RoadNet

Traffic Impact & Car Parking Assessment

of the

Proposed Extension to

Port Macquarie Indoor Stadium

in

Hibbard Drive, Port Macquarie

for

Facility Design Group

On behalf of

Port Macquarie Hastings Council

29 July 2013

Document Control Sheet

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1. INTRODUCTION

RoadNet Pty Ltd has been engaged by Facility Design Group Architects on behalf of Port Macquarie Hastings Council to provide a Traffic Impact and Car Parking Assessment for the proposed expansion of the Port Macquarie Indoor Stadium in Hibbard Drive, Port Macquarie.

The improvements include additions to the existing building - three basket ball courts, PCYC facilities and amenities - increasing the gross floor area from 3,000m^2 to 6,663m^2 in total. The proposal plans also include a more formal entry to the stadium with a new lounge and entry foyer.

This report has been prepared to accompany the development application of the proposal to Port Macquarie Hastings Council.

Figure 1 shows the locality plan. A site layout plan is included in Appendix A.

Figure 1: Locality Plan

The Port Macquarie Indoor Sports Stadium is part of Council's Stuart Park Sporting Complex and currently comprises three basketball courts, change rooms, reception, canteen and associated amenities. The basketball courts are used for a variety of other sporting activities, including netball, volleyball, multi-sports and mini-ball. The complex hosts a number of major tournaments during the year.

The Port Macquarie Gymnastics Club also has their facilities located adjacent to the stadium and conduct club and competition activities on a regular basis.

Badminton, wheelchair sports and Indoor soccer (Futsal) are the other sports included in the stadium programme.

1.1 Background

Previously, in October 2006 RoadNet completed a carparking assessment of the proposed extension to the stadium comprising of:

- 2 x Basketball courts;
- 4 x Squash courts and Meeting rooms; and
- upgrade of existing facilities.

Parking surveys were conducted to assess the parking demand at peak times during the week, midweek competition and on a Saturday, major tournament, which was a Grand Final night for the local competition. From the surveys a parking rate for the site, number of spaces/100m^2 was determined for normal and busy times. The parking requirement for this proposal was estimated at 154 from peak time demand for a major tournament.

As there been no change to the venue since the survey, these rates have been used in this assessment.

2. EXISTING TRAFFIC CONDITIONS

2.1 Site Description

Figure 2-1: Locality Plan (Google Maps)

The site is identified as Lot 361, DP 754434 and located at the north-west corner of Hastings Drive/Hibbard Drive intersection and bounded by Hastings River Drive in the south, Hibbard Drive to the east and Woods Street to the west.

There is a public reserve located on the northeast corner of the intersection, with residential housing immediately to the north of the reserve fronting Hibbard Drive. Car sales yards are situated on the southern side of the intersection on Hastings River Drive frontage.

Hastings River Drive

Hastings River Drive is a major arterial road generally running in an east-west direction, providing connection from the Pacific Highway in the west to the central business district and the eastern side of Port Macquarie. In the area of the proposed development, Hastings River Drive has 2-travel lanes, a parking lane and a cycle lane in each direction separated by a landscaped median, providing a sheltered right turn lane at the intersection with Hibbard Drive. An existing bus stop and adjoining pedestrian refuge across Hastings River Drive is situated to the east of the intersection. There is a concrete footpath running along both sides of Hastings River Drive.

There is a 60km/h speed limit on Hastings River Drive.

Figure 2-2: Hastings River Drive northern side looking east

Figure 2-3: Hastings River Drive southern side looking east

Hibbard Drive

Hibbard Drive is a loop road starting at the intersection near the indoor stadium heading in a northerly direction towards the Hastings River then turning in a westerly direction before turning in a southerly direction back towards Hastings River Drive, approximately 700m to the west of the eastern intersection. At the intersection with Hastings River Drive there is a central raised concrete median/pedestrian refuge. The formation width of Hibbard Drive is 13m with kerb and gutter on each edge of the formation.

There is a 50km/h speed limit in Hibbard Drive.

Figure 2-4: On-site parking lane (Zone 2) parallel to Hibbard Drive looking north

Figure 2-5: Hibbard Drive north of site access

Figure 2-6: Hibbard Drive/Hastings River Drive intersection

2.2 Existing Access

A 20m wide main access to the complex is located on Hibbard Drive approximately 100m north of the Hastings River Drive intersection.

Figure 2-7: Access from Hibbard Drive

Two other accesses are also located north of Hibbard Drive, providing access to the Stuart Park sports fields.

2.3 Parking Demand Survey 2006

The available parking spaces within the vicinity of the stadium were divided into three zones as explained below. Figure 2.8 provides an indication of the location of the zones used in the carparking assessment.

- Zone 1: Existing car park – 178 spaces;
- Zone 2: the 12m wide 285m long two-aisles parking strip with three accesses, running parallel to Hibbard Drive – 139 spaces; and
- Zone 3: Hibbard Drive frontage on-road – 120 spaces.

A total of 437 parking spaces are available in the surrounding area, on-site and Hibbard Drive frontage.

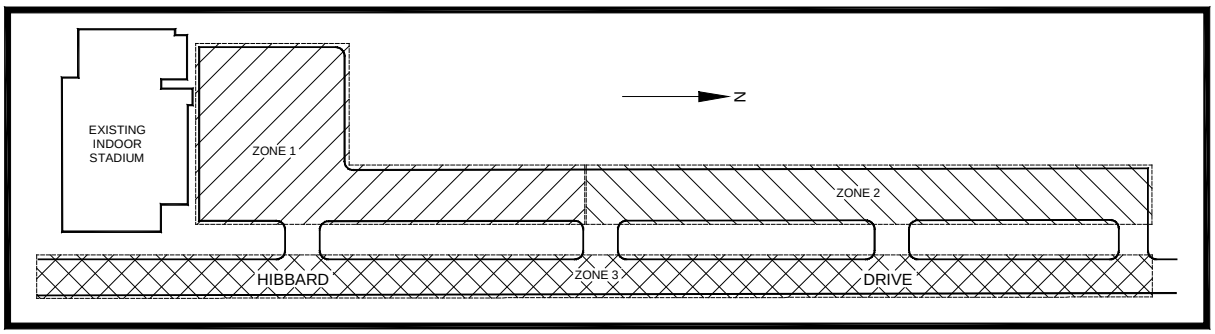


Figure 2-8: Carparking Assessment Zone Locations

Parking Survey – September 2006

The following describes the parking survey methodology.

Information obtained from the stadium management advised that Wednesday 27th September and Saturday 30th September 2006 would be peak times to conduct parking surveys. An afternoon/night time survey (4.00pm - 9.30pm) was conducted on the Wednesday as it was a Grand Final night for the local competition. A full day survey (10.00am - 8.00pm) was conducted on the Saturday as this was in the middle of a major carnival at the stadium with opening ceremony being conducted on this day. A copy of the tournament schedule is provided in Appendix C to give an indication of the hours of play.

Occupied spaces were counted every 15 minutes for both surveys along with an indication of people in the stadium for the Wednesday count. Full results are shown at Appendix B and a summary is shown in Table 2-1 below.

As can be seen from Table 2-1, the peak parking demand at the site was 62 spaces for the mid-week (Friday) local competition night and 87 spaces (Saturday) for the major carnival.

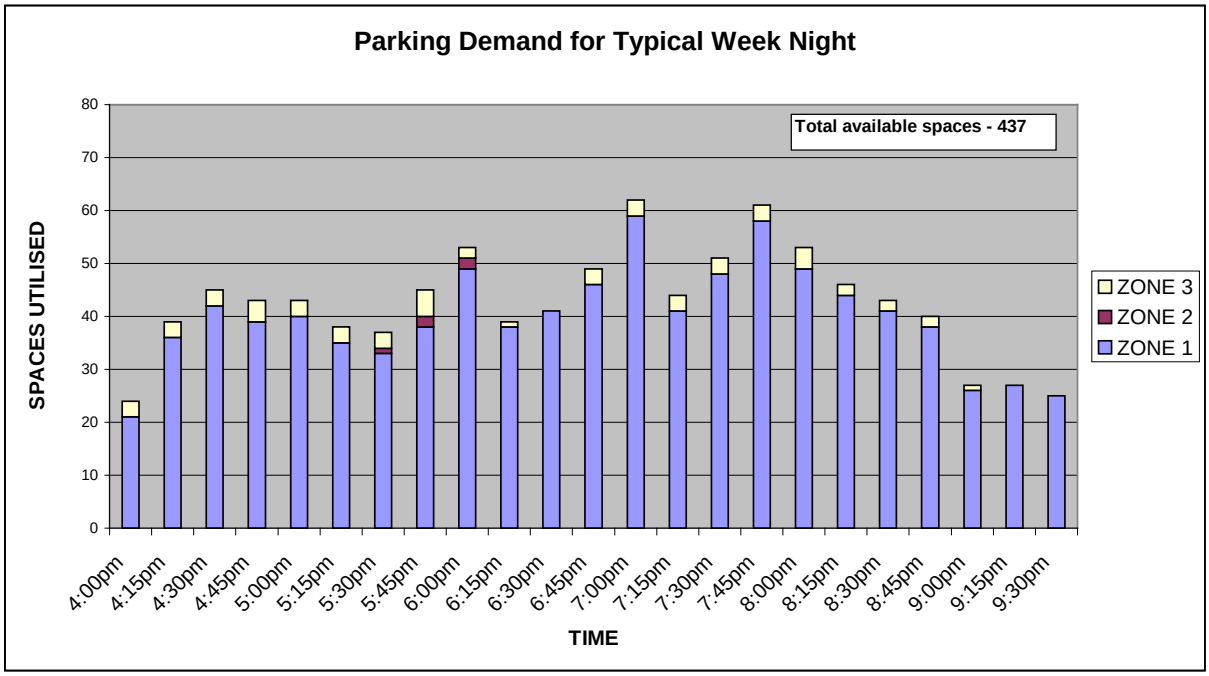
Table 2-1: Spare parking spaces in the study area – Wednesday and Saturday

Time	10.00	10.15	10.30	10.45	11.00	11.15	11.30	11.45	12.00	12.15	12.30	12.45	1.00	1.15	1.30	1.45	2.00
Wed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sat	394	385	378	372	362	364	381	387	377	364	358	363	384	400	405	408	410
Time	2.15	2.30	2.45	3.00	3.15	3.30	3.45	4.00	4.15	4.30	4.45	5.00	5.15	5.30	5.45	6.00	6.15
Wed	-	-	-	-	-	-	-	413	398	392	394	394	399	400	392	384	398
Sat	405	398	362	350*	369	389	395	388	387	386	387	382	388	385	384	383	374
Time	6.30	6.45	7.00	7.15	7.30	7.45	8.00	8.15	8.30	8.45	9.00	9.15	9.30				
Fri	396	388	375*	393	386	376	384	391	394	397	410	410	412				
Sat	373	391	393	395	393	426	436	-	-	-	-	-	-				

*Indicates the maximum parking period.

Table 2-2: Average Use for Each Zone throughout the Day.

Zone	Spaces	Wed	Sat	Comment
1	178	22.3%	28.2%	Peak 6.45 - 7.00pm Wed & 2.45 - 3.00pm Sat
2	139	0.16%	0.09%	Peak 5.30 - 6.00pm Wed & 1.45 -2.15pm Sat
3	120	2.05%	1.80%	Peak 5.30 - 5.45pm Wed & 2.45 - 3.00pm Sat



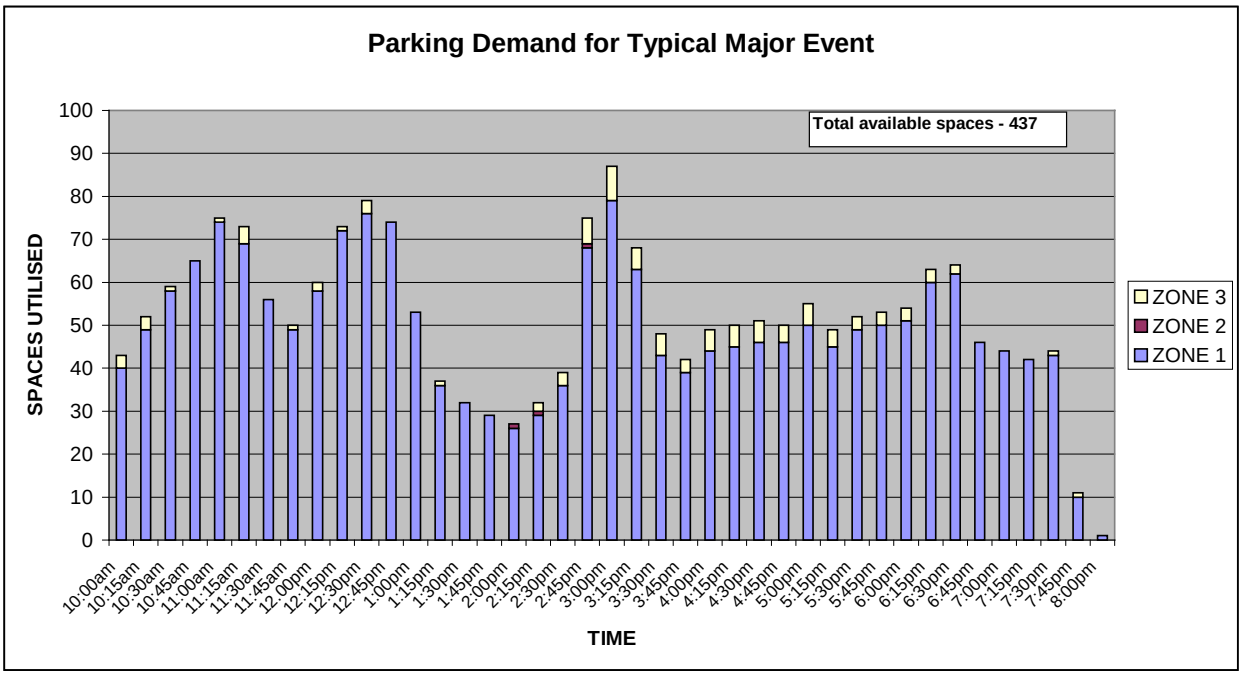


Figure 2-9: Car park survey Fri (mid-week) competition and Saturday (major tournament)

From the peak parking figures the parking rate for the two days are as shown in Table 2-3.

Table 2-3: Peak parking demand

	Time Period	Peak Parking	GFA m^2	Rate/100m^2
Wednesday	7:00-7:15 pm	62	3,005 m^2	2.1
Saturday	3:00-3:15 pm	87	3,005 m^2	2.9

2.4 Council DCP Requirement

According to the Council parking code DCP 2011, the parking requirement calculation is shown in Table 2-4 to calculate the parking requirement to comply with the stadium activities were considered individually as illustrated in Table 2-4:

1. Indoor Basket Ball Courts (3 off) – 2358m^2 ;

2. Gymnasium – 647m^2

Table 2-4: Parking Requirement as per Council DCP Code

	Floor Area (m^2)	Spaces /100m^2	Spaces Required
Basketball Courts x3	2358	7.5	177
Gymnasium	647	7.5	49
Total			226

2.5 Trip Generation

The trip generation of the existing stadium was calculated using the traffic count surveys at the stadium entrance vehicle movements. Table 2-5 summarise the results.

Table 2-5: Trip Generation Rates

	Floor Area (m^2)	In		Out	
		Trips	Rate/100m^2	Trips	Rate/100m^2
Wednesday	3,005	116	3.86	71	2.36
Friday	"	91	3.00	45	1.50
Total		207		116	

These rates will be used to calculate the post-development expected stadium traffic.

2.6 Road Network Operations

Attributes of the road network adjacent to the site are summarized in Table 2-6.

Table 2-6: Road Network Attributes

Attributes	Hastings River Drive	Hibbard Drive
Road Hierarchy	Arterial Road	Access Road
Directionality	2-way	2-way
Number of Lanes	4	2
Central Median	Solid	No
Speed Limit	60	50
Jurisdiction	RMS/Council	Council
Kerb-and-gutter	Yes	Yes
Dedicated Parking	Yes	Yes
Formal Footpaths	Yes	No
Bus Route	Yes	No

The key intersection proximate to the subject site is the Hastings River Drive/ Hibbard Drive give-way controlled intersection. To assist in the quantification of existing intersection operations, classified turning movement surveys were conducted for two afternoon peak periods on Wednesday 15th and Friday 17th May 2013. Conversations with stadium staff indicated that the busiest days at the stadium are those two days.

Stadium entrance and Hibbard Drive intersection were also surveyed to determine the peak hour traffic generation.

In order to capture the peak hour, counts were undertaken between 3:45 – 6:00pm. Traffic survey information is presented in Appendix B and summarised in Figures 2-10 and 2-11.

The traffic surveys indicated traffic peaks at different times as much as an hour, on Wednesdays and Fridays, at the two intersections. The main reason for this is the through traffic flow on Hastings River Drive which is heavier on Wednesday.

- Hastings River Drive/Hibbard Drive
  - Wednesday – 3:45 to 4:45pm
  - Friday – 4:15 to 5:15pm
- Hibbard Drive/Stadium Access
  - Wednesday – 3:45 to 4:45pm
  - Friday – 5:00 to 6:00pm

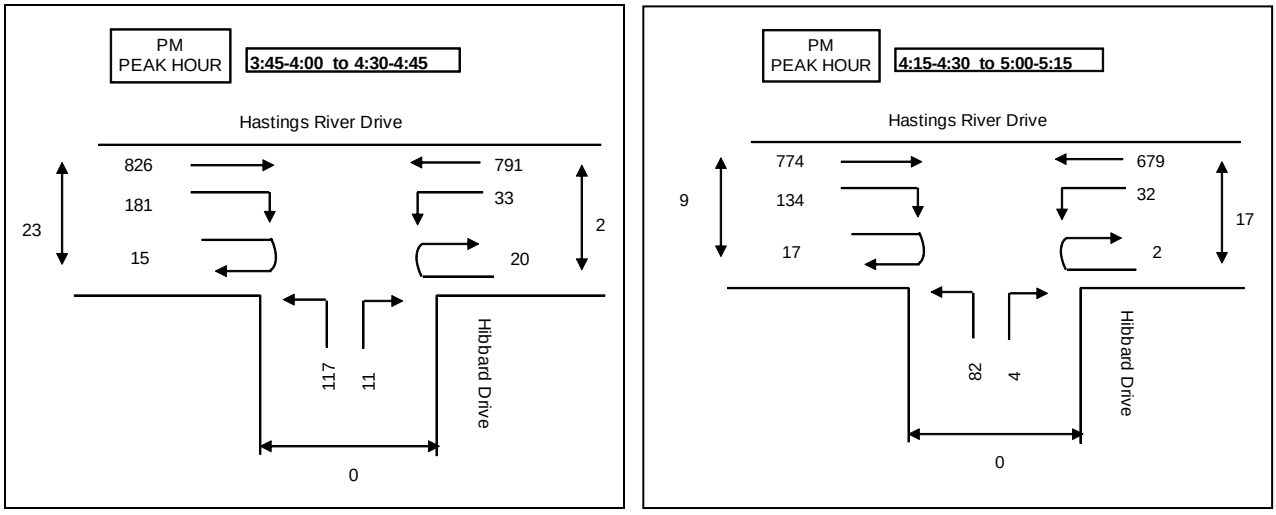


Figure 2-10: Hastings River Drive/Hibbard Drive Intersection – Traffic Counts

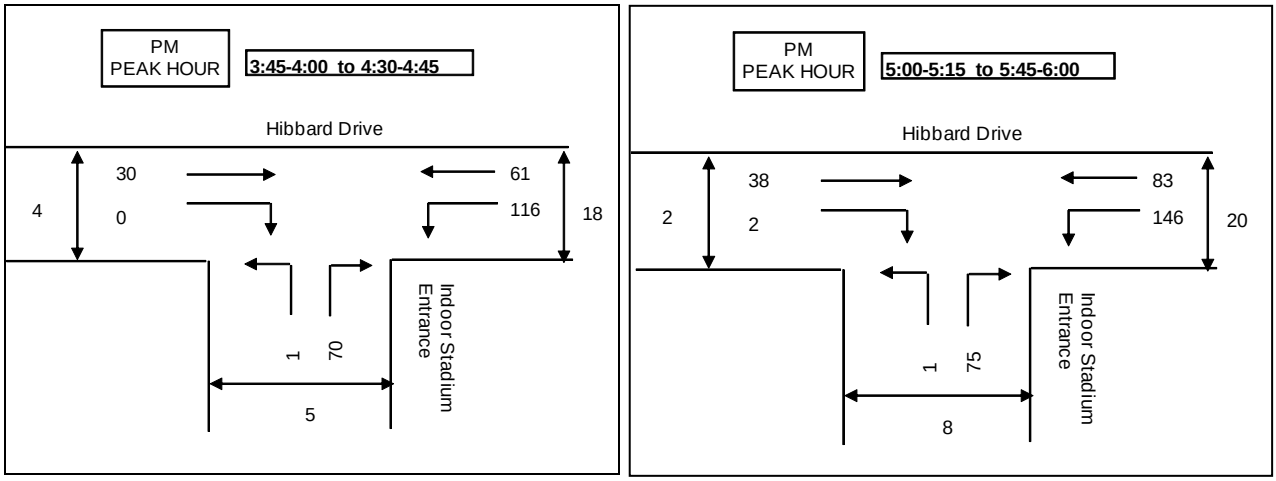


Figure 2-11: Hibbard Drive/Stadium access – Traffic Counts

2.7 Intersection Operation

A series of SIDRA Intersection analyses were conducted to quantify the evening peak hour traffic operations at each of the intersections. The SIDRA analyses were based on the traffic count data and assumed the following:

- peak hours deduced from the survey data;
- heavy vehicle percentages as observed; and
- SIDRA default values for all other parameters.

Each intersection was analysed for the peak hour at the intersection and therefore is considered the worst case in terms of traffic flow between intersections.

The results of these analyses are presented in Appendix C and are summarised in Table 2-7.

The degree of saturation for a movement is defined as the ratio of traffic demand to the capacity of the movement. The values given in Table 2-7 relate to the approach or movement with the highest degree of saturation.

Table 2-7: Existing Intersection Operation

Intersection Peak Hour and Scenario	Intersection Degree of Saturation	Average Intersection Delay (sec)	Critical Movement Performance		
			95%'ile Queue - length	Delay	LOS
Hastings River Drive					
Wednesday (3:45-4:45pm)	38.3%	4.3	Hastings River Dr RT – 13m		B
Friday (4:15-5:15pm)	25.1%	3.1	Hastings River Dr RT – 8m		A
Stadium Access					
Wednesday (3:45-4:45pm)	10.0%	5.8	All movements - negligible		A
Friday (5:00-6:00pm)	12.8%	5.6	" "		A

Table 2-8 is an extract from the SIDRA 5.1 manual, which defines the operational rating in relation to the degree of saturation for priority controlled intersections.

Table 2-8: Intersection Ratings DOS/Delay (RMS) - SIDRA 5.1

Rating	Level of Service	Degree of Saturation	Average Delay
Excellent	A	x <= 0.6	d ≤ 14.5
Very good	B	0.6 < x <= 0.75	14.5 < d ≤ 28.5
Good	C	0.75 < x <= 0.8	28.5 < d ≤ 42.5
Acceptable	D	0.8 < x <= 0.95	42.5 < d ≤ 56.5
Poor	E	0.95 < x <= 1.0	56.5 < d ≤ 70.5
Very poor	F	1.0 < x	70.5 < d

Thus, based on the results of the intersection analysis and the application of the aforementioned ratings, the two intersections currently exhibit "very good to "excellent" operation under existing peak hour conditions.

2.8 Pedestrians, Cyclists and Public Transport

Pedestrian facilities are provided at the intersection to cross Hastings River Drive and Hibbard Drive safely.

Marked cycle lanes exist on both sides of Hastings River Drive.

There are no formal pedestrian / cyclist facilities provided in Hibbard Drive.

3. PROPOSED DEVELOPMENT

The proposed stadium expansion includes:

- Three new basketball courts;
- PCYC and Police rooms ;
- New entry foyer and lounge areas;
- Activity/program and passive recreational activities; and
- Associated amenities.

A detailed breakdown of the proposed activities and areas are detailed in the site plan produced by Facility Design Group "AO2 Floor Plan, DA Issue" dated 22-06-13 and attached as Appendix B.

3.1 Site Layout and Access

The existing main access will be relocated approximately 30m north of the current location on Hibbard Drive. Vehicle crossing will be constructed to comply with Council requirements.

Car Drop-off Zone

A drop-off zone is provided for approximately six spaces on Hibbard Drive as shown in the layout plan within easy access to the stadium entrance. The drop-off zone will further offset the parking demand requirement for the proposal.

Bus Drop-off and Parking

The main participants of the activities at the stadium are school groups and teams. Therefore it is expected that group arrivals at the venue will be by bus. To meet this need bus and coach drop-off spaces are provided within the car park adjacent to Hibbard Drive as shown in the site plan. The space provided can accommodate five buses.

The bus parking and drop-off area will be signed accordingly to minimise car/bus conflicts.

Disabled Parking

Six disabled parking spaces are provided within close proximity to the stadium entrance and comply with requirements.

3.2 Commercial Vehicle Servicing

As shown in the layout plan, a refuse area is provided to the rear of the site. Refuse vehicle manoeuvring has been checked and complies with Council standards. As the refuse collection is undertaken in early

morning periods, refuse truck movements through the car parking area is not expected to create any safety issue.

3.3 Internal Layout

Pedestrian paths and crossing points are provided throughout the car park to safely direct pedestrians to the stadium entrance. The layout and provision of on-site queuing, car parking and internal manoeuvring are consistent with Council and AS/NZS 2890.1 requirements.

3.4 Car Parking

The carparking requirement for this development has been assessed and recommended to council based on the previous 2006 assessment completed by RoadNet for the site. At the time this assessment was accepted by Port Macquarie Hastings Council as a reasonable effort in determining the parking demand for this development.

Parking requirement for the proposed expansion was calculated in two ways (Table 3-1):

1. On-site observations; and

2. Parking codes as in Port Macquarie Hastings Council's DCP 2011

Table 3-1: Parking requirement

	Parking Rate/100m^2		GFA m^2		Parking Spaces	
	Observed	DCP	Existing	Extension	Demand	Code
Wednesday	2.1	7.5	3,005	3,658	140	500
Saturday	2.9	7.5	3,005	3,658	193	500

As can be seen from Table 3-1, where parking should be determined strictly in accordance with the PM Parking Code the number of spaces required is 500. However as was shown from the parking survey (Section 2-4), the on-site demand for local competition and major tournaments is 62 and 87 spaces respectively which corresponds to the parking rates shown above.

The proposed carparking layout will provide approximately 161 car spaces plus 6 disabled spaces and 3 shared areas along with parking / set down for 5 buses / coaches. A drop off zone is also being provided on the Hibbard Drive frontage which will provide storage for up to 6 cars.

As stated the proposal will provide a total of 167 spaces, this is a short fall of 26 spaces in relation to the Saturday peak requirement. Originally there was 387 available spaces including overflow parking, however as required the bus set down / parking area be located off street which resulted in a reduction of the available overflow parking.

There are approximately 130 overflow parking spaces available to the north of the stadium as overflow parking being part of the Stuart Park Sporting Complex. On street parking on the Hibbard Drive frontage of the stadium will be removed to cater for the proposed drop off zone. There will still be on street parking available north of the proposed northern access as overflow parking. Parking in this location for major events should be discouraged due to the existing residences located on the eastern side of Hibbard Drive.

There is also limited overflow parking (up to 15 spaces) available on Hastings River Drive. Parking here for major events should also be discouraged as this may impact the traffic flows on Hastings River Drive in peak periods with respect to pedestrians crossing the road and alighting from cars.

The above proposed on-site and existing off and on street parking overflow parking (312 spaces, plus bus parking) combined with car and bus drop-off zones more than meets the parking demand of the stadium upgrade being a minimum of 140 and a maximum of 193.

3.5 Trip Generation

Peak hour trip generation rates were calculated from the traffic surveys using the in and out vehicle movements at the entrance as shown in Table 3-2.

Applying the rates as per existing the expanded stadium is expected to generate approximately 485 and 353 trips during the peak hour on a Wednesday and a Friday respectively.

Table 3-2: Trip Generation Rates (from observations)

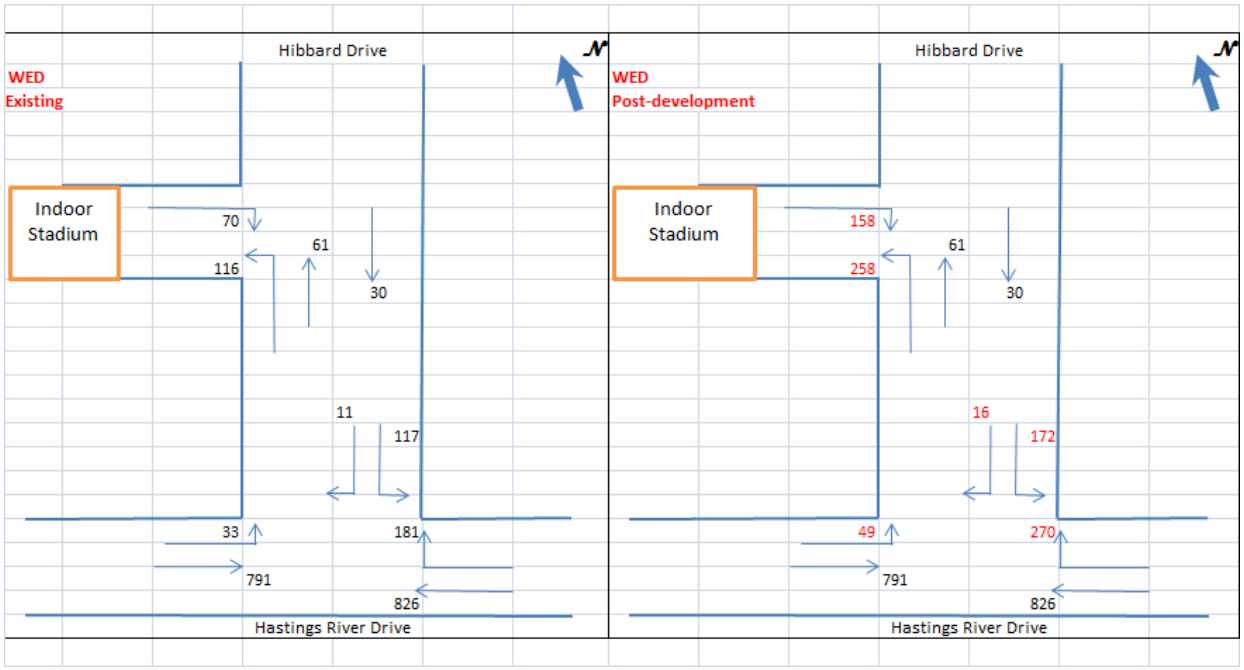
	Total Area (m^2)	In		Out		Total
		Rate/100m^2	Trips	Rate/100m^2	Trips	Trips
Wednesday	6,663	3.86	258	2.36	158	416
Friday	"	3.00	200	1.50	100	300

Hibbard Drive is fully developed with no extra growth required. Hastings River Drive is an arterial road with possible traffic growth for future consideration of any upgrades of the Hastings River Drive / Hibbard Drive intersection.

3.6 Trip distribution

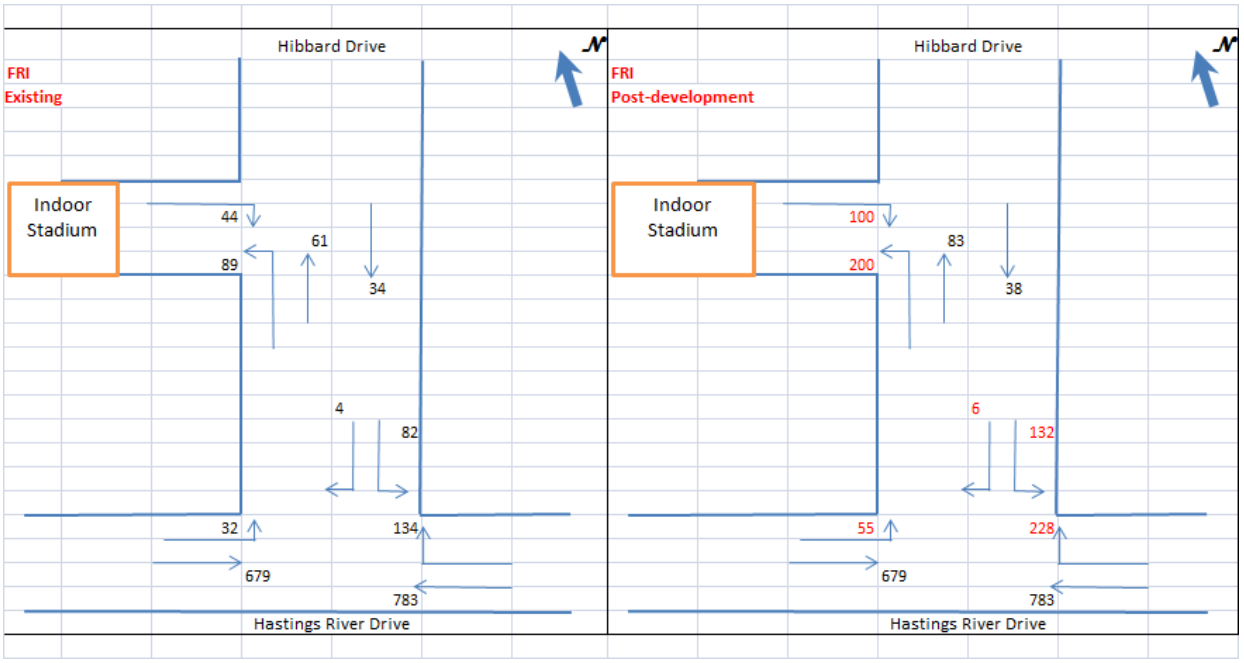
The distribution of development related traffic has been estimated based on the directional split inherent in the traffic surveys. The directional distribution adopted for the development generated traffic is shown in Figures 3-1 and 3-2 for Wednesday and Friday evening peak hours.

In order to match the flows between the intersections, the critical intersection for this study is the major road intersection of Hastings River Drive/Hibbard Drive and hence the peak period and flow calculations and trip distribution were undertaken for the peak period of that intersection.



*Numbers in red = development generated traffic

Figure 3-1: Directional Distribution – Wednesday Peak Hour 3:45-4:45PM



*Numbers in red = development generated traffic

Figure 3-2: Directional Distribution – Friday Peak Hour 5:00-6:00PM

4. TRAFFIC IMPACT

The likely impact of the proposed development on traffic operations on the surrounding road network has been assessed based on evening peak hour movements forecast for the opening year traffic conditions for two week days, a Wednesday and a Friday for the following locations:

- Hibbard Drive/Stadium access intersection,
- Hastings River Drive/Hibbard Drive intersection.

Note. As noted earlier peak hours at the two intersections differs for Wednesday and Friday and indicates the worst case scenario.

4.1 Intersection Operations

A series of SIDRA intersection analyses were conducted in order to quantify post-development traffic conditions at the two intersections. These analyses were based on the same parameters listed earlier with the results summarised in Table 4-1 and presented in Appendix C.

Table 4-1: Future Intersection Operations (Post-Development)

Intersection Peak Hour and Scenario	Intersection Degree of Saturation	Average Intersection Delay (sec)	Critical Movement Performance	
			95%'ile Queue - length	LOS
Hastings River Drive				
Wednesday (3:45 - 4:45pm)	65.0%	6.4	Hastings River Dr RT – 31m	B
Friday (4:15 - 5:15pm)	47.6%	4.6	Hastings River Dr RT – 19m	B
Stadium Access				
Wednesday (3:45 - 4:45pm)	20.4%	7.3	All movements - negligible	A
Friday (5:00 - 6:00pm)	17.9%	6.5	" "	A

As can be seen from the above results the intersections are expected to operate well under the proposed development generated traffic with LOS A/B.

The expected increases in peak hour traffic volumes on Hastings River Drive and Hibbard Drive are well within the notional capacities of the two roads and not expected to cause adverse effects.

Hastings River Drive Intersection

Queuing requirements on the Hastings River Drive west-bound right turn lane is expected to be adequate to cope with the increased right turners from the stadium expansion.

However, the worst traffic movement at this intersection is the Hibbard Drive right turn. This movement which is opposed by two lanes of traffic on Hastings River Drive in both directions but separated by the 3m

wide median assists drivers to complete the manoeuvre in two stages. Additionally, the number expected to be completing this manoeuvre is only 19 and can also utilise the right turn facility at Mumford/Kemp Street 190m away to execute a u-turn to head west.

This traffic assessment has been conducted to gauge the impacts of traffic generated by the stadium expansion proposal. The report has not considered growth of traffic on Hastings River Drive, an arterial road and major corridor which is an arterial road and has not assessed future requirements for the Hastings River Drive/Hibbard Drive intersection. Hibbard Drive on the other hand, is a fully developed residential street and hence will not have any growth.

4.2 Pedestrians, Cyclists and Public Transport

The proposed development is not expected to have significant adverse effects on pedestrian, cyclists or public transport operation.

As part of the development proposal a formal footpath will provide connection between Hastings River Drive and the Indoor Stadium.

5. CONCLUSION

The impact of the proposed expansion of the Port Macquarie Indoor Stadium has been assessed. The main points to note from this assessment are:

1. The proposed expansion of the indoor stadium comprises of three basketball courts, entry foyer and lounges, and PCYC facilities plus amenities.
2. The proposed expansion is expected to increase the existing GFA of 3,005m^2 by 3,658m^2.
3. The main vehicular access to the stadium will be relocated to a position 20m further north of Hibbard Drive.
4. The available sight distance at each of the site accesses is consistent with the requirements of Australian Standards AS 2890.1 2004 Parking Facilities Part 1: Off street car parking and AS 2890.2: Off street commercial vehicle facilities.
5. To better estimate the on-site parking demand surveys were undertaken in 2006 during a week-day event and a Saturday major tournament, from which a rate/100m^2 was calculated.
6. The on-site parking provision of 167 spaces and 130 overflow parking spaces is expected to meet the on-site demand for both weekday and major tournament events. The parking demand was assessed on a previous 2006 Carparking Assessment completed by RoadNet for the site.
7. The layout and design of on-site car parking is consistent with the intent of AS/NZS 2890.
8. Traffic turning movement surveys were conducted at the two key intersections, Hastings River Drive/Hibbard Drive and Hibbard Drive/Stadium access, to assess the impact of development generated traffic.

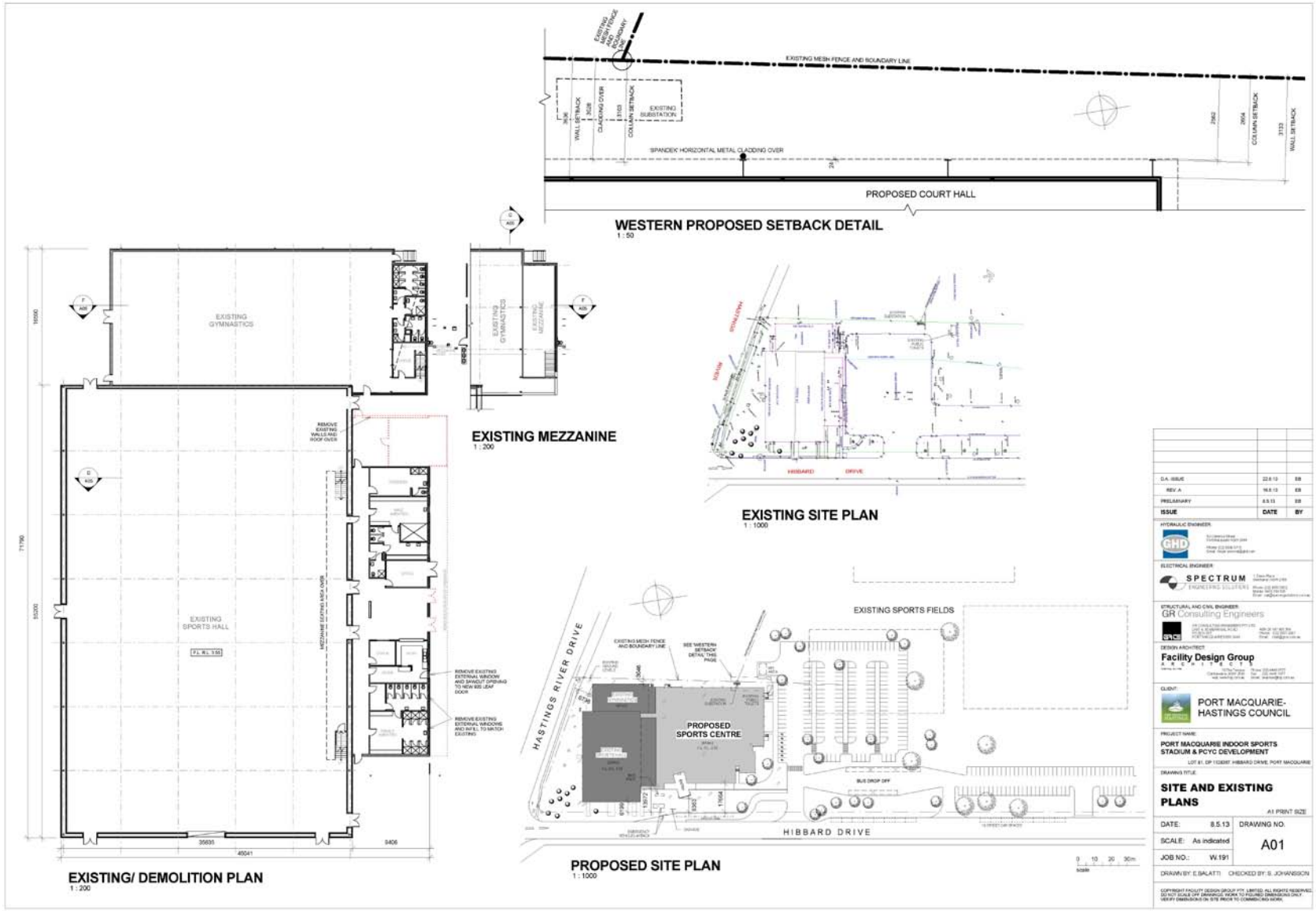
9. Traffic generation for the existing stadium was worked out from the turn movements at the access intersection from the May 2013 traffic surveys. The expected peak hour development traffic generation on Wednesday and Friday is 485 and 353 respectively.

10. The proposed expansion is not expected to have a significant adverse impact on the traffic operations of the two intersections.

11. The proposed expansion is not expected to have a significant adverse impact on the adjacent road network.

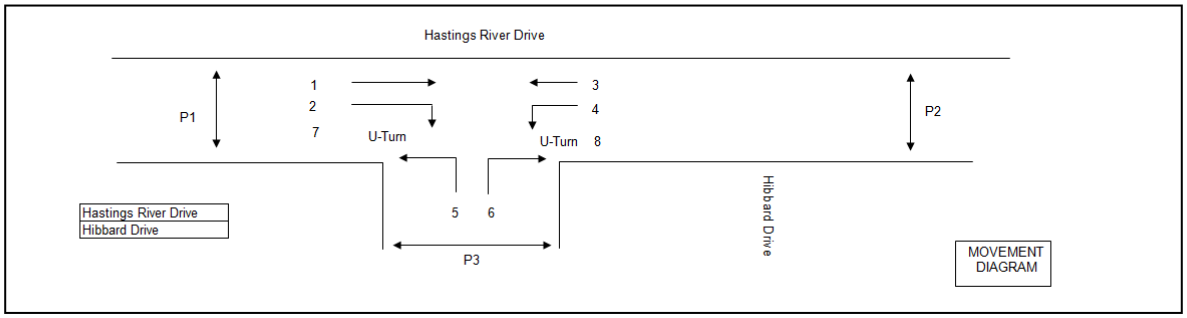
12. The proposed expansion is not expected to have adverse impacts on pedestrians, cyclists and public transport.

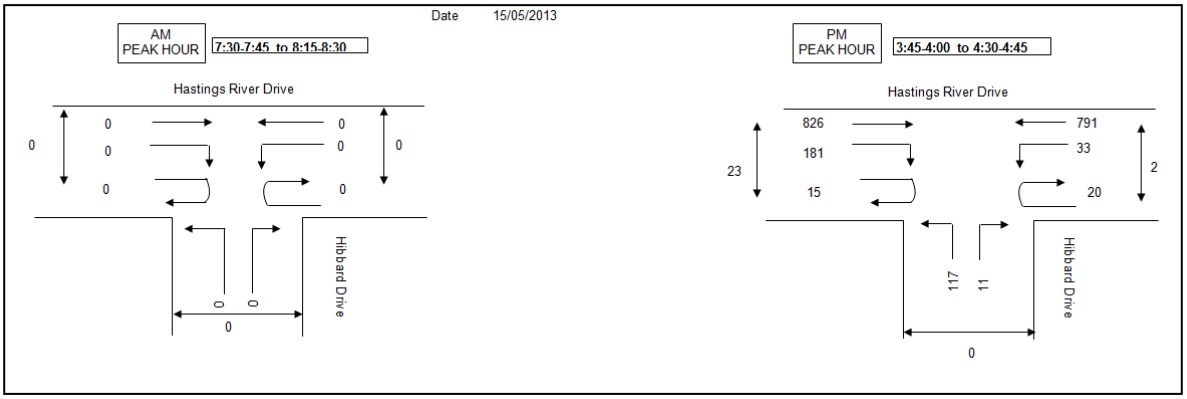
APPENDIX A: SITE LAYOUT PLAN


WESTERN PROPOSED SETBACK DETAIL
1 : 50
EXISTING MESH FENCE AND BOUNDARY LINE
SPANDEK HORIZONTAL METAL CLADDING OVER
PROPOSED COURT HALL
EXISTING MEZZANINE
1 : 200
EXISTING SITE PLAN
1 : 1000
EXISTING/ DEMOLITION PLAN
1 : 200
PROPOSED SITE PLAN
1 : 1000
EXISTING SPORTS FIELDS
HASTINGS RIVER DRIVE
HIBBARD DRIVE
PROPOSED SPORTS CENTRE
BUS DROP OFF
PORT MACQUARIE-HASTINGS COUNCIL
PORT MACQUARIE INDOOR SPORTS STADIUM & PCYC DEVELOPMENT
SITE AND EXISTING PLANS
DRAWING NO. A01
DATE: 8.5.13
SCALE: As indicated
JOB NO.: W.191

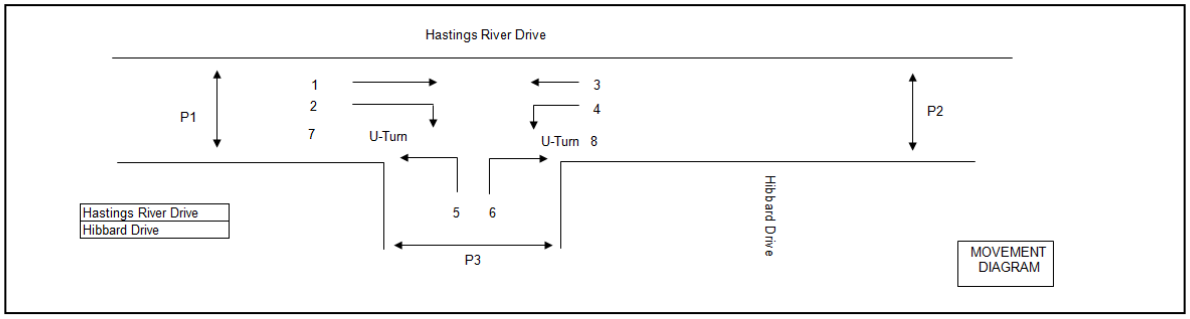
APPENDIX B: TRAFFIC SURVEY DATA

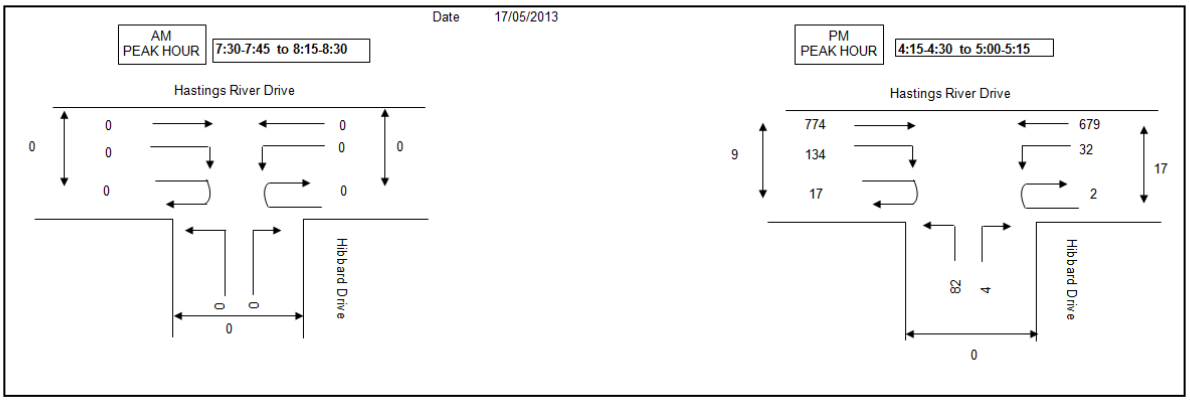
Time	1	H	2	H	3	H	4	H	5	H	6	H	7	H	8	H	1/4h totals	Hrly Total	P1	P2	P3	1/4h totals
3:45-4:00	217	5	42	1	214	0	20	1	37	0	3	0	2	0	4	0	546	Incl. Hvy	10	1	0	11
4:00-4:15	201	5	54	0	180	7	8	0	36	0	5	0	2	0	4	0	502	1048	3	0	0	3
4:15-4:30	207	6	48	0	196	12	0	0	30	0	2	0	5	0	6	0	512	1560	4	0	0	4
4:30-4:45	184	1	34	2	175	7	4	0	14	0	1	0	6	0	6	0	434	1994	6	1	0	7
4:45-5:00	176	0	19	0	165	11	7	0	20	0	0	0	5	0	9	0	412	1860	7	0	0	7
5:00-5:15	188	2	30	0	188	2	2	0	25	0	9	0	0	0	4	0	450	1808	5	5	0	10
5:15-5:30	173	1	38	0	200	4	5	0	53	0	3	0	2	0	2	0	481	1777	5	10	0	15
5:30-5:45	113	1	18	0	146	3	15	0	39	0	4	0	3	0	7	0	349	1692	8	9	0	17
5:45-6:00	138	1	35	0	120	2	7	0	10	0	1	0	3	0	4	0	321	1601	3	5	0	8
6:00-6:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1151	0	0	0	0
6:15-6:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	670	0	0	0	0
6:30-6:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	321	0	0	0	0
Total	1597	22	318	3	1584	48	68	1	264	0	28	0	28	0	46	0	Max Hr	1994	51	31	0	82
	Overall peak hour:						3:45-4:00 to 4:30-4:45											1				
Peak total	809	17	178	3	765	26	32	1	117	0	11	0	15	0	20	0	1994		23	2	0	25
Light+HV	826		181		791		33		117		11		15		20							



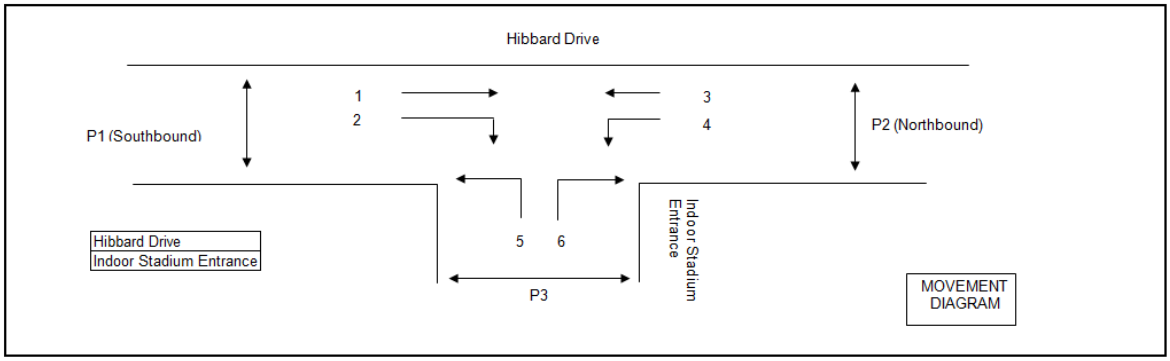


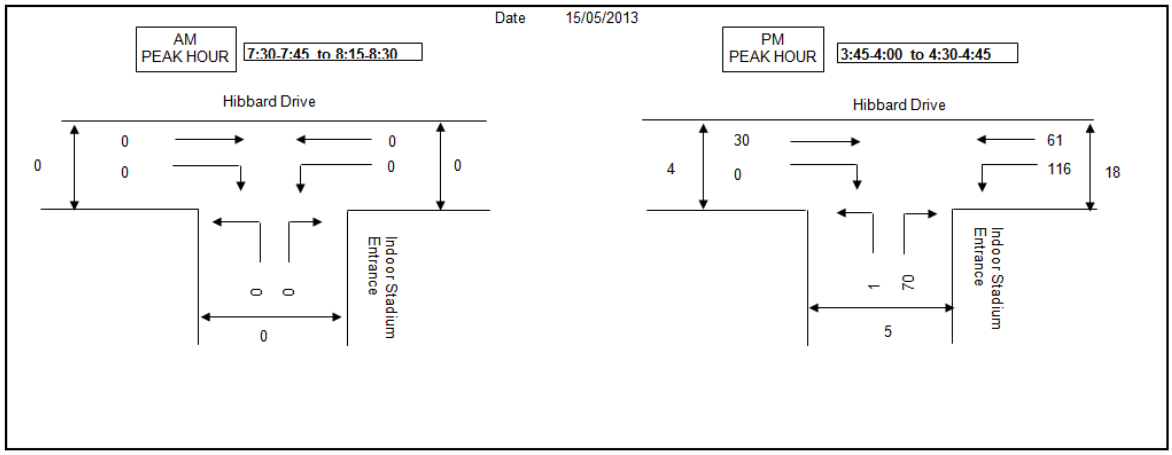
Time	1	H	2	H	3	H	4	H	5	H	6	H	7	H	8	H	1/4h totals	Hrly Total	P1	P2	P3	1/4h totals
3:45-4:00	215	8	34	0	151	3	4	0	22	0	3	0	9	0	0	0	449	Incl. Hvy	3	2	0	5
4:00-4:15	187	3	46	0	196	4	6	0	17	0	2	0	5	0	0	0	466	915	0	1	0	1
4:15-4:30	168	2	42	0	171	6	8	0	10	0	1	0	5	0	1	0	414	1329	4	2	0	6
4:30-4:45	193	6	21	0	123	6	9	0	15	0	0	0	4	0	0	0	377	1706	1	4	0	5
4:45-5:00	180	3	32	0	170	1	4	0	9	1	2	0	6	0	1	0	409	1666	4	5	0	9
5:00-5:15	222	0	39	0	198	4	11	0	47	0	1	0	2	0	0	0	524	1724	0	6	0	6
5:15-5:30	137	1	49	0	179	2	5	0	21	0	3	0	8	0	0	0	405	1715	2	0	0	2
5:30-5:45	133	5	56	0	145	3	5	0	28	0	1	0	4	0	1	0	381	1719	0	2	0	2
5:45-6:00	107	0	55	0	109	2	8	0	16	0	3	0	8	0	1	0	309	1619	0	3	0	3
6:00-6:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1095	0	0	0	0
6:15-6:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	690	0	0	0	0
6:30-6:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	309	0	0	0	0
Total	1542	28	374	0	1442	31	60	0	185	1	16	0	51	0	4	0	Max Hr	1724	14	25	0	39
	Overall peak hour:						4:15-4:30 to 5:00-5:15											3				
Peak total	763	11	134	0	662	17	32	0	81	1	4	0	17	0	2	0	1724		9	17	0	26
Light+HV	774		134		679		32		82		4		17		2							



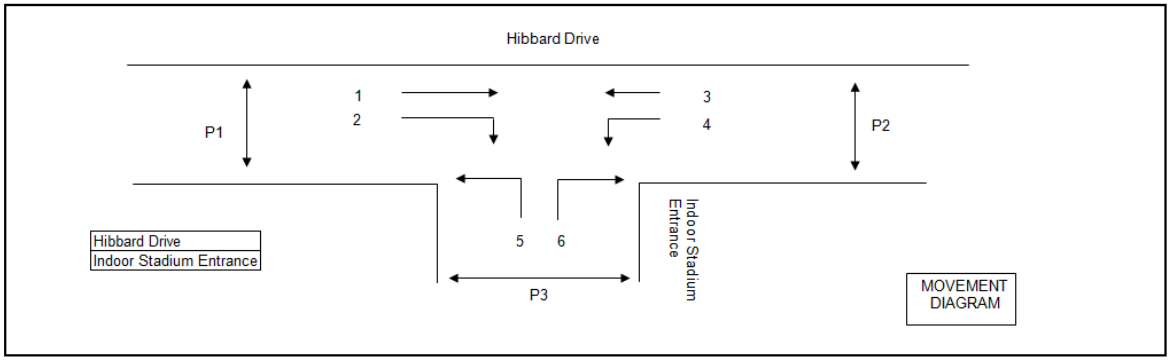


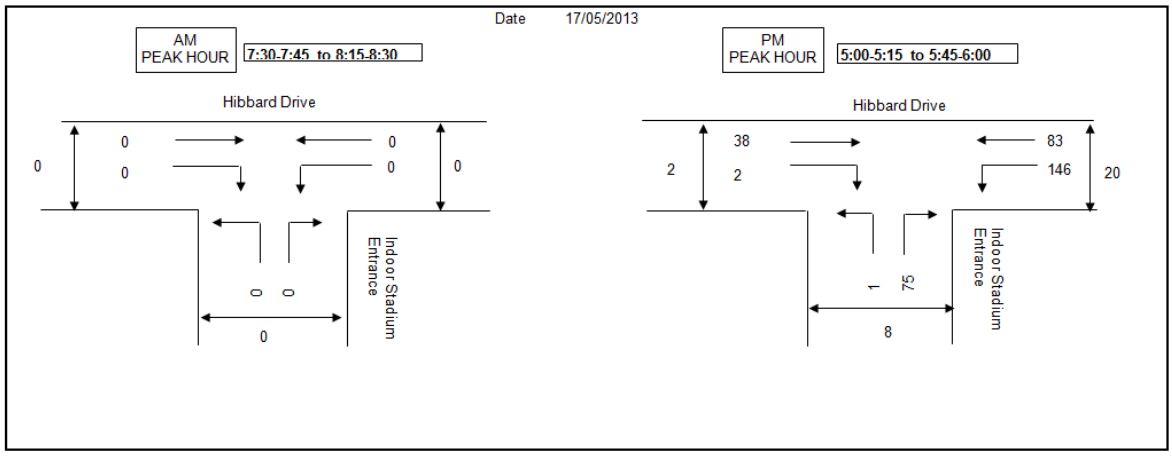
Time	1	H	2	H	3	H	4	H	5	H	6	H	1/4h totals	Hrly Total	P1	P2	P3	1/4h totals
3:45-4:00	8	0	0	0	10	0	43	0	1	0	22	0	84	Incl. Hvy	0	4	1	5
4:00-4:15	9	0	0	0	20	0	36	0	0	0	24	0	89	173	0	5	2	7
4:15-4:30	11	0	0	0	18	0	22	0	0	0	13	0	64	237	0	7	0	7
4:30-4:45	2	0	0	0	13	0	15	0	0	0	11	0	41	278	4	2	2	8
4:45-5:00	8	0	0	0	9	0	15	0	0	0	10	0	42	236	0	4	0	4
5:00-5:15	13	0	0	0	5	0	20	1	0	0	14	0	53	200	3	6	0	9
5:15-5:30	12	0	0	0	18	0	20	0	0	0	37	0	87	223	6	3	9	18
5:30-5:45	9	0	0	0	12	0	11	0	1	0	24	0	57	239	1	8	1	10
5:45-6:00	3	0	1	0	13	0	27	0	0	0	6	0	50	247	1	2	0	3
6:00-6:15	0	0	0	0	0	0	0	0	0	0	0	0	0	194	0	0	0	0
6:15-6:30	0	0	0	0	0	0	0	0	0	0	0	0	0	107	0	0	0	0
6:30-6:45	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	0	0	0
Total	75	0	1	0	118	0	209	1	2	0	161	0	Max Hr	278	15	41	15	71
	Overall peak hour:						3:45-4:00 to 4:30-4:45							1				
Peak total	30	0	0	0	61	0	116	0	1	0	70	0	278		4	18	5	27
Light+HV	30		0		61		116		1		70							





Time	1	H	2	H	3	H	4	H	5	H	6	H	1/4h totals	Hrly Total	P1	P2	P3	1/4h totals
3:45-4:00	4	0	0	0	10	0	24	0	0	0	11	0	49	Incl. Hvy	4	5	0	9
4:00-4:15	3	0	0	0	16	0	27	0	0	0	11	0	57	106	3	4	0	7
4:15-4:30	6	0	0	0	8	1	15	0	0	0	3	0	33	139	6	2	0	8
4:30-4:45	9	0	1	0	14	0	13	0	0	0	4	0	41	180	1	1	2	4
4:45-5:00	9	0	1	0	9	0	30	0	0	0	2	0	51	182	1	2	0	3
5:00-5:15	10	0	0	0	30	0	31	0	1	0	35	0	107	232	0	5	2	7
5:15-5:30	10	0	2	0	17	0	31	0	0	0	15	0	75	274	2	1	3	6
5:30-5:45	7	0	0	0	17	0	40	0	0	0	18	0	82	315	0	9	2	11
5:45-6:00	11	0	0	0	19	0	44	0	0	0	7	0	81	345	0	5	1	6
6:00-6:15	0	0	0	0	0	0	0	0	0	0	0	0	0	238	0	0	0	0
6:15-6:30	0	0	0	0	0	0	0	0	0	0	0	0	0	163	0	0	0	0
6:30-6:45	0	0	0	0	0	0	0	0	0	0	0	0	0	81	0	0	0	0
Total	69	0	4	0	140	1	255	0	1	0	106	0	Max Hr	345	17	34	10	61
	Overall peak hour:						5:00-5:15 to 5:45-6:00							6				
Peak total	38	0	2	0	83	0	146	0	1	0	75	0	345		2	20	8	30
Light+HV	38		2		83		146		1		75							





APPENDIX C: SIDRA INTERSECTION ANALYSES

MOVEMENT SUMMARY

Site: HRD-Hibbard Dr Exist Wed_PM Peak

Hastings River/Hibbard Drive Intersection
Exist Wed. PM Peak (3:45-4:45)
TC: 15-05-13
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Hastings River Dr WB											
5	T	869	2.1	0.226	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
6	R	206	1.6	0.383	15.2	LOS B	1.8	13.0	0.73	0.97	41.2
Approach		1076	2.0	0.383	2.9	NA	1.8	13.0	0.14	0.19	55.3
North: Hibbard Drive SB											
7	L	123	0.0	0.194	11.5	LOS A	0.7	4.7	0.61	0.86	40.3
9	R	12	0.0	0.203	55.3	LOS D	0.4	3.0	0.95	0.99	22.3
Approach		135	0.0	0.203	15.3	LOS B	0.7	4.7	0.64	0.87	37.7
West: Hastings River Drive EB											
10	L	35	3.0	0.247	7.5	LOS A	0.0	0.0	0.00	1.12	48.6
11	T	833	3.2	0.247	3.7	LOS A	3.7	26.5	0.40	0.00	52.4
12	R	21	0.0	0.247	17.8	LOS B	3.7	26.5	0.84	1.08	43.5
Approach		888	3.1	0.247	4.2	NA	3.7	26.5	0.39	0.07	52.0
All Vehicles		2099	2.3	0.383	4.3	NA	3.7	26.5	0.28	0.18	52.3

Level of Service (LOS) Method: Delay (RTA NSW).
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: 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 movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: HRD-Hibbard Dr Exist Fri_PM Peak

Hastings River/Hibbard Drive Intersection
Exist Friday PM Peak (4:15-5:15)
TC: 17-05-13
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Hastings River Dr WB											
5	T	824	2.6	0.215	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
6	R	159	0.0	0.251	12.6	LOS A	1.0	7.3	0.63	0.88	43.5
Approach		983	2.2	0.251	2.0	NA	1.0	7.3	0.10	0.14	56.6
North: Hibbard Drive SB											
7	L	86	0.0	0.118	10.4	LOS A	0.4	2.8	0.53	0.82	41.1
9	R	4	0.0	0.051	35.5	LOS C	0.1	0.7	0.91	0.97	27.9
Approach		91	0.0	0.118	11.6	LOS A	0.4	2.8	0.55	0.82	40.2
West: Hastings River Drive EB											
10	L	34	0.0	0.197	7.4	LOS A	0.0	0.0	0.00	1.10	48.6
11	T	715	2.5	0.197	3.3	LOS A	2.8	19.8	0.41	0.00	52.8
12	R	2	0.0	0.197	16.4	LOS B	2.8	19.8	0.79	1.09	44.7
Approach		751	2.4	0.197	3.6	NA	2.8	19.8	0.39	0.05	52.6
All Vehicles		1824	2.2	0.251	3.1	NA	2.8	19.8	0.24	0.14	53.8

Level of Service (LOS) Method: Delay (RTA NSW).
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: 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 movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: HRD-Hibbard Dr Post-Dev Wed_PM Peak

Hastings River/Hibbard Drive Intersection
Exist Wed. PM Peak (3:45-4:45)
TC: 15-05-13
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Hastings River Dr WB											
5	T	869	2.1	0.226	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
6	R	338	1.6	0.650	19.5	LOS B	4.4	31.0	0.83	1.16	38.0
Approach		1207	2.0	0.650	5.5	NA	4.4	31.0	0.23	0.33	51.9
North: Hibbard Drive SB											
7	L	206	0.0	0.329	12.6	LOS A	1.4	9.6	0.66	0.93	39.5
9	R	19	0.0	0.427	88.2	LOS F	1.0	6.7	0.97	1.02	16.7
Approach		225	0.0	0.427	18.9	LOS B	1.4	9.6	0.68	0.94	35.4
West: Hastings River Drive EB											
10	L	59	3.0	0.254	7.5	LOS A	0.0	0.0	0.00	1.07	48.6
11	T	833	3.2	0.254	3.9	LOS A	3.9	27.8	0.41	0.00	52.2
12	R	21	0.0	0.254	17.9	LOS B	3.9	27.8	0.84	1.08	43.4
Approach		913	3.1	0.254	4.4	NA	3.9	27.8	0.40	0.09	51.7
All Vehicles		2345	2.2	0.650	6.4	NA	4.4	31.0	0.34	0.29	49.6

Level of Service (LOS) Method: Delay (RTA NSW).
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: 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 movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: HRD-Hibbard Dr Post-Dev Fri_PM Peak

Hastings River/Hibbard Drive Intersection
Exist Friday PM Peak (4:15-5:15)
TC: 17-05-13
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Hastings River Dr WB											
5	T	824	2.6	0.215	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
6	R	289	0.0	0.476	15.0	LOS B	2.7	18.9	0.72	1.01	41.4
Approach		1114	1.9	0.476	3.9	NA	2.7	18.9	0.19	0.26	53.9
North: Hibbard Drive SB											
7	L	156	0.0	0.217	10.8	LOS A	0.8	5.4	0.56	0.84	40.8
9	R	7	0.0	0.113	44.8	LOS D	0.2	1.6	0.93	0.97	24.9
Approach		163	0.0	0.217	12.3	LOS A	0.8	5.4	0.58	0.85	39.7
West: Hastings River Drive EB											
10	L	64	0.0	0.205	7.4	LOS A	0.0	0.0	0.00	1.03	48.6
11	T	715	2.5	0.205	3.5	LOS A	2.9	20.8	0.43	0.00	52.5
12	R	2	0.0	0.205	16.5	LOS B	2.9	20.8	0.79	1.08	44.6
Approach		781	2.3	0.205	3.9	NA	2.9	20.8	0.39	0.09	52.1
All Vehicles		2058	1.9	0.476	4.6	NA	2.9	20.8	0.30	0.24	51.8

Level of Service (LOS) Method: Delay (RTA NSW).
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: 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 movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Hibbard Dr-Stadium Access
Exist Wed_PM Peak

Hibbard Dr/Stadium Access Intersection
Exist Wednesday PM Peak (3:45-4:45)
TC - 15-05-13
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Hibbard Drive NB											
1	L	122	0.0	0.099	8.2	LOS A	0.0	0.0	0.00	0.77	49.0
2	T	64	0.0	0.099	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		186	0.0	0.099	5.4	NA	0.0	0.0	0.00	0.50	52.3
North: Hibbard Drive SB											
8	T	32	0.0	0.017	0.5	LOS A	0.1	0.7	0.29	0.00	54.6
9	R	1	0.0	0.017	8.8	LOS A	0.1	0.7	0.29	0.92	49.1
Approach		33	0.0	0.017	0.8	NA	0.1	0.7	0.29	0.03	54.4
West: Stadium Access											
10	L	1	0.0	0.001	8.4	LOS A	0.0	0.0	0.15	0.61	48.3
12	R	74	0.0	0.058	8.9	LOS A	0.2	1.4	0.23	0.66	47.7
Approach		75	0.0	0.058	8.9	LOS A	0.2	1.4	0.23	0.66	47.7
All Vehicles		294	0.0	0.099	5.8	NA	0.2	1.4	0.09	0.49	51.3

Level of Service (LOS) Method: Delay (HCM 2000).
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: 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 movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Hibbard Dr-Stadium Access
Exist Fri_PM Peak

Hibbard Dr/Stadium Access Intersection
Exist Friday Exist PM Peak (5:00-6:00)
TC - 15-05-13
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Hibbard Drive NB											
1	L	154	0.0	0.128	8.2	LOS A	0.0	0.0	0.00	0.77	49.0
2	T	87	0.0	0.128	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		241	0.0	0.128	5.2	NA	0.0	0.0	0.00	0.49	52.5
North: Hibbard Drive SB											
8	T	40	0.0	0.022	0.7	LOS A	0.1	0.9	0.34	0.00	53.8
9	R	2	0.0	0.022	9.0	LOS A	0.1	0.9	0.34	0.90	49.1
Approach		42	0.0	0.022	1.2	NA	0.1	0.9	0.34	0.04	53.5
West: Stadium Access											
10	L	1	0.0	0.001	8.4	LOS A	0.0	0.0	0.18	0.60	48.2
12	R	79	0.0	0.065	9.1	LOS A	0.2	1.6	0.27	0.67	47.6
Approach		80	0.0	0.065	9.1	LOS A	0.2	1.6	0.26	0.67	47.6
All Vehicles		363	0.0	0.128	5.6	NA	0.2	1.6	0.10	0.48	51.4

Level of Service (LOS) Method: Delay (HCM 2000).
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: 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 movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Hibbard Dr-Stadium Access
Post-Dev Wed_PM Peak

Hibbard Dr/Stadium Access Intersection
Exist Wednesday PM Peak (3:45-4:45)
TC - 15-05-13
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Hibbard Drive NB											
1	L	317	0.0	0.204	8.2	LOS A	0.0	0.0	0.00	0.71	49.0
2	T	64	0.0	0.204	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		381	0.0	0.204	6.8	NA	0.0	0.0	0.00	0.59	50.5
North: Hibbard Drive SB											
8	T	32	0.0	0.017	1.3	LOS A	0.1	0.8	0.44	0.00	52.3
9	R	1	0.0	0.017	9.6	LOS A	0.1	0.8	0.44	0.89	49.2
Approach		33	0.0	0.017	1.6	NA	0.1	0.8	0.44	0.03	52.2
West: Stadium Access											
10	L	1	0.0	0.001	8.5	LOS A	0.0	0.0	0.21	0.60	48.0
12	R	194	0.0	0.166	9.4	LOS A	0.6	4.3	0.32	0.69	47.4
Approach		195	0.0	0.166	9.4	LOS A	0.6	4.3	0.32	0.69	47.4
All Vehicles		608	0.0	0.204	7.3	NA	0.6	4.3	0.13	0.59	49.6

Level of Service (LOS) Method: Delay (HCM 2000).
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: 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 movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Hibbard Dr-Stadium Access
Post-Dev Fri_PM Peak

Hibbard Dr/Stadium Access Intersection
Post-Development Friday PM Peak (4:15-5:15pm)
TC - 15-05-13
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Hibbard Drive NB											
1	L	248	0.0	0.179	8.2	LOS A	0.0	0.0	0.00	0.74	49.0
2	T	87	0.0	0.179	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		336	0.0	0.179	6.1	NA	0.0	0.0	0.00	0.55	51.4
North: Hibbard Drive SB											
8	T	40	0.0	0.022	1.1	LOS A	0.1	1.0	0.41	0.00	52.7
9	R	2	0.0	0.022	9.4	LOS A	0.1	1.0	0.41	0.89	49.1
Approach		42	0.0	0.022	1.5	NA	0.1	1.0	0.41	0.04	52.5
West: Stadium Access											
10	L	1	0.0	0.001	8.5	LOS A	0.0	0.0	0.21	0.60	48.0
12	R	123	0.0	0.105	9.3	LOS A	0.4	2.6	0.31	0.68	47.4
Approach		124	0.0	0.105	9.3	LOS A	0.4	2.6	0.31	0.68	47.4
All Vehicles		502	0.0	0.179	6.5	NA	0.4	2.6	0.11	0.54	50.5

Level of Service (LOS) Method: Delay (HCM 2000).
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: 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 movements.
SIDRA Standard Delay Model used.