PROPOSED BUNNINGS WAREHOUSE
CNR THE HORSLEY DRIVE AND O'CONNELL STREET, SMITHFIELD

Assessment of Traffic and Planning Implications

December 2010

Reference 10061

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1. INTRODUCTION

This report has been prepared to accompany a Development Application to Fairfield Council for a new Bunnings warehouse on a site with frontages to The Horsley Drive, O'Connell Street and Victoria Street at Smith Field (Figure 1).

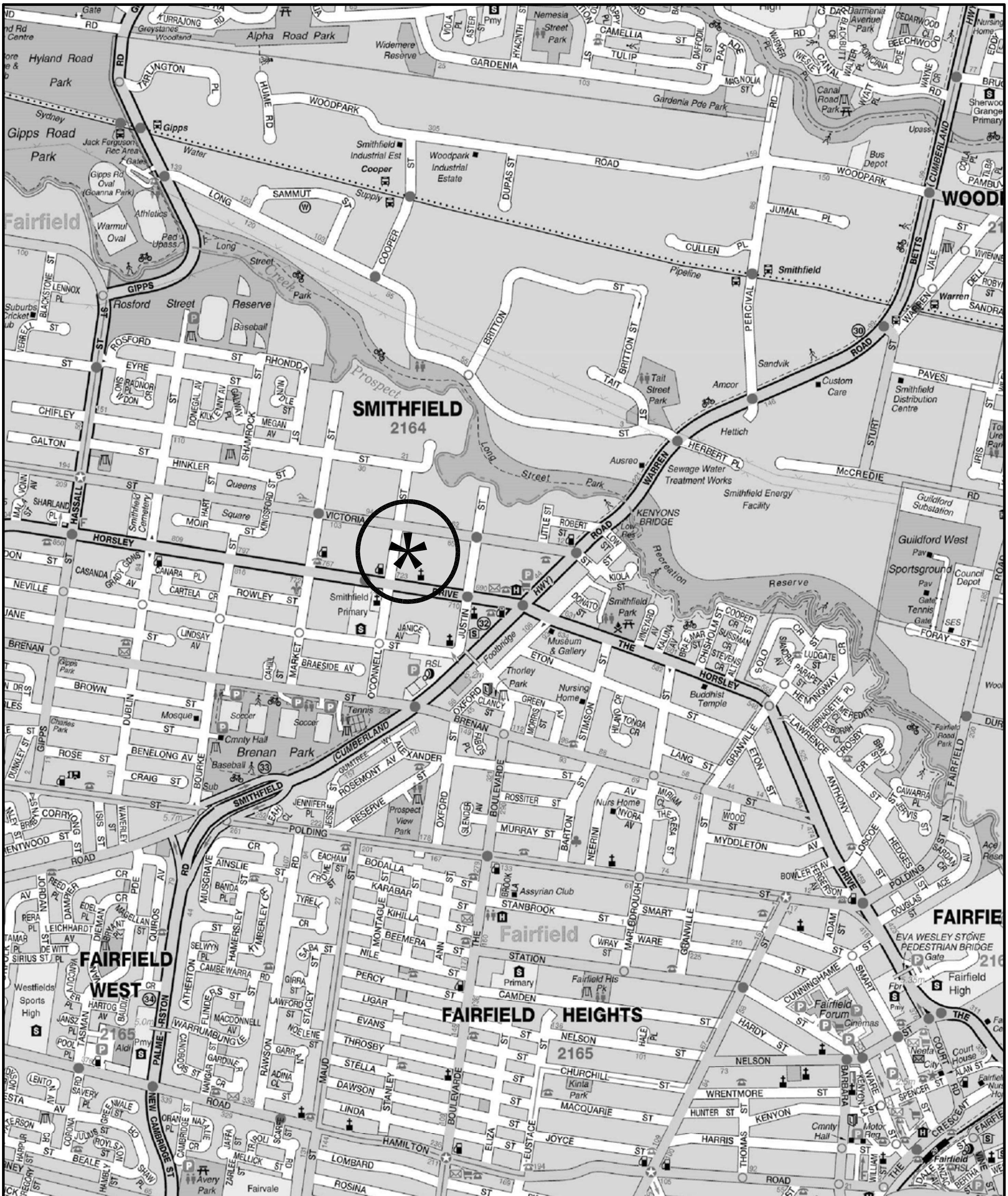
The large consolidated site has been the subject of various industrial uses in the past and the envisaged Bunnings development will be a contemporary warehouse comprising:

Warehouse		
	Level 1	$6,072m^2$
	Level 2	$7,415m^2$
	Total	**$13,487m^2$**
Trade Area		$1,960m^2$
Outdoor Nursery		$1,760m^2$
	Total	**$17,207m^2$**

A total of 378 parking spaces are to be provided with vehicle accesses on The Horsley Drive, O'Connell Street and Victoria Street frontages.

The purpose of this report is to:

* describe the site and the proposed development scheme
* describe the road network serving the site and traffic conditions on that network
* assess the proposed vehicle access arrangements
* assess the traffic potential implications
* assess the adequacy of the proposed parking provision.



LEGEND

LOCATION

FIG 1

2. DEVELOPMENT SCHEME

2.1 SITE, CONTEXT AND EXISTING USE

The site (Figure 2) is a consolidation of Lot 1 of DP 541457 and Lot 3 of DP 203077 occupying a total area of 14,246m^2 with frontages to the eastern side of O'Connell Street, the southern side of Victoria Street and northern side of The Horsley Drive. The site has been the subject of various industrial uses including an intense recycling depot activity on the southern part and a smash repair business on the northern part. There are a number of existing access driveways on each of the road frontages.

Residential development extends to the south while the nearby uses comprise:

∗ the industrial uses to the east and west

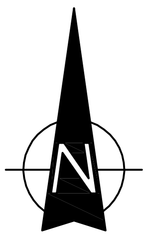
∗ the Primary School which extends along the southern side of The Horsley Drive west of O'Connell Street

∗ the retail and mixed commercial uses which extend along the Cumberland Highway to the east.

2.2 ENVISAGED DEVELOPMENT

The development scheme will involve demolition of the existing structures on the site with excavation to provide for basement carparking together with level building and hardstand areas. The new Bunnings warehouse building will occupy the greater part of the site with:

LEGEND



SITE

FIG 2

Level 1	-	6,072m^2
Level 2	-	7,415m^2
Total	**-**	**13,487m^2**
Outdoor Nursery	-	1,760m^2
Trade Area	-	1,960m^2

A total of some 378 parking spaces would be provided in two basement levels with vehicle access comprising:

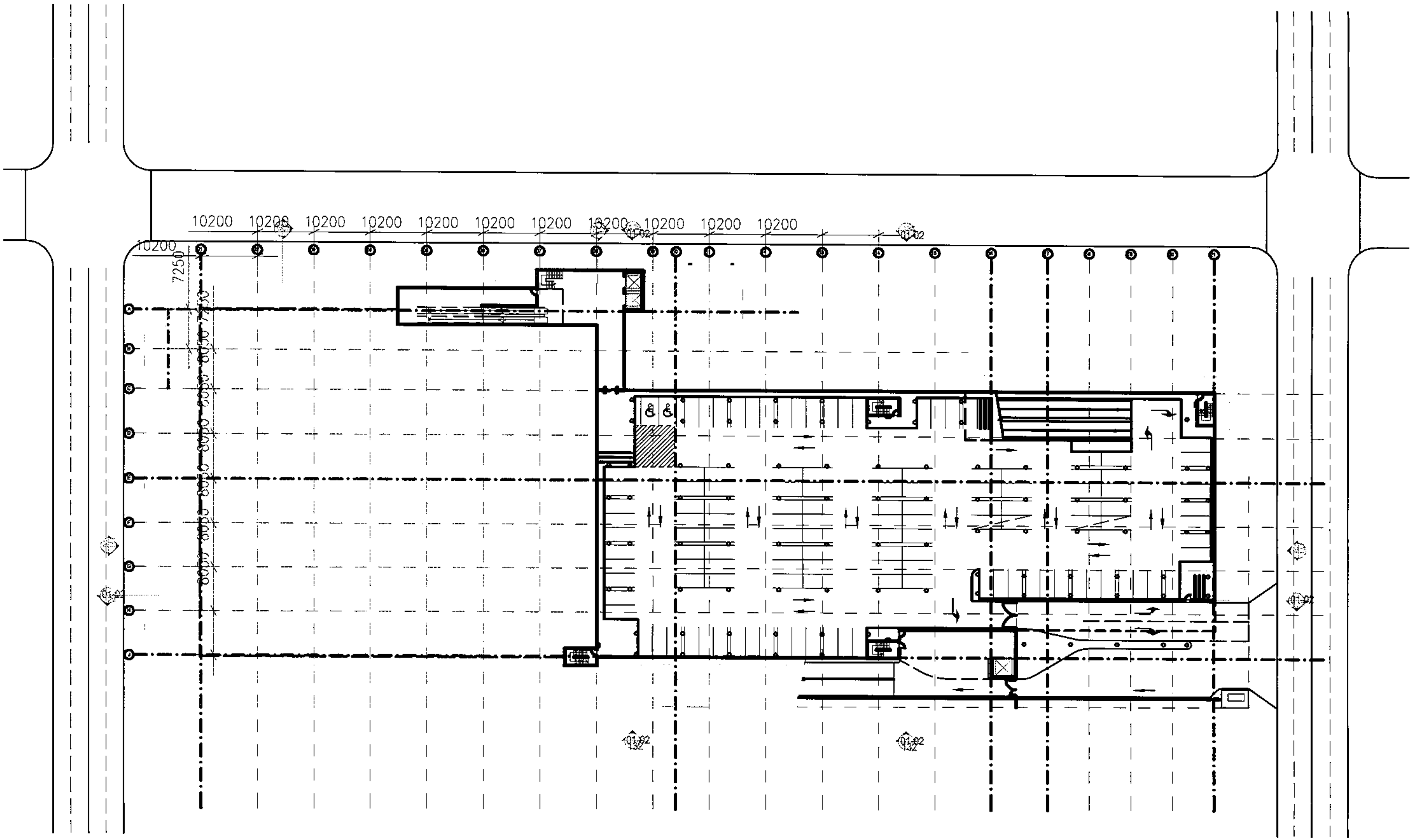
* separate ingress and egress driveways for cars on O'Connell Street

* separate ingress and egress driveways for customer goods pick-up on O'Connell Street

* an ingress driveway for cars and delivery vehicles with an adjacent egress driveway for cars on Victoria Street at the eastern boundary

* an egress driveway for delivery vehicles only on The Horsley Drive.

Details of the envisaged development are provided on the plans prepared by John R Brogan and Associates which are reproduced in part overleaf.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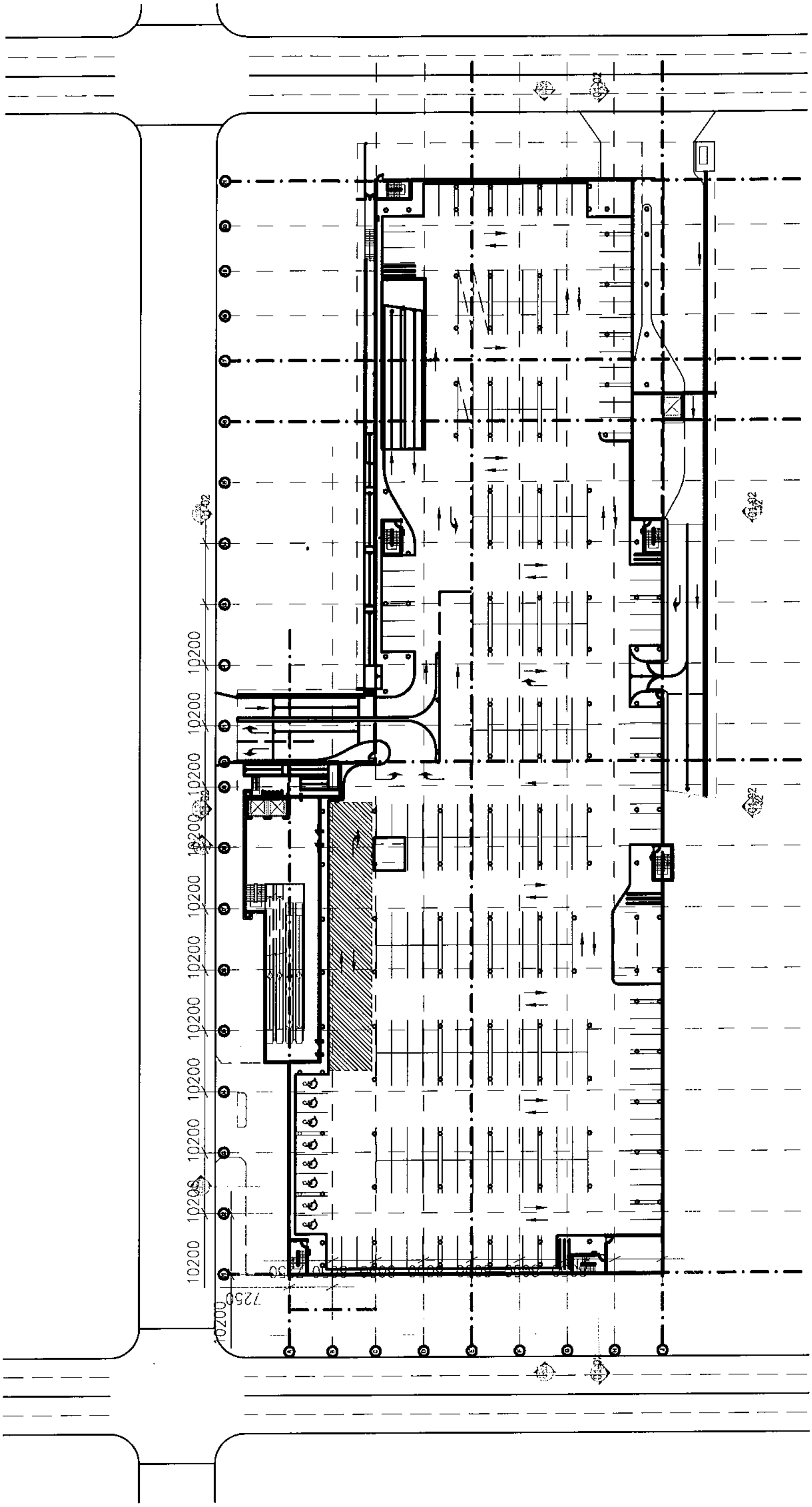
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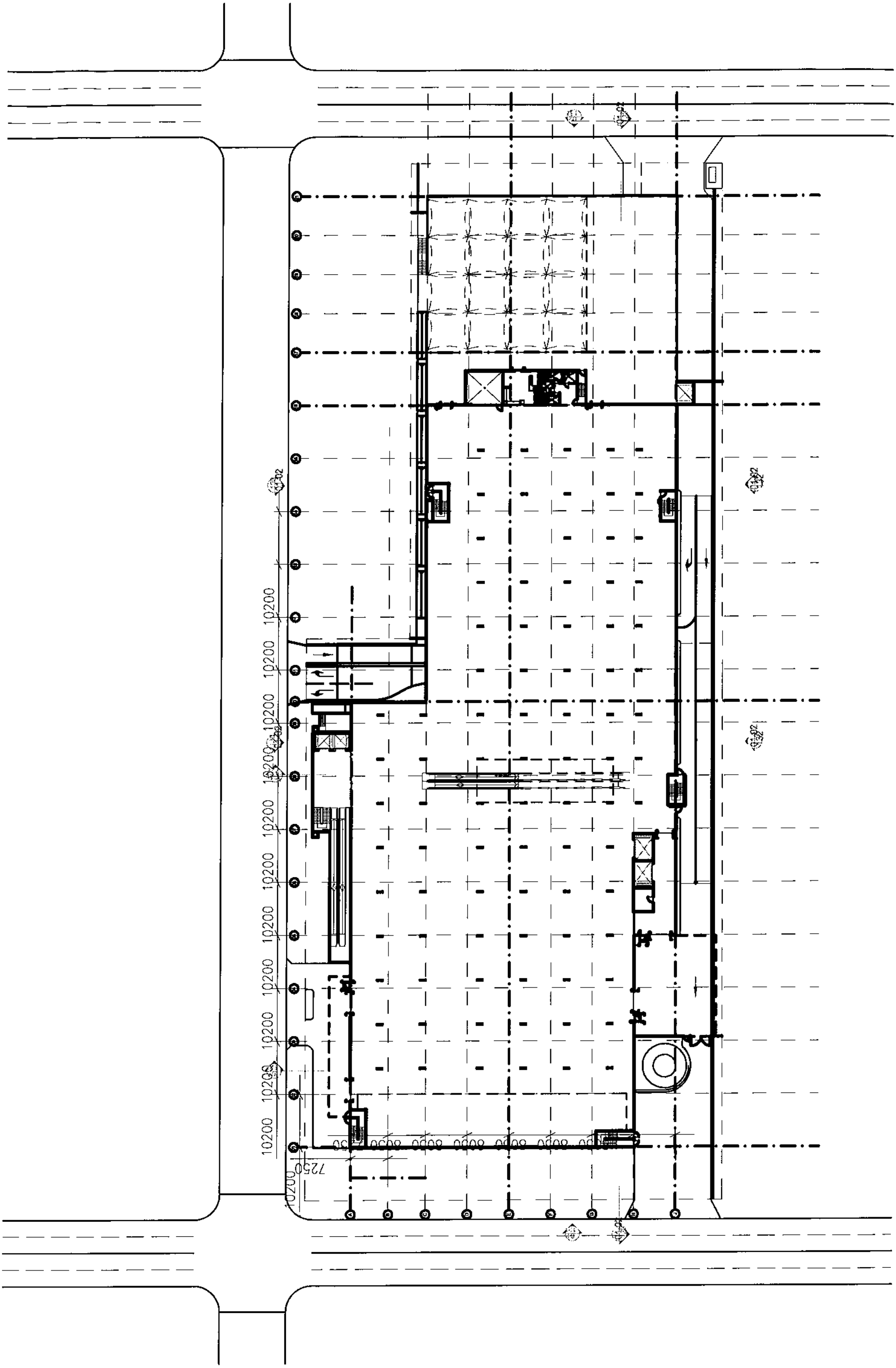

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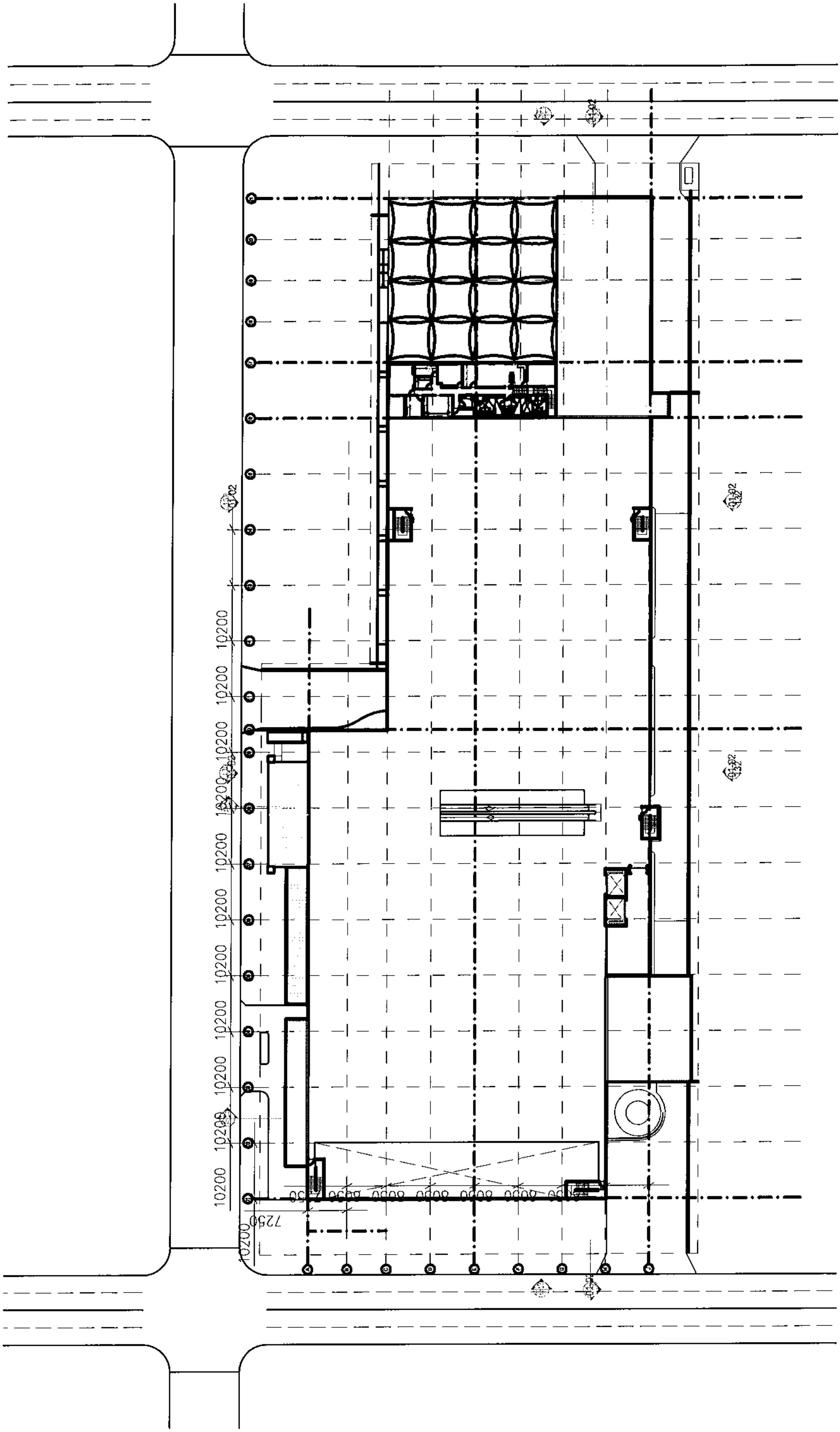
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3. ROAD NETWORK AND TRAFFIC CONTROLS

3.1 ROAD NETWORK

The road network serving the site (Figure 3) comprises:

∗ *Cumberland Highway (Smithfield Road)* – a State Road and arterial route which provides a principal north-south route across the western part of the metropolitan area

∗ *Victoria Street* – a State Road and major collector road route running parallel and to the north of The Horsley Drive

∗ *The Horsley Drive* – a Regional Road and major collector route providing a link between Villawood and Horsley Park

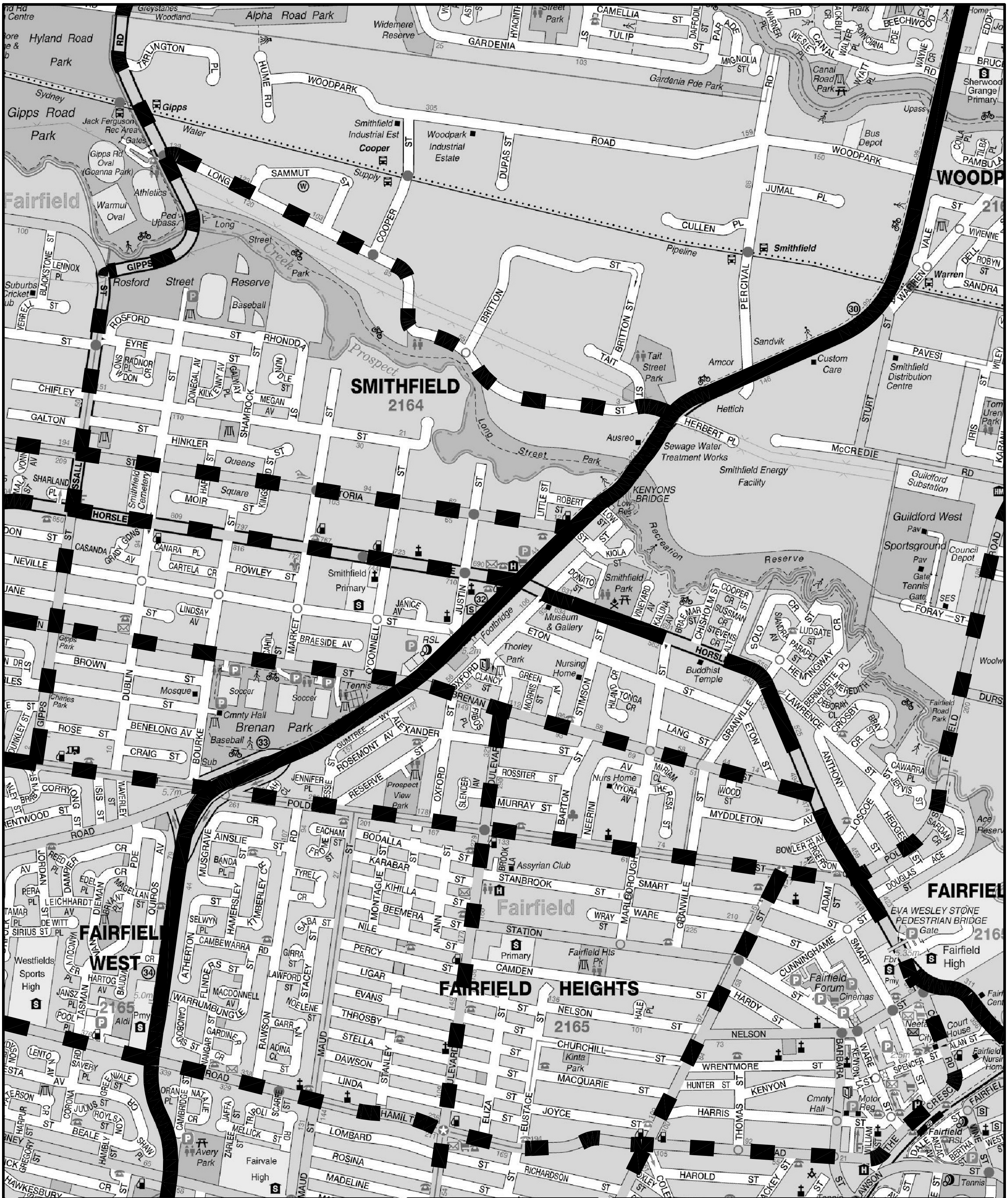
∗ *Hassall Street* – a State Road and sub-arterial route connecting between The Horsley Drive and Great Western Highway

∗ *O'Connell Street* – local access road running between Brennan Street and Chifley Street.

3.2 TRAFFIC CONTROLS

The existing traffic controls which have been applied to the road system in the area (Figure 4) comprise:

∗ the pedestrian crossing traffic signals on The Horsley Drive just to the west of O'Connell Street. Details of this facility are provided on the design plan provided overleaf



LEGEND

ARTERIAL

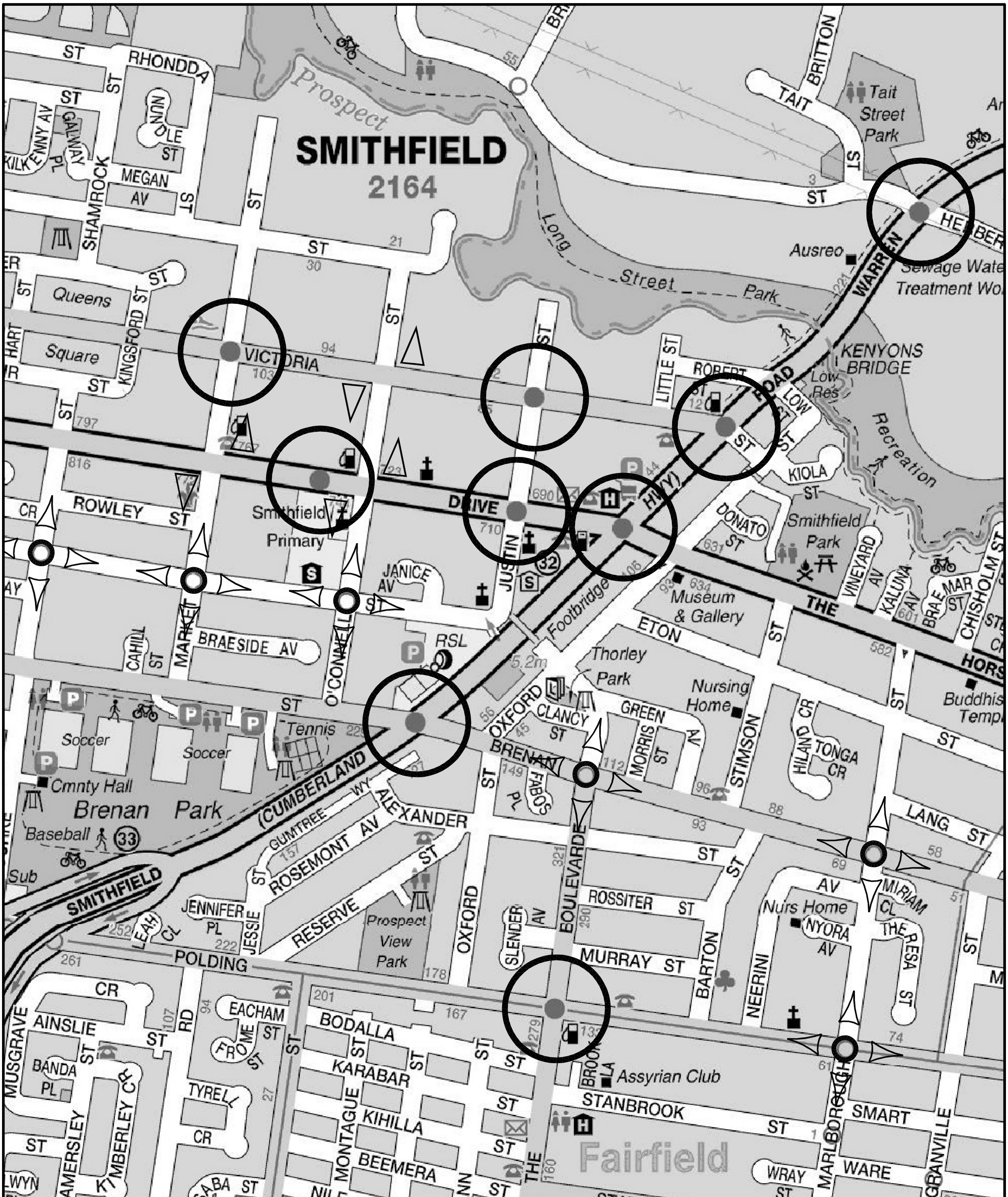
SUB-ARTERIAL

COLLECTOR

N

ROAD NETWORK

FIG 3



Legend

- TRAFFIC SIGNAL CONTROL
- ROUNDABOUT
- RESTRICTED TURNING MOVEMENT

N

Traffic Controls

Fig 4

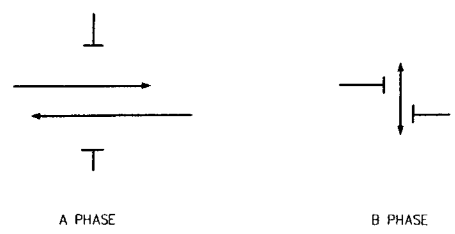
0609.156.VV.2158

DATE IN SERVICE : 00/00/00

RTA

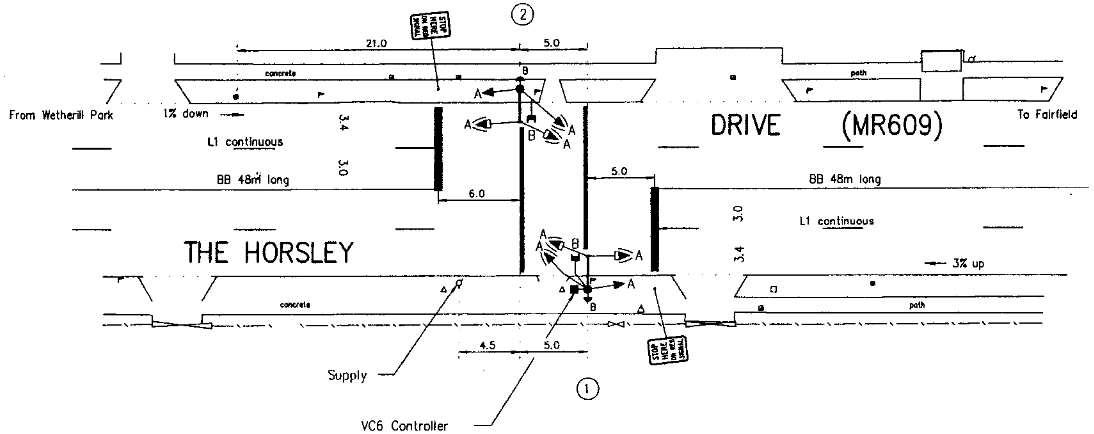
NOTES

1. This site is SCATS linked.
2. All push buttons are audio tactile.
3. Kerb ramps to be constructed at pedestrian crossing in accordance with the fig. 8 of AS1428.1-1993, ground tiles to be excluded from the ramps.



MOVEMENTS

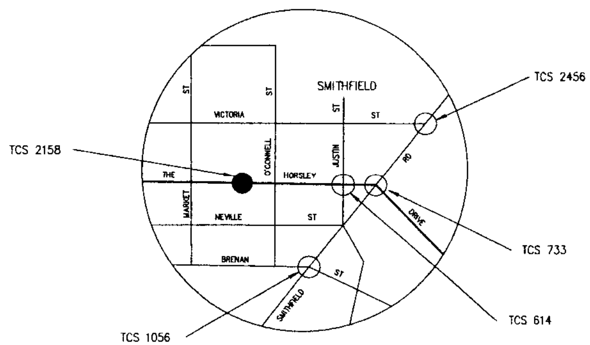
WAREHOUSES



SMITHFIELD PUBLIC SCHOOL

POSTS

POST	TYPE	REMARKS
1	5S	NEW
2	5S	NEW



LOCALITY

A ORIGINAL ISSUE
B Issue Office inst. 17/11/92 'A' lanterns wired to same group. P.G.
C Issue Jl SM121 24/1/00 Amended stop lines. Added Stop on red signs. 10/2/00 S.H.

PUBLIC UTILITY LEGEND	
HYDRANT	
STOP VALVE	
GAS VALVE	
SEWER MANHOLE	
TELECOM PIT	
ELECT LIGHT POLE	
POWER POLE	
STAY POLE	
TELEPHONE BOX	
TELECOM PILLAR	

REFERENCE PLANS	
SYMBOLS/ABBS.	V0003-6
STD POST	V0001-5
DET SCHED EXP	V0018-10
PRES. DETECT.	2C005-9
SSC DIS. SEQ.	V0018-8
SURVEYOR : G. CLARK	
DATE : AUG 1992	

U.B.D. Ref. 229 H4
I.S.G. CO-ORDS E. 293800 N. 1252700
DESIGNED L. NAGY
CHECKED G. RUTTER
L. NAGY SITE CHECKED
D. REID RECOMMENDED

APPROVED
SIGNED
T. McGRATH NAME
DES & EST MANAGER POSITION
FOR DIV. ENG. PARRAMATTA
8th OCTOBER 1992 DATE

Roads and Traffic Authority, N.S.W

CITY OF FAIRFIELD
THE HORSLEY DR (MR609)
WEST OF O'CONNELL ST
SMITHFIELD

DESIGN LAYOUT TCS No 2158

DESIGN OFFICE PARRAMATTA – SYDNEY TECHNICAL SERVICES
CADD DRAWING FILE: VV2158_1C.dgn
SCALE (1:200)
ISSUE C
FILE 156.TS.338
SUPERSEDES SHEET 1A
REGN. 0609.156.VV.2158
SHEET 1

* the traffic signals along Cumberland Highway including the Brennan Street, The Horsley Drive and Victoria Street intersections

* the traffic signals along The Horsley Drive including the Justin Street intersection

* the 60 kmph speed restrictions on The Horsley Drive and 50 kmph restriction on O'Connell Street with 40 kmph school restrictions adjacent to the Primary School

* the GIVE WAY sign control on O'Connell Street at the Victoria Street intersection

* the roundabout at the O'Connell Street/Neville Street intersection

* the approved B Double routes along The Horsley Drive and Victoria Street (but not along O'Connell Street).

3.3 TRAFFIC CONDITIONS

An indication of traffic conditions on the road network in the vicinity of the development site is provided by data published by the RTA and traffic surveys undertaken for this study. The data published by the RTA is expressed in terms of Annual Average Daily Traffic (AADT) and the most recent published data is provided in the following:

	AADT		
	1999	**2002**	**2005**
The Horsley Drive east of O'Connell Street	22,336	18,240	19,645

The results of surveys undertaken at and near The Horsley Drive and O'Connell Street intersections during the weekday afternoon and Saturday midday peak periods are provided in Appendix A and summarised in the following:

		AM	PM	Sat MD
The Horsley Drive	Eastbound	677	450	530
	Right-turn	28	31	17
	Left-turn	30	34	19
	Westbound	483	646	502
	Right-turn	47	46	31
	Left-turn	33	32	13
O'Connell Street	Northbound	8	10	5
	Right-turn	15	16	13
	Left-turn	69	63	26
	Southbound	4	26	12
	Right-turn	3	11	13
	Left-turn	16	26	23
O'Connell Street	Northbound	-	15	9
	Right-turn	-	22	20
	Left-turn	-	56	44
	Southbound	-	11	7
	Right-turn	-	14	5
	Left-turn	-	108	34
Victoria Street	Eastbound	-	630	346
	Right-turn	-	12	11
	Left-turn	-	8	5
	Northbound	-	579	310
	Right-turn	-	45	32
	Left-turn	-	31	31

The operational performance of the road system in the area is relatively satisfactory with the traffic signal controls providing access onto and across the major road routes.

4. ACCESS

The existing industrial development on the site has vehicle accesses on the O'Connell Street and The Horsley Drive frontages.

The proposed vehicle access arrangements would comprise:

* an ingress driveway for cars and delivery vehicles with an adjacent egress driveway for car on Victoria Street at the eastern boundary well removed from O'Connell Street intersection

* a combined ingress/egress driveway midway along the O'Connell Street frontage

* separate ingress and egress driveways on O'Connell Street for customer goods pick-up

* an egress driveway on The Horsley Drive at the eastern boundary for delivery vehicles.

The roadways are straight and level in the vicinity of the proposed accesses with good sight distance available and it is intended that the existing superfluous access driveways be removed and the footway/kerb and gutter reinstated.

In order to provide suitable operating conditions and relieve the existing road safety circumstances it is proposed to relocate the existing pedestrian signals on The Horsley Drive and incorporate them into traffic signal control at the O'Connell Street intersection and this proposal has been the subject of discussion with the RTA.

5. TRAFFIC

The existing small repairs business and previous recycling depot use on the site would generate some 40 to 50 vtph during the morning and afternoon peak periods.

TTPA have undertaken surveys and assessed data provided by Bunnings for existing comparable stores in NSW and Vic. The outcomes of that assessment are provided in the following:

	Traffic Generation vtph per 100m^2 GFA			
	Warehouse Area	**AM**	**PM**	**WE Midday**
Altona (Vic)	9199m^2	0.71	3.77	6.00
North Parramatta	9800m^2	0.73	2.38	6.16
Hyder 6 sites Sydney Metro Area (av 10,000m^2)		NA	2.39	NA
Thomastown (Vic)	10625m^2	NA	2.56	5.11
Minchinbury	11932m^2	0.63	2.20	4.40
Penrith	13500m^2	NA	1.80	4.37
Box Hill (Vic)	13762m^2	0.48	1.68	3.59

It is apparent that the peak traffic generation rates for Bunnings per 100m^2 GFA decrease as the floorspace increases. It is also relevant (and quite inevitable) that these traffic generation rates will decrease as:

- additional Bunnings stores open as part of the current expansion program
- additional new bulky goods hardware stores are opened by Bunnings competitors (ie Woolworths and Mitre 10/Metcash).

The proposed Smithfield store with 2 levels will be unlike existing Bunnings stores and assessment by Peter Leyshon Consulting (Appendix D) undertaken in relation to the proposed two-level Chatswood store indicates that trading on the second level will reflect a normal ‘constrained’ retail characteristic of 60% of the lower level.

The adopted traffic generation rates per 100m^2 relative to the proposed development are:

AM	PM	WE MD
0.64 vtph	2.35 vtph	4.5 vtph

On this basis the projected peak traffic generation for the proposed store will be as follows:

	AM	PM	Sat MD
Lower Level 6,072m^2	38	142	274
Upper Level 7,415m^2	28	104	200
Total	**66 vtph**	**246 vtph**	**474 vtph**

The ingress/egress distribution of these trips will reflect existing store patterns of:

AM		PM		Sat MD	
IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**
60%	40%	44%	56%	50%	50%

Thus the traffic generation for the development will comprise:

	TOTAL TRIPS					
	AM		**PM**		**Sat MD**	
	IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**
Projected	40	26	82	104	167	167

PASSING TRADE					
AM		**PM**		**Sat MD**	
IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**
-	-	30	30	70	70

Other issues which will impact on the 'nett' traffic circumstance resultant to the proposed development are the normal 'passing trade' factor traffic. The traffic generation of retail type uses, have an element of 'passing trade/diverted trips' (ie vehicles which are already on the road system serving the site) and research undertaken in relation to 'diverted' trips indicates representative factors for normal retail trade of 25% weekday and 30% weekend. However, the adopted trip factors for the envisaged bulky goods development with its limited 'main road' exposure are as follows:

	PM	**Sat**
Bunnings	20%	25%

The projected distribution is as follows:

The Horsley Drive west	25%
The Horsley Drive east	30%
Victoria Street west	15%
Victoria Street east	20%
O'Connell Street south	10%

The projected future (post development) traffic movements at the access intersections during the weekday afternoon and weekend midday periods (without discount of existing site generation) are as follows:

		WD PM	**WE MD**
The Horsley Drive	Eastbound	440	510
	Right-turn	31	17
	Left-turn	64	62
	Westbound	636	482
	Right-turn	81	101
	Left-turn	32	13
O'Connell Street	Northbound	18	21
	Right-turn	16	13
	Left-turn	63	26
	Southbound	36	28
	Right-turn	47	75
	Left-turn	67	93

		WD PM	WE MD
Victoria Street	Eastbound	642	370
	Right-turn	14	16
	Left-turn	8	5
	Westbound	593	334
	Right-turn	45	22
	Left-turn	31	31
O'Connell Street	Northbound	15	49
	Right-turn	22	20
	Left-turn	59	5
	Southbound	11	7
	Right-turn	14	5
	Left-turn	108	34

The potential implications of this traffic outcome for the access intersections have been assessed in terms of the operational performance and the results of that assessment undertaken with SIDRA which are summarised in the following:

	PM			Sat MD		
	LOS	**DS**	**AVD**	**LOS**	**DS**	**AVD**
The Horsley Dr and O'Connell St	B	0.432	15.5	B	0.509	23.0
Victoria Street and O'Connell Street	A-C	0.293	3.5	A-B	0.169	2.7

The criteria for interpreting SIDRA output are reproduced overleaf and the results of this operational performance assessment indicate that the proposed development will have a satisfactory traffic outcome (subject to the proposed provision of traffic signals at The Horsley Drive intersection).

Criteria for Interpreting Results of SIDRA Analysis

1. Level of Service (LOS)

LOS	Traffic Signals and Roundabouts	Give Way and Stop Signs
'A'	Good	Good
'B'	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
'C'	Satisfactory	Satisfactory but accident study required
'D'	Operating near capacity	Near capacity and accident study required
'E'	At capacity; at signals incidents will cause excessive delays. Roundabouts require other control mode	At capacity and requires other control mode
'F'	Unsatisfactory and requires additional capacity	Unsatisfactory and requires other control mode

2. Average Vehicle Delay (AVD)

The AVD provides a measure of the operational performance of an intersection as indicated on the table below which relates AVD to LOS. The AVD's listed in the table should be taken as a guide only as longer delays could be tolerated in some locations (ie inner city conditions) and on some roads (ie minor side street intersecting with a major arterial route).

Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way and Stop Signs
A	less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals incidents will cause excessive delays Roundabouts require other control mode	At capacity and requires other control mode

3. Degree of Saturation (DS)

The DS is another measure of the operational performance of individual intersections.

For intersections controlled by **traffic signals**[1] both queue length and delay increase rapidly as DS approaches 1, and it is usual to attempt to keep DS to less than 0.9. Values of DS in the order of 0.7 generally represent satisfactory intersection operation. When DS exceeds 0.9 queues can be anticipated.

For intersections controlled by a **roundabout or GIVE WAY or STOP signs**, satisfactory intersection operation is indicated by a DS of 0.8 or less.

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1 *the values of DS for intersections under traffic signal control are only valid for cycle length of 120 secs*

6. PARKING

Fairfield City Council's DCP specifies a parking provision in relation to bulky goods use of 1 space per 50m^2 GLA. However, survey and research of 9 existing Bunnings warehouse stores provides a comprehensive indication of the intrinsic parking demands for Bunnings. The peak demands occur on weekends the established peak parking demand characteristics are summarised in the following:

	Warehouse Floorarea	
North Parramatta	9,800m^2	2.7 spaces per 100m^2
Thomastown	10,625m^2	1.37 spaces per 100m^2
Minchinbury	11,932m^2	2.0 spaces per 100m^2
Penrith	13,500m^2	1.17 spaces per 100m^2
Hoopers Crossing	11,169m^2	1.74 spaces per 100m^2
Scoresby	11,882m^2	2.51 spaces per 100m^2
Mornington	10,599m^2	2.39 spaces per 100m^2
Box Hill	13,762m^2	1.41 spaces per 100m^2
Nunawading*	13,793m^2	2.84 spaces per 100m^2

* *Bunnings top trading store*

The envisaged Smithfield store of 13,487m^2 will have some 378 parking spaces which equates to a rate of 2.80 spaces per 100m^2 (or 1 space per 35.7m^2). It is apparent that this provision will be quite adequate even for peak seasonal demands as it will be:

- ∗ more than the average peak demand of the 9 stores
- ∗ equivalent to than that of the peak demand at Bunnings top trading store.

7. CONCLUSION

The proposed Bunnings warehouse development at Smithfield will utilise the relatively large site which has convenient access to the arterial road system. This assessment has concluded that:

∗ the development will not result in any adverse traffic impacts on the road system serving the site

∗ the proposed signals at the O'Connell Street/The Horsley Drive intersection will provide a good level of intersection operation, including the Saturday peak trading period

∗ on-site parking will be more than adequate to satisfy peak demands.

Appendix A

TRAFFIC SURVEYS

R.O.A.R. DATA
Reliable, Original & Authentic Results
Ph.88196847, Fax 88196849, Mob.0418-239019

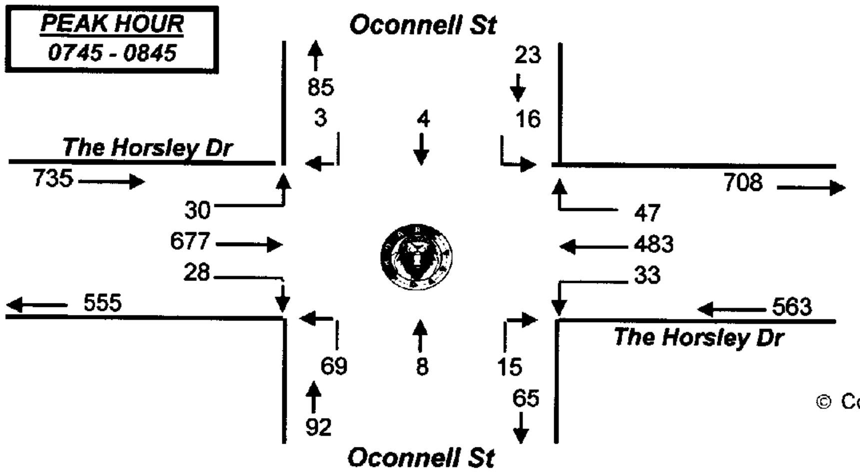
Client : T.T.P.A.
Job No/Name : SMITHFIELD Oconnell St
Day/Date : Friday 19th March 2010

All Vehicles	NORTH			WEST			SOUTH			EAST			
	Oconnell St			The Horsley Dr			Oconnell St			The Horsley Dr			
Time Per	L	T	R	L	T	R	L	T	R	L	T	R	TOT
0700 - 0715	2	0	2	3	187	1	1	2	1	0	95	14	308
0715 - 0730	2	0	2	6	192	1	5	5	3	0	104	13	333
0730 - 0745	4	2	0	6	168	1	3	5	1	1	115	11	317
0745 - 0800	2	1	0	5	161	1	8	2	2	3	140	19	344
0800 - 0815	7	1	1	6	170	6	16	3	4	3	123	6	346
0815 - 0830	3	1	2	10	164	9	25	1	2	8	95	10	330
0830 - 0845	4	1	0	9	182	12	20	2	7	19	125	12	393
0845 - 0900	4	2	2	6	128	12	19	4	6	17	128	5	333
Period End	28	8	9	51	1352	43	97	24	26	51	925	90	2704

All Vehicles	NORTH			WEST			SOUTH			EAST			
	Oconnell St			The Horsley Dr			Oconnell St			The Horsley Dr			
Time Per	L	T	R	L	T	R	L	T	R	L	T	R	TOT
1500 - 1515	4	5	4	11	113	9	28	3	6	10	131	18	342
1515 - 1530	11	4	3	10	112	6	16	3	7	11	161	9	353
1530 - 1545	5	5	1	8	129	9	12	3	2	6	181	11	372
1545 - 1600	6	12	3	5	96	7	7	1	1	5	173	8	324
1600 - 1615	2	3	6	8	118	6	5	4	0	2	166	8	328
1615 - 1630	2	3	3	10	118	11	6	1	2	0	175	9	340
1630 - 1645	4	10	4	6	122	5	9	1	0	3	174	11	349
1645 - 1700	6	2	7	4	111	6	3	2	3	6	140	9	299
1700 - 1715	9	4	5	6	96	5	3	2	2	5	137	14	288
1715 - 1730	2	3	8	3	125	5	5	2	0	1	184	9	347
1730 - 1745	3	8	5	3	110	1	3	3	0	4	177	12	329
1745 - 1800	4	5	4	7	139	4	3	2	1	1	185	9	364
Period End	58	64	53	81	1389	74	100	27	24	54	1984	127	4035

	NORTH			WEST			SOUTH			EAST			
	Oconnell St			The Horsley Dr			Oconnell St			The Horsley Dr			
Peak Time	L	T	R	L	T	R	L	T	R	L	T	R	TOT
0700 - 0800	10	3	4	20	708	4	17	14	7	4	454	57	1302
0715 - 0815	15	4	3	23	691	9	32	15	10	7	482	49	1340
0730 - 0830	16	5	3	27	663	17	52	11	9	15	473	46	1337
0745 - 0845	16	4	3	30	677	28	69	8	15	33	483	47	1413
0800 - 0900	18	5	5	31	644	39	80	10	19	47	471	33	1402
PEAK HOUR	16	4	3	30	677	28	69	8	15	33	483	47	1413

	NORTH			WEST			SOUTH			EAST			
	Oconnell St			The Horsley Dr			Oconnell St			The Horsley Dr			
Peak Time	L	T	R	L	T	R	L	T	R	L	T	R	TOT
1500 - 1600	26	26	11	34	450	31	63	10	16	32	646	46	1391
1515 - 1615	24	24	13	31	455	28	40	11	10	24	681	36	1377
1530 - 1630	15	23	13	31	461	33	30	9	5	13	695	36	1364
1545 - 1645	14	28	16	29	454	29	27	7	3	10	688	36	1341
1600 - 1700	14	18	20	28	469	28	23	8	5	11	655	37	1316
1615 - 1715	21	19	19	26	447	27	21	6	7	14	626	43	1276
1630 - 1730	21	19	24	19	454	21	20	7	5	15	635	43	1283
1645 - 1745	20	17	25	16	442	17	14	9	5	16	638	44	1263
1700 - 1800	18	20	22	19	470	15	14	9	3	11	683	44	1328
PEAK HOUR	26	26	11	34	450	31	63	10	16	32	646	46	1391



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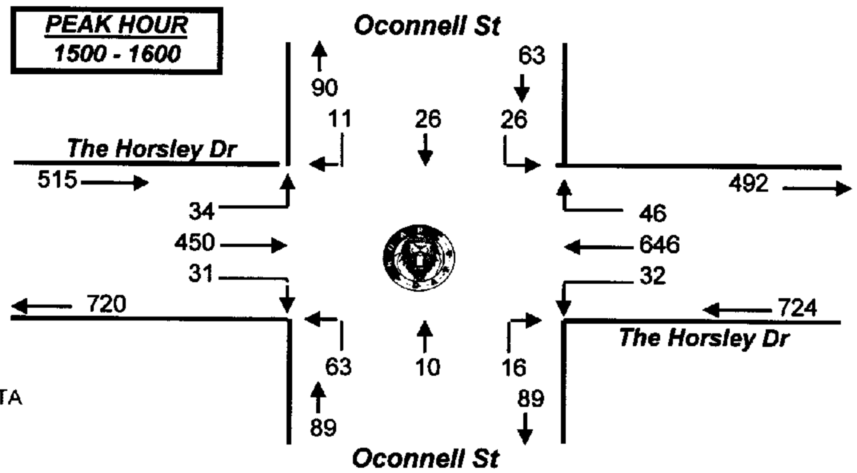


R.O.A.R. DATA

Reliable, Original & Authentic Results

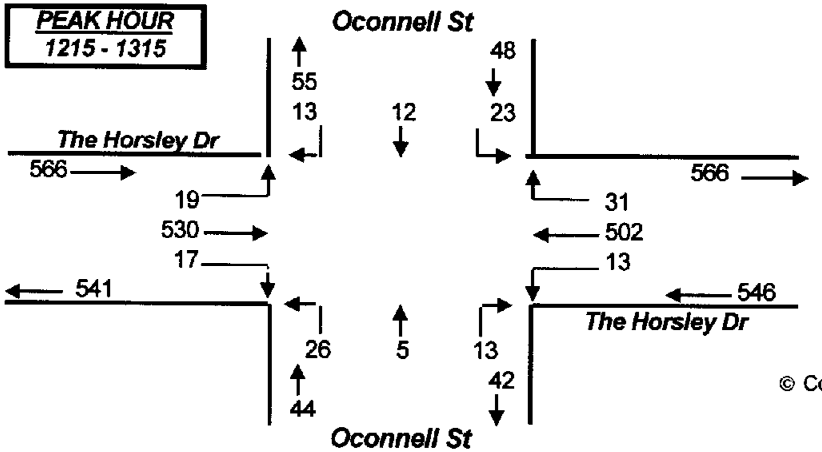
Ph.88196847, Fax 88196849, Mob.0418-239019

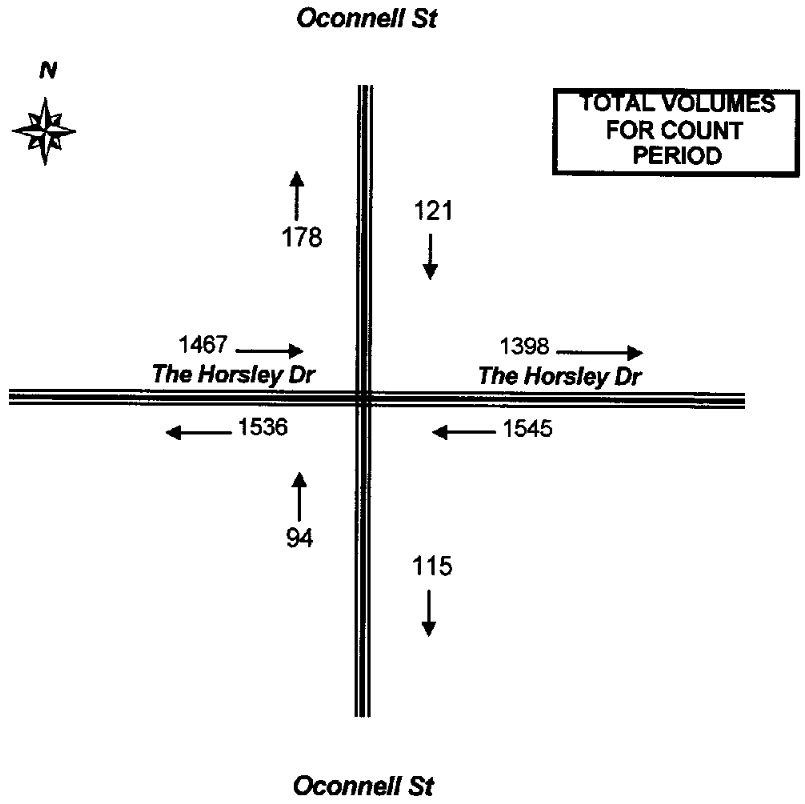
Client : T.T.P.A.
Job No/Name : SMITHFIELD Oconnell St
Day/Date : Saturday 20th March 2010

All Vehicles	NORTH			WEST			SOUTH			EAST			
	Oconnell St			The Horsley Dr			Oconnell St			The Horsley Dr			
Time Per	L	T	R	L	T	R	L	T	R	L	T	R	TOT
1200 - 1215	1	4	2	7	125	6	2	1	2	4	117	5	276
1215 - 1230	7	6	4	5	138	5	3	1	3	2	118	13	305
1230 - 1245	6	1	5	5	127	0	2	1	5	4	113	5	274
1245 - 1300	2	1	1	6	131	6	13	2	3	3	126	9	303
1300 - 1315	8	4	3	3	134	6	8	1	2	4	145	4	322
1315 - 1330	2	2	2	7	102	3	5	0	0	1	124	8	256
1330 - 1345	2	4	9	5	108	7	1	1	1	0	120	3	261
1345 - 1400	2	8	2	7	91	0	5	2	5	3	89	3	217
1400 - 1415	1	2	3	14	96	2	7	0	0	0	149	10	284
1415 - 1430	4	5	7	9	100	5	6	2	0	1	109	15	263
1430 - 1445	0	2	2	5	93	4	4	1	0	3	110	3	227
1445 - 1500	1	3	3	8	94	3	1	2	2	1	116	5	239
Period End	36	42	43	81	1339	47	57	14	23	26	1436	83	3227

	NORTH			WEST			SOUTH			EAST			
	Oconnell St			The Horsley Dr			Oconnell St			The Horsley Dr			
Peak Time	L	T	R	L	T	R	L	T	R	L	T	R	TOT
1200 - 1300	16	12	12	23	521	17	20	5	13	13	474	32	1158
[redacted]	23	12	13	19	530	17	26	5	13	13	502	31	1204
1230 - 1330	18	8	11	21	494	15	28	4	10	12	508	26	1155
1245 - 1345	14	11	15	21	475	22	27	4	6	8	515	24	1142
1300 - 1400	14	18	16	22	435	16	19	4	8	8	478	18	1056
1315 - 1415	7	16	16	33	397	12	18	3	6	4	482	24	1018
1330 - 1430	9	19	21	35	395	14	19	5	6	4	467	31	1025
1345 - 1445	7	17	14	35	380	11	22	5	5	7	457	31	991
1400 - 1500	6	12	15	36	383	14	18	5	2	5	484	33	1013

PEAK HOUR	23	12	13	19	530	17	26	5	13	13	502	31	1204





Appendix B

PETER LEYSHON ASSESSMENT

LEYSHON CONSULTING

Suite 1106 Level 11
109 Pitt Street, Sydney
NSW Australia 2000

Telephone 61 2 9224 6111
Facsimile 61 2 9224 6150
ABN 12 003 203 709

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8 July, 2008

Mr Rob Orr
John R Brogan & Associates
37 Pitt Street
SYDNEY NSW 2000

Dear Mr Orr

RE: PROPOSED BUNNINGS WAREHOUSE CHATSWOOD – PARKING PROVISION

I write in relation to your recent request for advice on the potential trading characteristics and hence influence on parking demand of a proposed two-level Bunnings Warehouse at Chatswood. I understand that Willoughby City Council (Council) has requested advice on the difference in terms of parking provision of a two-level store as opposed to single level Bunnings Warehouse.

There is no clear evidence of how a two-level Bunnings (as is proposed at Smith Street, Chatswood) will perform from a retail perspective and thus affect parking demand. It is our understanding that at present Bunnings does not operate any such stores in Australia from which observations could be made.

We are aware that in multi-level department stores, retail sales intensity (measured on a sq.m. basis) declines progressively as the floor level rises. The same is generally true of multi-level shopping centres.

The highest sales intensity of multi-level department stores is on the ground level. Consequently, stores tend to allocate products with slower "stock turns" or products which comprise a small proportion of total turnover to higher floors.

This phenomenon can be mitigated to some extent if access is available from multi-level car parking directly to upper floors or if the store allocates space on an upper level to a high volume product group. An example of the latter is found in Myer Central Plaza where consumer electronics are located on the top floor to try and "drag" customers up from lower levels.

In relation to the proposed Bunnings at Smith Street, Chatswood much will depend on how the store is merchandised. If, for example, the majority of low volume departments such as flooring, outdoor furniture, kitchens and cupboards, craft supplies and lighting are allocated to the first floor then there could be a large disparity between the sales rate achieved on the ground floor and that on the first level. I would anticipate that the sales rate (that is, $ per sq.m. of floorspace) achieved by the second level could be up to 50% less than that of the ground floor.

It is also likely that a reasonable percentage of shoppers at the store may reduce their time in the store per trip. This would result from a lower propensity on the part of shoppers to "browse" the total offering of the store if merchandise is displayed on two levels rather than one.

Given the above, I consider it would be unreasonable to expect that the traffic generation rate of a two-level Bunnings Warehouse would be the same on a sq.m. basis as would that of a single level store. As a very broad estimate, I consider the second level floorspace may only generate half the level of traffic as would the ground level.

I trust the above is of assistance to Bunnings as well as Council. Please contact me on 9224-6111 or pdl@leycon.com.au if any further information can be provided.

Yours sincerely

LEYSHON CONSULTING PTY LTD

PETER LEYSHON

DIRECTOR.

Appendix C

DIVERTED TRIP RESEARCH

F LINKED TRIPS

Traffic generation data for movements in and out of certain development types is readily available. However, there is a need to understand how much of the generated traffic is new and how much is already on the road network prior to opening of the development.

Historically, traffic impact assessments conservatively assumed that all generated traffic was new. More recently, 'discounts' have been applied to generated traffic to account for the 'drop in' component, which is not new traffic to the network.

Research undertaken on this subject has concluded that it is appropriate to make adjustments to generated traffic due to linked trips.

Definitions

Trips can be broadly categorised into the following types:

Linked Trip A journey where there is a chain of stops from origin to ultimate destination. A trip from home to work with stops at school and the post office comprises three linked trips:

- home to school;
- school to post office; and
- post office to work.

Unlinked Trip A journey with no intermediate stops.

For the purposes of a RIA, the following three types of trips are commonly used;

New Trip In traffic impact studies, unlinked trips are generally referred to as new trips. These are trips attracted to the development and without the development would not have been made – hence a new trip.

Diverted Drop In Trips A linked trip from an origin to a destination that has made a significant network diversion to use the new development.

Undiverted Drop In Trips A linked trip from an origin to a destination that previously passed the development site. This is also referred to as a 'pass by' trip and the new development is an intermediate stop on a trip that is made from an origin to a destination.

The diverted and undiverted drop in trips are considered to be trips that are already part of the existing flows on the road network.

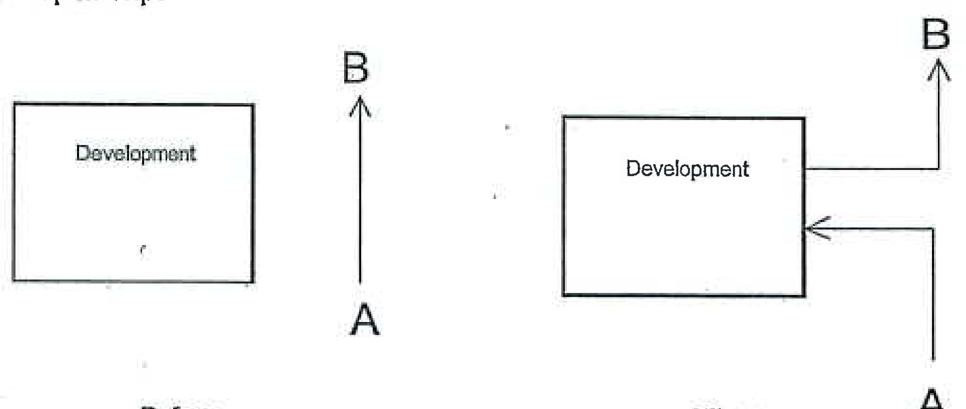
The treatment of the different trip types varies with the level of assessment. Hallam (1988) provides a reasoned basis for separating assessment into three levels:

- Regional Assessment – consideration of the impact of a development in the context of the total urban area;

- Local Assessment – consideration of the effect of a development over a substantial area focussed on the development; and
- Access Level – micro level assessment.

At the regional level, insertion of a new development could be considered to only increase travel by the new trips proportion of generation. Diverted and undiverted drop in trips would already be on the network.

Undiverted Drop In Trips



Before
Trip passes development site on route from A to B.

After
Trip which was previously passing the site drops in to development on route from A to B

Note: One original pass by trip becomes 2 drop in trips (1 in and 1 out)

A RIA is usually conducted over a limited part of the network. At a local level, both the new trips and diverted drop in trips are introduced into the area and represent additional trips on the local network. This local network may contain roads of regional significance. The undiverted drop in trips to developments on roads of regional significance can be regarded as already on the local network. It is important that these trips are considered. They must be rerouted from movements past the development to movements into and out of the development. For every two development trips assigned as undiverted drop in trips (1 in/1 out), one through trip should be removed from passing traffic.

In 1995, Eppell Olsen & Partners carried out surveys for Main Roads to segment traffic generation for specific developments. The results of these surveys are documented in the report, *Development Traffic Surveys: Linked/Unlinked Trips*.

The segmentation of traffic generation for shopping centres and fast food outlets is shown below:

Development	Trip Segmentation		
	New (%)	Diverted Drop In (%)	Undiverted Drop In (%)
Shopping Centres >20 000 m^2	63	18	19
Shopping Centre 3 000 m^2 – 20 000 m^2	50	22	28
Shopping Centres <3 000 m^2	50	32	18
Fast Food Outlets	40	25	35

Shopping Centres

The traffic generated by shopping centres is most influenced by the proximity of other centres. On site facilities such as cinemas, restaurants etc. can also have a significant impact on generation rates.

Thursday design generation rates are shown on Figure 2A.4 while Saturday rates are included as Figure 2A.5. Survey results indicate that during these peak hour periods the in/out proportion is approximately 50/50.

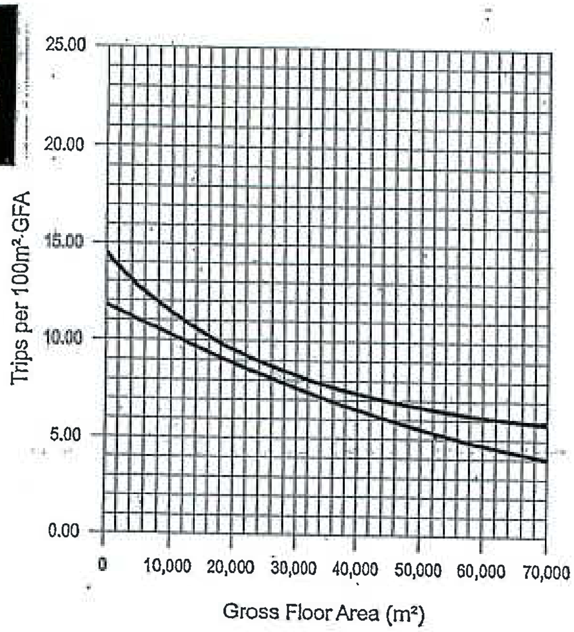


Figure 2A.1 SEQ Shopping Centre Generation (Thursday Afternoon peak)

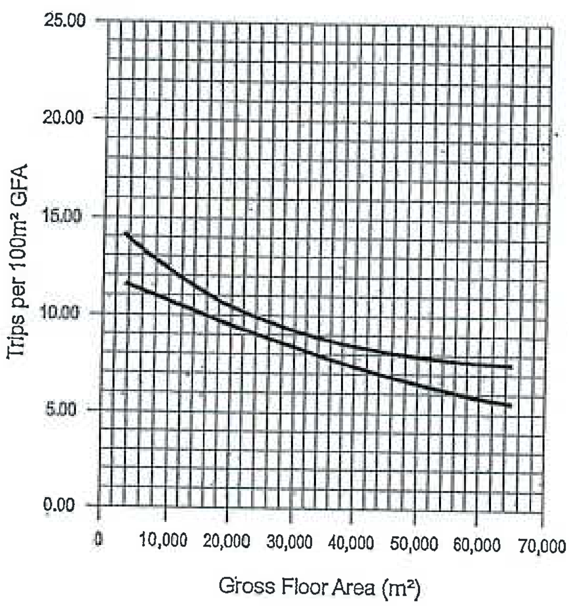


Figure 2A.2 SEQ Shopping Centre Generation (Saturday peak)

Considering the adjacent road network, three shopping centre trip types have been defined as follows:

- New Trips

Trips that would not have appeared on the immediate approaches, local street network or regional road network prior to the opening of the shopping centre. These trips only appear as a consequence of the opening of the centre.

- Diverted Trips

Linked trips (i.e. in conjunction with another trip purpose) which are diverted off the regional road network to access the shopping centre.

- Drop-In Trips

Linked trips that would have appeared in the local road network irrespective of the presence of the shopping centre.

Research undertaken by Hallam that developed the rates shown in Table 2A.7 for estimating the proportion of drop-in and diverted trips.

Table 2A.7 Proportion of Drop-in and Diverted Trips

Trip Type	Proportion of Trips Thursday	Proportion of Trips Saturday
New Trip	50%	68%
Diverted Trip	30%	20%
Drop-in Trip	20%	12%

Studies undertaken in the USA suggest the factors in Table 2A.8 are applicable to the above percentages to accommodate different diverted pattern trips for different sized centres.

Table 2A.8 Factors in Drop-in and Diverted Trips

Shopping Centre Size	Factors to be Applied to Proportion of Drop-in and Diverted Trips
0 - 10,000 m²	1.2
10,000 - 35,000 m²	1.0
> 35,000 m²	0.8

Upon determining the proportion of drop-in and diverted trips the traffic discounts in Table 2A.9 would be applicable.

Table 2A.9 Trip Discounts

Road Network Element	Trip Discounts Applicable
Immediate approach and site access	None
Local Road Network	Drop-in Trips
Regional Road Network	Drop-in + Diverted Trips

Appendix D

SIDRA RESULTS

MOVEMENT SUMMARY

Site: Weekday PM

The Horsley Drive (Signals)

Signals - Fixed Time   Cycle Time = 120 seconds

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: South approach											
1	L	66	0.0	0.406	38.3	LOS C	3.8	26.8	0.73	0.74	29.2
2	T	19	0.0	0.072	30.6	LOS C	3.8	26.8	0.73	0.55	30.7
3	R	17	0.0	0.072	38.8	LOS C	2.2	15.3	0.73	0.78	29.6
Approach		102	0.0	0.406	37.0	LOS C	3.8	26.8	0.73	0.71	29.5
East: The Horsley Drive east											
4	L	34	0.0	0.428	17.8	LOS B	11.2	78.4	0.37	0.98	41.4
5	T	669	0.0	0.427	10.3	LOS A	11.2	78.4	0.39	0.34	45.2
6	R	85	0.0	0.428	19.8	LOS B	8.7	61.2	0.42	0.91	39.7
Approach		788	0.0	0.427	11.6	LOS A	11.2	78.4	0.39	0.43	44.4
North: North approach											
7	L	71	0.0	0.432	38.4	LOS C	4.1	28.4	0.74	0.74	29.1
8	T	38	0.0	0.180	31.9	LOS C	5.1	35.6	0.76	0.61	29.9
9	R	49	0.0	0.181	40.1	LOS C	5.1	35.6	0.76	0.80	29.0
Approach		158	0.0	0.432	37.4	LOS C	5.1	35.6	0.75	0.73	29.3
West: The Horsley Drive west											
10	L	67	0.0	0.295	16.9	LOS B	7.3	51.2	0.32	0.93	41.8
11	T	463	0.0	0.295	9.5	LOS A	7.3	51.2	0.34	0.30	46.1
12	R	33	0.0	0.295	18.7	LOS B	6.2	43.2	0.36	0.95	40.6
Approach		563	0.0	0.295	10.9	LOS A	7.3	51.2	0.34	0.41	45.2
All Vehicles		1612	0.0	0.432	15.5	LOS B	11.2	78.4	0.43	0.47	41.2

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (RTA NSW).
Approach LOS values are based on average delay for all vehicle movements.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	10.4	LOS B	0.1	0.1	0.42	0.42
P3	Across E approach	53	26.7	LOS C	0.1	0.1	0.67	0.67
P5	Across N approach	53	10.4	LOS B	0.1	0.1	0.42	0.42
P7	Across W approach	53	26.7	LOS C	0.1	0.1	0.67	0.67
All Pedestrians		212	18.5				0.54	0.54

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual pedestrian movements: Delay (HCM).

MOVEMENT SUMMARY

Site: Weekend midday

The Horsley Drive (Signals)

Signals - Fixed Time   Cycle Time = 120 seconds

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: South approach											
1	L	27	0.0	0.142	28.7	LOS C	1.4	9.7	0.60	0.70	33.5
2	T	22	0.0	0.053	21.5	LOS B	1.8	12.9	0.61	0.47	35.7
3	R	14	0.0	0.053	29.6	LOS C	1.8	12.9	0.61	0.80	33.8
Approach		63	0.0	0.141	26.4	LOS B	1.8	12.9	0.61	0.64	34.3
East: The Horsley Drive east											
4	L	14	0.0	0.506	27.5	LOS B	15.9	111.2	0.59	0.96	35.5
5	T	507	0.0	0.504	20.5	LOS B	15.9	111.2	0.60	0.53	36.8
6	R	106	0.0	0.503	36.6	LOS C	8.4	58.7	0.70	0.83	30.3
Approach		627	0.0	0.504	23.3	LOS B	15.9	111.2	0.62	0.59	35.5
North: North approach											
7	L	98	0.0	0.509	29.7	LOS C	4.7	32.8	0.63	0.74	33.0
8	T	29	0.0	0.170	22.2	LOS B	5.3	36.8	0.65	0.53	34.6
9	R	79	0.0	0.170	30.4	LOS C	5.3	36.8	0.65	0.79	33.0
Approach		206	0.0	0.509	28.9	LOS C	5.3	36.8	0.64	0.73	33.2
West: The Horsley Drive west											
10	L	85	0.0	0.380	26.1	LOS B	11.4	79.8	0.53	0.90	35.8
11	T	537	0.0	0.380	19.2	LOS B	11.4	79.8	0.55	0.47	37.7
12	R	18	0.0	0.380	28.5	LOS B	10.9	76.0	0.57	0.94	34.9
Approach		640	0.0	0.380	20.4	LOS B	11.4	79.8	0.55	0.54	37.4
All Vehicles		1537	0.0	0.509	23.0	LOS B	15.9	111.2	0.59	0.59	35.9

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (RTA NSW).
Approach LOS values are based on average delay for all vehicle movements.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	16.5	LOS B	0.1	0.1	0.53	0.53
P3	Across E approach	53	18.7	LOS B	0.1	0.1	0.56	0.56
P5	Across N approach	53	16.5	LOS B	0.1	0.1	0.53	0.53
P7	Across W approach	53	18.7	LOS B	0.1	0.1	0.56	0.56
All Pedestrians		212	17.6				0.54	0.54

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual pedestrian movements: Delay (HCM).

MOVEMENT SUMMARY

Site: WeekdayPM

Victoria and O'Connell Streets
(Stop control)

Stop (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: Oconnell St south											
1	L	62	0.0	0.154	15.1	LOS B	0.5	3.4	0.56	0.99	43.3
2	T	16	0.0	0.213	31.5	LOS C	0.8	5.9	0.88	1.02	33.2
3	R	23	0.0	0.212	31.0	LOS C	0.8	5.9	0.88	1.01	33.3
Approach		101	0.0	0.212	21.3	LOS C	0.8	5.9	0.68	1.00	38.8
East: Victoria Street east											
4	L	33	0.0	0.056	8.2	LOS A	0.0	0.0	0.00	0.91	49.0
5	T	624	0.0	0.281	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
6	R	47	0.0	0.051	11.0	LOS A	0.3	1.9	0.56	0.75	46.1
Approach		704	0.0	0.281	1.1	LOS A	0.3	1.9	0.04	0.09	58.2
North: Oconnell St north											
7	L	114	0.0	0.290	16.4	LOS B	1.0	7.3	0.61	1.03	42.3
8	T	12	0.0	0.136	28.9	LOS C	1.0	7.3	0.86	1.00	34.5
9	R	15	0.0	0.135	28.5	LOS B	0.5	3.7	0.86	1.00	34.6
Approach		140	0.0	0.290	18.7	LOS C	1.0	7.3	0.65	1.02	40.6
West: Victoria Street west											
10	L	8	0.0	0.058	8.2	LOS A	0.0	0.0	0.00	1.04	49.0
11	T	676	0.0	0.293	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
12	R	15	0.0	0.017	10.7	LOS A	0.1	0.6	0.54	0.69	46.4
Approach		699	0.0	0.293	0.3	LOS A	0.1	0.6	0.01	0.03	59.5
All Vehicles		1644	0.0	0.293	3.5	NA	1.0	7.3	0.12	0.20	55.0

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (RTA NSW).
Approach LOS values are based on the worst delay for any vehicle movement.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Weekend Midday

Victoria and O'Connell Streets
(Stop control)

Stop (Two-Way)

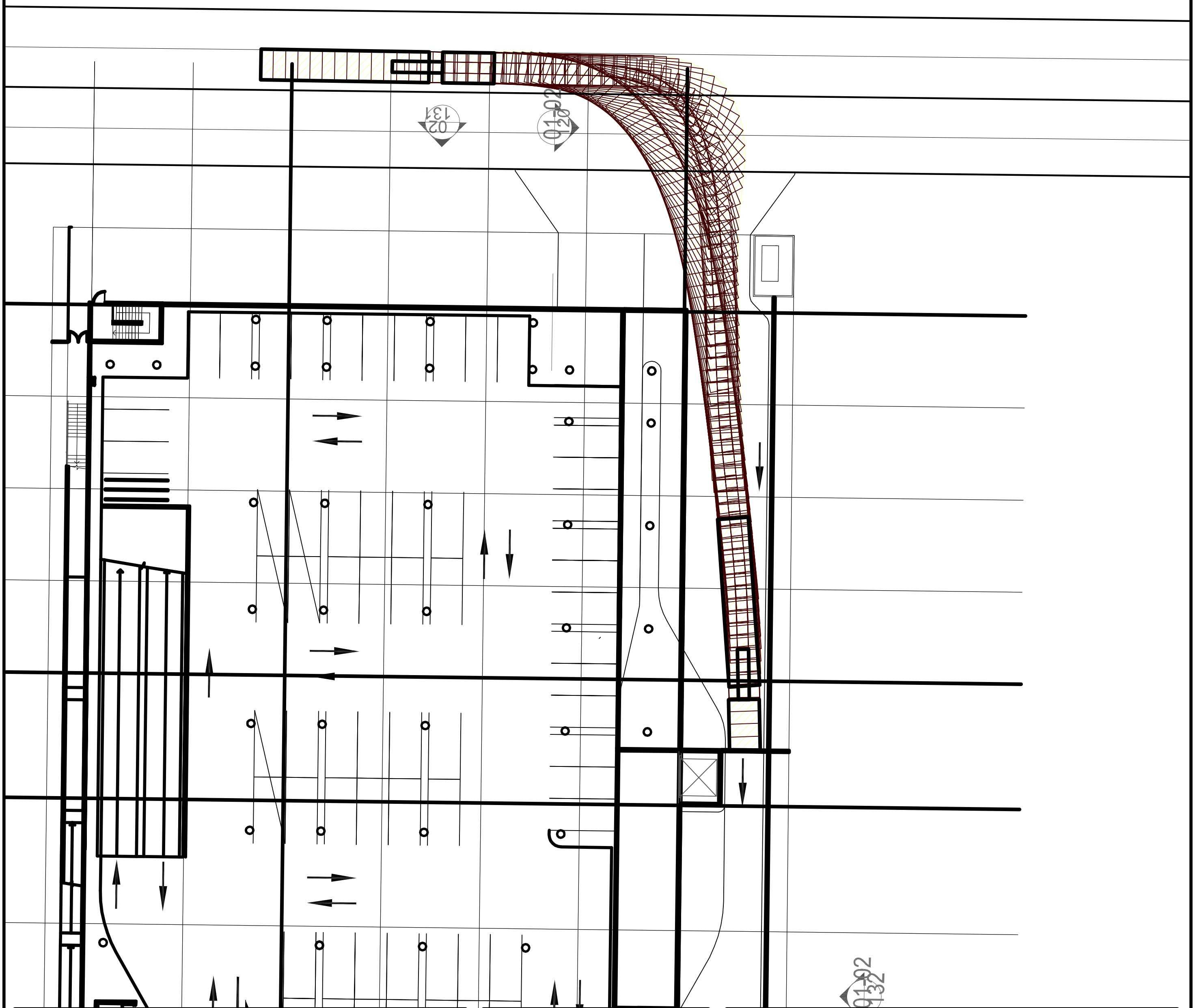
Movement Performance - Vehicles

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: Oconnell St south											
1	L	52	0.0	0.104	12.7	LOS A	0.3	2.0	0.42	0.90	45.3
2	T	9	0.0	0.066	17.3	LOS B	0.3	2.0	0.63	1.00	41.8
3	R	21	0.0	0.066	16.8	LOS B	0.3	2.0	0.63	1.00	42.1
Approach		82	0.0	0.104	14.3	LOS B	0.3	2.0	0.50	0.93	44.0
East: Victoria Street east											
4	L	33	0.0	0.033	8.2	LOS A	0.0	0.0	0.00	0.81	49.0
5	T	352	0.0	0.165	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
6	R	34	0.0	0.035	9.5	LOS A	0.1	1.0	0.43	0.65	47.1
Approach		418	0.0	0.165	1.4	LOS A	0.1	1.0	0.03	0.12	57.7
North: Oconnell St north											
7	L	36	0.0	0.074	12.8	LOS A	0.2	1.4	0.43	0.89	45.2
8	T	7	0.0	0.027	17.0	LOS B	0.2	1.4	0.62	0.95	42.0
9	R	5	0.0	0.027	16.6	LOS B	0.1	0.8	0.62	0.94	42.2
Approach		48	0.0	0.074	13.8	LOS B	0.2	1.4	0.48	0.91	44.3
West: Victoria Street west											
10	L	5	0.0	0.034	8.2	LOS A	0.0	0.0	0.00	1.03	49.0
11	T	389	0.0	0.169	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
12	R	17	0.0	0.017	9.4	LOS A	0.1	0.5	0.42	0.63	47.1
Approach		412	0.0	0.169	0.5	LOS A	0.1	0.5	0.02	0.04	59.2
All Vehicles		960	0.0	0.169	2.7	NA	0.3	2.0	0.09	0.19	56.0

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (RTA NSW).
Approach LOS values are based on the worst delay for any vehicle movement.

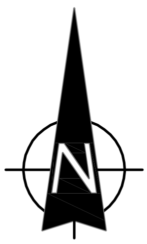
Appendix E

TURNING PATH ASSESSMENT



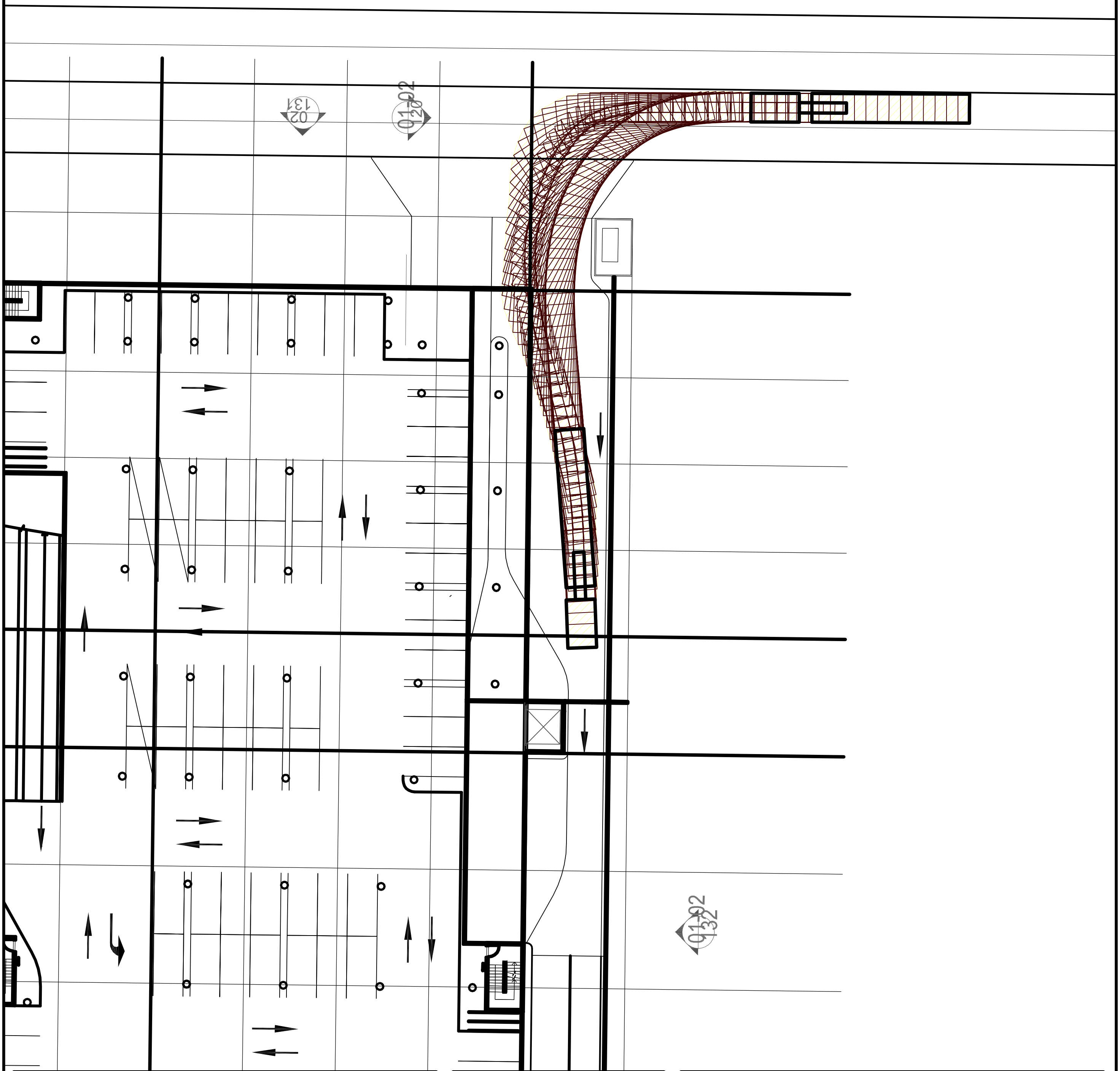
LEGEND

This drawing has been prepared using vehicle modelling computer software AutoTrack V5.00a in conjunction with AutoCAD 2000. The vehicle used is based upon vehicle data provided by Austroads and incorporates a reasonable degree of tolerance. However, it is not possible to account for all vehicle types/characteristics and/or driver ability.



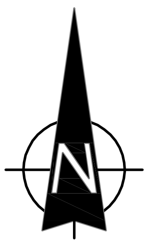
SWEPT PATH ANALYSIS OF A 19m ARTICULATED VEHICLE ENTERING THE SITE

SP 1



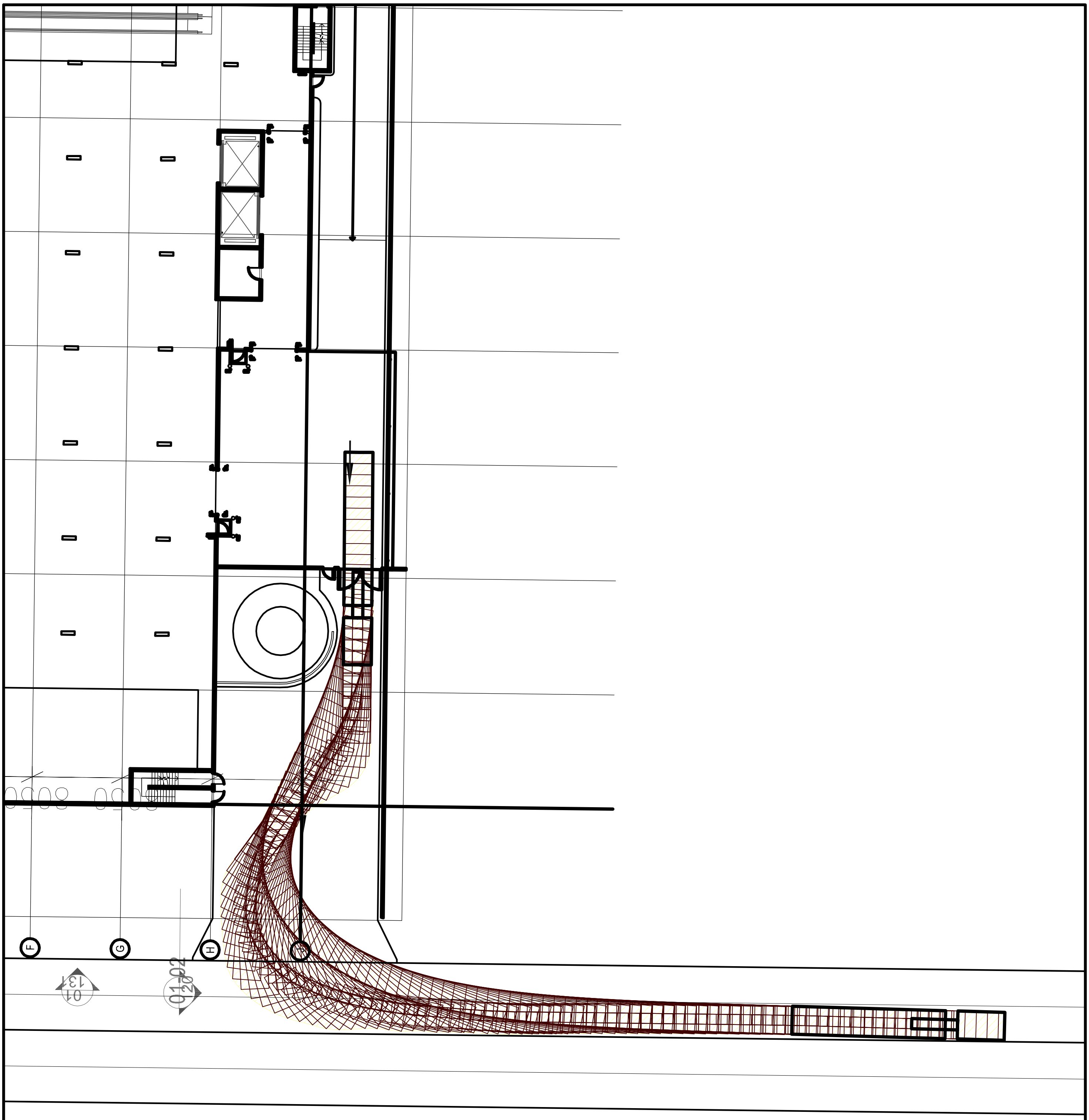
LEGEND

This drawing has been prepared using vehicle modelling computer software AutoTrack V5.00a in conjunction with AutoCAD 2000. The vehicle used is based upon vehicle data provided by Austroads and incorporates a reasonable degree of tolerance. However, it is not possible to account for all vehicle types/characteristics and/or driver ability.



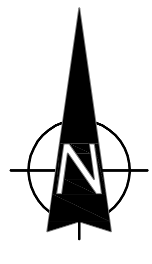
SWEPT PATH ANALYSIS OF A 19m ARTICULATED VEHICLE ENTERING THE SITE

SP 2



LEGEND

This drawing has been prepared using vehicle modelling computer software AutoTrack V5.00a in conjunction with AutoCAD 2000. The vehicle used is based upon vehicle data provided by Austroads and incorporates a reasonable degree of tolerance. However, it is not possible to account for all vehicle types/characteristics and/or driver ability.



SWEPT PATH ANALYSIS OF A 19m ARTICULATED VEHICLE EXITING THE SITE

SP 3