Our Reference: **PT22014**

Allam Property Group & Stockland

28 October 2024

Via Email: carmeno@allam.com.au

Proposed Rezoning for Residential Subdivision – The Gables Box Hill
Response to Council RFI Dated 25 September 2024

As requested, please find below and attached additional information in response to traffic, access and modelling matters raised in the Hills Shire Council second Request for Additional Information letter dated 25 September 2024. For ease of reference each item has been repeated with a response following.

Item
Infrastructure Items and Contributions Toward each Item

Council officers have undertaken a review of the infrastructure items proposed to support the West Gables precinct and the following feedback is provided.

1. Traffic and Transport Items

Council's analysis of the traffic and transport items necessary to support the development of West Gables indicates that items included in the VPA offers are not yet adequate. Additional items are needed to complete the road network and ensure that future development has appropriate traffic and transport infrastructure. Each item is discussed below:

a. Boundary Road

The VPAs currently propose kerb and gutter, asphalt upgrade and a 3m wide share path along the frontage of West Gables.

The original traffic report dated December 2022 notes that in the 2036 modelling that Boundary Road would be 4 lanes. The subsequent letter response indicates that the need for four lanes is predicated on a rezoning on the opposite side of Boundary Road, in the Hawkesbury local government area, and that this is noted in the original traffic report. Council is not able to locate this statement in the original traffic report. Further, Council is not aware of any rezoning in the Hawkesbury LGA opposite West Gables, therefore, the works being delivered to support this planning proposal are likely the ultimate outcome for the foreseeable future.

Positive Traffic Pty Ltd ATF Positive Traffic Trust
PO Box 3457, Rouse Hill NSW 2155
T: 0414 462247 / E: dean@positivetraffic.com.au

The current Northwest Growth Area boundary ends at Menin Road, opposite the Box Hill release area. The widening of Boundary Road to four lanes adjacent to the Box Hill release area (up to Old Pitt Town Road) is partially funded through Contributions Plan No.15 – Box Hill and there is a concept design for these works to be completed, with detailed design currently underway. The design for the Old Pitt Town Road and Boundary Road intersection includes four lanes, and it is noted that the VPA offers include additional land for intersection widening in the future.

It is ideal for Boundary Road to be upgraded to four lanes from Old Pitt Town Road to Maguires Road, to accommodate the ultimate increased traffic volumes from Gables and West Gables within a consistent and logical road network. It may however be appropriate that the upgrade to 4 lanes only occurs between the intersections of Old Pitt Town Road and Red Gables Road, being the frontage of the West Gables planning proposal site.

Boundary Road is currently a rural road standard and in poor condition. While it is not entirely clear, if the VPA, as currently submitted, is only proposing to provide a new asphalt layer on top of the existing road profile, this is inadequate and will not service the increased traffic demand from the development. The offer needs to include fill depth pavement reconstruction, based on an analysis of the projected future traffic demand for the road, of Boundary Road to support the future development. It is anticipated that this was the Proponent Group's intent, however the VPA should clearly specify this level of treatment.

Response

It must be noted that the provision of four (4) lanes in Boundary Road is not a proposal which is a requirement to accommodate the traffic demands of this proposal. The request for provision of four (4) lanes was specifically advised by Council representatives in our numerous consultation meetings which has been accommodated in the design. This is reinforced in the traffic impact assessment report *Box Hill North Traffic Impact Assessment Report – GTA Consultants July 2013* which underpinned in approval of the Box Hill North (The Gables) Precinct and its associated road / intersection arrangements to accommodate 2036 demands generated by the precinct.

As shown in **Figure 20** and **Figure 21** of our traffic impact assessment report, 2036 traffic conditions *only* required a single lane of travel in each direction in Boundary Road as repeated again below:

Figure 20 – Intersection 6 – Priority Controlled Intersection – Boundary Road / Cataract Road (now constructed as 'seagull' type intersection)

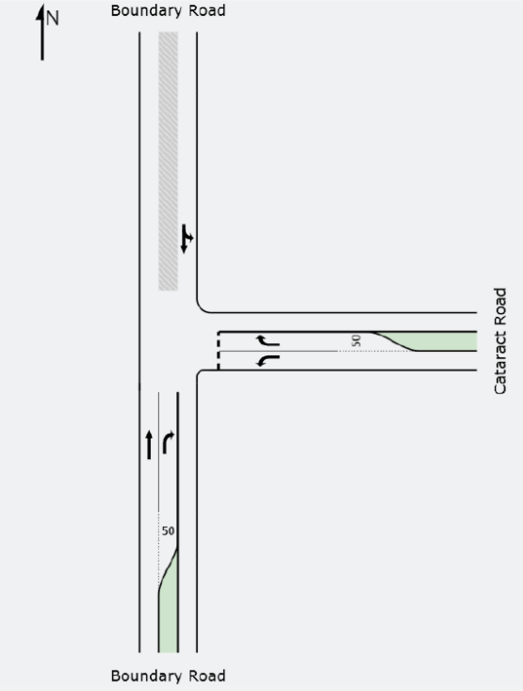
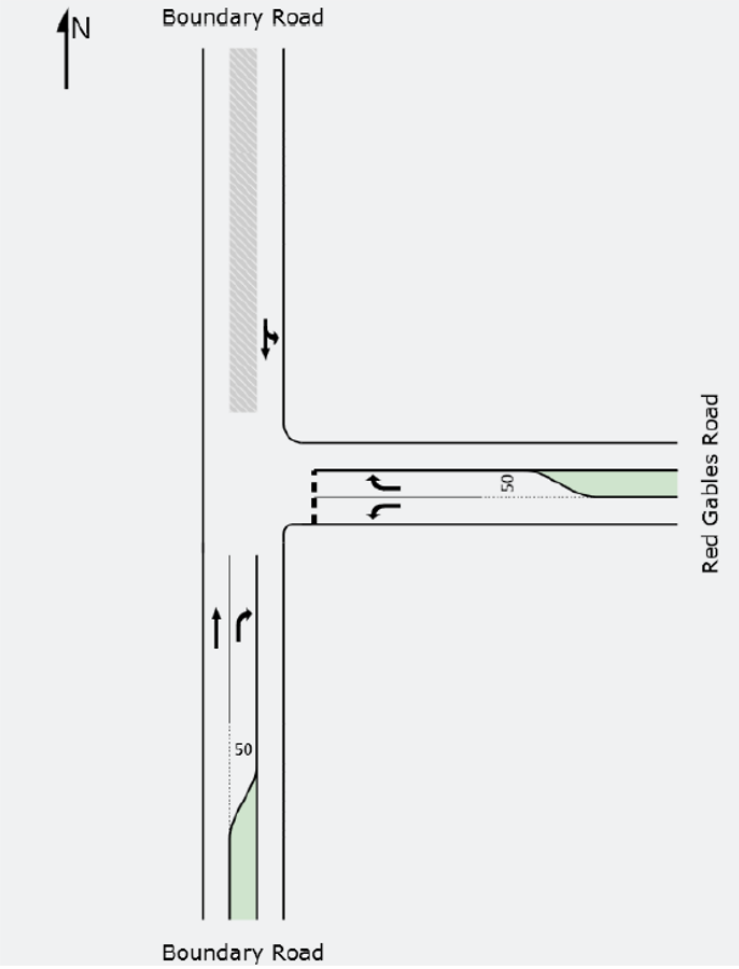


Figure 21 – Intersection 7 – T Intersection – Boundary Road / Red Gables Road



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Council representatives confirmed that kerb radii in both Red Gables Road and Cataract Road have been constructed to allow for a future dual lane roundabout which is shown below in **Figure 1** and **Figure 2**.

Figure 1 - Large Kerb Radii in Cataract Rd at Boundary Road for Future Dual Lane Roundabout

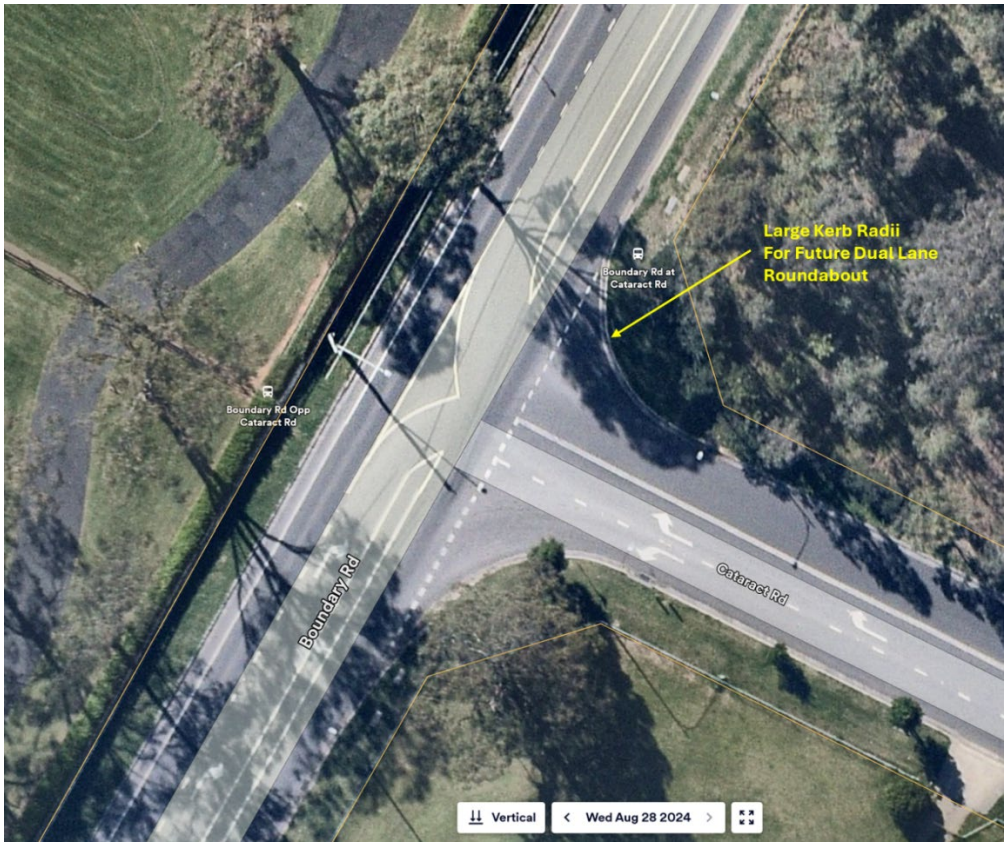


Figure 2 - Large Kerb Radii in Red Gables Road at Boundary Road Rd for Future Dual Lane Roundabout

Of note, there are currently no plans or report investigations which require provision of a dual lane roundabout and the above has been imposed by Council to future proof the intersection when at such a time development of land holdings within the Hawkesbury Council LGA occur (likely as outside PMF flood zones to the south).

With little to no traffic generated by the proposal seeking to travel north along Boundary Road towards Maguires Road there is no justification on traffic grounds to impose on this development proposal widening to four (4) lanes to Maguires Road across the frontages of now completed residential subdivisions which have allocated land holdings should this need to occur in the future.

Again, the provision of four (4) lanes in Boundary Road is a matter for Council's future planning provisions (where land holdings are set aside already as part of approved developments) should and at which such time development outside the Hills Council LGA might occur.

Item

b. Old Pitt Town Road – to 4 lanes between Boundary Road and Valletta Drive

The VPAs do not appear to include any works to Old Pitt Town Road, only the construction of a shared pedestrian and cycle path (unless works to mid-blocks on Old Pitt Town Road is included in Item T1 – Internal Road network).

The development on the southern side of Old Pitt Town Road will only complete half width road construction along the mid blocks. Accordingly, this proposal will also need to complete half width road construction along the mid blocks. The memo from Positive Traffic dated 16 February 2024 indicates that the proposal would provide these works to accommodate four travel lanes, including the provision of the pedestrian and cycle shared path. The memo also indicates that this proposal would not extend the full distance between Boundary Road and Fontana Drive, as this proposal does not extend for this full length and the properties further west would be required to deliver these works in association with future rezoning applications.

It is Council's understanding that the section of Old Pitt Town Road between 115A Old Pitt Town Road and 121 Old Pitt Town Road (inclusive) is being delivered as obligations under the existing Gables VPA and in association with the consents issued for this land. It is therefore not expected that road works to Old Pitt Town Road beyond 121 Old Pitt Town Road would be completed in association with the West Gables planning proposal.

It is expected that the portion of Old Pitt Town Road, along the frontage of the West Gables planning proposal site, is upgraded to 4 lanes, noting that West Gables is only responsible for half width construction as the properties on the south side of Old Pitt Town Road will also deliver half width road. The VPA offers should clearly include this item.

Response

The finer grain details of the VPA submitted for consideration by Council is a matter between the proponent and Council. Of note, the VPA is providing additional works in Old Pitt Town Road across the site frontages in the form of a shared pedestrian / cycle path which was not originally planned for as part of the Box Hill North (The Gables) precinct.

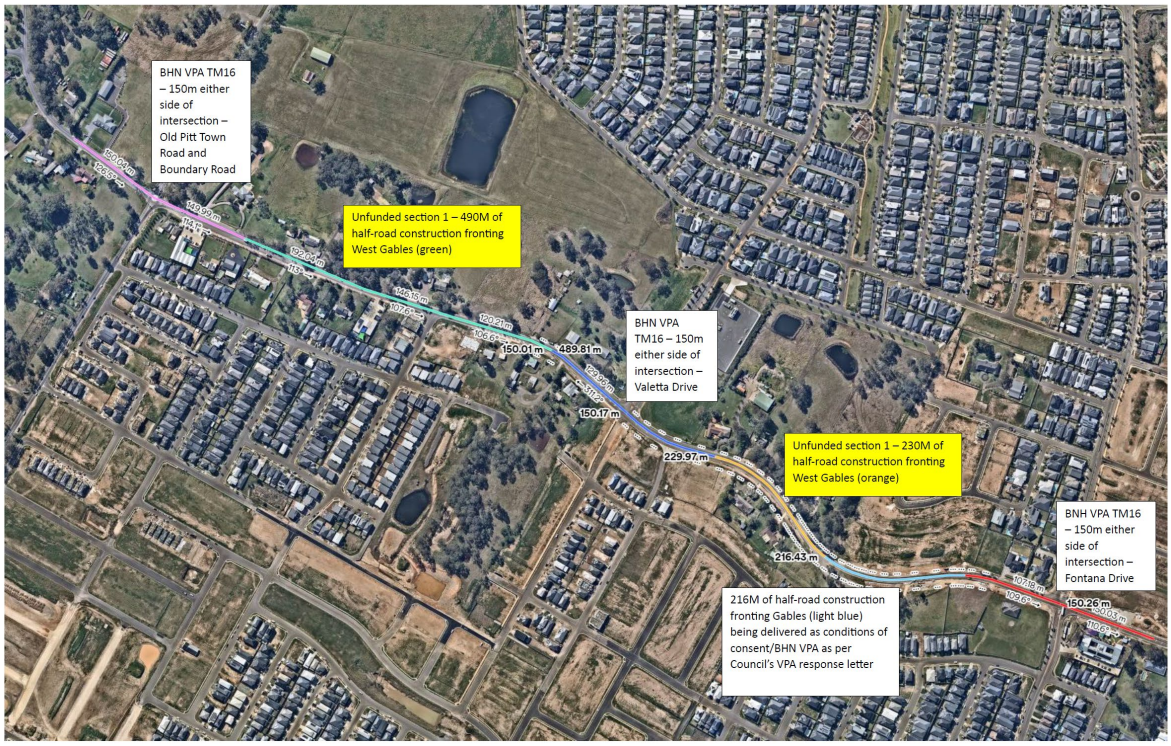
The provision of this shared pedestrian / cycleway was included after a request from Council's representatives to provide this pathway and link it to the shared pedestrian / cycleway on the eastern side of Boundary Road which would be delivered as part of this proposal across the site frontages between Old Pitt Town Road and Red Gables Road.

Further, the proponent is providing kerb and gutter / nature strip works across the full frontage of the development in Old Pitt Town Road.

A plan showing the extents of the Old Pitt Town Road pavement upgrade as detailed in the Contributions Plan CP 15 along with the designs provided by Hills Council for the upgrade of intersections of Boundary Road, Valetta Drive and Fontana Drive is shown below in **Figure 3**.

Figure 3 – CP 15 Old Pitt Road + Intersection Upgrades Works Extents Between Boundary Road and Fontana Drive

Old Pitt Town Road funding and delivery



Item

c. Boundary Road intersections with Cataract Road and Red Gables Road

The VPAs do not include any works to the Boundary Road intersections with Cataract Road and Red Gables Road. The memo from Positive Traffic indicates that following the widening of Boundary Road, the existing intersection arrangements would continue to operate satisfactorily following full development of the subject site.

Council officers are not satisfied that the existing intersection arrangements would be sufficient to service the planning proposal, especially noting that the existing seagull intersection at Boundary/Red Gables Road is already at capacity and fails at level of Service E during the evening peak. While Contributions Plan No. 16 – Gables Precinct anticipated these intersections as priority controlled, it did not account for any development on the subject site.

Upgrades to a dual lane roundabout should be provided at the Boundary Road/Red Gables Road intersection to adequately support the traffic generation of the planning proposal.

Response

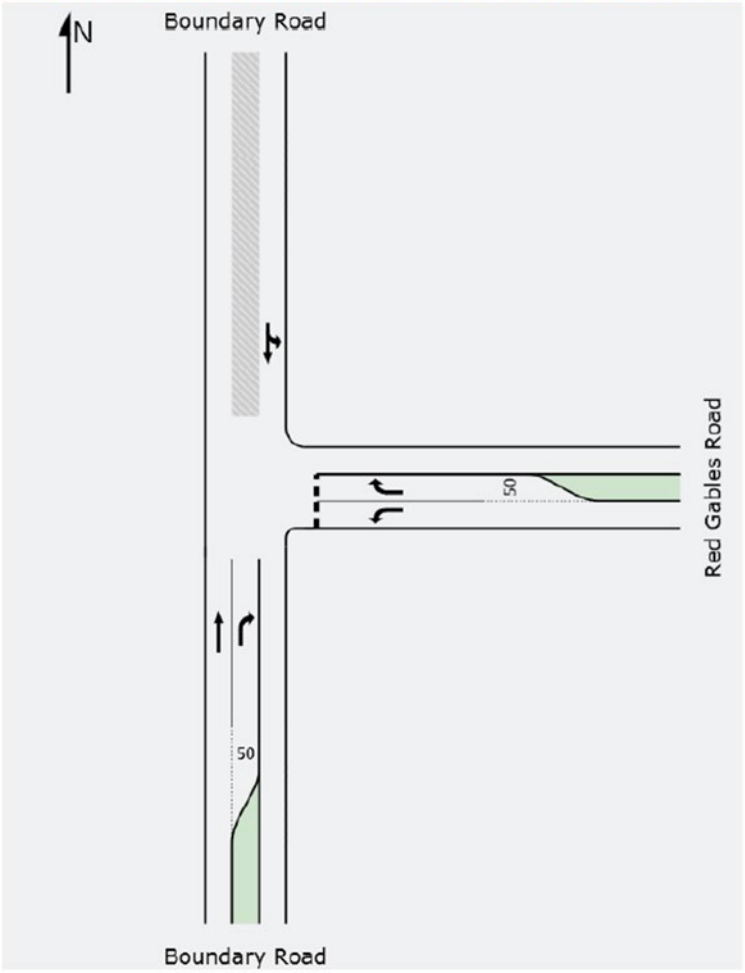
As explicitly stated in the traffic report, the Department of Planning approved increase of 42% additional development within The Gables precinct *has not included any formal modelling of the impacts to date*.

At the time of the intersection counts being undertaken to inform the traffic impact assessment report, the intersection of Red Gables Road was closed to traffic at Boundary Road noting since that time the road has opened.

Thus, no *existing* intersection operating conditions of this intersection was modelled in the report so the above statement that the intersection currently operates at Level of Service E is not based on modelling undertaken by Positive Traffic Pty Ltd.

The modelling in the report as specifically noted was for 2036 traffic conditions with a 42% *increase* in traffic generated by The Gables with and without the development proposal. In line with the traffic report undertaken for The Gables precinct as approved, the modelling assumed a single travel lane in each direction in Boundary Road and the same arrangement of the report as shown in **Figure 21** of the traffic report and repeated again below:

Figure 21 – Intersection 7 – T Intersection – Boundary Road / Red Gables Road



Of note, the Level of Service E in 2036 with the development (shown in the table below from the traffic report) only applied to the small volume right turn movement out of Red Gables Road where all other movements operated by Level of Service A.

Further, the conservatively modelling approach of the report did not account for the existing Seagull intersection arrangements which allow for a staged right turn from Red Gables Road into Boundary Road to head north.

The resulting 2036 with and without the proposed development intersection operating conditions for Boundary Road / Red Gables Road is shown below in **Table 1**.

Table 1 – Existing vs 2036 Weekday AM / PM Intersection Operating Conditions With & Without Development of Boundary Road / Red Gables Road Priority Controlled Intersection vs Existing Seagull Type Intersection

Intersection	Control	Morning Peak		Evening Peak	
		Av Delay	LOS	Av Delay	LOS
2036 – No Development					
Boundary Rd / Red Gables Rd***	Priority	12.4	A	53.6	E
Boundary Rd / Red Gables Rd***	Seagull	**9.0**	**A**	**13.9**	**A**
2036 With Development					
Boundary Rd / Red Gables Rd***	Priority	13.0	A	66.1	E
Boundary Rd / Red Gables Rd***	Seagull	**9.0**	**A**	**14.0**	**A**

Avg Delay (sec/veh) is over all movements at signals, and for worst movement at priority and roundabouts

*** 42% increase to 2036 forecast traffic flows into / out of The Gables as forecast in GTA report + development traffic

From **Table 1** it can be seen that as a single lane in each direction in the year 2036 whilst maintaining the existing seagull intersection arrangements at Boundary Road / Red Gables Road, the intersection would continue to operate satisfactory following *full development* of the subject site and no further intersection upgrades would be necessary.

It would be expected that in the future at such time as Boundary Road is considered necessary for two lanes per direction the provision for dual lane roundabouts by Council would be enacted likely associated with development of lands within the adjacent Hawkesbury Council LGA.

The intersection does not require upgrade to a dual lane roundabout to cater for the traffic demands of the proposal.

Copies of SIDRA outputs are provided in **Appendix A**.

Item

d. Old Pitt Town Road intersections

The VPAs do not include any contribution towards signalisation of the Old Pitt Town Road/Terry Road/Fontana Road intersection. The memo from Positive Traffic indicates that the planning proposal would only generate a 2.5% - 3% increase in traffic through this intersection and therefore part contributions towards the upgrade of this intersection to signals is not justified.

Given Old Pitt Town Road is a flood evacuation route and future residents of West Gables will need to utilise this road to safely evacuate in the event of a flood, it is considered appropriate for this planning proposal to contribute a portion of the cost of the upgrade to signals. Noting that a majority of this intersection is funded via Contributions Plan No.15 – Box Hill Precinct, Council is only seeking contribution from West Gables equivalent to $830,000 (approximately 9% of the total intersection upgrade cost).

With respect to the Old Pitt Town Road/Valetta Drive/Mount Carmel Drive intersection, Council is currently in negotiations with landowners of 99 to 109 Old Pitt Town Road, regarding acquisition of land for this intersection. While contributions (land and monetary contributions) toward this intersection are included in the Proponent Group's VPA offer, Council will likely require this land before it is able to be delivered through the VPA. It is suggested that the VPA may instead list this item as a reimbursement of Council's costs associated with Council acquiring this land in the shorter term.

With respect to the upgrade of the Boundary/Old Pitt Town Road intersection, the Traffic Impact Assessment assumes the upgrade of this intersection to signals. However, it is noted that the VPAs have only included the dedication of land to facilitate the enlargement of this intersection. The development facilitated by this planning proposal would be a key contributor to the additional traffic generated at this intersection and therefore a contribution towards the required upgrade works should be made in addition to the land dedication. It is noted that there is a contribution toward this intersection included in the existing Gables VPA, however this is not adequate to cater for the demand generated by development north of the intersection. The West Gables planning proposal creates additional demand for this intersection and contributions toward the intersection construction should be made as part of the VPAs for West Gables.

Response

The traffic report has provided to Council a transparent and scientific approach to the distribution of traffic generated by the proposal which accounts for all previous known traffic reports to date and which mirror expected travel behaviour of generated traffic.

This in turn has resulted in a 3% apportionment of traffic through the intersection of Old Pitt Town Road / Fontana Drive.

Further if $830,000 (9% of total cost) represents a total intersection upgrade cost of some $9,220,000 which in addition to the monies gained through the contribution plan for the intersection upgrade and monies for pavement widening / improvement works on the approaches in Old Pitt Town Road, this appears to be a significant cost for such an intersection based on our experience. It would be expected that a detailed cost breakdown of the intersection works would form path of any agreement.

On the matter of Old Pitt Town Road / Boundary Road, ongoing consultant with Council representatives confirmed the intersection requirements as imposed by Transport for NSW following consultation by Council for this signalised intersection.

Further, the land dedication allows for the dual right turn lanes from Old Pitt Town Road to head north along Boundary Road as imposed by Transport for NSW on the design.

The modelling in the report confirms that the ultimate intersection arrangements as designed by Council *without* the subject development and *with* the proposed development would function satisfactorily in the future. Unlike Valetta Drive, no further expansion is required to accommodate the traffic demands of the proposal.

The matter of any apportionment of costs is a matter between the proponent and Council and it would be expected that the costs of other offered works, including the works in kind offer of a shared pedestrian / cycleway along Old Pitt Town Road between Valetta Drive and Boundary Road would form part of these discussions.

Further, the proponent is providing kerb and gutter / nature strip works across the full frontage of the development in Old Pitt Town Road.

Item

Further input and feedback will need to be sought from Transport for NSW during the Gateway Assessment process with respect to the proposed intersection designs. The outcomes of TfNSW's review will inform and refine the final transport infrastructure list required to support development in the Precinct. Following TfNSW's review, a comprehensive revision of the SIDRA model will need to be undertaken, noting that some of the proposed intersection layouts used for the analysis are outdated and have been superseded.

Response

It is noted that the traffic report was submitted to Council in December 2022 and to date still no response has been obtained from Transport for NSW for consideration.

The comment that the modelled proposed intersection layouts being *outdated* or *superseded* is a point of ongoing vexation given a number of ongoing consultation meetings have been held with Council representatives of which the *latest* known designs of intersections were provided. Further and as stated previously the proposed intersection arrangement of Old Pitt Town Road / Valetta Drive is an *expansion in capacity* of the intersection arrangements as proposed by Council so any concerns for discrepancies should not be a significant issue.

It would be expected given the ongoing provision of designs for assessment by Council as part of the consultative process for this development proposal that Council would be forthcoming in any design changes which may have occurred. The modelling has adopted / expanded the latest design plans provided by Council.

Please do not hesitate to contact myself on 0414 462247 should you require any additional information.

Yours sincerely

DEAN BRODIE
Managing Director
B.Eng (Civil) MIEAust NER
RMS Accredited Level 3 (Lead) Road Safety Auditor
RPEQ 27423
Expert Traffic Engineering & Road Safety Witness at NSW Land & Environment & NSW Supreme Court

APPENDIX A – BOUNDARY RD / RED GABLES RD SIDRA MODELLING OUTPUTS

MOVEMENT SUMMARY

Site: 2 [Boundary_Cataract Stage 2_PM 2036 +Dev_V2 (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Staged crossing Stage 2 (Median) at three-way intersection with 5-lane major road.
Give-way behaviour assumed at Stage 2.
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Median Storage Area															
3	R2	All MCs	22	2.0	22	2.0	0.050	9.1	LOS A	0.1	0.8	0.69	0.69	0.69	6.7
Approach			22	2.0	22	2.0	0.050	9.1	LOS A	0.1	0.8	0.69	0.69	0.69	6.7
West: Boundary Rd															
11	T1	All MCs	976	2.0	976	2.0	0.507	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	109.7
Approach			976	2.0	976	2.0	0.507	0.0	NA	0.0	0.0	0.00	0.00	0.00	109.7
All Vehicles			998	2.0	998	2.0	0.507	0.2	NA	0.1	0.8	0.02	0.02	0.02	109.1

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

Vehicle movement LOS values are based on average delay per movement.

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

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

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

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

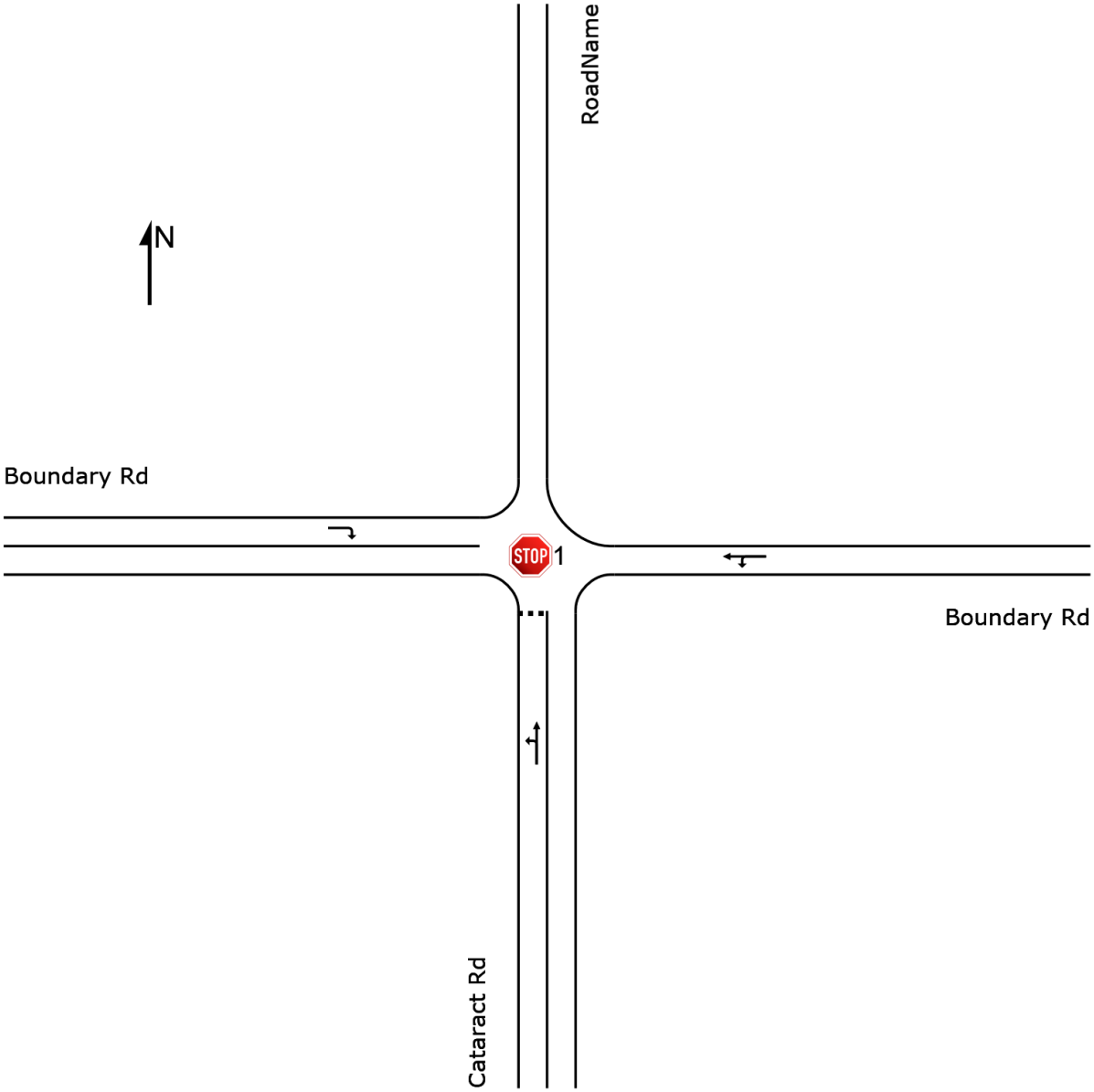
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

SITE LAYOUT

Site: 1 [Boundary_Red Gables Stage 1_PM 2036 + Dev (Site Folder: General)]

Staged crossing Stage 1 (Minor Road) at three-way intersection with 5-lane major road. Major road turn lane is treated as a full-length lane.
Site Category: (None)
Stop (Two-Way)

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



INTERSECTION SUMMARY

Site: 1 [Boundary_Red Gables Stage 1_PM 2036 + Dev (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Staged crossing Stage 1 (Minor Road) at three-way intersection with 5-lane major road. Major road turn lane is treated as a full-length lane.
Site Category: (None)
Stop (Two-Way)

Intersection Performance - Hourly Values			
Performance Measure	**Vehicles:**	**All MCs**	**Persons**
Travel Speed (Average)	km/h	60.0	60.0 km/h
Travel Distance (Total)	veh-km/h	764.0	916.9 pers-km/h
Travel Time (Total)	veh-h/h	12.7	15.3 pers-h/h
Desired Speed	km/h	68.3	
Speed Efficiency		0.88	
Travel Time Index		8.65	
Congestion Coefficient		1.14	
Demand Flows (Total)	veh/h	756	907 pers/h
Arrival Flows (Total)	veh/h	756	
Percent Heavy Vehicles (Demand)	%	2.0	
Percent Heavy Vehicles (Arrivals)	%	2.0	
Degree of Saturation		0.307	
Practical Spare Capacity	%	219.2	
Effective Intersection Capacity	veh/h	2462	
Control Delay (Total)	veh-h/h	1.00	1.20 pers-h/h
Control Delay (Average)	sec	4.8	4.8 sec
Control Delay (Worst Lane by MC)	sec	6.5	
Control Delay (Worst Movement by MC)	sec	7.9	7.9 sec
Geometric Delay (Average)	sec	4.1	
Stop-Line Delay (Average)	sec	0.7	
Idling Time (Average)	sec	0.0	
Intersection Level of Service (LOS)		NA	
95% Back of Queue - Veh (Worst Lane)	veh	1.7	
95% Back of Queue - Dist (Worst Lane)	m	11.8	
Ave. Que Storage Ratio (Worst Lane)		0.01	
Effective Stops (Total)	veh/h	340	408 pers/h
Effective Stop Rate		0.45	0.45
Proportion Queued		0.27	0.27
Performance Index		15.7	15.7
Cost (Total)	$/h	516.92	516.92 $/h
Fuel Consumption (Total)	L/h	67.5	
Carbon Dioxide (Total)	kg/h	159.6	
Hydrocarbons (Total)	kg/h	0.016	
Carbon Monoxide (Total)	kg/h	0.27	
NOx (Total)	kg/h	0.176	

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand effects.
In Network analysis, Arrival Flows will be reduced if Upstream Capacity Constraint exists.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
Site Model Variability Index (Average value of largest changes in Lane Degrees of Saturation from the third to the last Main (Timing-Capacity) Iterations): 0.0 %
Number of Iterations: 3 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 18.6% 22.1% 0.0%

Intersection Performance - Annual Values			
Performance Measure	**Vehicles:**	**All MCs**	**Persons**

Demand Flows (Total)	veh/y	362,779	435,335	pers/y
Delay (Total)	veh-h/y	480	576	pers-h/y
Effective Stops (Total)	veh/y	163,072	195,686	pers/y
Travel Distance (Total)	veh-km/y	366,741	440,089	pers-km/y
Travel Time (Total)	veh-h/y	6,115	7,338	pers-h/y
Cost (Total)	$/y	248,123	248,123	$/y
Fuel Consumption (Total)	L/y	32,418		
Carbon Dioxide (Total)	kg/y	76,602		
Hydrocarbons (Total)	kg/y	8		
Carbon Monoxide (Total)	kg/y	132		
NOx (Total)	kg/y	84		

1 Hours per Year: 480 (Site)

MOVEMENT SUMMARY

Site: 1 [Boundary_Red Gables Stage 1_PM 2036 + Dev (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Staged crossing Stage 1 (Minor Road) at three-way intersection with 5-lane major road. Major road turn lane is treated as a full-length lane.
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Cataract Rd															
1	L2	All MCs	58	2.0	58	2.0	0.053	6.2	LOS A	0.2	1.5	0.30	0.56	0.30	52.2
2	T1	All MCs	22	2.0	22	2.0	0.053	4.7	LOS A	0.2	1.5	0.30	0.56	0.30	52.6
Approach			80	2.0	80	2.0	0.053	5.8	LOS A	0.2	1.5	0.30	0.56	0.30	52.3
East: Boundary Rd															
4	L2	All MCs	36	2.0	36	2.0	0.125	7.8	LOS A	0.0	0.0	0.00	0.10	0.00	83.2
5	T1	All MCs	202	2.0	202	2.0	0.125	0.0	LOS A	0.0	0.0	0.00	0.10	0.00	94.7
Approach			238	2.0	238	2.0	0.125	1.2	NA	0.0	0.0	0.00	0.10	0.00	92.8
West: Boundary Rd															
12	R2	All MCs	438	2.0	438	2.0	0.307	6.5	LOS A	1.7	11.8	0.41	0.62	0.41	51.5
Approach			438	2.0	438	2.0	0.307	6.5	NA	1.7	11.8	0.41	0.62	0.41	51.5
All Vehicles			756	2.0	756	2.0	0.307	4.8	NA	1.7	11.8	0.27	0.45	0.27	60.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
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Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

INTERSECTION SUMMARY

Site: 2 [Boundary_Red Gables Stage 2_PM 2036 + Dev (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Staged crossing Stage 2 (Median) at three-way intersection with 5-lane major road.
Give-way behaviour assumed at Stage 2.
Site Category: (None)
Give-Way (Two-Way)

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles:**	**All MCs**	**Persons**	
Travel Speed (Average)	km/h	109.3	109.3	km/h
Travel Distance (Total)	veh-km/h	545.8	654.9	pers-km/h
Travel Time (Total)	veh-h/h	5.0	6.0	pers-h/h
Desired Speed	km/h	109.7		
Speed Efficiency		1.00		
Travel Time Index		9.96		
Congestion Coefficient		1.00		
Demand Flows (Total)	veh/h	562	675	pers/h
Arrival Flows (Total)	veh/h	562		
Percent Heavy Vehicles (Demand)	%	2.0		
Percent Heavy Vehicles (Arrivals)	%	2.0		
Degree of Saturation		0.281		
Practical Spare Capacity	%	249.3		
Effective Intersection Capacity	veh/h	2004		
Control Delay (Total)	veh-h/h	0.02	0.03	pers-h/h
Control Delay (Average)	sec	0.1	0.1	sec
Control Delay (Worst Lane by MC)	sec	3.0		
Control Delay (Worst Movement by MC)	sec	6.1	6.1	sec
Geometric Delay (Average)	sec	0.0		
Stop-Line Delay (Average)	sec	0.1		
Idling Time (Average)	sec	0.0		
Intersection Level of Service (LOS)		NA		
95% Back of Queue - Veh (Worst Lane)	veh	0.1		
95% Back of Queue - Dist (Worst Lane)	m	0.4		
Ave. Que Storage Ratio (Worst Lane)		0.02		
Effective Stops (Total)	veh/h	7	9	pers/h
Effective Stop Rate		0.01	0.01	
Proportion Queued		0.02	0.02	
Performance Index		5.1	5.1	
Cost (Total)	$/h	0.00	0.00	$/h
Fuel Consumption (Total)	L/h	0.0		
Carbon Dioxide (Total)	kg/h	0.0		
Hydrocarbons (Total)	kg/h	0.000		
Carbon Monoxide (Total)	kg/h	0.00		
NOx (Total)	kg/h	0.000		

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

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand effects.
In Network analysis, Arrival Flows will be reduced if Upstream Capacity Constraint exists.

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

Site Model Variability Index (Average value of largest changes in Lane Degrees of Saturation from the third to the last Main (Timing-Capacity) Iterations): 0.0 %

Number of Iterations: 3 (Maximum: 10)

Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 52.7% 0.0% 0.0%

Intersection Performance - Annual Values			
Performance Measure	**Vehicles:**	**All MCs**	**Persons**

Demand Flows (Total)	veh/y	269,811	323,773	pers/y
Delay (Total)	veh-h/y	10	12	pers-h/y
Effective Stops (Total)	veh/y	3,598	4,317	pers/y
Travel Distance (Total)	veh-km/y	261,972	314,367	pers-km/y
Travel Time (Total)	veh-h/y	2,397	2,876	pers-h/y
Cost (Total)	$/y	0	0	$/y
Fuel Consumption (Total)	L/y	0		
Carbon Dioxide (Total)	kg/y	0		
Hydrocarbons (Total)	kg/y	0		
Carbon Monoxide (Total)	kg/y	0		
NOx (Total)	kg/y	0		

1 Hours per Year: 480 (Site)

MOVEMENT SUMMARY

Site: 2 [Boundary_Red Gables Stage 2_PM 2036 + Dev (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Staged crossing Stage 2 (Median) at three-way intersection with 5-lane major road.
Give-way behaviour assumed at Stage 2.
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Median Storage Area															
3	R2	All MCs	22	2.0	22	2.0	0.026	3.0	LOS A	0.1	0.4	0.43	0.34	0.43	12.2
Approach			22	2.0	22	2.0	0.026	3.0	LOS A	0.1	0.4	0.43	0.34	0.43	12.2
West: Boundary Rd															
11	T1	All MCs	540	2.0	540	2.0	0.281	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	109.9
Approach			540	2.0	540	2.0	0.281	0.0	NA	0.0	0.0	0.00	0.00	0.00	109.9
All Vehicles			562	2.0	562	2.0	0.281	0.1	NA	0.1	0.4	0.02	0.01	0.02	109.3

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

Vehicle movement LOS values are based on average delay per movement.

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

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

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

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

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

INTERSECTION SUMMARY

Site: 1 [Boundary_Red Gables Stage 1_AM 2036 + Dev (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Staged crossing Stage 1 (Minor Road) at three-way intersection with 5-lane major road. Major road turn lane is treated as a full-length lane.
Site Category: (None)
Stop (Two-Way)

Intersection Performance - Hourly Values			
Performance Measure	**Vehicles:**	**All MCs**	**Persons**
Travel Speed (Average)	km/h	62.7	62.7 km/h
Travel Distance (Total)	veh-km/h	684.5	821.4 pers-km/h
Travel Time (Total)	veh-h/h	10.9	13.1 pers-h/h
Desired Speed	km/h	70.5	
Speed Efficiency		0.89	
Travel Time Index		8.76	
Congestion Coefficient		1.13	
Demand Flows (Total)	veh/h	676	811 pers/h
Arrival Flows (Total)	veh/h	676	
Percent Heavy Vehicles (Demand)	%	2.0	
Percent Heavy Vehicles (Arrivals)	%	2.0	
Degree of Saturation		0.264	
Practical Spare Capacity	%	203.3	
Effective Intersection Capacity	veh/h	2562	
Control Delay (Total)	veh-h/h	0.79	0.95 pers-h/h
Control Delay (Average)	sec	4.2	4.2 sec
Control Delay (Worst Lane by MC)	sec	6.2	
Control Delay (Worst Movement by MC)	sec	8.1	8.1 sec
Geometric Delay (Average)	sec	3.7	
Stop-Line Delay (Average)	sec	0.6	
Idling Time (Average)	sec	0.0	
Intersection Level of Service (LOS)		NA	
95% Back of Queue - Veh (Worst Lane)	veh	1.2	
95% Back of Queue - Dist (Worst Lane)	m	8.7	
Ave. Que Storage Ratio (Worst Lane)		0.01	
Effective Stops (Total)	veh/h	269	323 pers/h
Effective Stop Rate		0.40	0.40
Proportion Queued		0.23	0.23
Performance Index		14.1	14.1
Cost (Total)	$/h	447.55	447.55 $/h
Fuel Consumption (Total)	L/h	60.1	
Carbon Dioxide (Total)	kg/h	142.0	
Hydrocarbons (Total)	kg/h	0.015	
Carbon Monoxide (Total)	kg/h	0.28	
NOx (Total)	kg/h	0.155	

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand effects.
In Network analysis, Arrival Flows will be reduced if Upstream Capacity Constraint exists.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
Site Model Variability Index (Average value of largest changes in Lane Degrees of Saturation from the third to the last Main (Timing-Capacity) Iterations): 0.0 %
Number of Iterations: 3 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 23.3% 21.6% 0.0%

Intersection Performance - Annual Values			
Performance Measure	**Vehicles:**	**All MCs**	**Persons**

Demand Flows (Total)	veh/y	324,379	389,255	pers/y
Delay (Total)	veh-h/y	380	456	pers-h/y
Effective Stops (Total)	veh/y	129,141	154,969	pers/y
Travel Distance (Total)	veh-km/y	328,555	394,266	pers-km/y
Travel Time (Total)	veh-h/y	5,243	6,292	pers-h/y
Cost (Total)	$/y	214,825	214,825	$/y
Fuel Consumption (Total)	L/y	28,854		
Carbon Dioxide (Total)	kg/y	68,183		
Hydrocarbons (Total)	kg/y	7		
Carbon Monoxide (Total)	kg/y	134		
NOx (Total)	kg/y	74		

1 Hours per Year: 480 (Site)

MOVEMENT SUMMARY

Site: 1 [Boundary_Red Gables Stage 1_AM 2036 + Dev (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Staged crossing Stage 1 (Minor Road) at three-way intersection with 5-lane major road. Major road turn lane is treated as a full-length lane.
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Cataract Rd															
1	L2	All MCs	326	2.0	326	2.0	0.264	6.5	LOS A	1.2	8.7	0.35	0.59	0.35	51.9
2	T1	All MCs	46	2.0	46	2.0	0.264	4.5	LOS A	1.2	8.7	0.35	0.59	0.35	52.3
Approach			373	2.0	373	2.0	0.264	6.2	LOS A	1.2	8.7	0.35	0.59	0.35	51.9
East: Boundary Rd															
4	L2	All MCs	9	2.0	9	2.0	0.121	8.1	LOS A	0.0	0.0	0.00	0.03	0.00	87.4
5	T1	All MCs	222	2.0	222	2.0	0.121	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	105.3
Approach			232	2.0	232	2.0	0.121	0.3	NA	0.0	0.0	0.00	0.03	0.00	104.4
West: Boundary Rd															
12	R2	All MCs	72	2.0	72	2.0	0.050	6.2	LOS A	0.2	1.6	0.33	0.58	0.33	51.7
Approach			72	2.0	72	2.0	0.050	6.2	NA	0.2	1.6	0.33	0.58	0.33	51.7
All Vehicles			676	2.0	676	2.0	0.264	4.2	NA	1.2	8.7	0.23	0.40	0.23	62.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

INTERSECTION SUMMARY

Site: 2 [Boundary_Red Gables Stage 2_AM 2036 + Dev (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Staged crossing Stage 2 (Median) at three-way intersection with 5-lane major road.
Give-way behaviour assumed at Stage 2.
Site Category: (None)
Give-Way (Two-Way)

Intersection Performance - Hourly Values			
Performance Measure	**Vehicles:**	**All MCs**	**Persons**
Travel Speed (Average)	km/h	92.7	92.7 km/h
Travel Distance (Total)	veh-km/h	148.3	178.0 pers-km/h
Travel Time (Total)	veh-h/h	1.6	1.9 pers-h/h
Desired Speed	km/h	95.3	
Speed Efficiency		0.97	
Travel Time Index		9.69	
Congestion Coefficient		1.03	
Demand Flows (Total)	veh/h	169	203 pers/h
Arrival Flows (Total)	veh/h	169	
Percent Heavy Vehicles (Demand)	%	2.5	
Percent Heavy Vehicles (Arrivals)	%	2.5	
Degree of Saturation		0.064	
Practical Spare Capacity	%	1431.8	
Effective Intersection Capacity	veh/h	2649	
Control Delay (Total)	veh-h/h	0.01	0.01 pers-h/h
Control Delay (Average)	sec	0.1	0.1 sec
Control Delay (Worst Lane by MC)	sec	0.5	
Control Delay (Worst Movement by MC)	sec	0.9	0.9 sec
Geometric Delay (Average)	sec	0.0	
Stop-Line Delay (Average)	sec	0.1	
Idling Time (Average)	sec	0.0	
Intersection Level of Service (LOS)		NA	
95% Back of Queue - Veh (Worst Lane)	veh	0.1	
95% Back of Queue - Dist (Worst Lane)	m	0.6	
Ave. Que Storage Ratio (Worst Lane)		0.04	
Effective Stops (Total)	veh/h	4	5 pers/h
Effective Stop Rate		0.02	0.02
Proportion Queued		0.05	0.05
Performance Index		2.4	2.4
Cost (Total)	$/h	75.09	75.09 $/h
Fuel Consumption (Total)	L/h	13.7	
Carbon Dioxide (Total)	kg/h	32.4	
Hydrocarbons (Total)	kg/h	0.005	
Carbon Monoxide (Total)	kg/h	0.10	
NOx (Total)	kg/h	0.040	

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

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand effects.
In Network analysis, Arrival Flows will be reduced if Upstream Capacity Constraint exists.

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

Site Model Variability Index (Average value of largest changes in Lane Degrees of Saturation from the third to the last Main (Timing-Capacity) Iterations): 0.0 %

Number of Iterations: 3 (Maximum: 10)

Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 28.9% 0.0% 0.0%

Intersection Performance - Annual Values			
Performance Measure	**Vehicles:**	**All MCs**	**Persons**

Demand Flows (Total)	veh/y	81,347	97,617	pers/y
Delay (Total)	veh-h/y	3	4	pers-h/y
Effective Stops (Total)	veh/y	1,829	2,195	pers/y
Travel Distance (Total)	veh-km/y	71,201	85,441	pers-km/y
Travel Time (Total)	veh-h/y	768	922	pers-h/y
Cost (Total)	$/y	36,044	36,044	$/y
Fuel Consumption (Total)	L/y	6,571		
Carbon Dioxide (Total)	kg/y	15,557		
Hydrocarbons (Total)	kg/y	2		
Carbon Monoxide (Total)	kg/y	50		
NOx (Total)	kg/y	19		

1 Hours per Year: 480 (Site)

MOVEMENT SUMMARY

Site: 2 [Boundary_Red Gables Stage 2_AM 2036 + Dev (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Staged crossing Stage 2 (Median) at three-way intersection with 5-lane major road.
Give-way behaviour assumed at Stage 2.
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Median Storage Area															
3	R2	All MCs	46	4.0	46	4.0	0.036	0.5	LOS A	0.1	0.6	0.18	0.08	0.18	51.0
Approach			46	4.0	46	4.0	0.036	0.5	LOS A	0.1	0.6	0.18	0.08	0.18	51.0
West: Boundary Rd															
11	T1	All MCs	123	2.0	123	2.0	0.064	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	110.0
Approach			123	2.0	123	2.0	0.064	0.0	NA	0.0	0.0	0.00	0.00	0.00	110.0
All Vehicles			169	2.5	169	2.5	0.064	0.1	NA	0.1	0.6	0.05	0.02	0.05	92.7

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

Vehicle movement LOS values are based on average delay per movement.

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

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

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

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

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

INTERSECTION SUMMARY

Site: 1 [Boundary_Cataract Stage 1_AM 2036 + Dev_V2 (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Staged crossing Stage 1 (Minor Road) at three-way intersection with 5-lane major road. Major road turn lane is treated as a full-length lane.
Site Category: (None)
Stop (Two-Way)

Intersection Performance - Hourly Values			
Performance Measure	**Vehicles:**	**All MCs**	**Persons**
Travel Speed (Average)	km/h	70.5	70.5 km/h
Travel Distance (Total)	veh-km/h	1257.7	1509.2 pers-km/h
Travel Time (Total)	veh-h/h	17.8	21.4 pers-h/h
Desired Speed	km/h	78.3	
Speed Efficiency		0.90	
Travel Time Index		8.90	
Congestion Coefficient		1.11	
Demand Flows (Total)	veh/h	1242	1491 pers/h
Arrival Flows (Total)	veh/h	1242	
Percent Heavy Vehicles (Demand)	%	1.6	
Percent Heavy Vehicles (Arrivals)	%	1.6	
Degree of Saturation		0.415	
Practical Spare Capacity	%	92.9	
Effective Intersection Capacity	veh/h	2995	
Control Delay (Total)	veh-h/h	1.29	1.54 pers-h/h
Control Delay (Average)	sec	3.7	3.7 sec
Control Delay (Worst Lane by MC)	sec	9.2	
Control Delay (Worst Movement by MC)	sec	15.4	15.4 sec
Geometric Delay (Average)	sec	2.7	
Stop-Line Delay (Average)	sec	1.1	
Idling Time (Average)	sec	0.1	
Intersection Level of Service (LOS)		NA	
95% Back of Queue - Veh (Worst Lane)	veh	2.6	
95% Back of Queue - Dist (Worst Lane)	m	18.3	
Ave. Que Storage Ratio (Worst Lane)		0.01	
Effective Stops (Total)	veh/h	423	508 pers/h
Effective Stop Rate		0.34	0.34
Proportion Queued		0.24	0.24
Performance Index		24.2	24.2
Cost (Total)	$/h	749.77	749.77 $/h
Fuel Consumption (Total)	L/h	108.0	
Carbon Dioxide (Total)	kg/h	255.0	
Hydrocarbons (Total)	kg/h	0.032	
Carbon Monoxide (Total)	kg/h	0.65	
NOx (Total)	kg/h	0.226	

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand effects.
In Network analysis, Arrival Flows will be reduced if Upstream Capacity Constraint exists.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
Site Model Variability Index (Average value of largest changes in Lane Degrees of Saturation from the third to the last Main (Timing-Capacity) Iterations): 0.0 %
Number of Iterations: 3 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 33.1% 61.8% 0.0%

Intersection Performance - Annual Values			
Performance Measure	**Vehicles:**	**All MCs**	**Persons**

Demand Flows (Total)	veh/y	596,211	715,453	pers/y
Delay (Total)	veh-h/y	617	740	pers-h/y
Effective Stops (Total)	veh/y	203,169	243,803	pers/y
Travel Distance (Total)	veh-km/y	603,675	724,410	pers-km/y
Travel Time (Total)	veh-h/y	8,558	10,270	pers-h/y
Cost (Total)	$/y	359,891	359,891	$/y
Fuel Consumption (Total)	L/y	51,842		
Carbon Dioxide (Total)	kg/y	122,383		
Hydrocarbons (Total)	kg/y	15		
Carbon Monoxide (Total)	kg/y	310		
NOx (Total)	kg/y	109		

1 Hours per Year: 480 (Site)

MOVEMENT SUMMARY

Site: 1 [Boundary_Cataract Stage 1_AM 2036 + Dev_V2 (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Staged crossing Stage 1 (Minor Road) at three-way intersection with 5-lane major road. Major road turn lane is treated as a full-length lane.
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Cataract Rd															
1	L2	All MCs	468	1.0	468	1.0	0.415	7.4	LOS A	2.6	18.3	0.50	0.69	0.57	51.4
2	T1	All MCs	45	1.0	45	1.0	0.415	7.0	LOS A	2.6	18.3	0.50	0.69	0.57	51.8
Approach			514	1.0	514	1.0	0.415	7.4	LOS A	2.6	18.3	0.50	0.69	0.57	51.5
East: Boundary Rd															
4	L2	All MCs	9	2.0	9	2.0	0.169	8.2	LOS A	0.0	0.0	0.00	0.02	0.00	87.7
5	T1	All MCs	639	2.0	639	2.0	0.169	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	108.3
Approach			648	2.0	648	2.0	0.169	0.1	NA	0.0	0.0	0.00	0.01	0.00	107.9
West: Boundary Rd															
12	R2	All MCs	80	2.0	80	2.0	0.115	9.2	LOS A	0.4	3.1	0.57	0.79	0.57	50.0
Approach			80	2.0	80	2.0	0.115	9.2	NA	0.4	3.1	0.57	0.79	0.57	50.0
All Vehicles			1242	1.6	1242	1.6	0.415	3.7	NA	2.6	18.3	0.24	0.34	0.27	70.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

INTERSECTION SUMMARY

Site: 2 [Boundary_Cataract Stage 2_AM 2036 + Dev_V2 (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Staged crossing Stage 2 (Median) at three-way intersection with 5-lane major road.
Give-way behaviour assumed at Stage 2.
Site Category: (None)
Give-Way (Two-Way)

Intersection Performance - Hourly Values			
Performance Measure	**Vehicles:**	**All MCs**	**Persons**
Travel Speed (Average)	km/h	98.6	98.6 km/h
Travel Distance (Total)	veh-km/h	241.9	290.3 pers-km/h
Travel Time (Total)	veh-h/h	2.5	2.9 pers-h/h
Desired Speed	km/h	100.5	
Speed Efficiency		0.98	
Travel Time Index		9.79	
Congestion Coefficient		1.02	
Demand Flows (Total)	veh/h	262	315 pers/h
Arrival Flows (Total)	veh/h	262	
Percent Heavy Vehicles (Demand)	%	2.0	
Percent Heavy Vehicles (Arrivals)	%	2.0	
Degree of Saturation		0.112	
Practical Spare Capacity	%	774.2	
Effective Intersection Capacity	veh/h	2338	
Control Delay (Total)	veh-h/h	0.01	0.02 pers-h/h
Control Delay (Average)	sec	0.2	0.2 sec
Control Delay (Worst Lane by MC)	sec	1.0	
Control Delay (Worst Movement by MC)	sec	1.8	1.8 sec
Geometric Delay (Average)	sec	0.0	
Stop-Line Delay (Average)	sec	0.2	
Idling Time (Average)	sec	0.0	
Intersection Level of Service (LOS)		NA	
95% Back of Queue - Veh (Worst Lane)	veh	0.1	
95% Back of Queue - Dist (Worst Lane)	m	0.7	
Ave. Que Storage Ratio (Worst Lane)		0.04	
Effective Stops (Total)	veh/h	7	8 pers/h
Effective Stop Rate		0.03	0.03
Proportion Queued		0.05	0.05
Performance Index		3.3	3.3
Cost (Total)	$/h	115.74	115.74 $/h
Fuel Consumption (Total)	L/h	21.3	
Carbon Dioxide (Total)	kg/h	50.4	
Hydrocarbons (Total)	kg/h	0.008	
Carbon Monoxide (Total)	kg/h	0.18	
NOx (Total)	kg/h	0.051	

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

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand effects.
In Network analysis, Arrival Flows will be reduced if Upstream Capacity Constraint exists.

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

Site Model Variability Index (Average value of largest changes in Lane Degrees of Saturation from the third to the last Main (Timing-Capacity) Iterations): 0.0 %

Number of Iterations: 3 (Maximum: 10)

Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 34.4% 0.0% 0.0%

Intersection Performance - Annual Values			
Performance Measure	**Vehicles:**	**All MCs**	**Persons**

Demand Flows (Total)	veh/y	125,811	150,973	pers/y
Delay (Total)	veh-h/y	6	7	pers-h/y
Effective Stops (Total)	veh/y	3,197	3,837	pers/y
Travel Distance (Total)	veh-km/y	116,109	139,330	pers-km/y
Travel Time (Total)	veh-h/y	1,177	1,413	pers-h/y
Cost (Total)	$/y	55,557	55,557	$/y
Fuel Consumption (Total)	L/y	10,234		
Carbon Dioxide (Total)	kg/y	24,194		
Hydrocarbons (Total)	kg/y	4		
Carbon Monoxide (Total)	kg/y	85		
NOx (Total)	kg/y	24		

1 Hours per Year: 480 (Site)

MOVEMENT SUMMARY

Site: 2 [Boundary_Cataract Stage 2_AM 2036 + Dev_V2 (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Staged crossing Stage 2 (Median) at three-way intersection with 5-lane major road.
Give-way behaviour assumed at Stage 2.
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Median Storage Area															
3	R2	All MCs	46	2.0	46	2.0	0.039	1.0	LOS A	0.1	0.7	0.25	0.14	0.25	50.9
Approach			46	2.0	46	2.0	0.039	1.0	LOS A	0.1	0.7	0.25	0.14	0.25	50.9
West: Boundary Rd															
11	T1	All MCs	216	2.0	216	2.0	0.112	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	110.0
Approach			216	2.0	216	2.0	0.112	0.0	NA	0.0	0.0	0.00	0.00	0.00	110.0
All Vehicles			262	2.0	262	2.0	0.112	0.2	NA	0.1	0.7	0.05	0.03	0.05	98.6

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

Vehicle movement LOS values are based on average delay per movement.

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

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

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

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

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

INTERSECTION SUMMARY

Site: 1 [Boundary_Cataract Stage 1_PM 2036 +Dev_V2 (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Staged crossing Stage 1 (Minor Road) at three-way intersection with 5-lane major road. Major road turn lane is treated as a full-length lane.
Site Category: (None)
Stop (Two-Way)

Intersection Performance - Hourly Values			
Performance Measure	**Vehicles:**	**All MCs**	**Persons**
Travel Speed (Average)	km/h	60.5	60.5 km/h
Travel Distance (Total)	veh-km/h	914.6	1097.6 pers-km/h
Travel Time (Total)	veh-h/h	15.1	18.2 pers-h/h
Desired Speed	km/h	69.0	
Speed Efficiency		0.88	
Travel Time Index		8.62	
Congestion Coefficient		1.14	
Demand Flows (Total)	veh/h	903	1084 pers/h
Arrival Flows (Total)	veh/h	903	
Percent Heavy Vehicles (Demand)	%	2.0	
Percent Heavy Vehicles (Arrivals)	%	2.0	
Degree of Saturation		0.442	
Practical Spare Capacity	%	122.0	
Effective Intersection Capacity	veh/h	2046	
Control Delay (Total)	veh-h/h	1.34	1.60 pers-h/h
Control Delay (Average)	sec	5.3	5.3 sec
Control Delay (Worst Lane by MC)	sec	7.9	
Control Delay (Worst Movement by MC)	sec	10.5	10.5 sec
Geometric Delay (Average)	sec	4.0	
Stop-Line Delay (Average)	sec	1.3	
Idling Time (Average)	sec	0.0	
Intersection Level of Service (LOS)		NA	
95% Back of Queue - Veh (Worst Lane)	veh	3.0	
95% Back of Queue - Dist (Worst Lane)	m	21.0	
Ave. Que Storage Ratio (Worst Lane)		0.02	
Effective Stops (Total)	veh/h	428	514 pers/h
Effective Stop Rate		0.47	0.47
Proportion Queued		0.30	0.30
Performance Index		20.0	20.0
Cost (Total)	$/h	616.77	616.77 $/h
Fuel Consumption (Total)	L/h	81.7	
Carbon Dioxide (Total)	kg/h	192.9	
Hydrocarbons (Total)	kg/h	0.020	
Carbon Monoxide (Total)	kg/h	0.36	
NOx (Total)	kg/h	0.212	

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand effects.
In Network analysis, Arrival Flows will be reduced if Upstream Capacity Constraint exists.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
Site Model Variability Index (Average value of largest changes in Lane Degrees of Saturation from the third to the last Main (Timing-Capacity) Iterations): 0.0 %
Number of Iterations: 3 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 20.6% 42.1% 0.0%

Intersection Performance - Annual Values			
Performance Measure	**Vehicles:**	**All MCs**	**Persons**

Demand Flows (Total)	veh/y	433,516	520,219	pers/y
Delay (Total)	veh-h/y	641	769	pers-h/y
Effective Stops (Total)	veh/y	205,412	246,494	pers/y
Travel Distance (Total)	veh-km/y	439,026	526,831	pers-km/y
Travel Time (Total)	veh-h/y	7,263	8,715	pers-h/y
Cost (Total)	$/y	296,049	296,049	$/y
Fuel Consumption (Total)	L/y	39,195		
Carbon Dioxide (Total)	kg/y	92,615		
Hydrocarbons (Total)	kg/y	10		
Carbon Monoxide (Total)	kg/y	173		
NOx (Total)	kg/y	102		

1 Hours per Year: 480 (Site)

MOVEMENT SUMMARY

Site: 1 [Boundary_Cataract Stage 1_PM 2036 +Dev_V2 (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Staged crossing Stage 1 (Minor Road) at three-way intersection with 5-lane major road. Major road turn lane is treated as a full-length lane.
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Cataract Rd															
1	L2	All MCs	117	2.0	117	2.0	0.095	5.9	LOS A	0.4	2.9	0.24	0.54	0.24	52.2
2	T1	All MCs	22	2.0	22	2.0	0.095	6.3	LOS A	0.4	2.9	0.24	0.54	0.24	52.6
Approach			139	2.0	139	2.0	0.095	6.0	LOS A	0.4	2.9	0.24	0.54	0.24	52.3
East: Boundary Rd															
4	L2	All MCs	36	2.0	36	2.0	0.077	7.5	LOS A	0.0	0.0	0.00	0.16	0.00	78.1
5	T1	All MCs	260	2.0	260	2.0	0.077	0.0	LOS A	0.0	0.0	0.00	0.07	0.00	99.0
Approach			296	2.0	296	2.0	0.077	0.9	NA	0.0	0.0	0.00	0.08	0.00	95.9
West: Boundary Rd															
12	R2	All MCs	468	2.0	468	2.0	0.442	7.9	LOS A	3.0	21.0	0.51	0.70	0.60	51.0
Approach			468	2.0	468	2.0	0.442	7.9	NA	3.0	21.0	0.51	0.70	0.60	51.0
All Vehicles			903	2.0	903	2.0	0.442	5.3	NA	3.0	21.0	0.30	0.47	0.35	60.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

INTERSECTION SUMMARY

Site: 2 [Boundary_Cataract Stage 2_PM 2036 +Dev_V2 (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Staged crossing Stage 2 (Median) at three-way intersection with 5-lane major road.
Give-way behaviour assumed at Stage 2.
Site Category: (None)
Give-Way (Two-Way)

Intersection Performance - Hourly Values			
Performance Measure	**Vehicles:**	**All MCs**	**Persons**
Travel Speed (Average)	km/h	109.1	109.1 km/h
Travel Distance (Total)	veh-km/h	985.9	1183.1 pers-km/h
Travel Time (Total)	veh-h/h	9.0	10.8 pers-h/h
Desired Speed	km/h	109.8	
Speed Efficiency		0.99	
Travel Time Index		9.93	
Congestion Coefficient		1.01	
Demand Flows (Total)	veh/h	998	1197 pers/h
Arrival Flows (Total)	veh/h	998	
Percent Heavy Vehicles (Demand)	%	2.0	
Percent Heavy Vehicles (Arrivals)	%	2.0	
Degree of Saturation		0.507	
Practical Spare Capacity	%	93.3	
Effective Intersection Capacity	veh/h	1969	
Control Delay (Total)	veh-h/h	0.07	0.08 pers-h/h
Control Delay (Average)	sec	0.2	0.2 sec
Control Delay (Worst Lane by MC)	sec	9.1	
Control Delay (Worst Movement by MC)	sec	23.4	23.4 sec
Geometric Delay (Average)	sec	0.0	
Stop-Line Delay (Average)	sec	0.2	
Idling Time (Average)	sec	0.1	
Intersection Level of Service (LOS)		NA	
95% Back of Queue - Veh (Worst Lane)	veh	0.1	
95% Back of Queue - Dist (Worst Lane)	m	0.8	
Ave. Que Storage Ratio (Worst Lane)		0.04	
Effective Stops (Total)	veh/h	15	18 pers/h
Effective Stop Rate		0.02	0.02
Proportion Queued		0.02	0.02
Performance Index		9.2	9.2
Cost (Total)	$/h	0.00	0.00 $/h
Fuel Consumption (Total)	L/h	0.0	
Carbon Dioxide (Total)	kg/h	0.0	
Hydrocarbons (Total)	kg/h	0.000	
Carbon Monoxide (Total)	kg/h	0.00	
NOx (Total)	kg/h	0.000	

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

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand effects.
In Network analysis, Arrival Flows will be reduced if Upstream Capacity Constraint exists.

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

Site Model Variability Index (Average value of largest changes in Lane Degrees of Saturation from the third to the last Main (Timing-Capacity) Iterations): 0.0 %

Number of Iterations: 3 (Maximum: 10)

Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 75.7% 0.0% 0.0%

Intersection Performance - Annual Values			
Performance Measure	**Vehicles:**	**All MCs**	**Persons**

Demand Flows (Total)	veh/y	478,990	574,787	pers/y
Delay (Total)	veh-h/y	32	38	pers-h/y
Effective Stops (Total)	veh/y	7,361	8,834	pers/y
Travel Distance (Total)	veh-km/y	473,243	567,892	pers-km/y
Travel Time (Total)	veh-h/y	4,337	5,205	pers-h/y
Cost (Total)	$/y	0	0	$/y
Fuel Consumption (Total)	L/y	0		
Carbon Dioxide (Total)	kg/y	0		
Hydrocarbons (Total)	kg/y	0		
Carbon Monoxide (Total)	kg/y	0		
NOx (Total)	kg/y	0		

1 Hours per Year: 480 (Site)