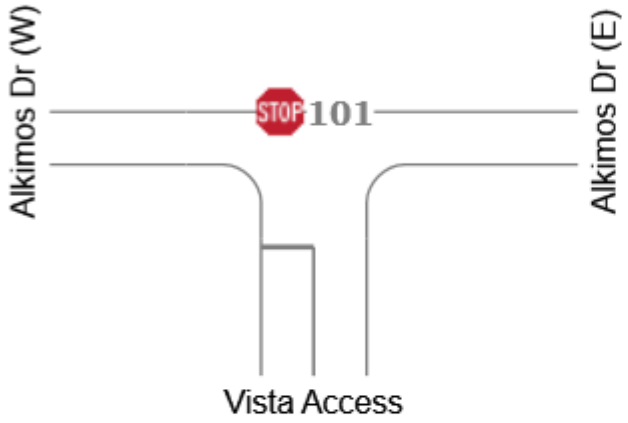
Alkimos Vista
Site Category: (None)
Stop (Two-Way)

Site Layout



Input Volumes

Volume Display Method: Total and %



	Tot	LV	HV
T1	1298	96%	4%
L2	3	96%	4%

	L2
Tot	32
LV	96%
HV	4%

	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Vista Access	32	31	1
E: Alkimos Dr (E)	1301	1249	52
Total	1333	1280	53

Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Vista Access													
Lane 1	34	4.0	599	0.056	100	12.8	LOS B	0.2	1.5	Full	500	0.0	0.0
Approach	34	4.0		0.056		12.8	LOS B	0.2	1.5				
East: Alkimos Dr (E)													
Lane 1	685	4.0	1875	0.365	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	685	4.0	1875	0.365	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1369	4.0		0.365		0.1	NA	0.0	0.0				
Intersection	1403	4.0		0.365		0.4	NA	0.2	1.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

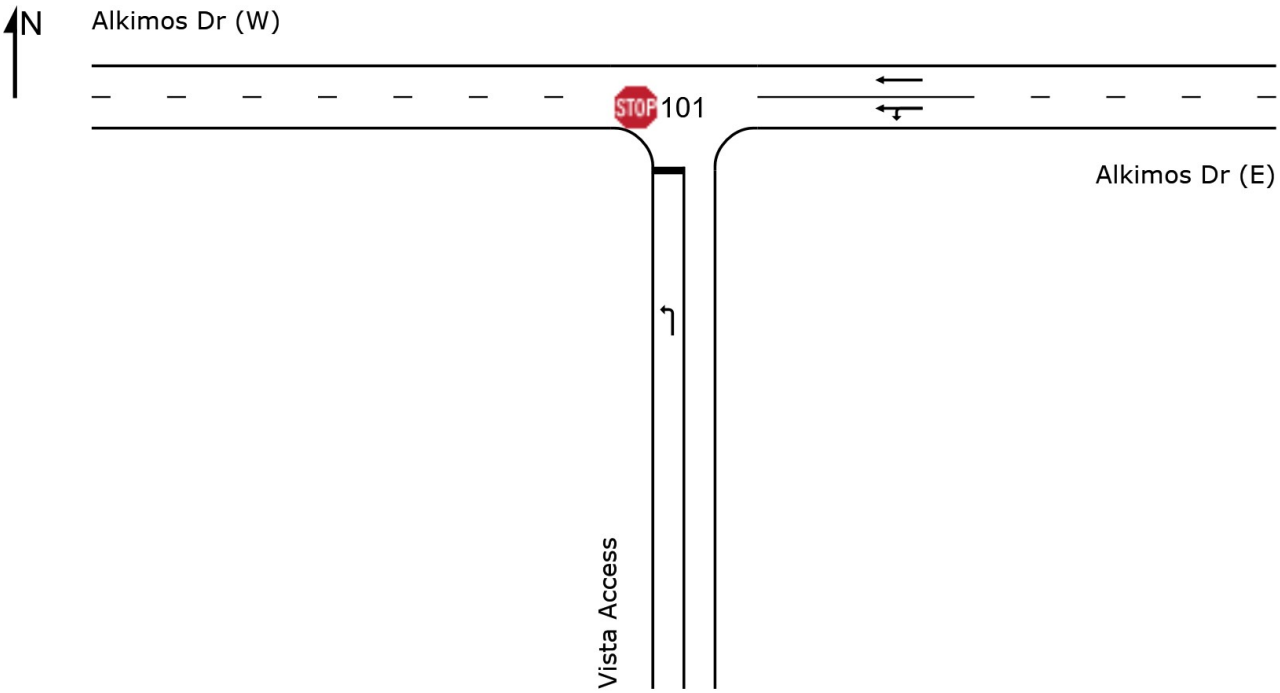
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Site: 101 [Alkimos Dr/LILO Access (With Dev) - PM Peak - 2031]

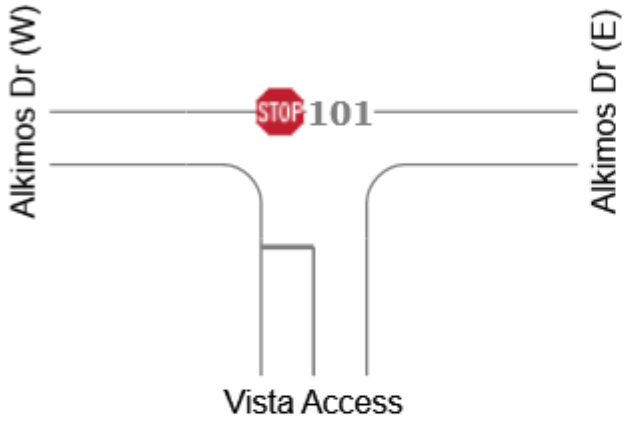
Alkimos Vista
Site Category: (None)
Stop (Two-Way)

Site Layout



Input Volumes

Volume Display Method: Total and %



	Tot	LV	HV
T1	1390	96%	4%
L2	7	96%	4%

	L2
Tot	14
LV	96%
HV	4%

	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Vista Access	14	13	1
E: Alkimos Dr (E)	1397	1341	56
Total	1411	1355	56

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Vista Access													
Lane 1	15	4.0	553	0.027	100	13.2	LOS B	0.1	0.7	Full	500	0.0	0.0
Approach	15	4.0		0.027		13.2	LOS B	0.1	0.7				
East: Alkimos Dr (E)													
Lane 1	735	4.0	1874	0.392	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	735	4.0	1875	0.392	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1471	4.0		0.392		0.1	NA	0.0	0.0				
Intersection	1485	4.0		0.392		0.2	NA	0.1	0.7				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

USER REPORT FOR SITE

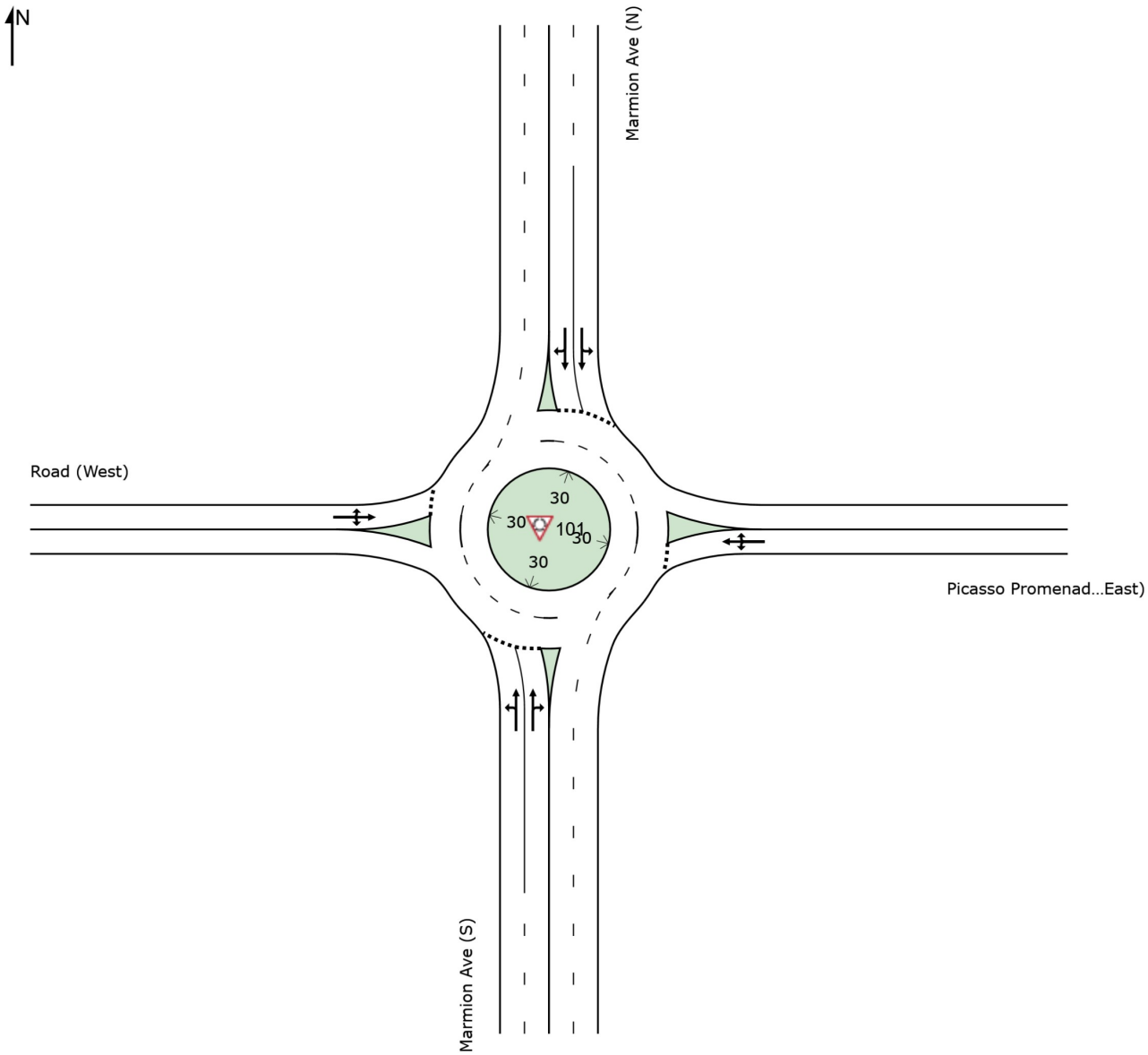
Project: Alkimos Vista - Interim -Reduced

Template: GTA Appendix Report (Non Signalised)

Site: 101 [2031 AM - Marmion Avenue / Picasso Promenade - Full Development]

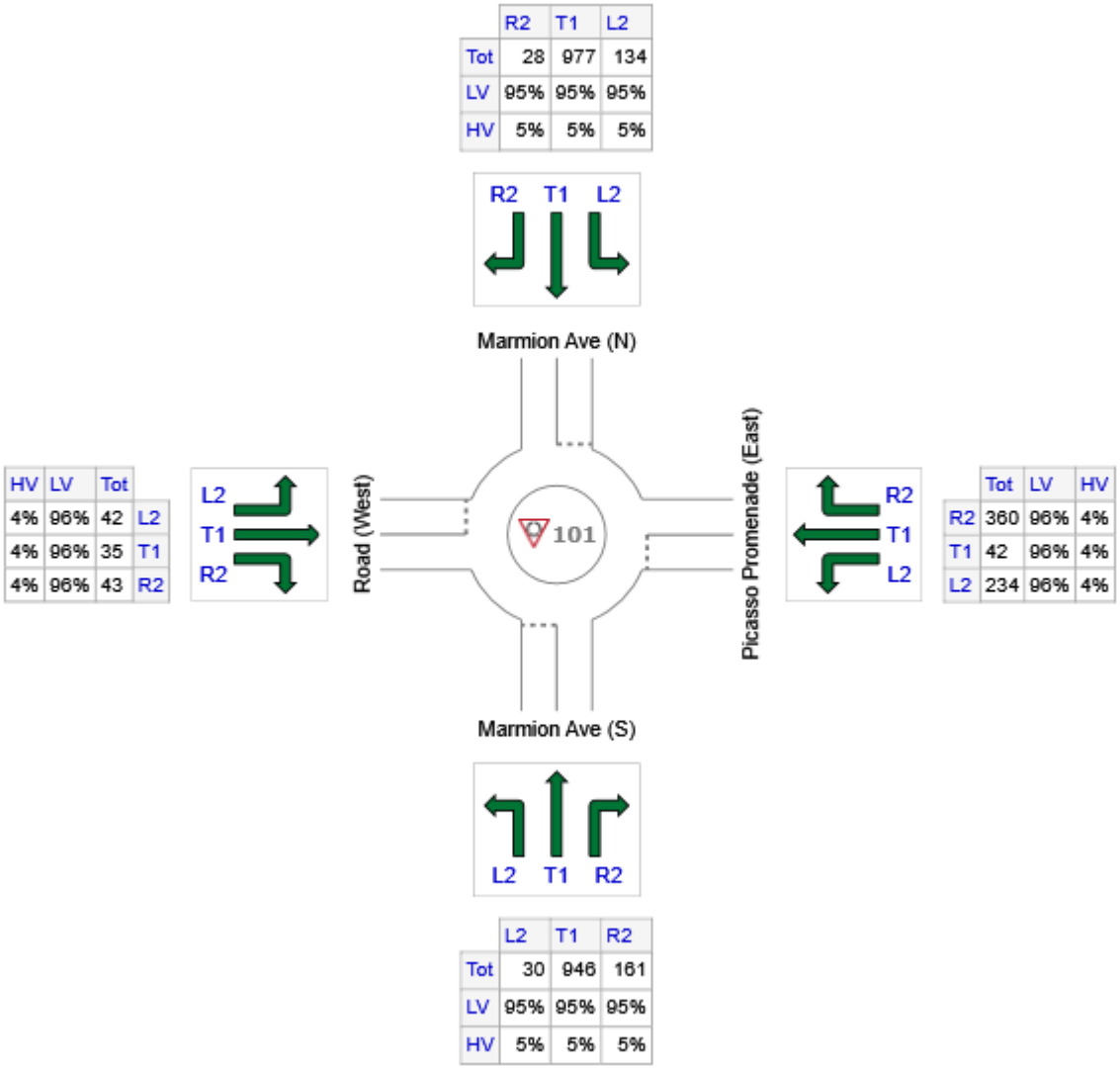
New Site
Site Category: (None)
Roundabout

Site Layout



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Marmion Ave (S)	1137	1080	57
E: Picasso Promenade (East)	636	611	25
N: Marmion Ave (N)	1139	1082	57
W: Road (West)	120	115	5
Total	3032	2888	144

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Marmion Ave (S)													
Lane 1[d]	638	5.0	1025	0.623	100	9.6	LOS A	6.1	47.2	Full	500	0.0	0.0
Lane 2	558	5.0	897	0.623	100	12.1	LOS B	5.9	45.4	Full	500	0.0	0.0
Approach	1197	5.0		0.623		10.8	LOS B	6.1	47.2				
East: Picasso Promenade (East)													
Lane 1[d]	669	4.0	657	1.018	100	58.4	LOS E	28.6	219.3	Full	500	0.0	0.0
Approach	669	4.0		1.018		58.4	LOS E	28.6	219.3				
North: Marmion Ave (N)													
Lane 1[d]	634	5.0	1268	0.500	100	7.2	LOS A	3.6	27.6	Full	500	0.0	0.0
Lane 2	565	5.0	1129	0.500	100	7.8	LOS A	3.5	26.8	Full	500	0.0	0.0
Approach	1199	5.0		0.500		7.5	LOS A	3.6	27.6				
West: Road (West)													
Lane 1[d]	126	4.0	468	0.270	100	11.2	LOS B	1.4	10.3	Full	500	0.0	0.0
Approach	126	4.0		0.270		11.2	LOS B	1.4	10.3				
Intersection	3192	4.8		1.018		19.6	LOS B	28.6	219.3				

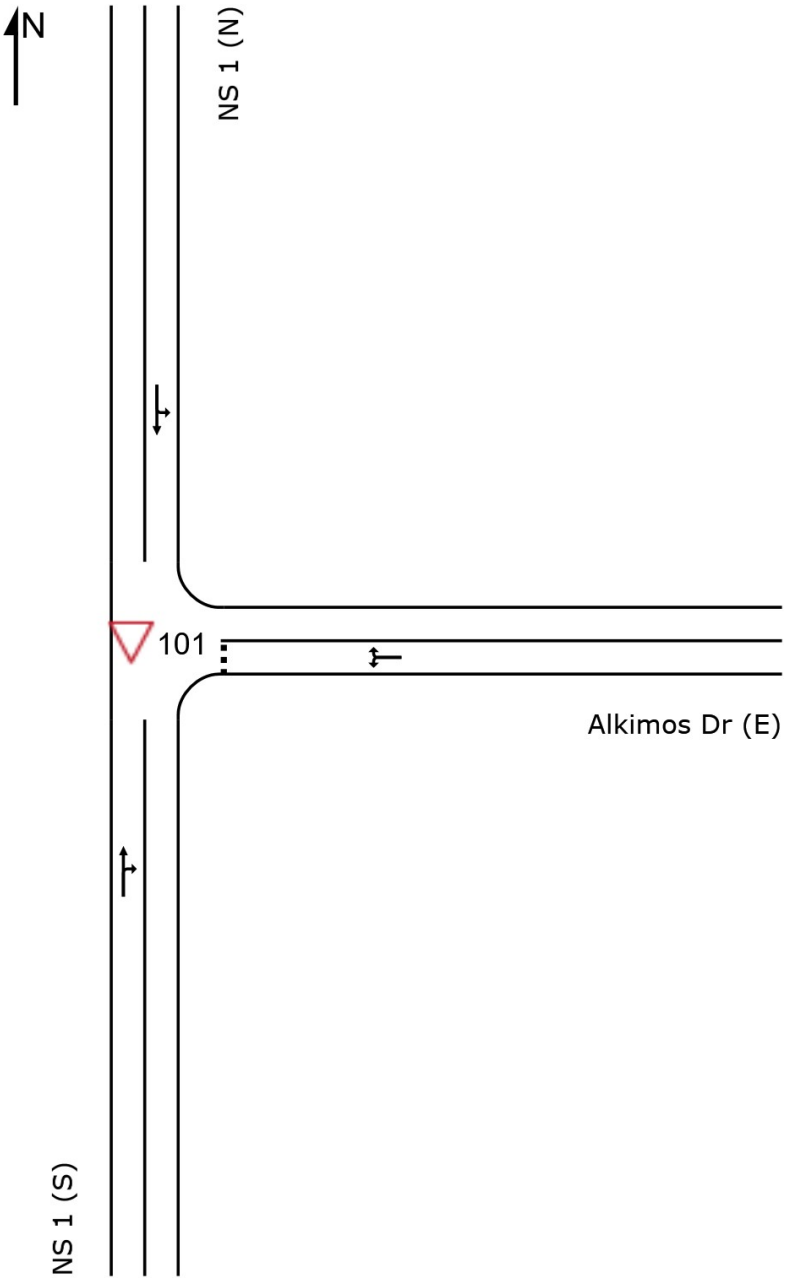
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

Site: 101 [2031 AM - NS 1 / Alkimos Drive]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

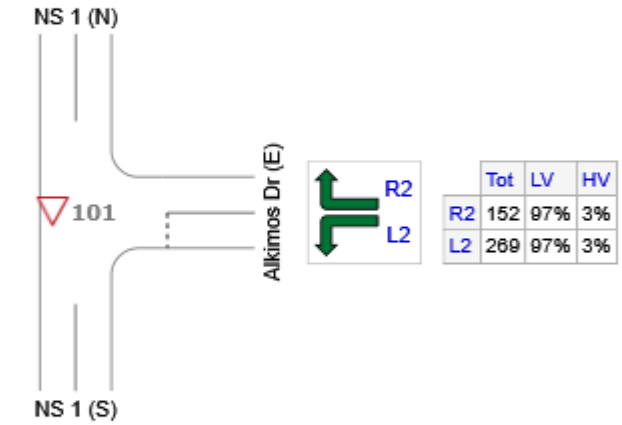
Site Layout



Input Volumes

Volume Display Method: Total and %

	T1	L2
Tot	122	74
LV	97%	97%
HV	3%	3%



	Tot	LV	HV
R2	152	97%	3%
L2	269	97%	3%

	T1	R2
Tot	102	167
LV	97%	97%
HV	3%	3%

	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: NS 1 (S)	269	261	8
E: Alkimos Dr (E)	421	408	13
N: NS 1 (N)	196	190	6
Total	886	859	27

Lane Use and Performance

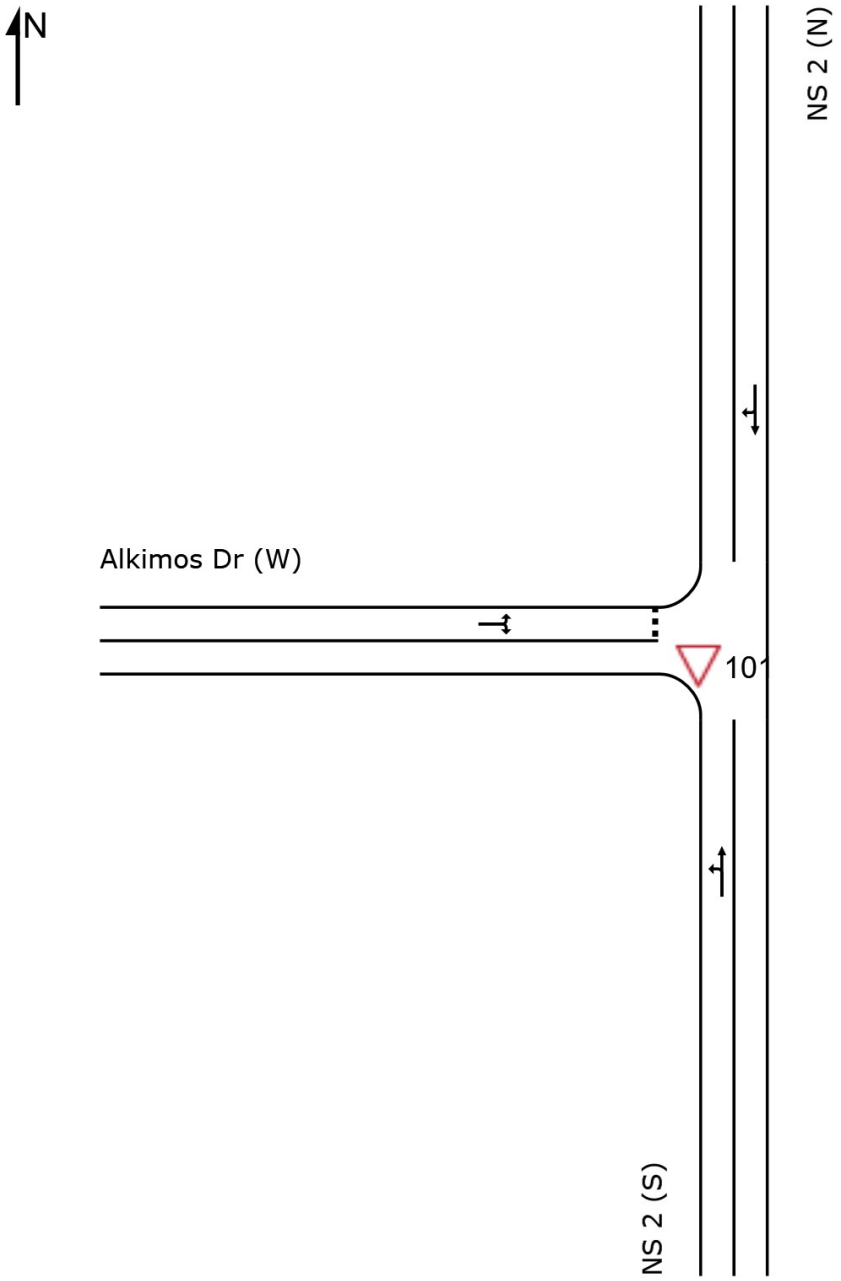
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: NS 1 (S)													
Lane 1	283	3.0	1585	0.179	100	4.2	LOS A	0.9	6.9	Full	500	0.0	0.0
Approach	283	3.0		0.179		4.2	NA	0.9	6.9				
East: Alkimos Dr (E)													
Lane 1	443	3.0	1134	0.391	100	7.1	LOS A	2.0	15.1	Full	500	0.0	0.0
Approach	443	3.0		0.391		7.1	LOS A	2.0	15.1				
North: NS 1 (N)													
Lane 1	206	3.0	1857	0.111	100	2.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	206	3.0		0.111		2.1	NA	0.0	0.0				
Intersection	933	3.0		0.391		5.1	NA	2.0	15.1				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Site: 101 [2031 AM - NS 2 / Alkimos Drive]

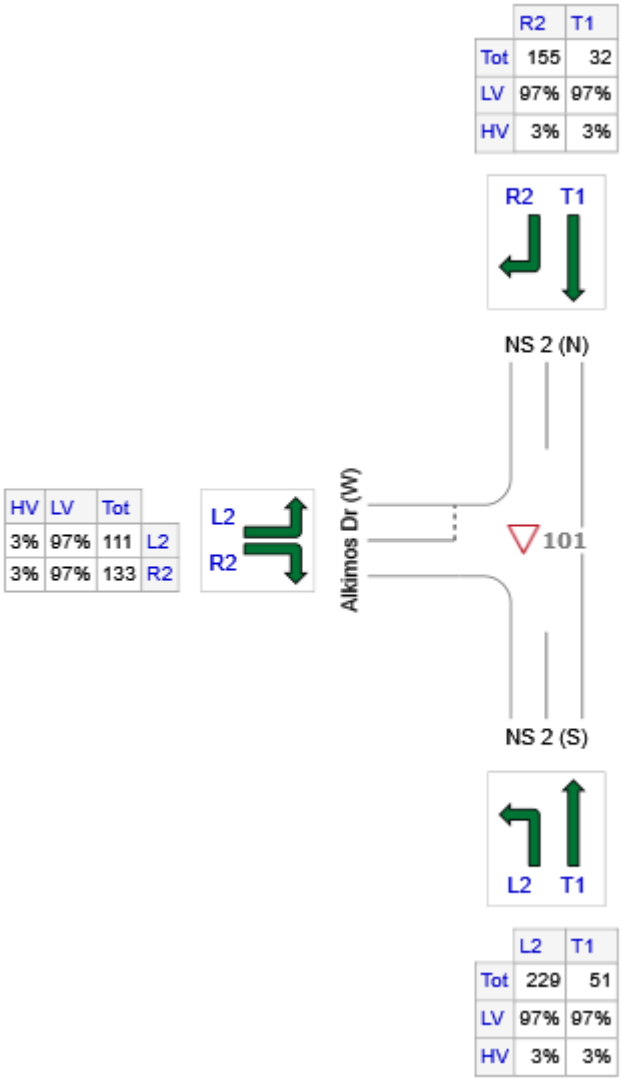
New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Site Layout



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: NS 2 (S)	280	272	8
N: NS 2 (N)	187	181	6
W: Alkimos Dr (W)	244	237	7
Total	711	690	21

Lane Use and Performance

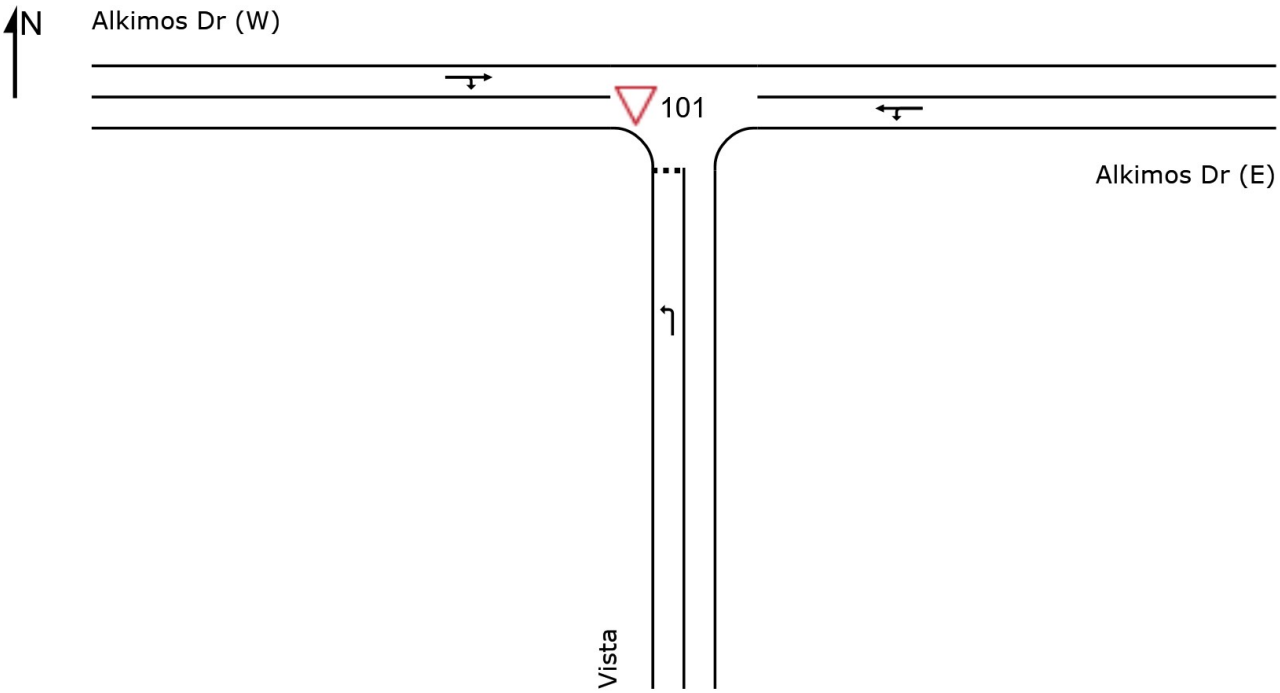
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: NS 2 (S)													
Lane 1	295	3.0	1816	0.162	100	4.6	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	295	3.0		0.162		4.6	NA	0.0	0.0				
North: NS 2 (N)													
Lane 1	197	3.0	1398	0.141	100	5.7	LOS A	0.7	5.2	Full	500	0.0	0.0
Approach	197	3.0		0.141		5.7	NA	0.7	5.2				
West: Alkimos Dr (W)													
Lane 1	257	3.0	1109	0.232	100	6.6	LOS A	0.9	7.1	Full	500	0.0	0.0
Approach	257	3.0		0.232		6.6	LOS A	0.9	7.1				
Intersection	748	3.0		0.232		5.6	NA	0.9	7.1				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Site: 101 [2031 AM - Alkimos Dr / Vista Access]

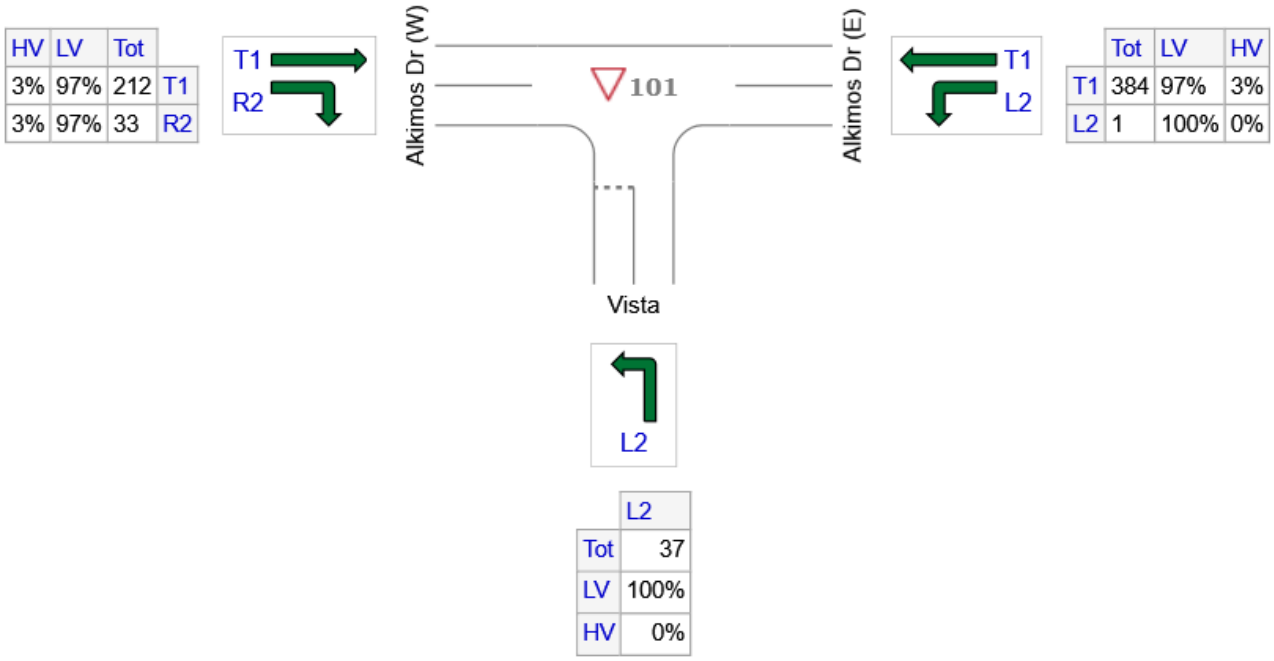
New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Site Layout



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Vista	37	37	0
E: Alkimos Dr (E)	385	373	12
W: Alkimos Dr (W)	245	238	7
Total	667	648	19

Lane Use and Performance

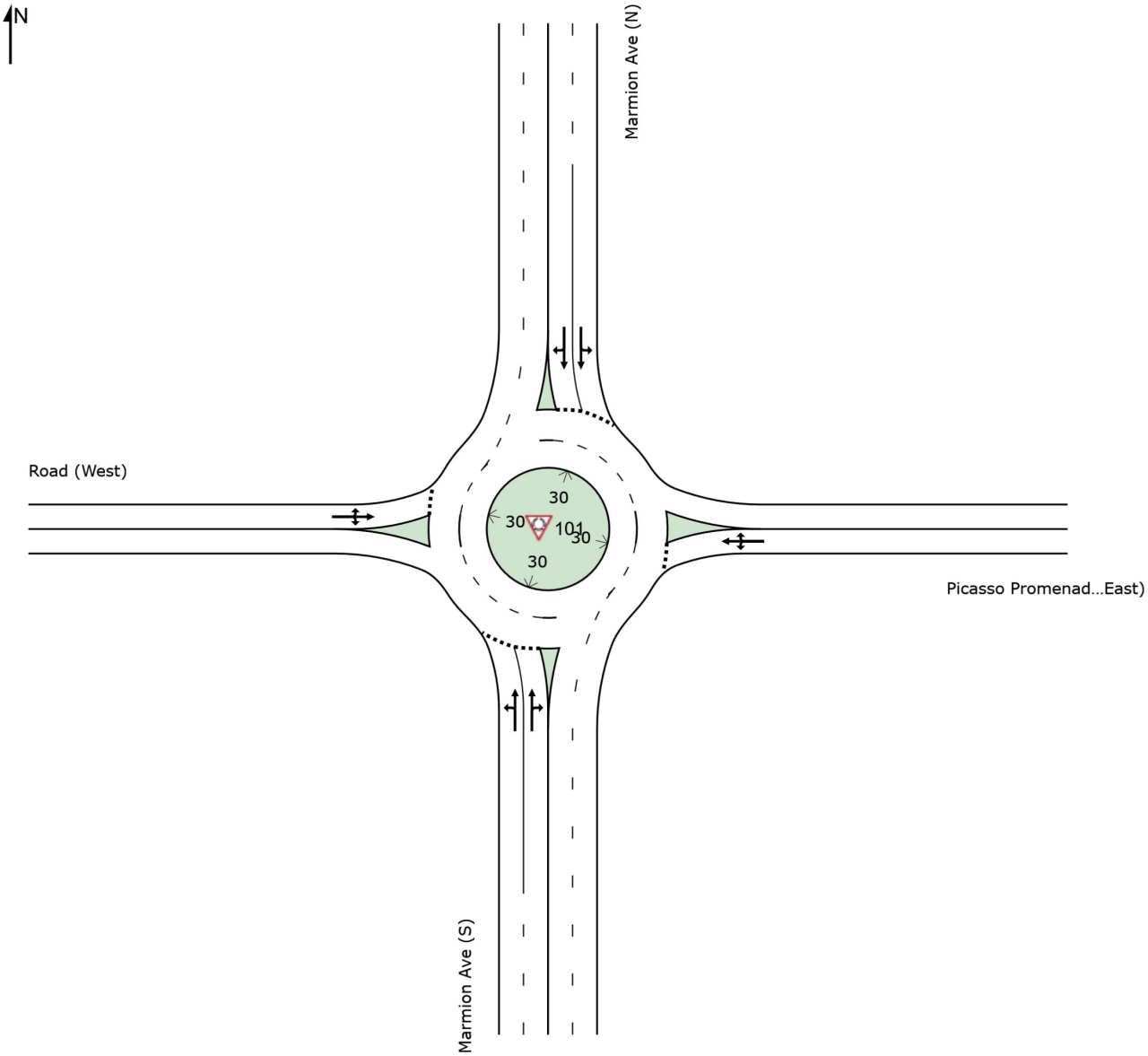
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Vista													
Lane 1	39	0.0	1108	0.035	100	7.0	LOS A	0.1	1.0	Full	500	0.0	0.0
Approach	39	0.0		0.035		7.0	LOS A	0.1	1.0				
East: Alkimos Dr (E)													
Lane 1	405	3.0	1893	0.214	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	405	3.0		0.214		0.0	NA	0.0	0.0				
West: Alkimos Dr (W)													
Lane 1	258	3.0	1740	0.148	100	1.3	LOS A	0.3	2.5	Full	500	0.0	0.0
Approach	258	3.0		0.148		1.3	NA	0.3	2.5				
Intersection	702	2.8		0.214		0.9	NA	0.3	2.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Site: 101 [2031 PM - Marmion Avenue / Picasso Promenade - Full Development]

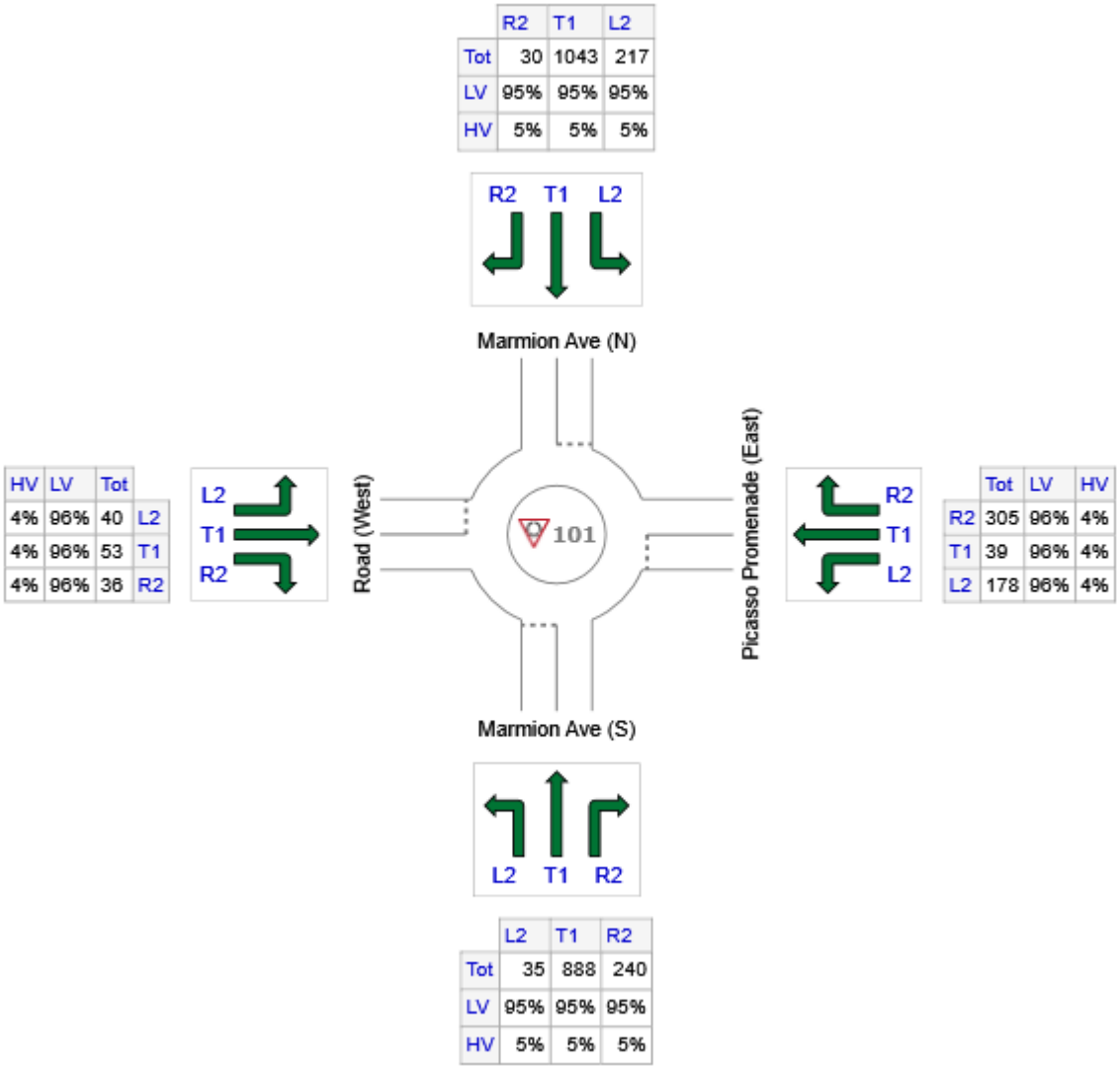
New Site
Site Category: (None)
Roundabout

Site Layout



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Marmion Ave (S)	1163	1105	58
E: Picasso Promenade (East)	522	501	21
N: Marmion Ave (N)	1290	1226	65
W: Road (West)	129	124	5
Total	3104	2955	149

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Marmion Ave (S)													
Lane 1[d]	651	5.0	1087	0.599	100	8.8	LOS A	5.5	42.7	Full	500	0.0	0.0
Lane 2	573	5.0	956	0.599	100	12.0	LOS B	5.4	41.5	Full	500	0.0	0.0
Approach	1224	5.0		0.599		10.3	LOS B	5.5	42.7				
East: Picasso Promenade (East)													
Lane 1[d]	549	4.0	593	0.927	100	29.4	LOS C	12.6	96.6	Full	500	0.0	0.0
Approach	549	4.0		0.927		29.4	LOS C	12.6	96.6				
North: Marmion Ave (N)													
Lane 1[d]	722	5.0	1177	0.613	100	8.4	LOS A	5.4	41.8	Full	500	0.0	0.0
Lane 2	636	5.0	1037	0.613	100	9.4	LOS A	5.3	41.3	Full	500	0.0	0.0
Approach	1358	5.0		0.613		8.9	LOS A	5.4	41.8				
West: Road (West)													
Lane 1[d]	136	4.0	489	0.277	100	10.5	LOS B	1.4	10.5	Full	500	0.0	0.0
Approach	136	4.0		0.277		10.5	LOS B	1.4	10.5				
Intersection	3267	4.8		0.927		13.0	LOS B	12.6	96.6				

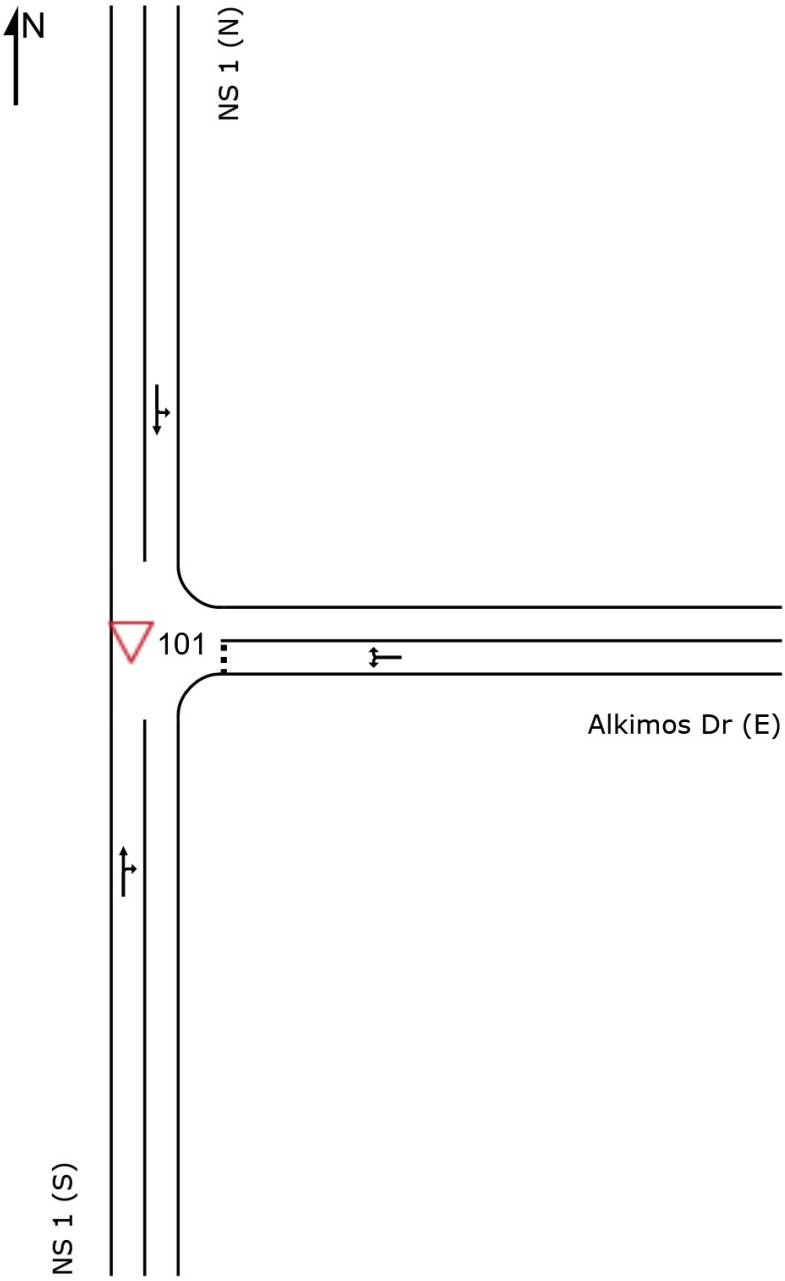
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

Site: 101 [2031 PM - NS 1 / Alkimos Drive]

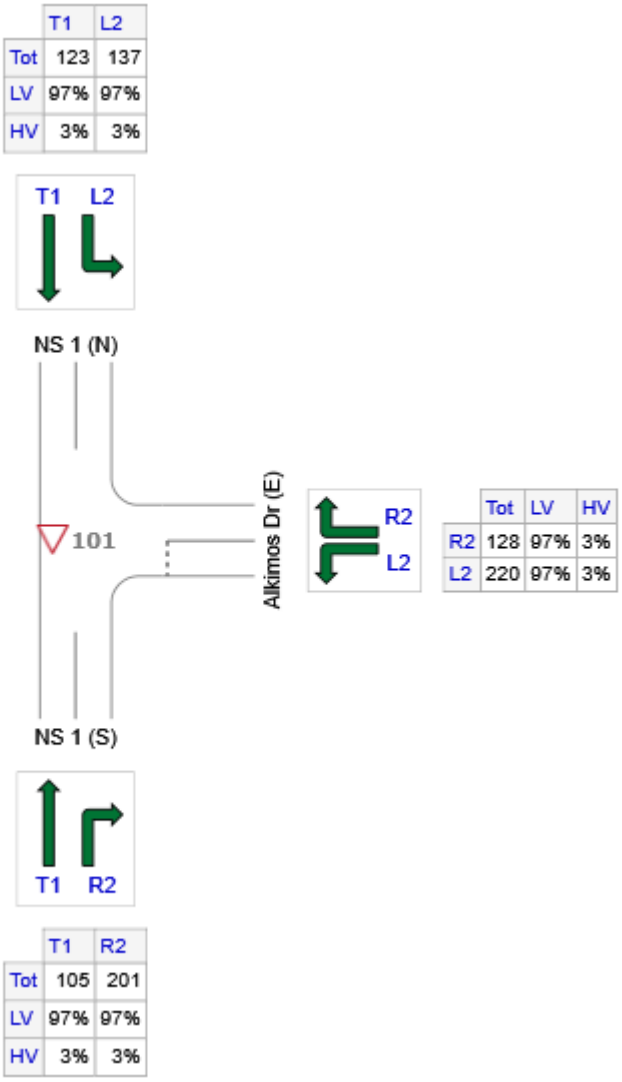
New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Site Layout



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: NS 1 (S)	306	297	9
E: Alkimos Dr (E)	348	338	10
N: NS 1 (N)	260	252	8
Total	914	887	27

Lane Use and Performance

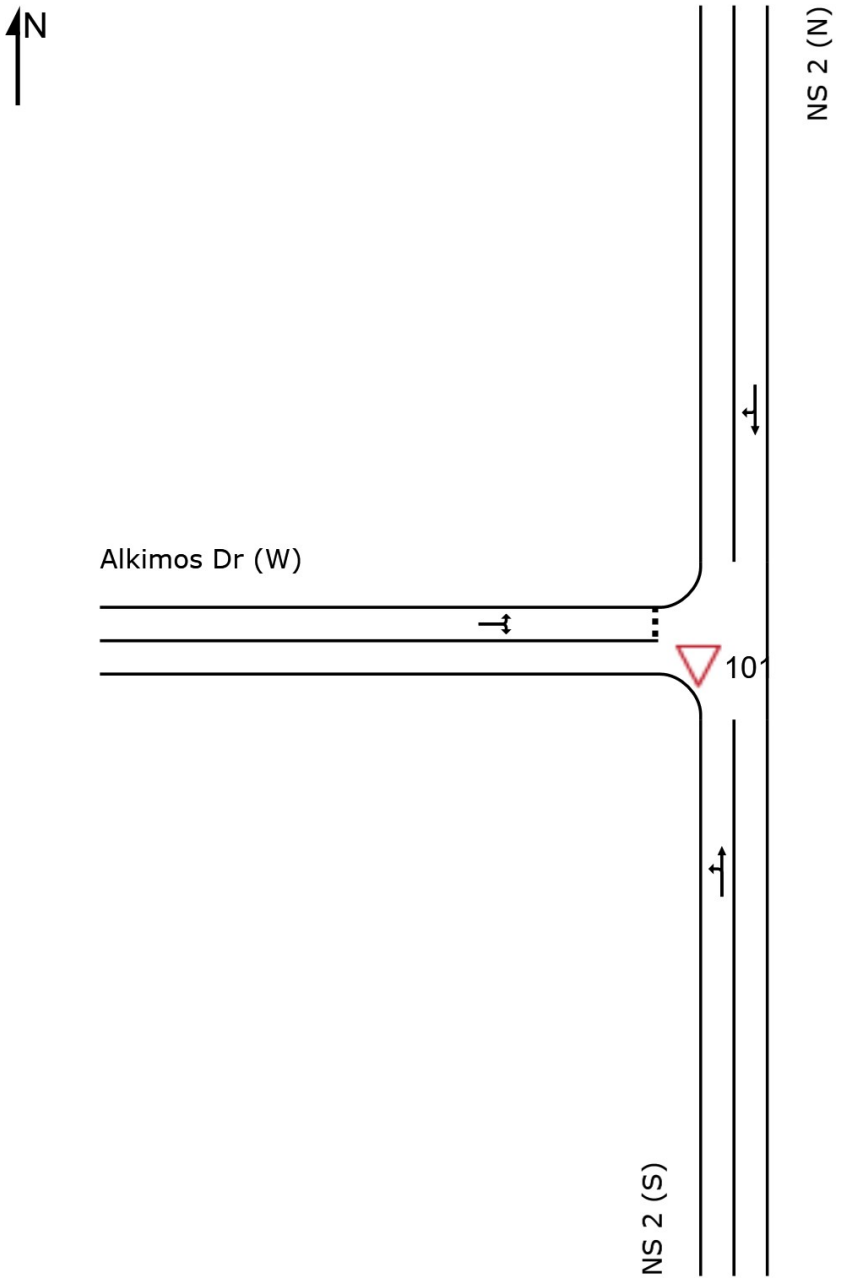
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: NS 1 (S)													
Lane 1	322	3.0	1496	0.215	100	4.7	LOS A	1.1	8.7	Full	500	0.0	0.0
Approach	322	3.0		0.215		4.7	NA	1.1	8.7				
East: Alkimos Dr (E)													
Lane 1	366	3.0	1082	0.338	100	7.1	LOS A	1.5	11.4	Full	500	0.0	0.0
Approach	366	3.0		0.338		7.1	LOS A	1.5	11.4				
North: NS 1 (N)													
Lane 1	274	3.0	1842	0.149	100	3.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	274	3.0		0.149		3.0	NA	0.0	0.0				
Intersection	962	3.0		0.338		5.1	NA	1.5	11.4				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Site: 101 [2031 PM - NS 2 / Alkimos Drive]

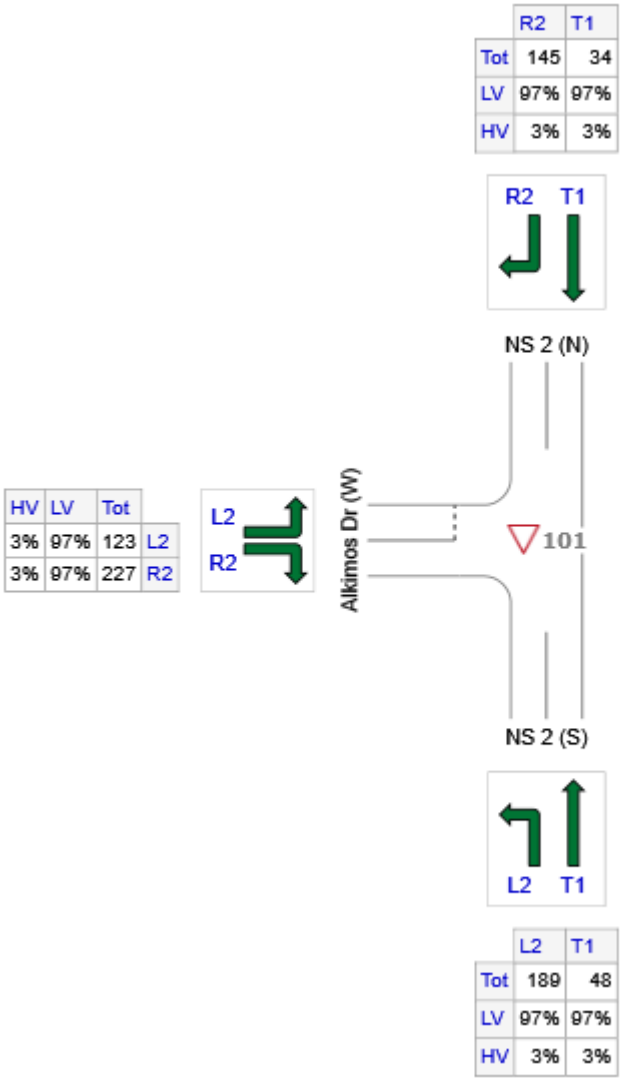
New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Site Layout



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: NS 2 (S)	237	230	7
N: NS 2 (N)	179	174	5
W: Alkimos Dr (W)	350	340	11
Total	766	743	23

Lane Use and Performance

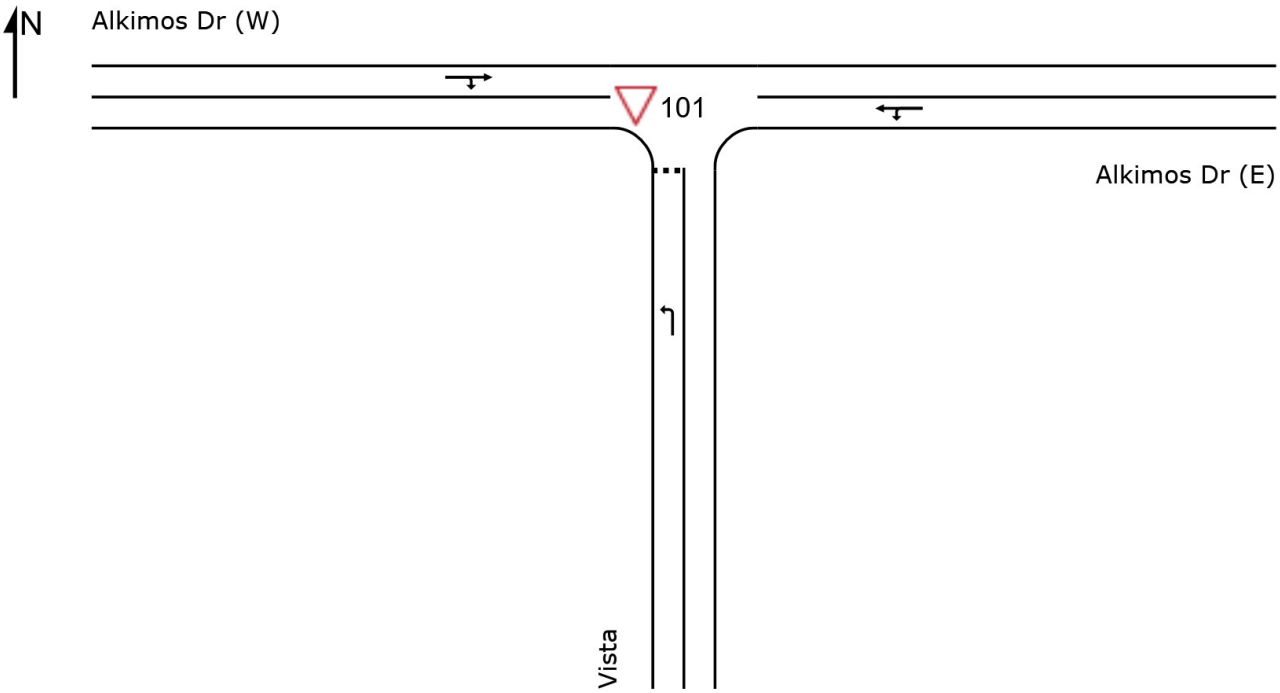
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: NS 2 (S)													
Lane 1	249	3.0	1817	0.137	100	4.5	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	249	3.0		0.137		4.5	NA	0.0	0.0				
North: NS 2 (N)													
Lane 1	188	3.0	1464	0.129	100	5.4	LOS A	0.6	4.8	Full	500	0.0	0.0
Approach	188	3.0		0.129		5.4	NA	0.6	4.8				
West: Alkimos Dr (W)													
Lane 1	368	3.0	1080	0.341	100	6.8	LOS A	1.5	11.3	Full	500	0.0	0.0
Approach	368	3.0		0.341		6.8	LOS A	1.5	11.3				
Intersection	806	3.0		0.341		5.8	NA	1.5	11.3				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Site: 101 [2031 PM - Alkimos Dr / Vista Access]

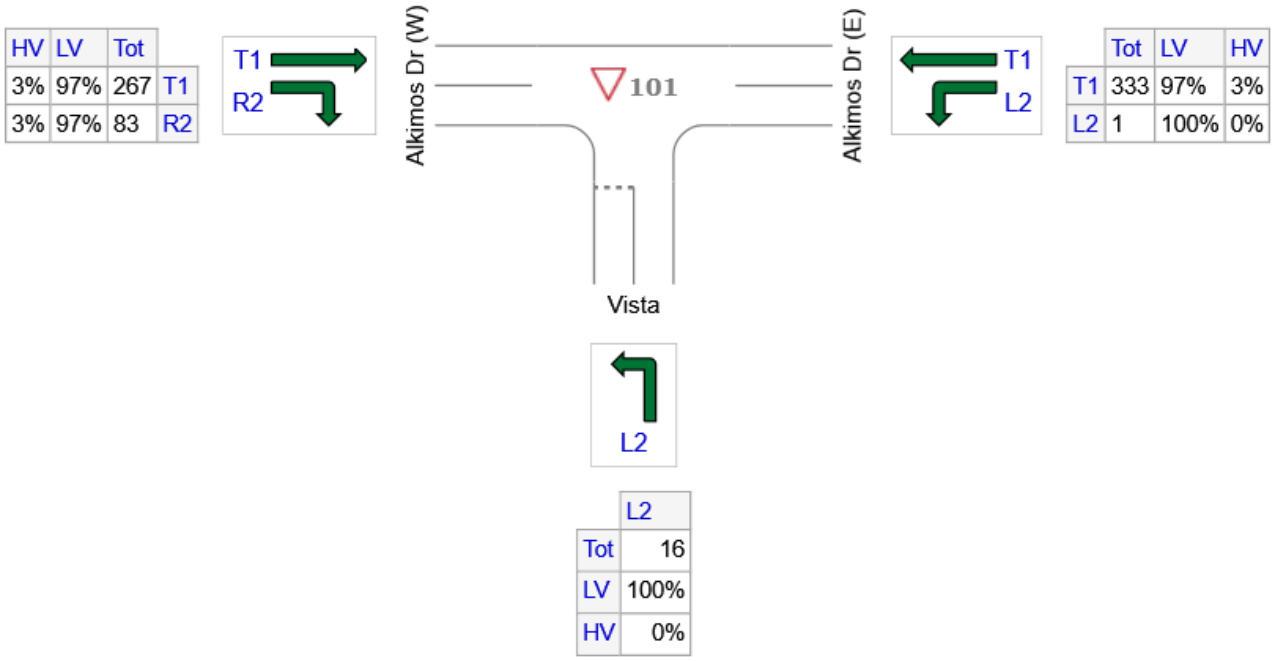
New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Site Layout



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Vista	16	16	0
E: Alkimos Dr (E)	334	324	10
W: Alkimos Dr (W)	350	340	11
Total	700	680	20

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Vista													
Lane 1	17	0.0	1176	0.014	100	6.7	LOS A	0.1	0.4	Full	500	0.0	0.0
Approach	17	0.0		0.014		6.7	LOS A	0.1	0.4				
East: Alkimos Dr (E)													
Lane 1	352	3.0	1893	0.186	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	352	3.0		0.186		0.0	NA	0.0	0.0				
West: Alkimos Dr (W)													
Lane 1	368	3.0	1675	0.220	100	2.2	LOS A	0.8	5.9	Full	500	0.0	0.0
Approach	368	3.0		0.220		2.2	NA	0.8	5.9				
Intersection	737	2.9		0.220		1.2	NA	0.8	5.9				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Attachment B – Alkimos Drive Cross-section (by Cossill & Webley, dated December 2019)

REV	DATE	DRN	CKD	APP	AMENDMENT
A	12.11.19	DP			ISSUED FOR INFORMATION

Cossill & Webley CONSULTING ENGINEERS

Mailing Address
PO Box 680
Subiaco WA 6904

Street Address
B12 (Level 2) 431 Roberts Road
Subiaco WA 6008

T (08) 9422 5800 F (08) 9422 5801 E admin@cosweb.com.au

CLIENT: DevelopmentWA

APPROVED: CHECK PRINT

DESIGNED: DP

SCALE: 1:500

PROJECT: ALKIMOS VISTA - PRECINT 2

TITLE: ULTIMATE ROAD LAYOUT CONCEPT SHEET 1 OF 2

WAPC No.

DRAWING No.: 6270-P2-SK01

REVISION: A

ORIGINAL SIZE: A1

APPENDIX D – LENDLEASE + DEPARTMENT OF EDUCATIONS LETTERS

Government of **Western Australia**
Department of **Education**

Your ref :
Our ref : D18/0435996
Enquiries :

Ms Laura Bowdell
Development Manager – Alkimos Vista
Lendlease Communities (Alkimos Central) Pty Ltd
Level 2, 10 Ord Street
WEST PERTH WA 6005

Dear Ms Bowdell

ALKIMOS VISTA – PRIMARY SCHOOL

I refer to your letter dated 18 September 2018 regarding the proposed amendments to the primary school site identified in the Central Alkimos Local Structure Plan No.95 (Structure Plan).

The Department of Education has reviewed the proposed amendments and has no objection to the draft revised Structure Plan subject to the levels on the primary school site being aligned with the adjacent road levels.

Should there be any questions on the above, please do not hesitate to contact Mr Matt Turnbull, Manager Land and Property at matt.turnbull@education.wa.edu.au or on 9264 5178.

Yours sincerely

ANNA BROWN
DIRECTOR
ASSET PLANNING AND SERVICES

11 October 2018

18 September 2018

Department of Education
Asset Planning and Services
Level 2, 151 Royal Street
EAST PERTH WA 6004

Attention: Ikmal Ahmad

Dear Ikmal,

RE: ALKIMOS VISTA – PRIMARY SCHOOL

Further to our meeting on 16 August 2018 regarding the Alkimos Vista Primary School site, the following is advised.

Lendlease is seeking the Department of Education's support to reorientate the Primary School site within the Central Alkimos Local Structure Plan No. 95 in accordance with the attached plan.

Matters to consider on the revised site are:

- Roads on all boundaries with a minimum width of 17 metres to allow for shared path and on-street parking;
- Rectangular is shape;
- Maximum 2.95% grade across the site (refer to attached levels plan from Cossill and Webley);
- There are no Bushfire Attack Levels on the site (note that the current site has a BAL12.5); and
- 4.0 hectares in area.

Can you please confirm in writing that the revised site is acceptable to the Department? If the Department wish for the site to be contoured such that there are flat pads and batters between pads/ovals then we are happy to accommodate this and incorporate it into an earthworks plan.

Should you require and clarification of the above or further information, please do not hesitate to contact the undersigned on 9223 2897.

Regards,

Laura Bowdell
Development Manager – Alkimos Vista

cc: via email: Ryan Darby (Roberts Day), Dale Slieker (Cossill and Webley)

CALCULATIONS

TYPE	POS (ha)	TOTAL (ha)
Residential		22.8972
Primary School		4.0067
Public Open Space - O1	2.2671	
Public Open Space - O3	0.0608	
Public Open Space - O3	0.3258	
Public Open Space - P	0.4967	
Public Open Space - S	0.713	3.8634
Railway Batter		0.5296
Road Reserve		15.3004
TOTAL PRECINCT AREA		**46.5973**
RESIDENTIAL LOTS		649

LEGEND

- PRECINCT 1 BOUNDARY
- RESIDENTIAL
- RAILWAY BATTER
- S POS — PUBLIC OPEN SPACE
- EDUCATION

LANDCORP lendlease

CADASTRAL INFORMATION
SOURCE: VERIS
YYMMDD: 180416
DWG REF: 21709-003-R0.dwg
PROJECTION: PCG94

AERIAL PHOTOGRAPHY
SOURCE: NA
YYMMDD: NA

DRAFT

SIZE A3_ 1:3000

0 metres 30 60 90 120 150

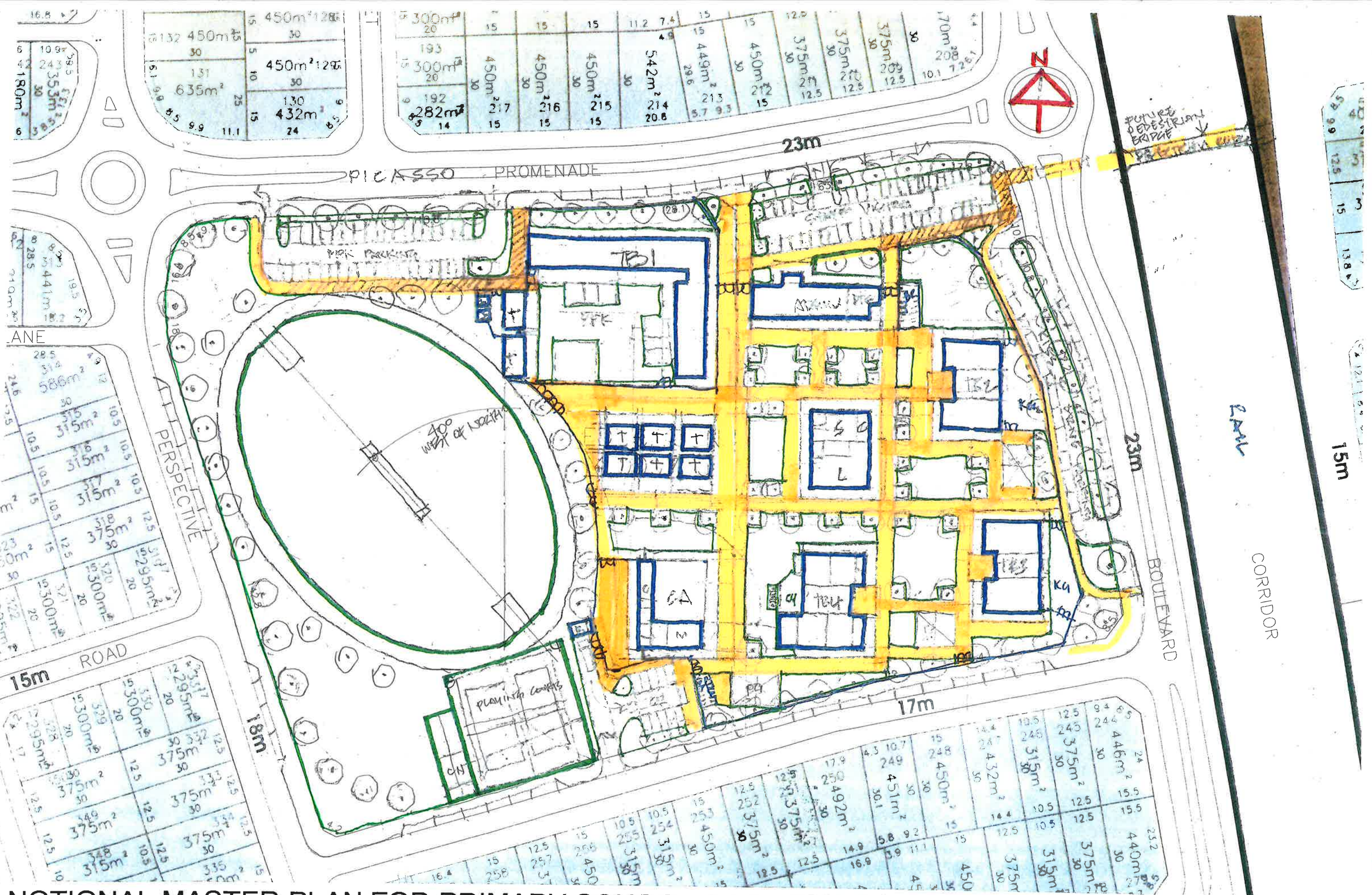
REV	DESCRIPTION	YYMMDD	DRAWN	APPR'D
B	PRECINCT 1 BOUNDARY MOD	180911	SB	RD
A	BASE DLL CEN RD1 043F	180911	SB	-

COMMERCIAL ASSESSMENT PLAN (OCTOBER 2018)

Alkimos Vista
City of Wanneroo

REF NO.	DRAW NO.	REV.
DLL CEN	**RD1 102**	**B**

APPENDIX E – PRIMARY SCHOOL CONCEPT PLAN

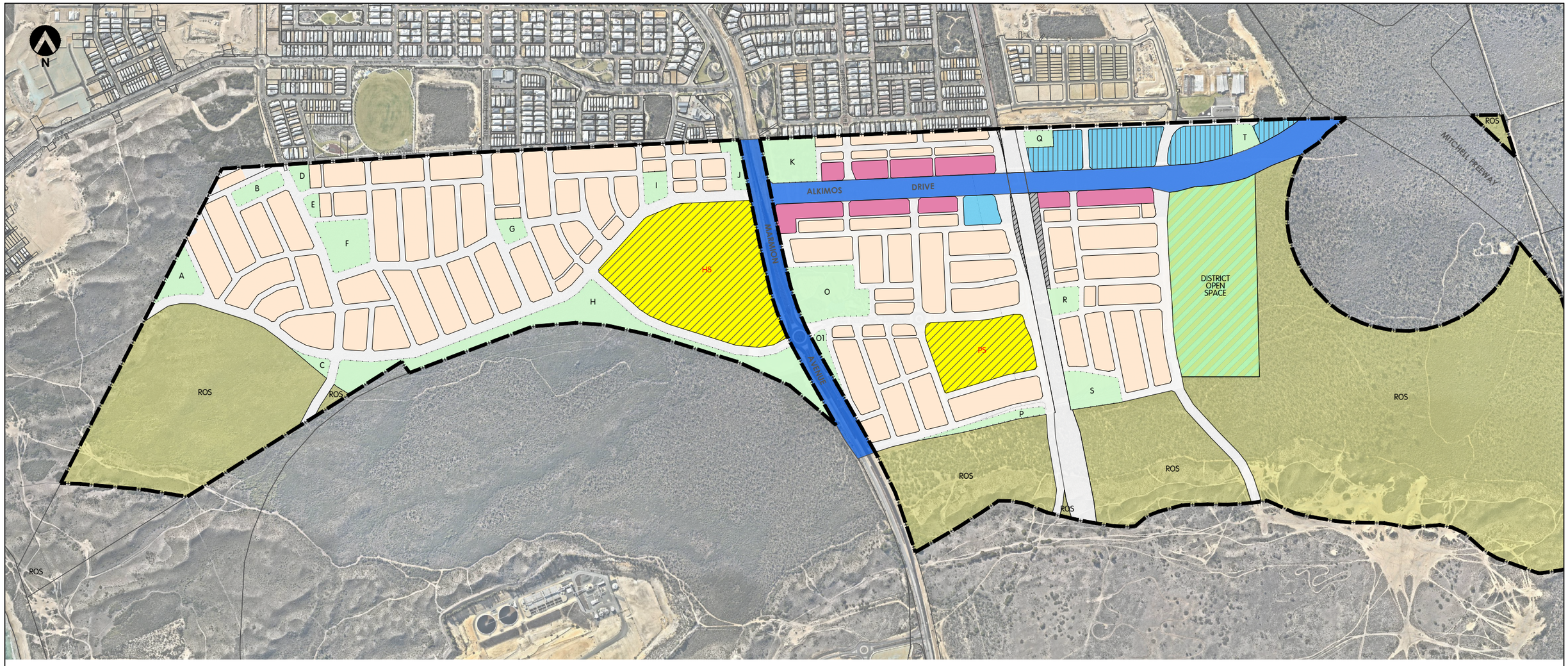


NOTIONAL MASTER PLAN FOR PRIMARY SCHOOL AT ALKIMOS NORTH EAST (CENTRAL)

OLDFIELD KNOTT ARCHITECTS PTY LTD

06/03/2019 DRWG NO.19010.MP.01.REV 2.

APPENDIX F – MASTERPLAN



LEGEND

STRUCTURE PLAN AREA	- 261.1697ha	MIXED USE	- 4.8593ha
POS/ DRAINAGE	- 17.0623ha	RESIDENTIAL	- 55.4333ha
DISTRICT OPEN SPACE	- 10.7066ha	BUSINESS	- 4.7570ha
REGIONAL PARKS & RECREATION	- 98.7628ha	COMMERCIAL	- 0.6574ha
RAILWAY RESERVE	- 4.5553ha	OTHER REGIONAL ROAD	- (Alkimos Drive 8.2912ha)
RAILWAY RESERVE (CUT-FILL AREA)	- 0.5818ha	ROAD RESERVE	- 39.9911ha
PRIMARY SCHOOL	- 4.0067ha		
HIGH SCHOOL	- 11.8049ha		

INDICATIVE ONLY

This plan depicts a hypothetical development scenario and is subject to statutory processes and approvals. The location of structural design elements including roads, public open space, drainage areas and access points are subject to detailed site mitigations and technical assessments.

LANDCORP lendlease

CADASTRAL INFORMATION
SOURCE: MAPS
YYMMDD: VARIED
DWG REF: VARIED
PROJECTION: PCG94

AERIAL PHOTOGRAPHY
SOURCE: NEARMAPS
YYMMDD:160423

great places

SIZE A3_1:10000

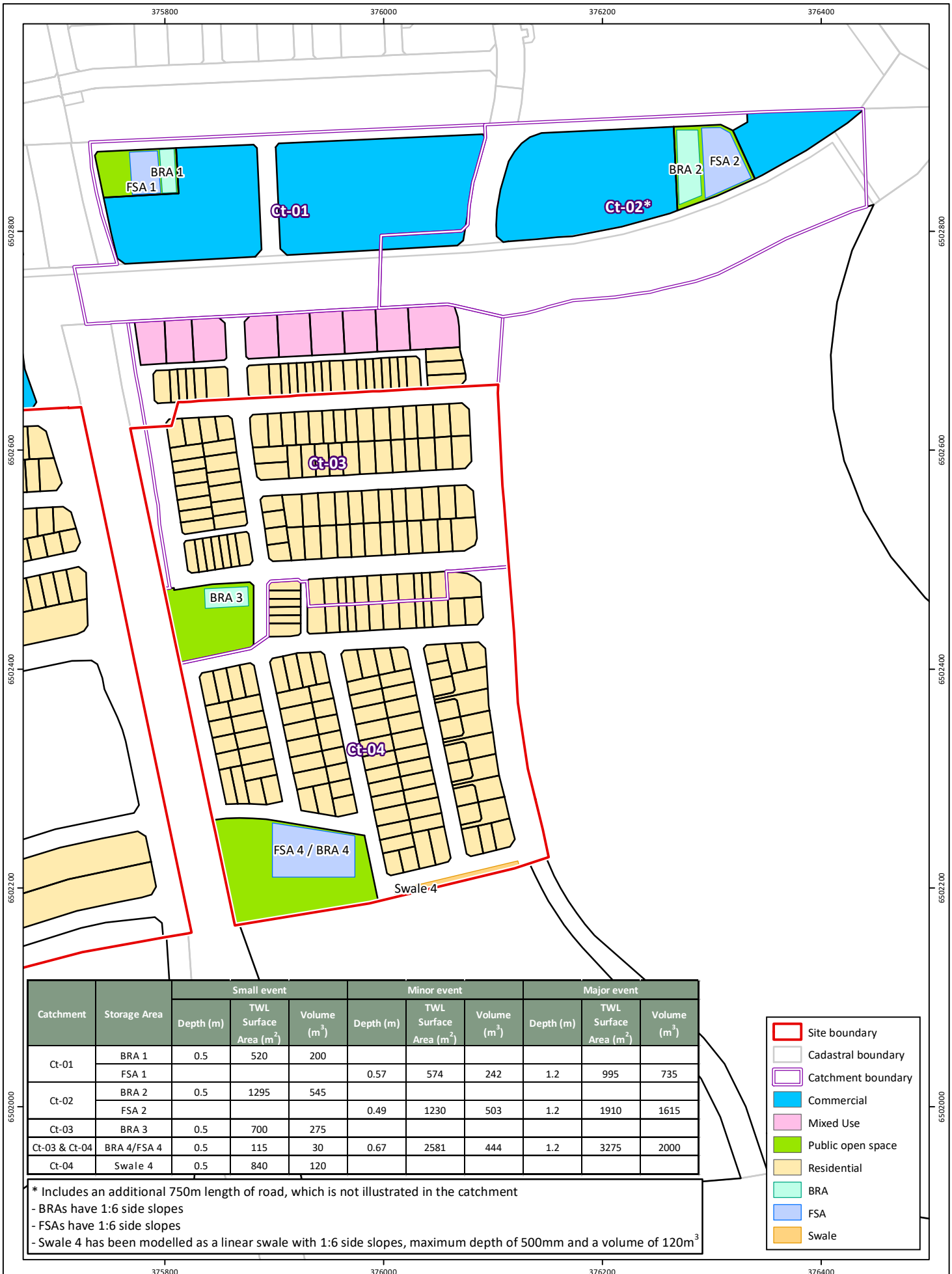
0 metres 100 200 300 400 500

REV	DESCRIPTION	YYMMDD	DRAWN	APPR'D
X	UPDATE VISTA EAST RD1CEN RD1 110G	200428	SB	DRAFT
W	UPDATE EAST OF PRECINCT 1	190909	SB	-
V	UPDATED FROM RD1 102 C	190121	HH	RD
U	UPDATED AERIAL	171123	HH	RD
T	REVISED RESIDENTIAL AREA	170926	HH	RD

MASTERPLAN
Alkimos Central, Alkimos
City of Wanneroo

REF NO.	DRAW NO.	REV.
DLL CEN	**RD1 019**	**X**

APPENDIX G – STORMWATER MANAGEMENT PLAN



Catchment	Storage Area	Small event			Minor event			Major event		
		Depth (m)	TWL Surface Area (m^2)	Volume (m^3)	Depth (m)	TWL Surface Area (m^2)	Volume (m^3)	Depth (m)	TWL Surface Area (m^2)	Volume (m^3)
Ct-01	BRA 1	0.5	520	200						
	FSA 1				0.57	574	242	1.2	995	735
Ct-02	BRA 2	0.5	1295	545						
	FSA 2				0.49	1230	503	1.2	1910	1615
Ct-03	BRA 3	0.5	700	275						
Ct-03 & Ct-04	BRA 4/FSA 4	0.5	115	30	0.67	2581	444	1.2	3275	2000
Ct-04	Swale 4	0.5	840	120						

* Includes an additional 750m length of road, which is not illustrated in the catchment
- BRAs have 1:6 side slopes
- FSAs have 1:6 side slopes
- Swale 4 has been modelled as a linear swale with 1:6 side slopes, maximum depth of 500mm and a volume of $120m^3$

Site boundary
Cadastral boundary
Catchment boundary
Commercial
Mixed Use
Public open space
Residential
BRA
FSA
Swale

WD: Stormwater Management Plan

Project: Alkimos Vista - Stage 2 LSP Amendment

Client: Lendlease Communities (Australia) Pty Ltd

Plan Number: EP17-001(07)--WD32a
Drawn: AFF
Date: 22/04/2020
Checked: JB
Approved: RLE
Date: 12/05/2020

N

0 50 100
Metres
Scale: 1:4,500@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

APPENDIX H – UPDATED ACOUSTIC ASSESSMENT

HERRING STORER ACOUSTICS

LENDLEASE

PRECINCT 1 SUBDIVISION
CENTRAL ALKIMOS

SPP 5.4 NOISE ASSESSMENT

MAY 2020

OUR REFERENCE: 24064-2-17018-02

Rochdale Holdings Pty Ltd A.B.N. 85 009 049 067 trading as:
HERRING STORER ACOUSTICS
P.O. Box 219, Como, W.A. 6952
(08) 9367 6200
hsa@hsacoustics.com.au

DOCUMENT CONTROL PAGE

NOISE ASSESSMENT
PRECINCT 1 CENTRAL ALKIMOS

Job No: 17018-02

Document Reference: 24064-2-17018-02

FOR

LENDLEASE

DOCUMENT INFORMATION			
Author:	Paul Daly	**Checked By:**	Tim Reynolds
Date of Issue:	22 May 2020		

REVISION HISTORY				
Revision	**Description**	**Date**	**Author**	**Checked**
1	Revision of sub-division lay out and update to latest SPP 5.4	22 May 2020	PLD	TR

DOCUMENT DISTRIBUTION				
Copy No.	**Version No.**	**Destination**	**Hard Copy**	**Electronic Copy**
1	1	Lendlease – Laura Bowdell laura.bowdell@lendlease.com		✓
1	2	Lendlease – Laura Bowdell laura.bowdell@lendlease.com		✓

CONTENTS

APPENDICES

1. INTRODUCTION

Herring Storer Acoustics was commissioned by Lendlease to undertake a road traffic noise assessment for the proposed development of Precinct 1 in Central Alkimos.

The purpose of this assessment was to assess noise received within the development from vehicles travelling along the Marmion Avenue for the future and passenger rail associated with the northern suburbs passenger railway line. Previously, an acoustic assessment, (reference *HSA 14882-2-12067 and 21437-5-17018*) was conducted for the overall development, including the proposed Precinct 1 in Central Alkimos. The purpose of this current acoustic assessment is to provide additional, detailed acoustic advice for individual lots, now that the final subdivision layout is known and to update the information contained within the study to reference the latest version of State Planning Policy 5.4, with was released in September 2019.

The traffic noise assessment has been carried out in accordance with the WAPC State Planning Policy 5.4 *"Road and Rail Noise"*.

For information, the development plan is attached in Appendix A.

2. SUMMARY

Under the Western Australian Planning Commission (WAPC) Planning Policy 5.4 *"Road and Rail Noise"* (SPP5.4), the appropriate criteria for assessment for this development are as listed below for "Noise Limits".

EXTERNAL

$L_{Aeq(Day)}$ of 55 dB(A); and
$L_{Aeq(Night)}$ of 50 dB(A).

INTERNAL

$L_{Aeq(Day)}$ of 40 dB(A) in living and work areas; and
$L_{Aeq(Night)}$ of 35 dB(A) in bedrooms.

Noise received at an outdoor area should also be reduced as far as practicable, with an aim of achieving an L_{Aeq} (night) of 50 dB(A).

From the modelling undertaken for the future Marmion Avenue, noise received at the development would exceed the above criteria. As the inclusion of a noise wall for the entire length of the development is not practical as future residential lots face the roadway, to comply with the requirements of SPP 5.4 "Quiet House" design is required. For side facing lots (two lots at the southern end of the development) a wall has been included at 1.8m high, hence provide amelioration to the outdoor living areas.

Appendix C details the Quiet House Design Packages required for each individual Lot with Appendix D containing the deemed to satisfy construction methods.

Due to the orientation of the lots, the outdoor living area is situated behind the house, away from the Marmion Avenue, therefore providing a barrier to noise level, hence compliance is achieved with the $L_{Aeq\ (night)}$ of 50 dB(A).

Additionally, noise modelling indicates that noise received at the closest residence to the extension of the Northern Suburbs Passenger Railway Line would comply with the above criteria.

Therefore, no acoustic amelioration, or notifications are required for those residential lots located adjacent to the Railway Line.

3. ACOUSTIC CRITERIA

3.1 ROAD AND RAIL TRAFFIC NOISE

The Western Australian Planning Commission (WAPC) released on 6th September 2019 State Planning Policy 5.4 *"Road and Rail Noise".* The requirements of State Planning Policy 5.4 are outlined below.

POLICY APPLICATION (Section 4)

When and where it applies (Section 4.1)

SPP 5.4 applies to the preparation and assessment of planning instruments, including region and local planning schemes; planning strategies, structure plans; subdivision and development proposals in Western Australia, where there is proposed:

*a) noise-sensitive land-use within the policy's trigger distance of a transport corridor as specified in **Table 1**;*

*b) New or major upgrades of roads as specified in **Table 1** and maps **(Schedule 1,2 and 3);** or*

*c) New railways or major upgrades of railways as specified in maps (**Schedule 1, 2 and 3);** or any other works that increase capacity for rail vehicle storage or movement and will result in an increased level of noise.*

Policy trigger distances (Section 4.1.2)

***Table 1** identifies the State's transport corridors and the trigger distances to which the policy applies.*

*The designation of land within the trigger distances outlined in **Table 1** should not be interpreted to imply that land is affected by noise and/or that areas outside the trigger distances are un-affected by noise.*

*Where any part of the lot is within the specified trigger distance, an assessment against the policy is required to determine the likely level of transport noise and management/ mitigation required. An initial screening assessment (**guidelines: Table 2: noise exposure forecast**) will determine if the lot is affected and to what extent."*

TABLE 1: TRANSPORT CORRIDOR CLASSIFICATION AND TRIGGER DISTANCES

Transport corridor classification	***Trigger distance***	***Distance measured from***
Roads		
Strategic freight and major traffic routes *Roads as defined by Perth and Peel Planning Frameworks and/or roads with either 500 or more Class 7 to 12 Austroads vehicles per day, and/or 50,000 per day traffic volume*	*300 metres*	*Road carriageway edge*
Other significant freight/traffic routes *These are generally any State administered road and/or local government road identified as being a future State administered road (red road) and other roads that meet the criteria of either >=23,000 daily traffic count (averaged equivalent to 25,000 vehicles passenger car units under region schemes)*	*200 metres*	*Road carriageway edge*
Passenger railways		
	100 metres	*Centreline of the closest track*
Freight railways		
	200 metres	*Centreline of the closest track*

Proponents are advised to consult with the decision making authority as site specific conditions (significant differences in ground levels, extreme noise levels) may influence the noise mitigation measures required, that may extend beyond the trigger distance.

POLICY MEASURES (Section 6)

The policy applies a performance-based approach to the management and mitigation of transport noise. The policy measures and resultant noise mitigation will be influenced by the function of the transport corridor and the type and intensity of the land-use proposed. Where there is risk of future land-use conflict in close proximity to strategic freight routes, a precautionary approach should be applied. Planning should also consider other broader planning policies. This is to ensure a balanced approach takes into consideration reasonable and practical considerations.

Noise Targets (Section 6.1)

***Table 2** sets out noise targets that are to be achieved by proposals under which the policy applies. Where exceeded, an assessment is required to determine the likely level of transport noise and management/mitigation required.*

In the application of the noise targets the objective is to achieve:

- *indoor noise levels as specified in **Table 2** in noise sensitive areas (for example, bedrooms and living rooms of houses, and school classrooms); and*

- *a reasonable degree of acoustic amenity for outdoor living areas on each residential lot. For non-residential noise-sensitive developments, for example schools and child care centres the design of outdoor areas should take into consideration the noise target.*

It is recognised that in some instances, it may not be reasonable and/or practicable to meet the outdoor noise targets. Where transport noise is above the noise targets, measures are expected to be implemented that balance reasonable and practicable considerations with the need to achieve acceptable noise protection outcomes.

TABLE 2: NOISE TARGETS

Proposals	***New/Upgrade***	***Noise Targets***		
		Outdoor		***Indoor***
		Day (L_{Aeq}(Day) dB) (6 am-10 pm)	***Night (L_{Aeq}(Night) dB) (10 pm-6 am)***	***(L_{Aeq} dB)***
Noise-sensitive land-use and/or development	*New noise sensitive land use and/or development within the trigger distance of an existing/proposed transport corridor*	*55*	*50*	*L_{Aeq} (Day) 40(Living and work areas)* *L_{Aeq} (Night) 35 (bedrooms)*
Roads	*New*	*55*	*50*	*N/A*
	Upgrade	*60*	*55*	*N/A*
Railways	*New*	*55*	*50*	*N/A*
	Upgrade	*60*	*55*	*N/A*

Notes:

- *The noise target is to be measured at one metre from the most exposed, habitable façade of the proposed building, which has the greatest exposure to the noise-source. A habitable room has the same meaning as defined in State Planning Policy 3.1 Residential Design Codes.*

- *For all noise-sensitive land-use and/or development, indoor noise targets for other room usages may be reasonably drawn from Table 1 of Australian Standard/New Zealand Standard AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors (as amended) for each relevant time period.*

- *The 5dB difference in the criteria between new and upgrade infrastructure proposals acknowledges the challenges in achieving noise level reduction where existing infrastructure is surrounded by existing noise-sensitive development.*

- *Outdoor targets are to be met at all outdoor areas as far as is reasonable and practical to do so using the various noise mitigation measures outlined in the guidelines. For example, it is likely unreasonable for a transport infrastructure provider to achieve the outdoor targets at more than 1 or 2 floors of an adjacent development with direct line of sight to the traffic.*

<u>Noise Exposure Forecast (Section 6.2)</u>

*When it is determined that SPP 5.4 applies to a planning proposal as outlined in Section 4, proponents and/or decision makers are required to undertake a preliminary assessment using **Table 2**: noise exposure forecast in the guidelines. This will provide an estimate of the potential noise impacts on noise-sensitive land-use and/ or development within the trigger distance of a specified transport corridor. The outcomes of the initial assessment will determine whether:*

- *no further measures is required;*

- *noise-sensitive land-use and/or development is acceptable subject to deemed-to- comply mitigation measures; or*

- *noise-sensitive land-use and/or development is not recommended. Any noise-sensitive land-use and/ or development is subject to mitigation measures outlined in a noise management plan."*

4. MODELLING

Modelling of noise received within the development from the Marmion Avenue was carried out using SoundPlan, using the Calculation of Road Traffic Noise (CoRTN) algorithms. The input data for the model included:

- Increased traffic volume, assuming 2% growth over 20 years.
- Other traffic data as listed in Table 4.1.
- A +2.5 dB adjustment to allow for façade reflection.

The traffic data is as listed in Table 4.1.

TABLE 4.1 - SUMMARY OF TRAFFIC DATA

Parameter	Marmion Avenue
Future Traffic Flow (vpd)	35,000
Percentage Heavy Vehicles (%)	3%
Speed (km/hr)	70

For this project, with reference to the DEFRA publication and as for the original assessment, the difference between the $L_{A10,18h}$ and the $L_{Aeq,8hr}$ and the $L_{Aeq,16hr}$ has been taken to be 10 and 2.5 dB(A) respectively. It was assumed that these differences would apply in the year 2031.

Notes:

1. As noise monitoring of existing road traffic noise emanating from Marmion Avenue is not possible at this time, as outlined in the Implementation Guidelines, the standard correction of -1.7 dB has been applied to the noise model.

2. We also note that with the difference between the $L_{Aeq,8hr}$ and the $L_{Aeq,16hr}$ being greater than 5 dB(A), achieving compliance with the day period criteria will also achieve compliance with the night period criteria. Therefore, noise modelling was only undertaken for the day period and the results are shown graphically in Appendix B.

Noise modelling for road noise was undertaken for the following scenarios:

S1 Noise emissions from Marmion Avenue (Future) without noise amelioration for front facing lots and a 1.8m wall for side facing lots, but with future residential buildings.

The 1.8m wall for the side facing lots has been assumed to be a minimum of 15kg/m^2 in density.

For the noise modelling of future traffic, it has been assumed that the percentage of future heavy vehicles remains the same as for the current traffic flows. In this case, we believe that this is a conservative approach, as we believe that the percentage of heavy vehicles would fall over time.

The noise modelling was carried out based on the number of train movements as summarised in Table 4.2. We understand that these movements were used to model noise emissions from other section of the Northern Suburbs Passenger Railway Line.

TABLE 4.2 – TRAIN MOVEMENTS

Parameter	Train Movements (per hour)	
	Day	Night
North Bound		
3 Car Set (75 metres long)	5.0	0.75
4 Car Set (100 metres long)	0.5	0
6 Car Set (150 metres long)	0.4	0
South Bound		
3 Car Set (75 metres long)	5.4	0.9
4 Car Set (100 metres long)	0.5	0
6 Car Set (150 metres long)	0.4	0

Based on the above number of train movements, once again if compliance is achieved with the day period criteria, compliance will also be achieved with the night period criteria. Therefore, noise modelling was only undertaken for the day period.

Noise modelling for rail was undertaken for the following scenario:

R1 Noise emissions from proposed northern suburbs railway, without noise amelioration.

5. ASSESSMENT

In accordance with the WAPC Planning Policy 5.4, an assessment of the noise that would be received within the development located at Precinct 1 from vehicles travelling on the Marmion Avenue has been undertaken.

In accordance with the Policy, the following would be the acoustic criteria applicable to this project:

External

Day	Maximum of 55 dB(A) L_{Aeq}
Night	Maximum of 50 dB(A) L_{Aeq}
Outdoor Living Areas (Night)	Maximum of 50 dB(A) L_{Aeq}

Internal

Sleeping Areas	35 dB(A) $L_{Aeq(night)}$
Living Areas	40 dB(A) $L_{Aeq(day)}$

Noise received at an outdoor area should also be reduced as far as practicable with an aim of achieving an $L_{Aeq\ (night)}$ of 50 dB(A).

From the modelling undertaken for the future Marmion Avenue, noise received at the development would exceed the above criteria. As the inclusion of a noise wall for the entire length of the development is not practical as future residential lots face the roadway, to comply with the requirements of SPP 5.4 “Quiet House” design is required. For side facing lots (two lots at the southern end of the development) a wall has been included at 1.8m high, hence provide amelioration to the outdoor living areas.

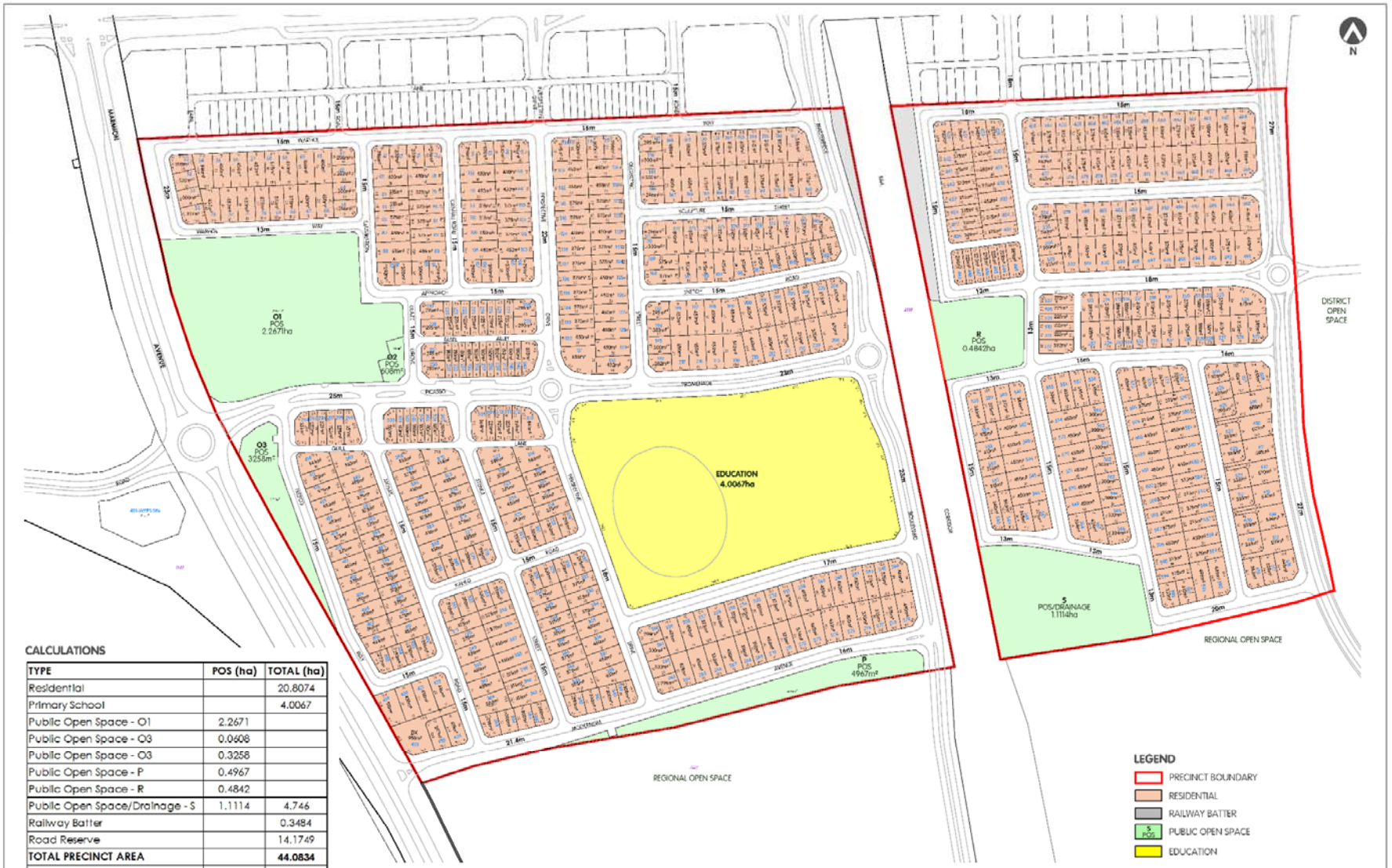
Appendix C details the Quiet House Design Packages required for each individual Lot with Appendix D containing the deemed to satisfy construction methods. We note that alternative constructions as to those listed in Appendix D, are acceptable, provided they are supported by an assessment undertaken by a suitably qualified acoustic consultant.

Due to the orientation of the lots, the outdoor living area is situated behind the house, away from the Marmion Avenue, therefore providing a barrier to noise level, hence compliance is achieved with the L_{Aeq} (night) of 50 dB(A).

Additionally, noise modelling indicates that noise received at the closest residence to the extension of the Northern Suburbs Passenger Railway Line would comply with the above criteria. Therefore, no acoustic amelioration, or notifications are required for those residential lots located adjacent to the Railway Line.

APPENDIX A

PRECINCT 1
DEVELOPMENT PLAN



CALCULATIONS

TYPE	POS (ha)	TOTAL (ha)
Residential		20.8074
Primary School		4.0067
Public Open Space - O1	2.2671	
Public Open Space - O3	0.0608	
Public Open Space - O3	0.3258	
Public Open Space - P	0.4967	
Public Open Space - R	0.4842	
Public Open Space/Drainage - S	1.1114	4.746
Railway Batter		0.3484
Road Reserve		14.1749
TOTAL PRECINCT AREA		**44.0834**
RESIDENTIAL LOTS		562

LANDCORP lendlease

CADASTRAL INFORMATION
SOURCE: VERIS
YYMMDD: 180416
DWG REF: 21709-003-R0.dwg
PROJECTION: PCG94

AERIAL PHOTOGRAPHY
SOURCE: NA
YYMMDD: NA

SIZE A3 1:3000

0 metres 30 40 90 120 150

REV	DESCRIPTION	YYMMDD	DRAWN	APPR'D	
F	UPDATE POS FIGURE ON TABLE	200507	SB	DRAFT	
E	UPDATE VISTA EAST RD1 102D	200424	SB	DRAFT	
D	YR MODIFIED IN TITLE	190909	SB	RD	
C	REMOVE NTHN LOTS	181012	SB	RD	

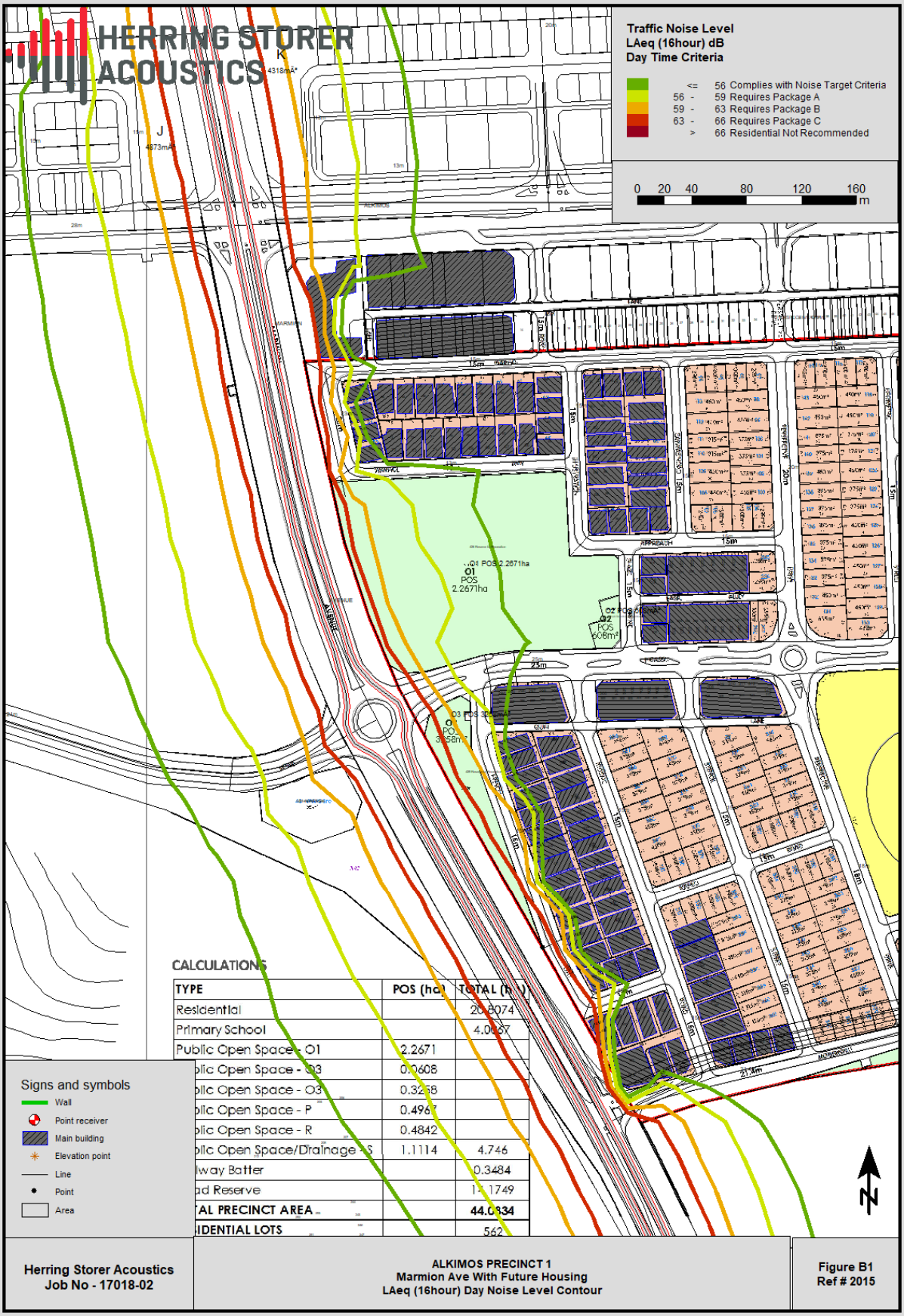
COMMERCIAL ASSESSMENT PLAN (APRIL 2020) (NORTHERN LOTS EXCLUDED)

Alkimos Vista
City of Wanneroo

REF NO. **DLL CEN** | DRAW NO. **RD1 102** | REV. **F**

APPENDIX B

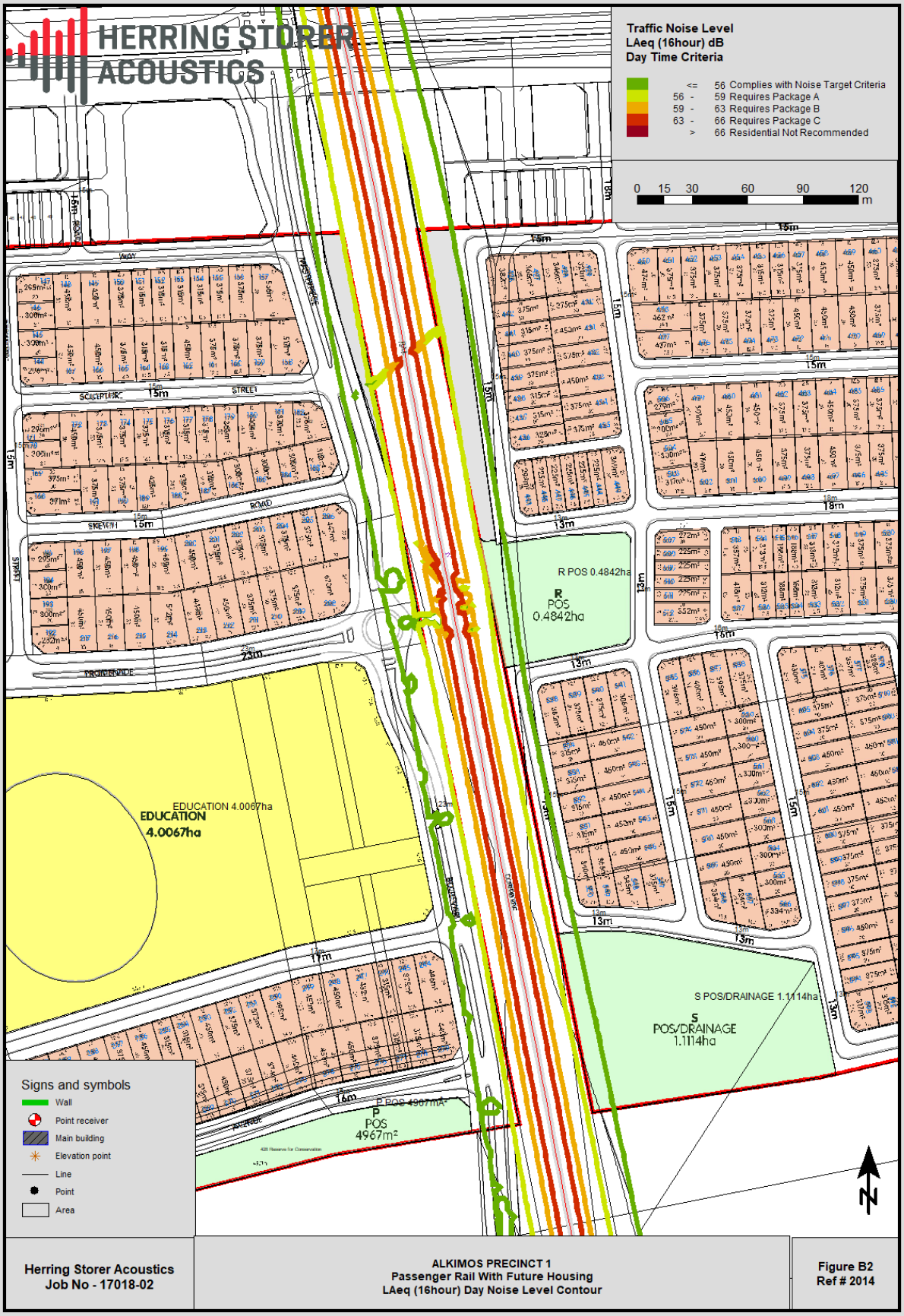
NOISE CONTOUR PLOT



Herring Storer Acoustics
Job No - 17018-02

ALKIMOS PRECINCT 1
Marmion Ave With Future Housing
LAeq (16hour) Day Noise Level Contour

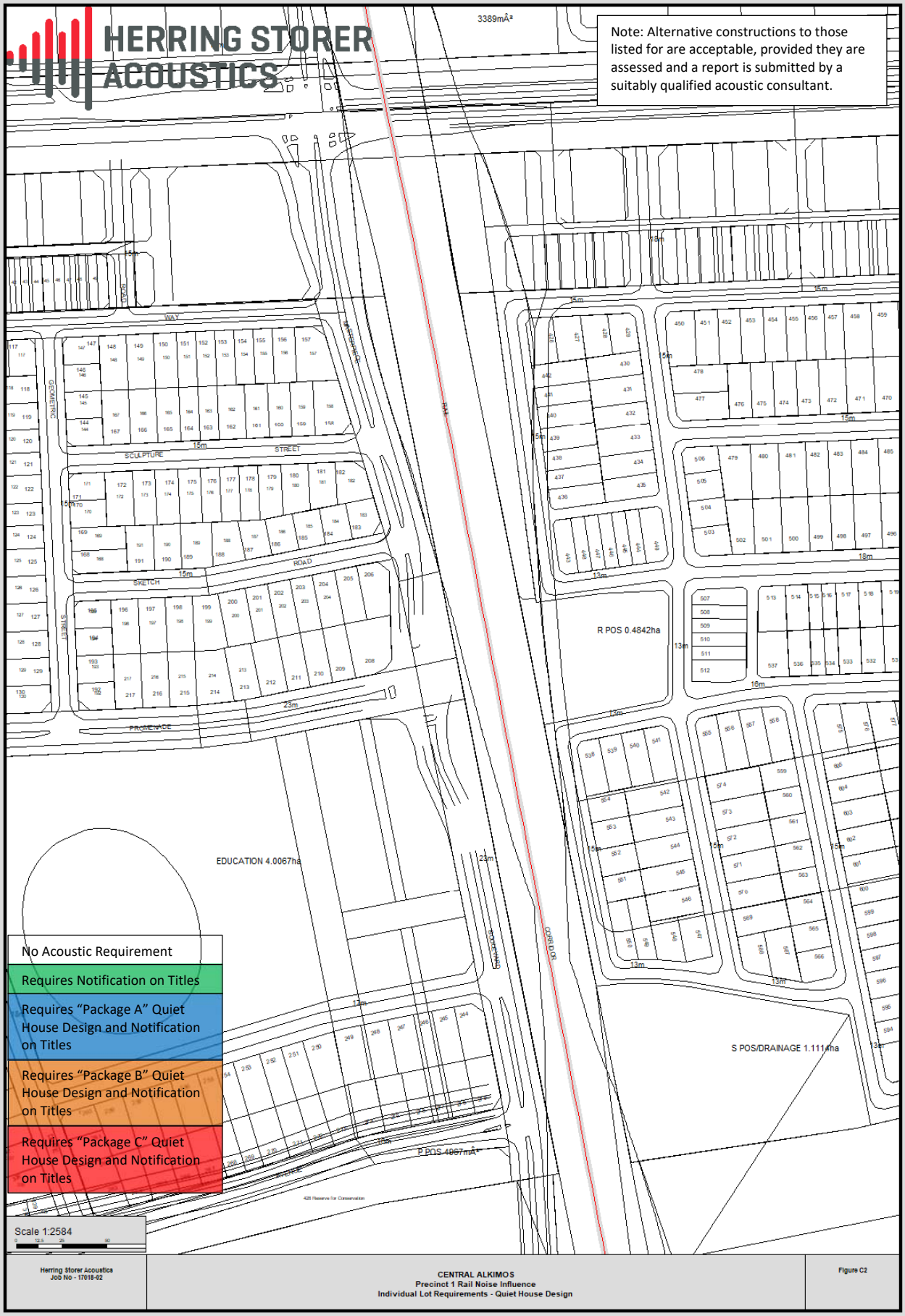
Figure B1
Ref # 2015


HERRING STORER ACOUSTICS
Traffic Noise Level
LAeq (16hour) dB
Day Time Criteria
<= 56 Complies with Noise Target Criteria
56 - 59 Requires Package A
59 - 63 Requires Package B
63 - 66 Requires Package C
> 66 Residential Not Recommended
0 15 30 60 90 120 m
R POS 0.4842ha
R
POS
0.4842ha
EDUCATION 4.0067ha
EDUCATION
4.0067ha
S POS/DRAINAGE 1.1114ha
S
POS/DRAINAGE
1.1114ha
P POS 4967m²
P
POS
4967m²
Signs and symbols
Wall
Point receiver
Main building
Elevation point
Line
Point
Area
N
Herring Storer Acoustics
Job No - 17018-02
ALKIMOS PRECINCT 1
Passenger Rail With Future Housing
LAeq (16hour) Day Noise Level Contour
Figure B2
Ref # 2014

APPENDIX C

Quiet House Design – Individual Lot Requirements


HERRING STORER ACOUSTICS
Note: Alternative constructions to those listed for are acceptable, provided they are assessed and a report is submitted by a suitably qualified acoustic consultant.
MARMION
AVENUE
WARHOL
WAY
ILLUSTRATION
CANVAS ROAD
PERSPECTIVE
PERSPECTIVE DRIVE
APPROACH
O1 POS 2.2671ha
O2 POS 1608mÂ²
O3 POS 325mÂ²
GLAZE
EASEL
ALLEY
DRIVE
PICASSO
QUILL
LANE
ROAD
MOSAIC
STENCIL
KAHLO
STREET
MODE
No Acoustic Requirement
Requires Notification on Titles
Requires "Package A" Quiet House Design and Notification on Titles
Requires "Package B" Quiet House Design and Notification on Titles
Requires "Package C" Quiet House Design and Notification on Titles
Scale 1:2433
Herring Storer Acoustics
Job No - 17018-02
CENTRAL ALKIMOS
Precinct 1 Road Noise Influence
Individual Lot Requirements - Quiet House Design
Figure C1


HERRING STORER ACOUSTICS
Note: Alternative constructions to those listed for are acceptable, provided they are assessed and a report is submitted by a suitably qualified acoustic consultant.
3389mÂ²
R POS 0.4842ha
EDUCATION 4.0067ha
S POS/DRAINAGE 1.111 4ha
P POS 4867mÂ²
No Acoustic Requirement
Requires Notification on Titles
Requires "Package A" Quiet House Design and Notification on Titles
Requires "Package B" Quiet House Design and Notification on Titles
Requires "Package C" Quiet House Design and Notification on Titles
Scale 1:2584
Herring Storer Acoustics
Job No - 17018-02
CENTRAL ALKIMOS
Precinct 1 Rail Noise Influence
Individual Lot Requirements - Quiet House Design
Figure C2

APPENDIX D

QUIET HOUSE DESIGN GUIDELINES

Road Traffic and Passenger Rail
Quiet House Requirements
(*Based on Table 3 of State Planning Policy 5.4 2019*)

Exposure Category	Orientation to corridor	Acoustic rating and example constructions					Mechanical ventilation/air conditioning considerations
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor Living areas**	
A **Quiet House A**	**Facing**	**Bedroom and Indoor Living and work areas to Rw + Ctr 45dB** **Stud Frame Walls** ➢ One row of 92mm studs at 60mm centres with: ➢ Resilient steel channels fixed to the outside of the studs; and ➢ 9.5mm hardboard or 9mm fibre cement weatherboards or one layer of 19mm board cladding fixed to the outside of the channels; and ➢ 75mm glass wool (11kg/m3) or 75mm polyester (14kg/m3) insulation, positioned between the studs; and ➢ -Two layers of 16mm fire-protective grade plasterboard fixed to the inside face of the studs. **Brick Walls** ➢ Single leaf of 150mm brick masonry with 13mm cement render on each face: **OR** ➢ Double brick: two leaves of 90 mm clay brick masonry with a 20mm cavity between leaves.	**Bedrooms**: ➢ Fully glazed hinged door with certified **R_w+C_{tr} 28dB** rated door and frame including seals and 6mm glass **Indoor Living and work areas:** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals	**Bedrooms**: ➢ Total external door and window system area up to 40% of room floor area: Sliding or double hung with minimum 10 mm single or 6mm-12mm-10mm double insulted glazing (**R_w+C_{tr} 28 dB**). Sealed awning or casement windows may use 6 mm glazing instead**: OR** ➢ Up to 60% floor area: as per above but must be sealed awning or casement type windows (**R_w+C_{tr} 31dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 25dB): OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr28 dB : OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 31 dB**).	**To R_w+C_{tr} 35dB** ➢ Concrete or terracotta tile or metal sheet roof with sarking and at least 10mm plasterboard ceiling	➢ At least one outdoor living area located on the opposite side of the building from the transport corridor and/or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum **2 metres** height above ground level	➢ Acoustically rated openings and ductwork to provide a minimum sound reduction performance of **Rw 40dB** into sensitive spaces ➢ Evaporative systems require attenuated ceiling air vents to allow closed windows ➢ Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements ➢ Openings such as eaves, vents and air inlets must be acoustically treated, closed or relocated to building sides facing away from the corridor where practicable
	Side On		As per "Facing" above, except R_w+C_{tr} values may be 3dB less, e.g. glazed sliding door with 10 mm glass and weather seals for bedrooms	As above, except R_w+C_{tr} values may be 3dB less, or max % area increased by 20%			
	Opposite		No specific requirements	No specific requirements			

Road Traffic and Passenger Rail
Quiet House Requirements
(*Based on Table 3 of State Planning Policy 5.4 2019*)

Exposure Category	Orientation to corridor	Acoustic rating and example constructions					Mechanical ventilation/air conditioning considerations
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor Living areas**	
B **Quiet House B**	**Facing**	**Bedroom and indoor living and work areas to R_w+C_{tr} 50dB** **Single leaf of 90 mm clay brick masonry with:** ➢ A row of 70 mm x 35 mm timber studs or 64 mm steel studs at 600 mm centres; ➢ A cavity of 25 mm between leaves; ➢ 50 mm glass wool or polyester cavity insulation (R2.0+) insulation between studs; and ➢ One layer of 10mm plasterboard fixed to the inside face ➢ Single leaf of 220mm brick masonry with 13mm cement render on each face ➢ 150mm thick unlined concrete panel or 200mm thick concrete panel with one layer of 13mm plasterboard or 13mm cement render on each face **Double brick: two leaves of 90mm clay brick masonry with:** ➢ A 50mm cavity between leaves ➢ 50mm glass wool or polyester cavity insulation (R2.0+) ➢ Resilient ties where required to connect leaves **Double brick: two leaves of 110mm clay brick masonry with** ➢ 50mm cavity between leaves and R2.0+ cavity insulation	**Bedrooms** ➢ Fully glazed hinged door with certified **R_w+C_{tr} 31dB** rated door and frame including seals and 10mm glass **Indoor Living and work areas** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals	**Bedrooms**: ➢ Total external door and window system area up to 40% of room floor areas: Fixed sash, awning or casement with minimum 6mm single or 6mm-12mm-6mm double insulted glazing (**Rw+Ctr 31dB**). ➢ Up to 60% floor area: as per above but must be minimum10mm single or 6mm-12mm-10mm double insulated glazing (**Rw+Ctr 34dB**) **Indoor Living and work areas** ➢ Up to 40% floor area; Sliding or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (R_w+C_{tr} 28dB). Sealed awning or casement windows may use 6mm glazing instead. **: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**R_w+C_{tr} 31dB**). **: OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 34dB).**	**To R_w+C_{tr} 35dB** ➢ Concrete or terracotta tile sarking and at least 10mm plasterboard ceiling, R3.0+ insulation **OR** ➢ Metal sheet roof, sarking and at least 10mm plasterboard ceiling, R3.0+ insulation	➢ At least one outdoor living area located on the opposite side of the building from the corridor and/or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum **2.4 metres** height above ground level	➢ Acoustically rated openings and ductwork to provide a minimum sound reduction performance of **Rw 40dB** into sensitive spaces ➢ Evaporative systems require attenuated ceiling air vents to allow closed windows ➢ Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements ➢ Openings such as eaves, vents and air inlets must be acoustically treated, closed or relocated to building sides facing away from the corridor where practicable
	Side-On		**Bedrooms**: ➢ Fully glazed hinged door with certified **R_w+C_{tr} 28dB** rated door and frame including seals and 6mm glass **Indoor Living and work areas:** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals	**Bedrooms**: ➢ Total external door and window system area up to 40% of room floor area: Sliding or double hung with minimum 10 mm single or 6mm-12mm-10mm double insulted glazing (**R_w+C_{tr} 28 dB**). Sealed awning or casement windows may use 6 mm glazing instead. **: OR** ➢ Up to 60% floor area: as per above but must be sealed awning or casement type windows (**R_w+C_{tr} 31dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 25dB**). **: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr28 dB**) **: OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 31 dB**).			
	Opposite		As above, except R_w+C_{tr} values may be 3dB less, or max % area increased by 20%	As above, except R_w+C_{tr} values may be 3dB less, or max % area increased by 20%			

Road Traffic and Passenger Rail
Quiet House Requirements
(*Based on Table 3 of State Planning Policy 5.4 2019*)

Exposure Category	Orientation to corridor	Acoustic rating and example constructions					
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor Living areas**	**Mechanical ventilation/air conditioning considerations**
C **Quiet House C**	**Facing**	**Bedroom and indoor living and work areas to R_w+C_{tr} 50dB** **Single leaf of 90 mm clay brick masonry with:** ➢ A row of 70 mm x 35 mm timber studs or 64 mm steel studs at 600 mm centres; ➢ A cavity of 25 mm between leaves; ➢ 50 mm glass wool or polyester cavity insulation (R2.0+) insulation between studs; and ➢ One layer of 10mm plasterboard fixed to the inside face **Double brick: two leaves of 90mm clay brick masonry with:** ➢ A 50mm cavity between leaves ➢ 50mm glass wool or polyester cavity insulation (R2.0+) ➢ Resilient ties where required to connect leaves	**Bedrooms** ➢ External doors to bedrooms facing the corridor are not recommended. **Indoor Living and work areas** ➢ Fully glazed hinged door with certified **Rw+Ctr 31dB** rated door and frame including seals and 10mm glass**: OR** 40mm solid core timber frame and door (without glass or with glass inserts not less than 6mm), side hinged with certified **Rw 32dB** acoustically rated door and frame system including seals	**Bedrooms**: ➢ Total external door and window system area up to 20% of room floor area: Fixed sash, awning or casement with minimum 6mm single or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 31dB): OR** ➢ Up to 40% floor area; as per above but must be minimum 10mm single or 6mm-12mm-10mm double insulted glazing (**R_w+C_{tr} 34dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulated glazing (**R_w+C_{tr} 31dB**). Sealed awning or casement windows may use 6mm glazing instead**: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr 34dB)**	**To R_w+C_{tr} 40dB** ➢ To al bedrooms, 2 layers of 10mm plasterboard, or one layer 13mm high density sealed plasterboard (minimum surface density of 12.5 kg/m2), affixed using steel furring channels beneath ceiling rafters/supports**: and** ➢ R3.0+ insulation batts laid in cavity **: and** ➢ Concrete or terracotta tile roof with sarking, or metal sheet roof with foil backed R2.0+ fibre insulation between steel sheeting and roof battens	➢ At least one outdoor living area located on the opposite side of the building from the corridor and/or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum **2.4 metres** height above ground level	➢ Acoustically rated openings and ductwork to provide a minimum sound reduction performance of Rw 40dB into sensitive spaces. ➢ Evaporative systems require attenuated ceiling air cents to allow closed windows. ➢ Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements ➢ Openings such as eaves, vents and air inlets must be acoustically treated, close or relocated to building sides facing away from the corridor where practicable.
	Side-on	**Single leaf of 220mm brick masonry with 13mm cement render on each face** ➢ 150mm thick unlined concrete panel or 200mm thick concrete panel with one layer of 13mm plasterboard or 13mm cement render on each face	**Bedrooms** ➢ Fully glazed hinged door with certified **R_w+C_{tr} 31dB** rated door and frame including seals and 10mm glass **Indoor Living and work areas** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals				
	Opposite	**Double brick: two leaves of 110mm clay brick masonry with** ➢ 50mm cavity between leaves and R2.0+ cavity insulation	**Bedrooms**: ➢ Fully glazed hinged door with certified **R_w+C_{tr} 28dB** rated door and frame including seals and 6mm glass **Indoor Living and work areas:** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals	**Bedrooms**: ➢ Total external door and window system area up to 40% of room floor area: Sliding or double hung with minimum 10 mm single or 6mm-12mm-10mm double insulted glazing (**R_w+C_{tr} 28 dB**). Sealed awning or casement windows may use 6 mm glazing instead**: OR** ➢ Up to 60% floor area: as per above but must be sealed awning or casement type windows (**R_w+C_{tr} 31dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 25dB): OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr28 dB : OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 31 dB**).			

Note: The above treatments are a deemed to satisfy construction. Alternative designs are acceptable, provided they are certified by a suitable qualified acoustic consultant.